Czech Society for New Materials and Technologies

NANOTECHNOLOGIES IN THE CZECH REPUBLIC 2008

Prepared by a team of authors

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1. INTRODUCTION

The publication "Nanotechnologies in the Czech Republic – 2005"[1] was published in December 2005 within the project LA249 "CSNMT participation in the development of nanotechnological research". The publication described the development in this field in the Czech Republic from its beginning, from the end of the 1980s till 2005. As this research and the practical use of nanotechnologies has been intensively developing not only around the world, but also in the Czech Republic, the team of authors, from the Czech Society for New Materials and Technologies, has prepared this updated publication version.

The publication of 2005 informed about the basic and the applied research in the area of nanosciences and nanotechnologies in 18 institutes of the Academy of Sciences of the Czech Republic, 28 university faculties and institutes, and in 4 allowance organisations managed by resorts. There was the applied research and development identified and described in 9 private research workplaces, in 6 large enterprises, and in 19 small and medium-size enterprises (SME). The authors of the publication of 2005 noticed also trade activities of 7 enterprises focussing on sales of equipment for the research of nanotechnologies, sales of nanomaterials, and sales of the first "nano – products". They also mentioned other activities (activities by expert societies and voluntary groupings, the situation in education and in standardisation) and listed publications and activities, published after 1986, making the area of nanotechnologies more popular.

This publication has got a similar structure as the previous volume. However, the number of identified and described institutions and organisations has significantly increased – **Table No. I**.

Table No. I – Comparison of the number of subjects described in the years 2005 and 2008

Institutions	2005	2008
Institutes of the Academy of Sciences of CR	18	**26**
Universities	13	**15**
Faculties and other workplaces	28	**37**
Allowance organisations	4	**9**
Research institutes (private)	9	**15**
Large enterprises (≥ 250 employees)	6	**12**
Small and medium-size enterprises	19	**57**

When compared with 2005, the support of research and development of nanotechnologies from public funds has increased in the Czech Republic and further activities have developed.

[1] "Nanotechnologies in the Czech Republic", the authors: Kraus L., Kubátová J., Prnka T., Shrbená J., Šperlink K., published by Repronis Ostrava in December 2005, ISBN 80-7329-111-8. The publication is available in full at www.nanotechnology.cz.

2. DEFINITIONS AND NOMENCLATURE

There are many more or less similar definitions of nanosciences and nanotechnologies. We prefer the definitions formulated in the British study "Nanoscience and Nanotechnologies: Opportunities and Uncertainties"[2] in 2004.

The nanoscience is the study of phenomena and of the handling of materials at the atomic, molecular and supramolecular levels, where the properties significantly differ from the properties in larger size scales.

The nanotechnologies related to the designing, characterising, production, and application of structures, facilities and systems by the management of shapes and sizes in the nanometric scale.

It is important to define this interdisciplinary area of science and technology in order to set it apart from classical scientific and technological disciplines. This is why words with the prefix nano-are often used, e.g. nanomaterials, nanomedicine, nanobiotechnology, nanoanalytics, nanoelectronics, and many others, but also nanochemistry and nanophysics, and that could be sometimes quite confusing. On the other hand, many authors, institutions and enterprises do not use the prefix nano-, when naming their work in the field of nanometres. This makes the identification of their activities difficult and can lead to incorrect results of the executed survey.

We have used the following nomenclature, when characterising the field – **Table No. II**. It is an adjusted nomenclature used in the publication of 2005.

Table No. II – Nanotechnologies – Nomenclature

1. **Nanomaterials**
   a) Nanopowder materials, nanoparticles, quantum dots, and nanofibres
   b) Composite materials containing nanoparticles
   c) Materials with carbon nanotubes or fullerenes
   d) Thin layers, nanolayers, and nanocoatings
   e) Nanostructural metals and alloys
   f) Nanoceramics
   g) Polymer nanocomposites and polymer nanomaterials
2. **Nanotechnology for the storage and transmission of information, micro- and nanoelectronics**
   a) Nanoelectronics, materials and equipment
   b) Photonics
   c) Optic materials, structures and equipment
   d) Magnetic materials and equipment, spintronics
   e) Organic photonics and bioelectronics
   f) MEMS, NEMS

[2] "Nanoscience and Nanotechnologies: Opportunities and Uncertainties", Royal Society and Royal Academy of Engineering, 29 July 2004, www.nanotec.org.uk.

3. **Nanobiotechnology and nanomedicine**
   a) Encapsulating of drugs
   b) Targeted transport of medicine
   c) Tissue engineering
   d) Biocompatible and bio-analogical materials and layers
   e) Molecular analysis and DNA analysis
   f) Biological-inorganic interface and hybrids
   g) Diagnostics and molecular recognition
4. **Nanotechnology for applications in sensors**
   a) Sensors utilising nanomaterials
   b) Biomolecular sensors
5. **Nanotechnology in the (electro) chemical processing technologies**
   a) Filtration, membranes, molecular sieves, and zeolites
   b) Catalysis or electrodes with nanostructural surfaces
   c) Chemical synthesis, supramolecular chemistry
6. **Long-term research with the wide spectrum of applications**
   a) Self-assembly
   b) Quantum physics, quantum phenomena in nanosizes, and nanophysics
   c) Nano- and mesoscopic systems
   d) Chemical materials and processes – nanochemistry
   e) Ultra-precise engineering
7. **Instruments and facilities, research and applications of technologies**
   a) Analytical instruments, methods, techniques, and research
   b) Manufacture (preparation) of nanopowders (nanoparticles) and their processing
   c) Facilities and methods for the creation of layers and coatings
   d) Facilities and methods for the creation of objects (patterning, ECAP, fibre fabrication, etc.)
   e) Ultra-precise machining and nanometrology
8. **Health, ecological, ethical, social and other aspects of nanotechnologies**
   a) Toxicity of nanoparticles
   b) Environmental aspects
   c) Social and ethical aspects
   d) Standardisation
   e) Patenting
   f) Roadmaps and foresight
   g) Popularisation of nanotechnologies
   h) Trade in nanoproducts

3. SUPPORT OF RESEARCH AND DEVELOPMENT OF NANOTECHNOLOGIES IN CR

Research and development (R&D) in the Czech Republic has been funded from both public and private funds.[3] There was 1.42 % of the gross domestic product (GDP) allocated to R&D in 2007, thereof 0.62 % was from the public funds. The finance given to the research of nanotechnologies cannot be precisely estimated because statistics do not monitor this area and there are the above-mentioned problems with the projects' identification.

The basic research of nanotechnologies is basically funded in the Czech Republic only from public resources. The applied research, especially its part – the industrial research, may be funded from both resources. The support of the industrial research is governed in the Czech Republic by the rules of the European Union and relevant support programmes are approved of by the Office for the Protection of Competition.

The area of the public support of research and development has been currently subjected to the Act No. 130/2002 Coll. on the support of research and development from public funds, which has been valid since 1 July 2002. It determines in details the basic terms, the support subjects and ways, support conditions, the ownership of tangible assets acquired for research and development, the research and development public tenders, the provision of information about research and development, and the research and development authorities. The Act has been put into life by the three following Governmental Directives:

- Government Directive No. 267/2002 Coll. on the research and development information system.
- Government Directive No. 461/2002 Coll. o the target-oriented support of research and development from public funds and on public tenders in research and development.
- Government Directive No. 462/2002 Coll. on institutional support of research and development from public funds and on the assessment of research plans.

The finance for R&D from public funds is provided in two ways:

- **Institutional support –** this is the provision of the so-called institutional finance for a research plan, for specific research organised at universities or within the international cooperation of the Czech Republic in research and development,
- **Target-oriented support –** this is the provision of the so-called target-oriented finance for a specific research and development project. The target-oriented support is provided in the form of a subsidy to legal and natural persons. There are programme projects solved within research programmes and grant projects solved within tenders organised by grant agencies (the Grant Agency of CR, Grant Agency of the Academy of Sciences of CR).

Definitions of individual terms are presented in **the slidebar 1**.

[3] Detailed information could be found in the publication "State Supported R&D in the Czech Republic – 2008" available at www.nanotechnologie.cz. Further information could be obtained on the page by the Research and Development Council www.vyzkum.cz.

SLIDEBAR 1

Basic definitions and terms, according to the Act No. 130/2002 Coll. on the support of research and development:

Research is systematic creative work extending knowledge, including knowledge about humans, culture, or society by methods which allow the confirmation, supplementation or rejecting of gained knowledge. It is done in the form of:

1. **Basic research** that covers experimental and theoretical works conducted with the objective of gaining knowledge about fundamentals or basics of observed phenomena, the explanation of their causes and possible impacts, when the gained knowledge is utilised.
2. **Applied research** that covers experimental and theoretical works conducted with the objective of gaining new knowledge focussed on its future utilisation in practice. The part of the applied research results of which are utilised through development in new products, technologies and services, determined for business by a special legal regulation (e.g. the Commercial Code) is called **the industrial research**.

The development is the systematic creative use of research results, or of other ideas, for the manufacture of new or improved materials, products, and equipment, or for the implementation of new or improved technologies, systems, and services, including the acquisition and verification of prototypes, semi-operational or demonstration facilities.

A research plan determines the subject of research activities conducted by a legal person or by an organisational unit, its objectives, strategy, costs, and envisaged results, which ensure a conceptual development in the basic or in the applied research, with the exception of the industrial research, for the period of 5 to 7 years.

The specific university research is the research part conducted at universities which is closely connected with education and in which students participate.

International cooperation of the Czech Republic in research and development means the cooperation done on the basis of international treaties by which the Czech Republic is bound.

A programme project – the receiving party presents in which way and under which conditions it would contribute to the achievement of programme objectives formulated by the provider.

A grant project – the receiving party determines in the basic research the objectives and solution ways by itself.

A provider – the administrator of the state budget chapter (*SB*), who decides on the provision of support and who provides it.

An accepting party – a state organisational unit, legal person, or natural person, for the benefit of whom the provider decided on the support provision.

3.1. RESEARCH PLANS AND RESEARCH PROGRAMMES

Research and development of nanotechnologies in the Czech Republic has been currently supported from public funds in two ways:

- Institutional funding
- Target-oriented funding

3.1.1. Institutional funding – research plans

The institutional funding supports research plans of individual organisations of the Academy of Sciences of the Czech Republic, organisations within the sphere of the Ministry of Education, Youth and Sports, and organisations within the sphere of the Ministry of Health. Objectives of research plans, the contents of which fully or partly focussed on nanoscience or nanotechnologies, are presented in the text related to the individual accepting parties.

3.1.2. Target-oriented funding – research programmes

There are currently the following research programmes, which partly or fully focus on nanotechnologies:

3.1.2.1. PROVIDER: "ACADEMY OF SCIENCES OF THE CZECH REPUBLIC" (AS CR)

The main mission of the Academy of Sciences and its workplaces is the execution of the basic research within the broad spectrum of natural, technical, humanitarian and social sciences. This research, either highly specialised or interdisciplinary in its nature, tries for the development of knowledge at the international level, but it respects the actual needs of the Czech society and the domestic culture. Workplaces of the Academy of Sciences participate in education, especially in the training of young researchers during the conduct of post gradual study programmes, but also by pedagogical activities of its workers at universities. The Academy develops also the cooperation with the applied research and with the industry. Involvement of the Czech science within the international context is strengthened by a number of joint international projects and by exchanges of researchers with foreign partner institutions.

The programme "Nanotechnology for the Society" is currently very much focussed on the support of research in the area of nanotechnologies. Projects focussed on this area are solved also within other programmes of AS CR.

3.1.2.1. 1. Programme "Nanotechnology for the Society" – (Code KA)

This programme was announced by the Academy of Sciences of the Czech Republic (AS CR) on 14 December 2005. The main objective of this programme has been the achievement of a pronounced progress in the development of research and in the practical utilisation of nanotechnologies and nanomaterials within the Czech society. The programme also wishes to create a platform involving AS CR, universities and the industrial sector in the Czech Republic. That should ensure the long-term development in this area of science. The analysis of the current situation indicated that only specific, unified and concentrated programme supporting the development of research of nanotechnologies in the Czech Republic could contribute to the change in the so far unfavourable situation existing in this area. The finalisation of this programme is planned in 2012.

There have been three tender rounds organised so far and the last round, for projects starting on 1 January 2008, was finalised on 27 July 2007. No further tenders will be announced.

Programme objectives

- The creation of new materials and their preparation methods, the preparation of an optimising method and the achievement of target-modified mechanical, electric and other utility material properties based on the unique character of nanoparticles, nanofibres, composite and nanostructural materials.

- ➢ By an efficient transfer of knowledge to extend the spectrum of technologies useful in the industry and based on practical utilisation of nanoparticles, nanofibres, nanocoatings, nanostructures, and nanocomposites in the manufacture of materials in the Czech Republic. The assessment of possible negative impacts of, especially, free nanoparticles and nanofibres on the environment and humans.
- ➢ The utilisation of nanostructures and nanocomplexes, including hybrid materials manageable by the external magnetic field, for new forms of medicine, contrast substances and carriers, which would ensure the targeted transport of these substances, or the transfer of gene information, their activation and biodegradation in organisms.
- ➢ The design of new biosensors and diagnostic systems allowing the sensitive detection of molecular objects and the support of implementation of modern nanotechnological materials and methods in the Czech healthcare practice.
- ➢ The design of new instruments, tools and facilities for the creation and characterising of high resolution nanostructures, and the preparation of new methods for the handling and interconnecting of nanoobjects with their micro and macro surroundings, especially with microelectronics.
- ➢ In the case of technologically interesting volume and gradient materials, the creation of new metrology processes for the concurrent characterising of the topography and of the chemical composition of these material surfaces offering the high lateral resolution and the preparation of optimising methods related to utility mechanical, electric and other properties of these materials.
- ➢ The design, preparation, characterising, and modelling of new nanostructures suitable for detectors, photonic crystals, lasers and new semiconducting spintronic materials for the development of a new generation of nanoparts recording or transmitting information.
- ➢ The elaboration of new preparation methods for nanostructures and nanomaterials with the targeted management of object sizes or their self-assembly, especially the preparation, characterising and optimising of new nano-carbon and nano-diamond materials for bioapplications and nanoelectronics.

Programme structure

1) Sub programme “Nanoparticles, nanofibres and nanocomposite materials”
2) Sub programme “Nanobiology and nanomedicine”
3) Sub programme “Nano-macro interface”
4) Sub programme “New phenomena and materials for nanoelectronics”

Priorities of individual sub programmes:

1) Sub programme “Nanoparticles, nanofibres and nanocomposite materials”

- ➢ **Nanoparticles of metals and metallic oxides.** The research will focus on the preparation nanotechnology related to metal nanoparticles (e.g. Au, Ag, etc.) and their oxides, nitrides and other compounds (e.g. MgO, TiO_2, etc.), the technology of their compacting and stability, the utility properties of nanoparticles, and the research of their application and impacts on the environment and humans.

- ➢ **Ceramic materials-based nanoparticles and nanolayers.** The preparation and characterising of nanograins, ultra thin layers and super matrices based on nanocrystalline ceramics of unique properties. Specifically, it could relate to studies and the research of new nanocomposites from magnetic oxides, size effects of layered cuprates, ferroelectric and ferromagnetic materials. These nanomaterials could be themselves subjects of the research or industrial manufacturing in the areas of mechanical engineering, electric engineering, or electronics.
- ➢ **Carbon-based nanofibres of special inorganic materials and polymers.** The research will focus on materials with target-modified mechanical, electric, magnetic, or optic properties. These nanomaterials could be themselves subjects of the research or industrial manufacturing for the gaining of products of higher utility value and they could ensure practical applications in new technologies, e.g. in the energy conversion and accumulation.
- ➢ **Nanocoatings, nanostructures and nanocomposite materials.** The research of nanocoatings and functional nanostructures in thin layers will be target-oriented on the improvement of utility properties of practically important materials, e.g. the development of self-cleaning and antibacterial layers or products used for the protection of the environment, especially for the removal of pollutants from water and air. The research of nanocomposites will focus on the finding of suitable bonds between the metallic, ceramic or polymer matrix and the strengthening nanostructural (usually ceramic) composite phase. These materials will be determined for extreme mechanical and chemical loads. The application areas will be miniaturised systems and their integration in a new generation of products at the micro and nano size levels.

2) Sub programme "Nanobiology and nanomedicine"

- ➢ **The targeted transport of biologically active substances and nanosystems for diagnostics, therapy and radiotherapy, e.g. with the assistance of polymer or "molecular vessels".** The research of medicine forms, contrast substances and diagnostics based on biodegradable (especially polymer) systems allowing connection of medicine, or possibly other diagnostics or other biologically active molecules as the units ensuring the organ or cell-specific transport of the entire system in the living organism and its specific activation in the required place of effect. In an ideal case, this system should function as a diagnostic agent and, at the same time, as a specific therapeutic agent. The most important is the transport of chemotherapeutic and radiotherapeutic agents determined for the treatment of tumorous diseases.
- ➢ **Magnetic nanoparticles for medical purposes.** The stress will be put on hybrid materials consisting of magnetic cores and a biocompatible macromolecular shell. The external magnetic field will be able to manage their transport, distribution and behaviour. These nanoparticle systems should serve in vivo in diagnostics and therapy for the targeted transport of medicine, chemotherapeutic agents and radiotherapeutic agents, but also as contrast substances for the imagining magnetic resonance and the local destruction of cancerous tumours by the magnetic hyperthermy.
- ➢ **The biofunctioning of surfaces.** It is about the understanding of fundamental processes influencing the interaction of molecular objects at metal and semiconductors' surfaces, of their creation and self-assembly. The stress will be put on the nanobiotechnologies creating defined interfaces between the biological and non biological environments. That should

allow the achievement of a specific biological activity, e.g. the creation, regeneration and reconstruction of cells and tissues (the bioengineering) and the creation of biocompatible surfaces of medical preparations, facilities, instruments and the adjustment of surfaces specifically reacting to the presence of selected molecules (the detection system of biosensors). This should be utilised not only in the medical practice.

➢ **Biosensors and diagnostic systems.** The research of diagnostic systems and chips based on the surface modification of nanofibres, matrices or sensitive sensors of antibodies specifically aimed against different molecules. The interaction of an even small amount of molecules with the antibodies and the related highly sensitive change in the conductivity, or in other properties, should be utilised for specific detections.

➢ **Polymer nanocomplexes for the transfer of gene information and gene therapy.** The preparation and study of properties and the research of DNA complexes, which allow for the in vivo effective targeted transport of gene information to the beforehand selected cell types, or utilised as systems ensuring the efficient transfection of more cell types and their utilisation for therapy.

➢ **Supramolecular creation of nanostructures.** The creation of artificial nanostructures by the managed setting up of target-prepared molecular building parts is fundamental for the biomedical utilisation. This is, together with the maximal utilisation of self-assembly, covalent and non covalent bonds, one of the main objectives of the supramolecular chemistry.

3) Sub programme “Nano-macro interface”

➢ **The development of instruments, tools, facilities and methods for the creation and characterisation of high resolution nanostructures,** which will focus on the characterising of materials from the points of view of topographical, electric, optic and magnetic properties, their passivation, heat resistance, and the resistance against intensive beams and mechanical effects. These nanotechnological instruments will allow direct controls of individual technological steps.

➢ **The development of methods for the handling and interconnecting of nanoobjects with micro and macro surroundings, especially with microelectronics.** This should allow the measuring of electric and operational parameters of individual electronic elements and nanostructures. There will be researched the methods of handling atoms, molecules and clusters, the lithographical methods for contacting nanostructures and nanoparts, and their insertion to complex circuits and electronic instruments.

➢ **The development of metrology methods and characterising of surfaces of technologically interesting macroscopic materials of the nm sizes** with the utilisation of scanning probe microscopes, optics, diffraction electron and photoelectron methods. There will be metrology processes designed for the determination of nanoobject sizes and, at the same time, of their chemical composition, topography and electron properties. These methods will be used also for grants of attests and guaranties related to new product properties, where the surface plays an important role.

➢ **The studies of bulk materials the properties of which are fundamentally influenced by their microstructures or nanostructures, especially the nanometric grain borders.** An important group of such materials consists of nanostructural bulk and gradient dielectric and metallic materials the research of which will focus mostly on the preparation nanotechnology of nanostructural ceramics or ultrafine-grain metals and intermetallic alloys (e.g. applications of the severe plastic deformation or the influencing of grain borders) with the objective of gaining materials which are extraordinarily strong and ductile and having excellent electric and magnetic properties.

4) Sub programme "New phenomena and materials for nanoelectronics"

- **Nanophotonics and, especially, new laser kinds.** The stress will be put on the study of quantum properties of electrons and their effects on emissions, spread and photon absorption in double, single and zero-dimensional structures, their theoretical modelling and simulations of general nanophotonic systems. The preparation and characterising of nanostructures or nano-size polymers, suitable for sensors, photonic crystals, emission diodes, and lasers, will be the most important.
- **The semiconducting spintronics focussed** on the preparation, characterising and utilisation of spintronic materials and structures combining magnetic and non magnetic semiconductors. The stress will be put on the preparation of nanoparts which would not use electron charge for the recording or transmission of information. They should utilise their spin and become thus an important part of nanoelectronics.
- **Carbon-based nanostructures and nanodiamond layers.** The objective of this research of unique electric, optic and magnetic properties of carbon nanostructures, which contain the carbon atom in sp, sp2 and sp3, will be the exploration of new carbon nanomaterials' properties and new physical phenomena, which are exclusively tied with nanocarbon and which are perspective for nanoelectronic and bio applications. An important task will relate to the management of nanodiamond layers' depositing in substrates of sizes exceeding 10 cm^2 and the modification of their surfaces, which should achieve unique electric and surface utility properties.
- **Nanotechnologies and nanophenomena at the atomic and molecular levels.** A significant part should focus on the development and implementation of the preparation methods for nanostructures and nanomaterials with the target management of object sizes and self-assembly. This could relate to lithographical, epitaxial, evaporation or sputtering methods, sol-gel, the laser managed or other techniques, but also to the preparation and utilisation of metallic nanostructures in the area of plasmonics focussed on the research of electromagnetic signal spreading along nanostructures. A fundamental role will be assigned to the creation of nanoelectronic elements and parts (e.g. a single electron transistor) and their applications in the research of quantum phenomena with the perspective utilisation in nanoelectronics and molecular electronics.

3.1.2.1. 2. Sub programme "Support of target-oriented research" – (1Q)

This programme is the second partial programme of the section programme "Integrated research" that makes a part of the National Research Programme (NRP I) announced for the period 2004–2009. The objectives of this programme are as follows:

1. The provisions of tools targeting advanced exploratory research on the achievement of results practically useful in further development of innovative technologies, new materials, and products of high value added, or in applications within the social-economic area.

2. The support of specific projects strengthening the interdependence of individual research and development stages: the exploratory research – target-oriented research – applied research and development.
3. The creation of prerequisites for higher economic appreciation of results of the own exploratory research by the support of more consistent utilisation of intellectual property and rights related to the research and development results.

No public tenders are announced within this programme.

3.1.2.1. 3. Programme "Grants of significant exploratory character focussed on the area of the currently developed research, especially within AS CR" – (IA)

This is a programme for the long-term exploratory research started in 2002.

3.1.2.1. 4. Programme "Junior exploration grants" – (KJ)

Project topics are decided on by proposing parties and they have the character of the basic research. Its expert focus corresponds with the National R&D Policy of the Czech Republic. Grant projects could be solved by researchers younger than 35 years of age, who graduated or who participate in post gradual studies (they participate in the last stage of the studies) by themselves, or with a research team, while the share of young researchers prevails in the team. The average team age, including the researcher, must not exceed 38 years of age (considering the envisaged research capacities). Project solutions could be planned for the period of 1 to 3 complete calendar years.

3.1.2.2. PROVIDER: GRANT AGENCY OF THE CZECH REPUBLIC (GA CR)

GA CR announces public tenders within research and development every year. The tenders support grant projects of the basic research within all sciences, see **Table No. III**.

Table No. III – List of branch and sub branch commissions of GA CR

1. Technical sciences
   - 101 – Mechanical engineering
   - 102 – Electrical engineering and cybernetics
   - 103 – Civil engineering, architecture and transport
   - 104 – Chemical technology
   - 105 – Mining
   - 106 – Metallurgy and the materials engineering
2. Natural sciences
   - 201 – Mathematics and informatics
   - 202 – Physics
   - 203 – Chemistry
   - 204 – Cell and molecular biology
   - 205 – Earth and space related sciences
   - 206 – General and ecological biology
3. Medical sciences
   - 301 – Molecular biology

302 – Genetics and human development
303 – Biochemistry, pathobiochemistry and toxicology
304 – Morphological fields
305 – General physiology
306 – Pathological and clinical physiology
307 – Pharmacology
308 – Experimental surgery
309 – Neurosciences
310 – Microbiology and immunology
311 – Metabolism and nutrition
312 – General oncology
313 – Epidemiology and hygiene

4. Social sciences
   401 – Philosophy, theology, and religion related science
   402 – Economic sciences
   403 – Sociology
   404 – History and ethnography
   405 – Philology
   406 – Psychology and pedagogy
   407 – Legal sciences and politics related sciences
   408 – Aesthetics, musicology and art sciences
   409 – History of the 19th and 20th centuries
5. Agricultural sciences
   521 – Plant production, genetics and breeding
   522 – Phytopathology and plant physiology
   523 – Livestock production, genetics and breeding
   524 – Animal physiology and pathology
   525 – Agricultural products, food technology and eco-toxicology
   526 – Ecology, forestry, and soil protection

Table No. III clearly shows that the interdisciplinary area of nanotechnologies does not have its own sub commission and applicants can submit their “nano projects” in any sub area, according to their considerations. **Annex 1** indicates that projects focussed on nanotechnologies have been identified in the sub areas 101, 102, 103, 104, 106, 202, 203, 204, 205, 305, and 309. As in programmes by other providers, it is very difficult to identify projects in the area of nanobiotechnology and nanomedicine (see **Table No. II**) also in the programmes by GA CR because most researchers do not use the prefix nano-, or the above-presented terms.

Projects focussing on nanotechnologies are solved in the following GA CR programmes:

- Programme of standard grants (GA)
- Programme for post gradual projects (GP)
- Programme EUROCORES (GE)

More detailed information is available at the address www.gacr.cz.

3.1.2.2. 1. Programme "Standard grants" – (GA)

Main activities of GA CR focus on the programme of standard projects in which any legal or natural Czech person can be involved. Topics of these projects are decided by proposing parties themselves within the above-presented branches and sub branches. A public tender is announced every year, usually in February.

3.1.2.2. 2. Programme "Post gradual projects" – (GP)

The programme objective is the support of interests of post graduates in the work conducted by research institutions. The programme should assist these institutions in the provision of wages for starting research workers which would prevent them to leave the scientific practice. The effort relates also to the utilisation of potentials of well-known experts by the involvement of young promising researchers in problems resolved by them.

3.1.2.2. 3. Programme "EUROCORES" – (GE)

The Grant Agency of the Czech Republic, which is a member organisation of the European Science Foundation (ESF), has been involved in the European Science Foundation Collaborative Research Programme (EUROCORES) since 2002. It is a programme of the international cooperation of research teams solving projects in selected topical areas.

The international management committee of the programme selects five actual, perspective and interdisciplinary topics every year. Submitted project proposals are assessed by an international panel. When a grant is assigned, the research is funded by national agencies (GA CR). Programmes are announced on a unified date in March every year and the tender deadline is in May. The Grant Agency of CR announces public tenders, related to EUROCORES projects, in an extension of the programmes announced by ESF. More detailed information could be found at www.esf.org and www.gacr.cz.

3.1.2.3. PROVIDER: MINISTRY OF EDUCATION, YOUTH AND SPORTS (MEYS, or MŠMT)

MEYS is the central administrator responsible for research and development in the Czech Republic. The Ministry especially looks after:

a) Preparation of the National Research and Development Policy of the Czech Republic in correspondence with international treaties and it controls the Policy implementation in the form of its opinion on the correspondence of the research and development programmes submitted by providers with the National Research and Development Policy of the Czech Republic before these programmes are approved of by the government,
b) Preparation of priorities in the form of National Research Programme,
c) Implementation of research priorities in areas which are not covered by responsibilities of providers in the form of organisation of a part of the National Research Programme,
d) Preparation of legal research and development regulations and the assessment of impacts of other legal regulations on research and development,
e) The international cooperation of the Czech Republic in research and development, including negotiations with bodies and institutions of the European Community and of individual European Community countries looking after research and development, with the exception of the international cooperation in defence research and development, which is the responsibility of the Ministry of Defence,

f) When the Czech Republic is represented in the relevant international bodies or organisations by a ministry, the ministry presents a report on the course and results of the cooperation to the government, after discussing it with the Research and Development Council, and makes it public, after the approval by the government.

MEYS has got a special position among sectors in the relation to the state-supported research and development.

- "Department of international relations in research and development" organises the broad area of research and development conducted at the international level, including the preparation of a conception of the international cooperation in research and development.
- "Department of research and development programmes" manages research programmes at universities and also other specific research programmes.

In 2008, MEYS provides its support to the following research programmes, the project of which focus, among other things, also on the research of nanotechnologies:

3.1.2.3. 1. Programme "Research Centres" – (1M)

This programme is the first partial programme of the section programme "Integrated Research" that makes a part of the National Research Programme (NRP I) announced for the period 2004–2009. The programme "Research Centres" is one of the basic and financially well subsidised instruments removing prevailing obstacles in the inter-sector cooperation and also an instrument for further development of R&D in the Czech Republic. There have been 36 projects (research centres) recommended within the public tenders, eight of which focus on nanotechnologies (see **Annex I**). No public tenders are currently announced within this programme.

3.1.2.3. 2. Programme "Basic Research Centres" – (LC)

The programme objective is the support of cooperation of top workplaces involved in the Czech Republic in the area of basic research. It should increase their competitiveness in the European Research Area. The programme contributes, at the same time, to education of young experts. Research workplaces must have a joint research programme with their international research workplace(s). The programme has been announced for the period 2005–2009. There have been 51 projects (research centres) recommended within the public tenders, eight of which focus on nanotechnologies (see **Annex I**).

3.1.2.3. 3. Programme "Healthy and High Quality Life" – (2B)

The programme is the second topical programme of the National Research Programme II, which has been announced for the period 2006–2011. The Programme has got the following topical areas:

T2-1-1 Healthy and safe foods
T2-1-2 Systems and methods for the assessment of health safety of food materials, foods and feeds
T2-1-4 Non traditional use of the agricultural produce
T2-2-1 Development of new diagnostics based on molecular-biologic methods
T2-2-2 Molecular genetics and biotechnology for new medicine
T2-2-3 Nanomaterials in biology and medicine
T2-2-4 Biomaterials for the transplanting medicine
T2-2-5 Genomics, proteomics and pathophysiology of cardiovascular diseases

T2-2-6 Genomics and proteomics in the differentiation of cells in cancerous diseases
T2-3-1 Reduction of surface water pollution
T2-3-2 Bioremedy for the environment with the assistance of micro organisms
T2-3-3 Modernisation of the waste handling
T2-3-4 Biodiversity
T2-3-5 The environment and health

There have been 4 projects focussing on nanotechnologies accepted for the period 2006–2010 (2011) so far (see **Annex 1**).

3.1.2.3. 4. Programme of the international cooperation in research and development "COST" – (OC)

COST (European Cooperation in the Field of Scientific and Technical Research) is a European multilateral cooperation in the area of research and development focussed on exploratory and applied research. The Czech Republic has become a member of COST in 1993. COST coordinates research and development by the so-called Actions, in which scientists and researchers from COST member countries could participate with their own projects. The organisation and work principles of COST are based on the approach "bottom-up" and "à la cart" – the actions are proposed by scientists and researchers. The research is funded at the national level.

3.1.2.3. 5. Programme of the international cooperation in research and development "KONTAKT" – (ME)

The programme "KONTAKT" supports the participation of Czech research and development workers in multilateral research programmes ESA, SEI (the Central European Initiative), OECD, and NATO, and in some important bilateral programmes with countries with which the Czech Republic has got cooperation agreements on research and development and in programmes by National Science Foundation – NSF (USA).

3.1.2.3. 6. Programme "EUREKA" – European cooperation in the area of applied and industrial research and development – (OE)

The programme "EUREKA" started in 1998 with the objective of supporting the cooperation between industrial enterprises, research institutes and universities. It should thus create conditions for technical advancement and improved performance of the European industry, develop the common infrastructure and resolve problems relevant in several countries. EUREKA projects serve to civil purposes and they focus on both private and public sectors. Their outputs should be top products, technologies and progressive services highly competitive in the market. The objective is the active research and development involvement in market economy mechanisms, i.e. the results must be commercially applicable. EUREKA currently associates 37 European countries, while the European Union is the 38th regular member.

3.1.2.4. PROVIDER: MINISTRY OF INDUSTRY AND TRADE (MIT, or MPO)

MIT provides support mainly to programmes of industrial research and development. In 2008, MIT provides support to the following research programmes the projects of which are also focussing on the research of nanotechnologies:

3.1.2.4. 1. Programme "POKROK" (PROGRESS) – (1H)

The programme is the third topical programme of the National Research Programme I announced for the period 2004–2009 and it focuses on the support of projects of the industrial research and development directed to the achievement of increased competitiveness of the Czech economy, while its sustainable development is maintained as well as the energy for this economy and the society. There are currently 3 projects focussed on nanotechnologies solved within the programme. No public tenders are announced within this programme anymore.

3.1.2.4. 2. Programme "Permanent Prosperity" – (2A)

The programme is the first topical programme of the National Research Programme II and it has been announced for the period 2006–2011. Objectives of the programme are as follows:

1. The preparation of new materials and processes for the utilisation of renewable and non traditional energy sources, including the hydrogen energy.
2. The increased reliability of facilities transmitting electric energy.
3. The preparation of new processes for the nuclear energy technologies.
4. The reduction of energy intensity of building operations.
5. Designs of new non conventional machine structures and constructions.
6. Designs of new materials with new utility properties, including nanomaterials and new methods for material diagnostics.
7. The preparation of new semiconductor parts for diagnostics and management.
8. The increased utilisation of the safe transport system.
9. The implementation of new processes in selected branches of the chemical and pharmaceutical industries.
10. The development of new materials, new additives for products by other industries, new polymers and catalysts.

The following topical areas have been announced within the programme:

T1-1-1 Increased reliability of electric networks and high voltage switch stations
T1-1-2 The use of hydrogen and fuel cells as energy sources
T1-1-3 New nuclear technologies for the generation of power, high potential heat, and hydrogen
T1-1-4 Reduced energy intensity in building operations
T1-1-5 Renewable energy resources
T1-2-1 New technologies and materials for the air protection
T1-2-2 Technology protecting water and the mineral environment
T1-3-1 New materials with new usable properties
T1-3-2 Applications of new materials in the machinery designs
T1-3-3 Mechatronic systems and robotics
T1-3-4 New structures of manufacturing machines
T1-3-5 New semiconductor sensors and nanodevices
T1-3-6 Longer operational life span and reliability of machinery products and of facilities with high technical parameters
T1-3-7 New methods in nanodiagnostics
T1-4-1 Alternative energy sources in transport
T1-4-2 Higher quality and improved reliability of the transport infrastructure

T1-4-3 Transport equipment and systems for the public and individual transport
T1-5-1 Chemical optimising and development of new pharmaceutical technologies
T1-5-2 Safety of chemicals
T1-5-3 Nanomaterials and processes
T1-5-4 Development of new chemical additives for products by other industries
T1-5-5 Functional polymers
T1-5-6 Organic syntheses for products with the high value added
T1-5-7 Catalysts for the protection of environment, energy industry, food industry, and low-waste chemical technologies

There have been three public tenders in the total announced which called for submission of proposed projects. The list of the currently solved projects in the area of nanotechnologies is presented in **Annex 1**. Public tenders for this programme will not be announced in future.

3.1.2.4. 3. Programmes "Tandem" – (FT) and "Impuls" – (FI)

MIT provides funds for the solution of research projects of the industrial research and development conducted within the programmes TANDEM and IMPULS in the period 2004–2010. The programme TANDEM focuses mostly on the support of projects of the target-oriented research the results of which would be utilised, through the consequent industrial research and development, in new products, technologies and services. The conditions require project solutions by consortia consisting of workers from industrial organisations and research workplaces (academic, university ones and others).

The programme IMPULS focuses on the support of industrial research and development, but it does not include the above-mentioned condition.

There will be no new public tenders announced within these programmes.

Nanotechnologies and nanomaterials make some of the priorities in both these programmes. Information about projects related to the area of nanotechnologies currently solved is presented in **Annex 1**.

3.1.2.4. 4. Programme "TIP" – (FR)

The programme "TIP" (Technology, Information systems, and Products) has been approved by the government of the Czech Republic by the Resolution No. 942 of 22 August 2007. The first public tender calling for the submission of project proposals within this new sector research programme will be announced probably in November 2008. The programme should take place in the period from 2009 to 2014. All projects should be finalised in 2017. Individual projects must be finalised within four years (48 months).

Objectives of the programme TIP and their reasoning

a) New materials and products:

There will be supported research and development projects which would ensure the implementation of good ideas in new competitive materials and in materials of so far unknown properties, **nanomaterials**, new or improved industrial products and facilities, including the acquisition and verification of samples, prototypes, or demonstration facilities and verification of new technologies. Research and development must focus on future market needs; follow sustainability and saving of resources, and respect environmental, energy and social factors.

b) New progressive technologies:

The optimising of conventional manufacturing processes, the development of new and the utilisation of progressive better performing technologies is the necessary prerequisite for the maintenance of the position within conditions of the progressively stronger global competition. When new manufacturing processes are designed, improvement possibilities must be broadly analysed and they must be fully utilised.

The objective is the achievement of competitiveness through the internationally recognised values of preciseness, quality, manufacturing safety, fast organised deliveries, economy, ecology, and through technologies allowing a multiple utilisation, multidisciplinary technologies, biotechnologies, **nanotechnologies**, etc.

c) New information and management systems:

Very important parts of the rational and progressive manufacturing, which influence it significantly, are: the optimal management of manufacturing processes, the maximum of relevant information entering the manufacturing process, information about the course of technological operations, information about products and their utilisation, about newly occurring requirements on products, and also the maximum information assessing the manufacturing process during its entire course.

There will be research and development projects supported, which would result in the more economic, environmentally friendlier, safer, more flexible, and faster manufacture.

4. CENTRES OF NANOTECHNOLOGY R&D IN CR

There are workplaces characterised in this chapter in which research and development make a significant part of the activities. They are mostly:

- Institutes of AS CR which are public research institutions,
- University workplaces (faculties, departments, institutes), which conduct research and development together with their pedagogic activities,
- Allowance sector organisations which conduct research and development together with other activities,
- Research organisations in the private sector.

4.1. WORKPLACES OF THE ACADEMY OF SCIENCES OF THE CZECH REPUBLIC

The Academy of Sciences of the Czech Republic (AS CR) was founded by the Act No. 283/1992 Coll. as the Czech successor of the former Czechoslovak Academy of Sciences (CSAV). It is a set of 53 public research institutions and 3 service workplaces, including the Office of AS CR (see www.cas.cz). There are almost 7 thousand employees; thereof more than a half are researchers with university education.

The main mission of the Academy of Sciences and of its workplaces is the organisation of the basic research in the broad spectrum of natural, technical, humanitarian and social sciences. This research – specialised or interdisciplinary in its nature – tries for the development of knowledge at the international level, but it respects actual needs of the Czech society and local culture. Workplaces of the Academy of Sciences participate in education, mostly by the training of young researchers in post gradual study programmes, but also with pedagogical activities of their workers at universities. The Academy also develops cooperation with the applied research and industry. A number of joint international projects and exchanges of workers with foreign partner institutions strengthen the involvement of Czech science within the international context.

The conducted survey has shown that there are currently 25 institutes of AS CR and the Technological Centre of AS CR involved, with varied intensity, in the research of nanotechnology.

4.1.1. Institute of Biophysics of AS CR (BFU)

Královopolská 135, 612 65 Brno, I.D. 68081707
www.ibp.cz

Brief Institute characteristics

The Institute was established on 1 January 1955 from the Biophysical Laboratory of CSAV founded on 1 January 1954. The institute has become a public research institution on 1 January 2007.

The subject of the Institute main activities is the scientific research of structures, functions and dynamics of biological systems (biomolecules, cell organelle, cells, and cell populations) by methods of the molecular biology, biophysics, biochemistry, and bioinformatics. The Institute activities contribute to the improved level of knowledge and education, to the development in biotechnologies and to the transfer of research results to practice, especially in the area of clinical medicine.

The Institute of Biophysics of AS CR is divided into 9 laboratories:

- Biophysical chemistry and molecular oncology laboratory (the leader is M. Fojta)
- Structure and nucleic acids' dynamics laboratory (J. Šponer)
- Molecular biophysics and pharmacology laboratory (V. Brabec)
- CD spectroscopy of nucleic acids' laboratory (M. Vorlíčková)
- Laboratory of the molecular epigenetics (A. Kovařík)
- Molecular cytology and cytometry laboratory (S. Kozubek)
- Development plant genetics laboratory (B. Vyskot)
- Cytokinetics laboratory (A. Kozubík)
- Laboratory of the pathophysiology of free radicals (A. Lojek)

Doc. RNDr. Stanislav Kozubek, DrSc., is the Institute's Director

Research and development focus

The research organised by the Institute of Biophysics of AS CR focus, in the period 2005–2010, mostly on two research plans and, in 2008, on the solution of 72 programme projects.

Research plan AV0Z50040507 **"Biophysics of dynamic structures and functions of biological systems"**, 1/2005–12/2010, the researcher is doc. RNDr. Stanislav Kozubek, DrSc., the total costs of CZK 609.202 million, thereof CZK 608.522 million from the state budget. Year 2008 – 28.491/28.491, the nomenclature – the area 3, the share of the nanotechnology research – 40 %.

The research focuses on relations between the primary DNA structure with its conforming properties considering the evolution of genomes, the DNA interactions with proteins (histones, HMG proteins, and oncoproteins) and with effective anticancer substances containing metals, DNA interactions and proteins in between phases in relation to electrochemical sensors for genomics and proteomics, on the architecture of cell core, arrangement and modifications of chromatin, the structure and function of nucleoproteins and telometric complexes, dynamics of genomes and genome territories, relations between the gene expression, cell differentiation, oncogenic transformation and ontogenetic development, the effect of endo- and exogenic mediators modifying proliferation, differentiation and apoptosis in cell populations, the computer-assisted simulations of the dynamic structure and DNA/RNA interactions with proteins and biologically active substances. Applications aim at medicine, agrobiology, eco-toxicology, and biotechnology.

AV0Z50040702 **"Genome and epigenome: 1D and 3D structures, dynamics, interactions with proteins, and functions"**, 1/2007–12/2013, the researcher is doc. RNDr. Miroslav Fojta, CSc., the total costs of CZK 559.847 million, all from the state budget. The year 2008 – 1.245/1.245, the nomenclature – the area 3, the share of the nanotechnology research – 10 %.

The research focuses on the study of molecular and space structures of genome, the effect of epigenetic variations on the genome arrangement in the cell core, genome, epigenome and proteome dynamics during the cell cycle, the differentiation and malign cell transformations. There are researched the mechanisms of the epigenetic regulation of the gene expression and the role of epigenome in the inheritance of the transcription profile and its changes in differentiations, in the ontogenesis and external factors (physical and chemical) at the levels of genome, epigenome, transcriptome, proteome, and metabolon. An important part of the research is the extension of the methodological equipment of the involved scientific branches, including the development and implementation of new experimental approaches and analytical instruments. The research results should be applicable especially in biomedicine, agricultural biotechnologies, and eco-toxicology.

It results from the above-presented description that the Institute focuses its activities on the area of molecular biology, biotechnology, genomics, proteomics, and other biosciences. A number of above-mentioned issues belong to the area of nanosciences, bionanotechnology, and nanomedicine.

The research of the bionanotechnological character is mostly conducted in the Biophysical chemistry and molecular oncology laboratory (M. Fojta, S. Hasoň, V. Ostatná, V. Vetterl, P. Kostečka, E. Paleček, F. Jelen, and L. Havran) and also in the Molecular biophysics and pharmacology laboratory (V. Brabec, J. Kašpárková) and in the Cytokinetics laboratory (A. Kozubík).

Selected research areas connected with nanotechnologies

- Applications of new electrochemical methods combined with diffraction optical methods for the targeted creation of nanometric adsorbed layers of biomolecules on materials;
- Development of electrochemical supplementary facilities (there was, for example, the "invert" microlitre chemical cell for the amplification of oligonucleotides developed in the laboratory);
- Diffraction optical studies of the adsorption/desorption phenomena and of the structure of adsorbed protein layers in modern materials usable in biomedicine (considering their surface modifications);
- Studies of the protein interactions with electrically charged surfaces; applications in the electrochemical protein analysis;
- Constructions of marked/functional nucleic acids; the insertion of modified nucleotides into nucleic acids; applications in the sequentially specific DNA scanning (the cooperation with the team of doc. M. Hock from the Institute of Organic Chemistry and Biochemistry of AS CR, Praha);
- Microfluid facilities for the analysis of not modified and marked (derived) biopolymers;
- Applications of magnetic separation technologies in the detection of nucleic acids and proteins;
- Research of self-assembled monolayers of nucleic acids modified by thiol on mercury and amalgam electrodes; the creation of layers recognising bio entities;
- Research focussed on the finding of molecular mechanisms of anti tumour activities of nanopharmaceuticals.

Projects solved in the area of nanotechnologies

a) <u>Projects solved in the Institute:</u>

- Project of AS CR KAN200040651 "Electrochemical and optical analyses of bio-macromolecules on microelectrodes covered with nanolayers of electroactive materials", 07/2006–12/2010, the researcher is Mgr. Stanislav Hasoň, Ph.D.
- Project GP202/07/P497 "Interaction of proteins with surfaces. New biophysical methods analysing the tumour suppressor p53", 1/2007–12/2009, the researcher is RNDr. Veronika Ostatná, Ph.D.

- Project GA202/08/1688 “The use of physical study methods related to the adsorption of nucleic acids and proteins at interfaces in medical diagnostics and in studies of biocompatibility”, 1/2008–12/2010, the researchers is prof. RNDr. Vladimír Vetterl, DrSc.
- Project GA203/07/1195 “Analysis of the structure and the DNA interactions with the assistance of electrochemical techniques and chemical probes. New methods and sensors detecting damaged DNA”, 1/2007–12/2009, the researcher is doc. RNDr. Miroslav Fojta, CSc.
- Project GP203/08/P598 “Electrochemical instruments for the detection of mutations and polymorphisms in DNA”, 1/2008–12/2010, the researcher is Mgr. Pavel Kostečka, Ph.D.
- Project GA301/07/0490 “Proteins and DNA modified by electrodes. New instruments for the biomedicine”, 1/2007–12/2009, the researcher is prof. RNDr. Emil Paleček, DrSc.
- Project MEYS LC06035 “Centre of biophysical chemistry, bioelectrochemistry and bioanalysis. New instruments for genomics, proteomics, and biomedicine”, 3/2006–12/2010, the researcher is doc. RNDr. Miroslav Fojta, CSc.
- Project GA AS CR IAA100040602 “New approaches in the electrochemical analysis of nucleic acids and oligonucleotides focussed on the ultra sensitive microdetection of DNA and DNA hybridisation”, 1/2006–12/2008, the researcher is RNDr. František Jelen, CSc.
- Project GA AS CR IAA100040611 “The use of electrochemical methods in studies of oligonucleotides as models of alternative DNA structures”, 1/2006–12/2008, the researcher is Mgr. Luděk Havran, Dr.
- Project GA AS CR IAA400040804 “Applications of electrochemical methods focussed on the microanalyses of nucleic acid bases and oligonucleotides”, 1/2008–12/2010, the researcher is RNDr. František Jelen, CSc.

b) Projects in which the Institute is also involved:

- Project of AS CR KAN200200651 “Nanoparticle and supramolecular systems for the targeted transport of medication”, 07/2006–12/2010, the researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the researcher on behalf of Institute of Biophysics is prof. RNDr. Viktor Brabec, DrSc. The mission of the institute is the study of interactions of nanopharmaceuticals with biomacromolecules..
- Project GA203/06/1685 “Microanalytical instruments for analyses of biopolymers modified by structural probes”, 1/2006–12/2008, the researcher is Ing. František Foret, CSc., Institute of Analytical Chemistry of AS CR, Brno, the researcher on behalf of Institute of Biophysics is prof. RNDr. Emil Paleček, DrSc.

Results in the nanotechnology areas/cooperation

- There is the cooperation with HVM PLASMA, spol. s r.o., Praha. The company prepares suitable materials with varied treated surfaces and structures with adsorbed protein biofilms used in dentistry for the basic research of adsorption and desorption.
- The objective of the cooperation with Zentiva, a.s., Praha, the potential user of results, is the design, preparation and testing of new systems for the targeted transport of nanopharmaceuticals.

Experts/field

- prof. RNDr. Viktor Brabec, DrSc. – molecular biophysics a pharmacology
- doc. RNDr. Miroslav Fojta, CSc. – chemical modifications of nucleic acids and proteins, construction of marked/functional nucleic acids, DNA hybridisation, damaged DNA, interactions of DNA with small molecules, interactions of DNA – protein, interactions of nucleic acids with electrically charged surfaces, development of biosensors, technology of magnetic particles
- Mgr. Stanislav Hasoň, Ph.D. – physics of biopolymers, interactions of biomolecules with surfaces, analysis of surface structures, diffraction optic sensors
- doc. RNDr. Jana Kašpárková, Ph.D. – biochemistry, molecular biology and pharmacology
- doc. RNDr. Stanislav Kozubek, DrSc. – molecular cytology and cytometry, radiation biology, biology of tumours, the Institute Director
- doc. RNDr. Alois Kozubík, CSc. – cytokinetics, cell oncology, metal-based cytostatics, lipid emulsion
- prof. RNDr. Emil Paleček, DrSc.- chemical reactivity of nucleic acids, interactions of DNA with proteins, electrochemistry of proteins and nucleic acids, self-assembled monolayers of DNA and proteins on electrodes
- doc. RNDr. Jiří Šponer, DrSc. – structure, dynamics and molecule interactions of RNA and DNA
- prof. RNDr. Vladimír Vetterl, DrSc. – physics of biopolymers, interactions of biomolecules with surfaces, impedance spectroscopy, nanobiotechnology

4.1.2. Biology Centre of AS CR (BC)

Branišovská 1160/31, 370 05 České Budějovice, I.D. 60077344
www.bc.cas.cz

Brief centre characteristics

The subject of the main activities of the Biology Centre is the scientific research in the areas of general and applied entomology and in related fields, hydrobiology-limnology and related fields, parasitology and related fields, molecular and cell biology, genetics, physiology and plant pathogens, soil zoology, soil microbiology, soil chemistry, soil micromorphology and ecology, and the utilisation of gained knowledge in the protection of nature, environment, in agriculture, water management, forestry and medicine. The Biology Centre was founded on 15 December 2005 by merging research institutes of AS CR in České Budějovice with the Joint Technical-Economic Administration of Biological Workplaces of AS CR, which has changed its name to the Biology Centre of AS CR. The Centre has got the following organisational units:

- Institute of Entomology
- Institute of Hydrobiology
- Institute of Parasitology (Director is prof. RNDr. Tomáš Scholz, CSc.)
- Institute of Plant Molecular Biology (Director is prof. Ing. Josef Špak, DrSc.)
- Institute of Soil Biology
- Technical and Administrative Service

The Director of the Biology Centre of AS CR is prof. RNDr. František Sehnal, CSc. Research activities in the area of bionanotechnologies have been identified in the Institute of Parasitology and in the Institute of Molecular Plant Biology.

4.1.2.1. BIOLOGY CENTRE OF AS CR, INSTITUTE OF PARASITOLOGY

www.paru.cas.cz

Brief Institute characteristics

The Institute develops activities in the fields of protozoology, helminthology and acaroentomology, including studies of some infections transferred by arthropods, and their origins. The main focus deals with the following areas:

- Diversity, phylogenesis and pathogenicity of fish parasites
- Molecular biology and functional genomics of parasite protozoans and eelworms
- Biology of disease carriers and the molecular interactions in pathogen transfers
- Molecular taxonomy, parasite phylogenesis and their coevolution with hosts
- Human and farm animals' parasite protozoans with the stress put on origins of opportunistic diseases

The Institute is divided into 6 departments which are further divided into 13 laboratories. The research in the area of nanotechnologies takes place mostly in the Laboratory of electron microscopy (J. Nebesářová).

Research and development focus

Research in the Institute of Parasitology focuses in 2008 mostly on a single research plan and 3 programme projects. Institute researchers focus, in the area of nanotechnologies and microtechnologies, mostly on the gaining of knowledge about studied objects like, for example, the use of immobilisation techniques for cell components at the electron microscopic level, the search of new processes in immunolocalisation with the use of the scanning electron microscope, having the auto-emission nozzle working in the cryo mode and with the use of low-voltage electron microscopy for biological preparates.

Projects solved in the area of nanotechnologies

- Project GA AS CR 1QS600220501 "Application workplace for the low-voltage electron microscopy used for biological preparations", 1/2005–12/2009, the researcher is Ing. Jana Nebesářová, CSc.
- Cooperation in the solution of the project of the programme of AS CR "Nanotechnology for the Society" KAN200520704 "New nanoparticles for the ultrastructural diagnostics", 01/2007–12/2011, the researcher is doc. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics of AS CR, Praha, the researcher on behalf of the Institute of Parasitology is Ing. Jana Nebesářová, CSc.

Experts/field

- Ing. Jana Nebesářová, CSc. – electron microscopy
- RNDr. Marie Vancová, Ph.D. – immunolocalisation at the electron-microscopic level
- RNDr. Stanislav Hucek, Ph.D. – electron diffraction, high resolution electron microscopy

4.1.2.2. BIOLOGY CENTRE OF AS CR, INSTITUTE OF PLANT MOLECULAR BIOLOGY

www.umbr.cas.cz

Brief Institute characteristics

Research activities of the Institute range from the molecular plant biology to agro-ecological studies. They focus mostly on the genetic plant engineering, molecular genetics and cytogenetics, diagnostics of plant viruses and viroids, and the photosynthesis biophysics and physiology. The Institute also participates in the applied research in the area of vegetable biotechnologies. The Institute is divided into 5 departments:

- Gene manipulations (the leader J. Bříza)
- Molecular cytogenetics (J. Macas)
- Molecular genetics (J. Matoušek)
- Photosynthesis (F. Vácha)
- Plant virology (K. Petrzik)

Research in the area of bionanotechnologies takes place at the limited scale mostly in the Departments of photosynthesis and plant virology.

Research and development focus

Research in the Institute focus, in the period 2005–2010, mostly on the issues of a single research plan containing parts of bionanotechnologies and on 5 programme projects.

- Research plan AV0Z50510513 "Research of the structure of the genetic vegetable information and the pathogens at the molecular level, the induction and analysis of target changes in genome and plastome, and the study of photosynthetic processes and inheritance expressions in the interaction with the environment and pathogens", 1/2005–12/2010, the researcher is prof. Ing. Josef Špak, DrSc., the total costs CZK 216.985 million, thereof CZK 197.549 million from the state budget. The year 2008 – 3.193/3.193, the nomenclature – the area 3, the nanotechnological research share – 10 %.

Subjects of the plan solutions are as follows:

1) The molecular organisation of the plant genome and of chromosomes and the mechanism of gene expression: the sequences of the repetitive DNA genome of tare plants, the genetic and physical mapping; the functioning genomics, transgenosis and the molecular biodiversity of flax and Arabidopsis hops; the analysis of structures and functions of chimeric cell RNA, aberrant RNA and dsRNA in relations with the gene expression; the transformations of genome and plastome for the purpose of studies of gene cores' expression, the function of the photosystem II and the production of foreign proteins.
2) The molecular interactions plant-pathogen: the genome variability, the structure and functions of viruses, viroids and phytoplasma; the mechanism of the gene silencing and the "antisensing"; the development of high performance detection methods of pathogens.
3) The research of photosynthesis: primary processes in the transfer of light energy to energy and chemical bonds; the structure and functions of reaction centres of the complex photosystem II; the exchange of gases and the effect of carbon oxide fixation on the photosynthesis regulation.

Activities in the area of nanotechnologies

The Department of plant virology solves, in the areas of diagnostics and molecular recognition, the problem of the development of biomarkers for the detection of fruit viruses with the use of array technologies.

The Department of photosynthesis studies molecular mechanisms of the photosynthesis and the structure of photosynthetic apparatus. They do the spectroscopy of a single molecule.

Projects solved in the area of nanotechnologies

None has been found.

Experts/field

- prof. Ing. Josef Špak, DrSc. – virology, the Institute Director (spak@umbr.cas.cz)
- doc. RNDr. František Vácha, Ph.D. – biochemistry, biochemistry and biophysics of the photosynthesis, spectroscopy of a single molecule, the kinetic spectroscopy (vacha@umbr.cas.cz)

4.1.3. Institute of Biotechnology of AS CR (BTU)

Vídeňská 1083, 142 20 Praha 4, I.D. 86652036

Brief Institute characteristics

The subject of main activities by the Institute of Biotechnology of AS CR is the scientific research in the area of preparation of transgene production of cell lines, animals and plants, molecular foundations of serious inflammatory, tumorous, and infectious diseases, biochemistry and the biology of cell reproduction, the biology of substance effects on cell functions, the biochemistry of protein interactions, the genetic, cell and protein engineering, and the cell immunology. In this connection, there is the research of bond interactions between proteins developed, the research of diagnostic principles based on polymer chain reaction, interactions of cytokinins with receptors, and the T lymphocyte reactions to vaccination. Subjects of the research are also processes leading to the preparation of recombinant diagnostic and therapeutic proteins. The Institute was founded on 1 January 2008 by separation from the Biotechnological sector of the Institute of Molecular Genetics of AS CR. Together with the personnel, research projects have also transferred to the new institute. The Institute has got currently 6 research laboratories:

- Reproduction medicine diagnostic laboratory – (the leader J. Pěknicová)
- Laboratory of the bonding proteins' engineering – (P. Šebo)
- Autoimmune disease diagnostic laboratory – (Š. Růžičková)
- Laboratory of the molecular therapy – (J. Neužil)
- Laboratory of the chemical genetics – (P. Bartůněk)
- Laboratory of the gene expressions – (M. Kubista)

The authorised Director is Ing. Peter Šebo, CSc.

Research and development focus

In the first year after founding of the Institute of Biotechnology, the attention has been paid to the solution of the research plan AV0Z50520701 **"The building of the Institute of Biotechnology of AS CR"**, 1/07–12/2013, the researcher is Ing. Peter Šebo, CSc., which includes also solution of the problems connected with bionanotechnologies and the solutions of 14 programme projects. The year 2008 – 3.086/3.086, the nomenclature – the area 3, the nanotechnological research share – 10 %.

The main objective of the research plan relates to the building of foundations of this independent Institute of Biotechnology of AS CR. The primary focus will turn on the biotechnology-oriented applied research and development in close cooperation with implementing subjects. The main goal is the achievement of internationally pronounced and economically important application results, especially in the following topics: the diagnostics for the reproduction medicine; the development of recombinant antigens, vaccines, antibodies, and other diagnostics and therapeutics; the development of advanced analytical and preparation methods for practical biotechnological applications; the applied chemical genetics; the preparation of transgene animals.

The Institute coordinates two projects of the programme "Nanotechnology for the Society".

Projects solved in the areas of nanotechnologies

a) Projects solved in the Institute:

- Project of AS CR KAN200520702 **"Nanoimmunity sensors detecting cytokinins"**, 01/2007–12/2011, the researcher is Ing. Peter Šebo, CSc.
- Project of AS CR KAN200520703 **"The use of ultrasound in nanomedicine"**, 01/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc.

Experts/field

- doc. Ing. Jiří Neužil, CSc. – molecular therapy
- Ing. Peter Šebo, CSc. – molecular biology of bacterial pathogens

4.1.4. Institute of Physics of AS CR (FZU)

Na Slovance 2, 182 21 Praha 8, I.D. 68378271
www.fzu.cz

Brief Institute characteristics

The Institute was founded on 1 January 1954 from the Nuclear physics laboratory of CSAV and the Laboratory of experimental and theoretical physics of CSAV, which were established on 1 January 1953. It merged, in 1979, with the Laboratory of low temperature physics and with the Institute of solid matter physics of CSAV, which was founded before WWII as the Research Institute of Škoda Plants. The Institute has become a public research institution on 1 January 2007.

The current research programme covers elementary particle physics, the physics of condensed systems, and the physics of plasma and optics. It focuses mostly on the following areas of research: mathematical physics, quantum thermodynamics, the structure of elementary particles, plasma diagnostics, particle detectors, properties of substances of different kinds and of varied level of arrangement, surfaces and interfaces in solid substances, quantum-size phenomena, quantum liquids, superconductivity, phase interfaces, classical and modern technologies for the preparation of crystals and thin layers, non linear and quantum optics, and special optical equipment.

Research is organised in 5 sections:

- Section of the physics of elementary particles (the leader J. Chýla)
- Section of condensed substances (M. Glogarová)
- Section of the physics of solid substances (A. Šimůnek)
- Section of optics (J. Řídký)
- Section of performance systems (K. Jungwirth)

The Institute Director is prom. fyz. Jan Řídký, CSc.

The sections are divided into 24 research departments, which are further divided to laboratories or groups. Research in the areas of nanosciences (nanophysics) and nanotechnologies involves a large number of research teams. The Institute is a coordination workplace of the "MOSFET" network and the initiator and coordinator of the virtual centre for the physics of nanostructures "Czech Nano-team". The Institute was an initiator of the programme of AS CR "Nanotechnologies for the Society".

Research and development focus

In the period 2005–2010, the research in the Institute of Physics of AS CR focuses mostly on the solution of five research plans, three of which focus, up to a certain level, on nanotechnologies and, in 2008, on the solution of 161 programme projects. Objectives of the solution of the research plans focussing on nanotechnologies are as follows:

AV0Z10100520 **"Specific phenomena in condensed systems with a reduced space dimension and disrupted symmetry"**, 1/2005–12/2010, the researcher is prom. fyz. Milada Glogarová, CSc., the total costs CZK 806.003 million, thereof CZK 805.091 million from the state budget. The year 2008 – 103.146/103.146, the nomenclature – the area 6b, the nanotechnological research share – 100 %.

The subject of activities is the study of dynamic and cooperative phenomena in condensed substances with significantly disturbed symmetry caused by the decreased dimension, defects and irregularities in the space arrangement (thin layers, super matrices, grain boundaries and domains and phases, impurities, clusters, nanocomposites, and liquid crystals). There is studied the effect of electron correlations, additives and non homogeneity on the formation of the electron structure of materials with complicated crystalline structures. The studies also relate to dynamics of dielectric reactions of materials of pronounced dielectric properties, mechanical and structural properties of grain boundaries in selected metal polycrystals and to the phase transformation in intermetallic alloys having the shape memory (high temperature alloys, magnetic alloys, etc.) in the polycrystalline state. There are also studies of the nanocrystalline structures of metallic materials, including the presence of micro tensions and reminding deformations, changes in the matrix parameter and in the structure of grain boundaries, which differs in these materials from the structure of classical polycrystals. There are systems prepared and tested which have important magnetic cooperative properties. The goal of the theoretical part of the plan is the microscopic description of electron and atomic properties of systems, which have a non trivial structure, disrupted symmetry, decreased dimension, or exist in extreme conditions in the state of the thermodynamic balance or outside it. Researchers' work is based on the fundamental theory of electron and atom processes qualitatively described with microscopic models of specific solid substance aspects, but also on applications of the basic theory of the material research, which requires realistic calculations for specific systems. The gained knowledge should become a base for the further development of materials of required properties and of functional materials utilising characteristic changes in their properties initiated by effects of external conditions.

AV0Z 10100521 **"Physical properties and the preparation of nanostructures, surfaces and thin layers"**, 1/2005–12/2010, the researcher is RNDr. Antonín Šimůnek, CSc., the total costs CZK 1051.394 million, thereof CZK 1050.027 million from the state budget. The year 2008 – 135.964/135.964, the nomenclature – the area 6b, the nanotechnological research share – 100 %.

The research plan focuses the main activities on exploratory research of new forms of solid substances the properties and behaviour of which are largely determined by their surfaces or by their nanometric, layer or aperiodic structures. The worldwide research trends of these materials are significantly influenced by successful, or at least promising practical applications, but also by the scale of revealed new physical phenomena. The research of these "modern" materials is possible in this workplace, thanks to good conditions given by the previous successful experimental and theoretical studies of many years which related to semiconductors and magnetic materials. The solution of this research plan presents a purposeful connection of advanced technologies of preparation of the researched materials, unique methods of their experimental studies, within the extensive field of external conditions, and the theoretical processing of the achieved knowledge with the assistance of microphysical theoretical models and the ab initio calculations.

The subject of research activities focuses on the three topical directions (I, II, and III):

I

The study of surfaces, of thin layers' growth and of nanostructures, mostly of silicon and diamond, but also of the scintillation materials, the determination of their microstructures with the nanometric resolution, and the study of microstructure effects on transport and optical properties.

- The research of thin Si layers is focussed on growth of the micro (nano) crystalline Si, especially at low-temperature depositing, the creation of predictive model and its utilisation for the verification of implementation possibilities of non traditional photovoltaic cells, but also the utilisation possibility of utilising these materials in the nanolithography. The Si nanostructures prepared in the form of thin layers from nanoparticles gained by the photochemical etching or implantation of Si ions, e.g. into the Infrasile, are studied with the goal to verify the existence of the optical gain and the consequent preparation of the Si laser for the silicon nanophotonics.
- The subject of the research is the study of surfaces of semiconductors and their reconstruction at the atom level, and the diffusion of adsorbed atoms. There is the STM microscopy utilised and the topographic units are characterised with the local density of electron states in the real space. This decisively determines future applications in nanotechnologies.

The STS spectroscopy will allow the chemical identification of observed objects, which will be interpreted with model and ab initio calculations within the DFT formalism.

- Diamond is prepared in the form of homoepitaxy and heteroepitaxy layers. There are studied the structural, electron and spectroscopic properties in the atom scale and the optic and electric characterising of layers is organised as well as the spectroscopy of defects and additives in diamond layers, including the macroscopic sample characterisation. There are electronic devices (e.g. detectors) and bioactive surfaces for DNA biochips, also biosensors in future, prepared on the basis of diamond layers.
- On the selected scintillation materials, there are studied the energy transmission and capture processes, the stability of materials in conditions of the scintillation conversion, and the effects of material defects. There are the methods of time-differentiated spectroscopy and ERP utilised, especially on monocrystals of complex fluorides and oxides with the wide banned band, including the modelling of dynamics in excited states of luminescence centres.

II

Semiconductors' structures based on AIIIBV compounds, especially the research of nanostructures, systems with the decreased dimension, and dissolved ferromagnetic semiconductors.

The research covers:

- The optimising of structural growth of required parameters prepared by the MBE technologies, or MOVPE.
- Experimental studies of electric, optic and magnetic properties of the samples prepared from these structures. In the case of nanostructures and low-dimension systems, it is mostly about the luminescence spectroscopy and the electron transport, or the magneto-transport and the cyclotron resonance. In the case of ferromagnetic semiconductors, the transport measuring is accompanied with magneto optical experiments and studies of magnetism and the magnetic susceptibility.
- The quantitative theoretical description of phenomena observed within the quantum electrodynamics. In the case of ferromagnetic semiconductors, there is the introduced methodology developed, which is based on the model of magnetic interaction between local added spins mediated by movable carriers in the valence semiconductor band.
- The research of non magnetic nanostructures focuses on future potential applications in optoelectronics. The dissolved ferromagnetic semiconductors will be utilised in the so-called spin electronics (spintronics). The implemented methodology will allow the quantitative modelling of spintronics functions connected with the phenomena like the giant magnetic resistance, by the current induced magnetism change, the Kerr and Faraday rotations, etc. Preliminary researchers indicate that these phenomena could be in the semiconductors of this type stronger by several orders, when compared with the classical metal ferromagnetic materials.

III

Crystal structure, magnetic and transport properties of selected materials.

Research focuses on:

- Layered, nanosegregated and special complex oxides and intermetallic compounds presenting a strong reaction to changes in thermodynamic conditions, which are researched in combined extreme terms, i.e. in very low or very high temperatures, high pressures, and high magnetic fields.
- In nanostructural superconductors, there are experimentally and theoretically studied superconductive whirls and ab initio and model calculations of the electron system structure with a strong electron correlation are done.
- The development of calculation methods related to electron states from the first principles based on the theory of spin density functional, especially the methods suitable for systems with a strong correlation, where the current approaches has not provided for satisfactory agreement between the theory and experiments. In parallel with the electron structure, there is experimentally and theoretically researched the real material structure by diffraction and spectroscopic methods. There are description methods developed for roentgen absorption spectra (XANES) for the purpose of structural cluster analyses (the cluster size, the effects of shapes and cluster surfaces).
- The general meaning of not connected modulation functions in the cases presenting one-dimension modulation on two or up to three-dimension modulations. It has been indicated that the high symmetry of some substances leads consequently to the occurrence of several modulation vectors.
- The implementation of a general multiphase description of material structure analyses consisting of more phases.

The research activities on the mentioned materials, done at the atom level, should allow, together with theoretical models and calculations, not only the analysis and interpretation of experiment data, but also the prediction of physical properties of the studied systems. There are new possibilities for the solid substance physics opening by putting the Czech measuring station, in the synchrotron Elettra in Trieste, into full operations.

AV0Z10100522 **“Wave and particle light spreading, optic materials and technologies”**, 1/2005–12/2010, the researcher is prom. fyz. Jan Řídký, CSc., the total costs CZK 483.909 million, thereof CZK 463.618 million from the state budget. The year 2008 – 42.363/42.363, the nomenclature – the area 6b, the nanotechnological research share – 70 %.

The plan relates to the study of properties of classical and quantum aspects of the light spreading, of optic materials, layered structures, and optical systems and technologies. In the classical optics, works will focus mostly on the interferometry, holography, the coherent and statistical behaviour of light beams, and on the fractal optics. In the area of quantum optics, there will be different kinds of sources of correlated photon pairs constructed. Works related to the quantum informatics will focus on the measuring of overlaps, fidelity and purity of quantum states. In the case of optical materials, the research of selected multiply doped oxide crystals with high polarisation and of nanostructured optical materials will focus mostly on abnormal behaviour of optic properties in surroundings of phase transition areas. Optical technologies will cover the studies of physical foundations of non traditional optic and optoplasmatic technologies suitable for the preparation of new kinds of functional optic thin layered systems and nanostructures. In the roentgen optics, the works will focus on the crystal optics for the synchrotron radiation.

In relation to nanotechnologies, there are physical properties of thin layers, prepared with the assistance of modified low-temperature plasma technologies, studied. This is mostly about thin layers, multilayer systems and nanostructures determined for the research and applications in optics or optoelectronics. There is the research of basic micromechanical parameters of optic functioning thin-layered systems done as well as the research of nanocomposites, interfaces and nanostructured surfaces. The experimental research will focus mostly on structures prepared on the basis of varied forms of doped carbon or perovskite oxides, including studies of diffusion and adsorption processes on defined surfaces. The research focuses mostly on the following forms of optical materials: crystals, textures, ceramics, thin layers and their systems, interfaces, sub surface layers and surface structures, nanocomposites, nanoparticles and nanoporous systems, the creation of nanocrystalline, nanocomposite and gradient layers of new and perspective materials in the reactive surrounding environment. There are studies and optimising organised of the depositing process with the goal of creation stoichiometric and crystalline layers at low depositing temperatures on large areas of bases (3×3 cm^2) and the thickness of non homogeneity below 10 %. The attention focuses mostly on the C, Ti, Zr, Zn, Al, Fe, BN, Cr, and Si materials.

Projects solved in the areas of nanotechnologies

a) Projects solved in the Institute:

Projects of the programme "Nanotechnologies for the Society"

- KAN400100652 "Structures for spintronics and quantum phenomena in nanoelectronics created with the electron lithography", 7/2007–12/2010, the head researcher is Ing. Ludvík Smrčka, DrSc.
- KAN400100653 "Self-organised magnetic nanostructures", 7/2007–12/2010, the head researcher is Ing. Ján Lančok, Ph.D.,
- KAN300100702 "Creation of nanostructures by X-ray lasers", 01/2007–12/2011, the researcher is Ing. Bedřich Rus, Dr.
- KAN400100701 "Functional hybrid semiconductor and metal nanosystems with organic substances (FUNS)", 01/2007–12/2011, the researcher is RNDr. Bohuslav Rezek, Ph.D.
- KAN200100801 "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy", 01/2008–12/2012, the head researcher is prof. RNDr. Miloš Nesládek, CSc.
- KAN300100801 "Multifunctional metallic bulk materials of the nanocrystalline and ultrafine grain structures", 01/2008–12/2012, the head researcher is prof. Ing. Pavel Lejček, DrSc.
- KAN300100802 "Nanocomposite, ceramic and thin layer scintillators", 01/2008–12/2012, the head researcher is Ing. Martin Nikl, CSc.

Project programmes by MEYS "Basic Research Centres"

- LC 510: "Centre for nanotechnologies and materials for nanoelectronics", 1/2005–12/2009, the researcher is RNDr. Jan Kočka, DrSc.

Projects by GA AS CR

- IAA1010404 “Impact of external fields on small-size electron structures”, 1/2004–12/2008, the researcher is Ing. Jozef Krištofík, CSc.
- IAA1010413 “Nanoscience and nanotechnology with probe microscopy: From phenomena at the atomic level to material properties”, 1/2004–12/2008, the researcher is Ing. Vladimír Cháb, CSc.
- 1QS100100553 “New hybrid magnetic nanocomposite materials for selected applications in medicine, for the magnetic imagining resonance and the magnetic hyperthermy”, 7/2005–12/2008, the head researcher is doc. Ing. Emil Pollert, DrSc.
- IAA100100616 “The electron structure and physical properties of materials for nanoelectronics”, 1/2006–12/2009, the head researcher is RNDr. Václav Drchal, CSc.
- IAA100100622 “Conjugated silicon polymers for resistors in nanotechnologies”, 1/2006–12/2009, the head researcher is RNDr. Josef Zemek, CSc.
- IAA100100632 “Interfaces in nanogranular systems – the impact of high external pressures on magnetic and magnetic-transport properties”, 1/2006–12/2008, the head researcher is RNDr. Zdeněk Arnold, CSc.
- IAA100100718 “Metallodielectric nanostructures for optics”, 1/2007–12/2009, the head researcher is Dr. Ing. Jiří Bulíř, Dr.
- IAA100100719 “The managed preparation of semiconductor quantum dots”, 1/2007–12/2009, the head researcher is doc. Ing. Eduard Hulicius, CSc.
- IAA100100729 “Development of new hybrid deposition techniques for the preparation of thin nanostructural fluoride layers of distinct fluorescence properties”, 1/2007–12/2010, the head researcher is Ing. Ján Lančok, Ph.D.
- IAA200100701 “Magnetic nanocomposites based on 3d-metals for the high-frequency and sensor applications prepared with the assistance of the UHV plasma jet nozzle”, 1/2007–12/2009, the head researcher is Ing. Bc. František Fendrych, Ph.D.
- KJB100100623 “Growth of a nanocrystalline diamond at low temperatures and the bio-activation of the surface”, 1/2006–12/2008, the head researcher is Mgr. Zdeněk Remeš, Ph.D.
- KJB100100701 “New magnetic composite nanoparticles for medical purposes derived from hexagonal ferrite”, 1/2007–12/2009, the head researcher is Ing. Pavel Veverka, Ph.D.
- KJB100100704 “Dimensioned phenomenon in ferroelectrics”, 1/2007–12/2009, the head researcher is Ing. Dmitry Nuzhnyy, PhD
- KJB100100707 “Low-temperature plasma deposition of polycrystalline and nanocrystalline thin oxide layers with the assistance of the hollow cathode system”, 1/2007–12/2009, the head researcher is Mgr. Jiří Olejníček

Projects by GA CR

- GA202/06/0718 “Quantum dots’ engineering”, 1/2006–12/2008, the researcher is Ing. Jiří Oswald, CSc.
- GA202/07/0456 “New materials for spintronics: Computer assisted design of magnetically doped semiconductors”, 1/2007–12/2009, the researcher is RNDr. František Máca, CSc.
- GA202/07/0601 “GaAs and $Ga_{1-x}Mn_xAs$ nanolayer surfaces prepared by the low-temperature molecular epitaxy”, 1/2007–12/2010, the researcher is doc. RNDr. Igor Bystroň, DrSc.

- GEFON/06/E001 “Spin-dependent transport and electron correlations in nanostructures”, 1/2006–12/2009, the head researcher is Ing. Vít Novák, CSc.
- GEFON/06/E002 “Spin coherent transport in quantic nanostructures”, 1/2006–12/2009, the head researcher is Dr. Tomáš Jungwirth, CSc.
- GA202/08/0722 “Physical properties of high-temperature superconductors having nanoscopic defects”, 1/2008–12/2009, the researcher is RNDr. Miloš Jirsa, DSc.

b) <u>Selected projects in which the Institute is also involved:</u>
- Project of AS CR KAN200200651 “Nanoparticle and supramolecular systems for the targeted transport of medication”, 07/2006–12/2010, the head researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the researcher on behalf of the Institute of Physics is doc. Ing. Emil Pollert, DrSc.
- Project of AS CR KAN401770651 “Molecular nanosystems and nanoparts: electric transport properties”, 7/2007–12/2010, the head researcher is Ing. Martin Weiter, Ph.D., Brno University of Technology, Faculty of Chemistry, the researcher on behalf of the Institute of Physics is Ing. Irena Kratochvílová, Ph.D.
- Project of AS CR KAN301370701 “Nanostructural macroscopic systems – preparation technology and characterisation”, 01/2007–12/2011, the researcher is prof. RNDr. Miroslav Hrabovský, DrSc., Palacky University Olomouc, Faculty of Science, the researcher on behalf of the Institute of Physics is Ing. Ivan Gregora, CSc.
- Project of AS CR KAN400480701 “Nanostructures based on carbon and polymers for the use in bioelectronics and in medicine”, 01/2007–12/2011, the researcher is Mgr. Jiří Vacík, CSc., Nuclear Physics Institute of AS CR, Husinec, the researcher on behalf of the Institute of Physics is Ing. Bc. František Fendrych, Ph.D.
- Project of AS CR KAN400720701 “Hierarchy nanosystems for microelectronics”, 01/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the researcher on behalf of the Institute of Physics is Mgr. Zdeněk Hubička, Dr.
- Project MEYS LC06040 “Structures for nanophotonics and nanoelectronics”, 3/2006–12/2010, the head researcher is prof. RNDr. Tomáš Šikola, CSc., Brno University of Technology, Faculty of Mechanical Engineering, the researcher on behalf of the Institute of Physics is RNDr. Antonín Fejfar, CSc.
- Project MEYS, programme “Research Centres” 1M06002 “Optical structures, detection systems and the related technologies for the low-photonic applications”, 3/2006–12/2009, the researcher is prof. RNDr. Miroslav Hrabovský, DrSc., Palacky University Olomouc, Faculty of Science, the researcher on behalf of the Institute of Physics is RNDr. Ondřej Haderka, Ph.D.
- Project GA of AS CR IAA400720619 “New laser-initiated process producing new carbon nanomaterials and nanomaterials incorporating N, B, and Si heteroatoms”, 1/2006–12/2010, the researcher is RNDr. Josef Pola, DrSc., Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, the researcher on behalf of the Institute of Physics is Ing. Miroslav Maryška, CSc.
- Project GA CR GA102/06/0381 “Spintronic applications of ferromagnetic semiconductor nanostructures”, 1/2006–12/2008, the head researcher is doc. RNDr. Jan Voves, CSc., Czech Technical University in Praha, Faculty of Electrical Engineering, the researcher on behalf of the Institute of Physics is RNDr. Miroslav Cukr, CSc.

- Project GA CR GA104/06/0642 “Thin layers of magnetically transported semiconductors A(III)N for applications in the spin electronics”, 1/2006–12/2008, the researcher is prof. Ing. David Sedmidubský, Dr., University of Chemical Technology in Praha, Faculty of Chemical Technologies, the co-researcher on behalf of the Institute of Physics is Ing. Jiří Hejtmánek, CSc.
- Project GA CR GA/202/07/0818 “Silicon nanophotonics – from individual nanocrystals to photonic structures”, 1/2007–12/2009, the researcher is doc. RNDr. Jan Valenta, Ph.D., Charles University in Praha, Faculty of Mathematics and Physics, the researcher on behalf of the Institute of Physics is RNDr. Kateřina Herynková, Ph.D.
- Project GA CR GA203/07/0546 “Laser disintegration of cobalt and nickel carbonyls at the presence of acetylene for the preparation of metallic nanoparticles coated with carbon”, 1/2007–12/2009, the researcher is RNDr. Radek Fajgar, CSc., Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, the researcher on behalf of the Institute of Physics is RNDr. Miroslav Maryška, CSc.

c) <u>Projects of the international cooperation:</u>

Projects by EU:

- 2004-005567 “Synthesis of orbital magnetism of plastic nanoparticles” (2004–2008), the researcher is RNDr. Zdeněk Frait, DrSc.
- CT-04-512224 “Research of diamond interfaces for all-round electronics” (2004–2008), the researcher is RNDr. Milan Vaněček, CSc.

Programme COST:

- OC 101 “Nanoscopic ferroelectrics and their spectroscopic characterising”, 3/2006–12/2009, the head researcher is RNDr. Přemysl Vaněk, CSc.
- OC 137 “Transport of charge carriers in solid molecular substances and nanoparts”, 3/2006–12/2010, the head researcher is Ing. Irena Kratochvílová, Ph.D.
- OC08030 “Electromagnetic treatment of nanostructured materials based on 3d metals”, 1/2008–12/2009, the researcher is Ing. Bc. František Fendrych, Ph.D.

Programme Kontakt:

- ME 866 **“Synthesis and research of new semiconductor structures of quantum dots”**, 3/2006–12/2010, the head researcher is RNDr. Karel Král, CSc.
- ME08109 **“Dynamic nano-clusters in polar perovskites”**, 1/2008–12/2012, the researcher is Ing. Jiří Hlinka, Ph.D.

Experts/field

- prof. RNDr. Igor Bartoš, DrSc. – theory of surfaces and interfaces
- RNDr. Miroslav Cukr, CSc. – MBE technology
- RNDr. Václav Drchal, CSc. – theory of magnetic semiconductors
- RNDr. Antonín Fejfar, CSc. – probe microscopy, nanocrystalline materials, thin layers of semiconductors for solar cells
- Ing. František Fendrych, Ph.D. – depositing of nanogranular magnetic layers, magnetoresistance, spin-dependent tunnelling of electrons

- doc. Ing. Eduard Hulicius, CSc. – quantum-size semiconductor structures, the epitaxial semiconductor technology, especially MOVPE
- Ing. Alice Hospodková, Ph.D. – MOVPE technology of nanostructures, quantum wells and dots
- Ing. Vladimír Cháb, CSc. – semiconductor surfaces at the atom level, the characterising and calculations
- RNDr. Tomáš Jungwirth, CSc. – spintronics, nanoelectronics, theory of the Hall phenomenon
- Ing. Miroslav Jelínek, DrSc. – thin layers, laser depositing, laser applications
- RNDr. Jan Kočka, DrSc. – multifunctional materials in the areas of non crystalline semiconductors with the stress put on the nanotechnology and silicon nanoelectronics
- RNDr. Miroslav Kotrla, CSc. – theory of surface processes of growth, the methodology of numeric simulations
- RNDr. Karel Král, CSc. – the quantum theory of solid substances, the quantum transport in nanostructures, quantum calculations
- Ing. Luděk Kraus, CSc. – nanomagnetic materials
- RNDr. Jiří J. Mareš, CSc. – transport properties of low-dimension semiconductor nanostructures
- Ing. Jiří Oswald, CSc. – luminescence of low-dimension semiconductor nanostructures
- prof. RNDr. Ivan Pelant, DrSc. – optic properties of nanocrystalline semiconductors, especially of silicon
- RNDr. Jan Petzelt. DrSc. – dielectrics, ferroelectrics, the infrared and Raman spectroscopy
- doc. Ing. Emil Pollert, DrSc. – nanomagnetic materials for the use in medicine
- Ing. Ludvík Smrčka, DrSc. – spintronics, theory of low-dimension structures
- Ing. Pavel Středa, DrSc. – theory of low-dimension structures and of the Hall phenomenon
- RNDr. Antonín Šimůnek, CSc. – electron states in the bulk and on the surface of solid substances and nanostructures
- RNDr. Milan Vaněček, CSc. – preparation and characterising of diamond and nano-diamond layers
- RNDr. Zdeněk Výborný, CSc. – lithography and nanolithography

4.1.5. Institute of Physiology of AS CR (FGU)

Vídeňská 1083, 142 20 Praha 4, I.D. 67985823

www.biomed.cas.cz/fgu

Brief Institute characteristics

The Institute was founded on 1 January 1954. It was based on the Department of physiology established in 1953 within the then Institute of Biology of CSAV. The Institute has become a public research institution on 1 January 2007.

The Institute focuses in its role of a workplace of the basic biomedicine research on the following main topics:

- In the neurophysiology, it deals with a spectrum of problems ranging from mechanisms of neuro-transferors releasing to their membrane receptors to the regulation of body functions at the level of the whole organism
- In the cardiovascular physiology, it focuses on the development aspects of the contractile function of myocardium, experimental hypertension and the epithelium physiology with special considerations of the protein and cell membrane roles and on the search of suitable genetic markers of some socially serious diseases (e.g. hypertension, diabetes, etc.)
- In the molecular and cell physiology, it solves problems related to the cell metabolism, transmission of the signals and the transport of substances with the high contents of energy with the goal of contributing to the clarification of cell processes and of the intercellular interactions.

Research activities of the Institute are divided into 25 departments. The research belonging to the area of bionanotechnologies, thanks to its focus, is done especially in the following departments:

- Department of the analysis of biologically important substances (the leader I. Mikšík)
- Department of protein structures (J. Teisinger, CSc.)
- Department of cell populations' growth and differentiation (L. Bačáková)
- Department of biomathematics (L. Kubínová)

The Institute Director is RNDr. Jaroslav Kuneš, DrSc.

Research and development focus

Research in this Institute focuses, in the period 2005–2010, mostly on issues of the research plan AV0Z50110509 **"Research of molecular and cell foundations of physiological and pathophysiological processes with the objective to clarify mechanisms of creation of serious human diseases"**, 1/2005–12/2010, the researcher is RNDR. Jaroslav Kuneš, DrSc. The year 2008 – 40.482/40.482, the nomenclature – the area 3, the nanotechnological research share – 30 %. The Institute solves 101 programme projects in 2008.

The objective of the research plan is the gain of new knowledge about physiological and pathophysiological processes at the levels of molecules, cells, organs, and the whole organism. The knowledge should deepen the understanding of the theoretical base of human medicine. At the levels of molecular and cell physiology, there is the relation studied between the structure and function of the key regulation molecules, the metabolism, the energy cell metabolism, the transport functions of cell membranes, mechanisms of the fast signal transmission between cells and inside cells, and the genetic determination of these functions. At the level of organs and systems, there are development aspects of the obesity causes researched as well as the causes of atherosclerosis and hypertension, heart functions and functions of the vascular system, and integrative functions of the nerve system. The results should contribute to the clarification of pathogenesis of serious metabolic, cardiovascular and nerve human diseases with the goal of improving their diagnostics and searching for new efficient therapies and prevention. The research plan contains selected areas of bionanotechnologies and nanomedicine.

Research in FGU focuses in the area of bionanotechnologies, for example, on:

- Studies of adhesion, growth, differentiation, survival, and immunity activating cells (especially in veins and bones) in cultures on artificial stable and degradable materials for tissue replacements
- Impacts of material nanostructures and microstructures on the cell behaviour
- Innovation of the existing bone and vein replacements (e.g. the improvement of the integration of composite joint replacements in cooperation with Beznoska, s.r.o., the reconstruction of tunica intima and the medium on vein prostheses manufactured in VÚP, a. s. Brno)
- Construction of own bio-artificial vein, valve and bone replacements
- Systems of medicine deliveries to vein auto-transplants
- Microstructured surfaces for the regionally selective cell adhesion for the tissue engineering and biotechnologies (e.g. microarrays)
- Confocal and two-photon microscopy: the data analysis, application of modern fluorescence methods and the method of two-photon microscopy, calibration measuring
- New methods identifying and quantifying physiologically important substances
- Cell interactions with hard biocompatible layers constructed of carbon nanoparticles (nanodiamonds, fullerenes, nanotubes), with composites polymer-nanotubes for the construction of 3D scaffolds for bone replacements and with composites polymer--polymer-ceramic nanoparticles
- Interactions of vein and bone cells with constructs of nanofibres manufactured by ELMARCO Liberec and TU Liberec
- The covering of vein prostheses with nanostructured layers of protein molecules and their endothelialisation
- Construction of systems for the targeted medicine deliveries to veins with the assistance of nanofibre carriers
- Utilisation of nanofibres for valve constructions
- Interactions of cells with materials of the hierarchy-organised micro and nano structure imitating the architectonic principle of physiological tissues

Projects solved in the area of nanotechnologies

a) Projects solved in the Institute:

- Project GA of AS CR 1QS500110564 "New hybrid bio-artificial vascular substitutes by the tissue engineering methods", 7/2005–12/2009, the researcher is MUDr. Lucie Bačáková, CSc.
- Project GA CR GA204/06/0225 "Adhesion, growth and differentiation of bone and vascular cells on carbon allotropes", 1/2006–12/2008, the researcher is MUDr. Lucie Bačáková, CSc.

b) Selected projects in which the Institute is also involved:

- Project MEYS, the programme "Basic Research Centres", LC066063 "Fluorescence microscopy in the biological and medical research", 3/2006–12/2010, the researcher coordinator is doc. Martin Hof, Dr. rer. nat., the researcher on behalf of FGU is RNDr. Lucie Kubínová, CSc.

- Project GA CR GA106/06/1576 “Porous composite materials with the polyamide lining and the siloxane matrix with nano-hydroxyapatite as biomaterials”, 1/2006–12/2008, the researcher is Ing. Karel Balík, CSc., Institute of Rock Structure and Mechanics of AS CR, Praha, the researcher on behalf of FGU is MUDr. Lucie Bačáková, CSc.
- Project of AS CR, the programme “Nanotechnology for the Society”, KAN101120701 KAN101120701 “Nanocomposite layers and nanoparticles created in the low pressure plasma for surface modifications”, 01/2007–12/2011, the head researcher is prof. RNDr. Hynek Biederman, DrSc., Charles University in Praha, Faculty of Mathematics and Physics, Praha, the researcher on behalf of FGU is MUDr. Lucie Bačáková, CSc.
- Project of AS CR, the programme “Nanotechnology for the Society” KAN400480701 “Nanostructures based on carbon and polymers for the use in bioelectronics and in medicine”, 01/2007–12/2011, the researcher is Mgr. Jiří Vacík, CSc., Nuclear Physics Institute of AS CR, Husinec, the researcher on behalf of FGU is MUDr. Lucie Bačáková, CSc.
- Project by the Ministry of Health No. NR9358-3 “Local medicine inhibition of the neointimal proliferation of vein grafts after the interposition to the abdominal aorta in a brown rat”, 1/2007–12/2009, the head researcher is MUDr. Ivo Skalský, IKEM Praha, the researcher on behalf of FGU is MUDr. Lucie Bačáková, CSc.

Results in the area of nanotechnologies/cooperation

- Cooperation with the manufacturing and clinical spheres (Beznoska, s.r.o, Kladno; VÚP, a. s., Brno; Synthesia, a.s., Pardubice, ELMARCO, s.r.o.; Liberec, IKEM Praha; the Bulovka Hospital, Praha),
- The patent application “The way of preparation of regulated fibrin layers on solid surfaces”, the authors are Eduard Brynda, Tomáš Riedel, Jan Dyr, Milan Houska, Lucie Bačáková, Elena Filová, Jaroslav Chlupáč, Petr Lesný, Pavla Jendelová, and Eva Syková.

Experts/field

- MUDr. Lucie Bačáková, CSc., the Manager of the Department of cell populations’ growth and differentiation. There are the following experts, involved in nanotechnologies, working in this Department:
    - Mgr. Elena Filová: vein cells on defined nanostructured molecular protein layers, the extra cellular matrix, synthetic degradable polymers functionalised by the adhesive oligopeptides, space bioresorbed scaffolds for the tissue engineering, the development of extra vascular system for the deliveries of anti proliferation substances to veins
    - MUDr. Jaroslav Chlupáč: the practical use of molecular protein layers for the innovation and endothelialisation of clinically used polyethylenterephtalate vein prostheses manufactured in VÚP Brno
    - Mgr. Lubica Grausová: interactions of bone cells with materials modified by carbon nanoparticles
    - Mgr. Martin Pařízek: Microstructured materials for the regional-selective adhesion of cells, cellulose-based materials as potential cell carriers
    - Mgr. Marta Vandrovcová: bone cells on hard biocompatible nanostructured layers carbon-titanium, on TiO_2 layers, on polymer composites with ceramic nanoparticles.

4.1.6. Institute of Microbiology of AS CR (MBU)

Vídeňská 1083, 142 20 Praha 4, I.D. 61388971
www.biomed.cas.cz

Brief Institute characteristics

The Institute's foundations were built in 1950 by the creation of the Department of microbiology in the then Central Biology Institute, which became, after the establishment of CSAV, the Institute of Biology of CSAV on 1 January 1953. The Institute of Biology of CSAV was divided, on 1 January 1962, into several independent institutes. Some of its departments and laboratories became the Institute of Microbiology of CSAV. The Institute has become a public research institution on 1 January 2007.

The subject of activities by the Institute of Microbiology of AS CR is the scientific research in the areas of physiology, biochemistry and genetics of microorganisms, molecular biology and molecular microbiology, the studies of microbial products and their creations, the research of biodegradable activities by microorganisms, and of symbiotic relations of biological models, including the development of new biotechnological processes. Research activities take place in 5 sectors:

- Biogenesis and biotechnology of natural substances (the leader M. Flieger)
- Cell and molecular microbiology (J. Nešvera)
- Ecology (F. Nerud)
- Immunology and gnathology (B. Říhová)
- Autotroph microorganisms (O. Prášil)

The Institute Director is RNDr. Martin Bilej, DrSc.

The sectors are divided into 29 laboratories. Research works in the area of bionanotechnologies take place especially in the Laboratory characterising molecular structures (V. Havlíček), in the Laboratory of biotransformation (V. Křen), in the Laboratory of tumour immunology (M. Kovář), and in the Laboratory of proteins' architecture (K. Bezouška).

Research and development focus

In the period 2005–2010, the research focuses on the issues of a single research plan and, in 2008, on the solution of 148 programme projects.

Research plan AV0Z50200510 **"Microorganisms in research and biotechnologies"**, 1/2005–12/2010, the researcher is prof. RNDr. Blanka Říhová DrSc., the total costs CZK 1624.775 million, thereof CZK 1551.887 million from the state budget. The year 2008 – 38.530/38.530, the nomenclature – the area 3, the nanotechnological research share – 20 %.

Works focus on genomics, proteomics, bioinformatics, physiology, stress factors, differentiation, morphology, phylogenesis and ecology of microorganisms, including their biodegradable activities, and on mechanisms of their long-term adaptation to unfavourable conditions. There are also studied biotransformations and the recombinant and transgene microbe technologies. Breeding and molecular genetic methods prepare recombinant microorganisms and there are their products obtained in semi-operations. In the case of algae and bacteria, there are studied the molecular mechanisms of photosynthesis processes and the phototrophic and heterotrophic reproductions. There are also molecular aspects of bacterial pathogenicity analysed, the inborn and gained immune reactions of conventional and microbe-free animals and their regulation within physiologically and pathologically changed conditions. The attention is paid to the study of the possible influencing of auto-immune reactions and tumorous diseases, vaccine preparations, anticancer medicine and immunotherapeutics.

Some works belong to the area of nanotechnologies, especially to nanobiotechnologies and nanomedicine like, for example:

- Preparation of organic-metallic nanocomposites based on soluble exopolysaccharides, Al, Fe, Cu, and Cd (M. Flieger)
- The targeted transport of medicine – anticancer medicine covalently bound to a polymer carriage (B. Říhová)
- Development of electrochemical biosensors for the detection of herbicides (J. Masojídek)
- Genetic modification of restrictive-modification enzymes of the type I for their utilisation in nanobiotechnologies – a molecular motor, a part of biosensors (M. Weiserová)

Projects solved in the area of bionanotechnologies

a) Projects solved in the Institute:

Project programme "Nanotechnology for the Society":

- KAN200200651 "Nanoparticles and supramolecular systems for the targeted transport of medicine", 07/2006–12/2010, the researcher is prof. RNDr. Blanka Říhová, DrSc.

Project programme by MEYS "Basic Research Centres"

- LC06010 "Centre of biocatalysis and biotransformation", 3/2006–12/2010, the researcher is doc. Ing. Vladimír Křen, DrSc.

b) Selected projects in which the Institute is also involved:

- Project of AS CR KAN200520702 "Nanoimmunity sensors detecting cytokinins", 01/2007–12/2011, the researcher is Ing. Peter Šebo, CSc., Biotechnology Institute of AS CR, Praha, the researcher on behalf of MBU is Ing. Radim Osička, Ph.D.
- Project of AS CR KAN400720701 "Hierarchy nanosystems for microelectronics", 01/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the researcher on behalf of MBU is RNDr. Tomáš Cajthaml, Ph.D.
- Project MEYS 1M0505 "Centre of targeted therapeutics", 1/2005–12/2009, the researcher is doc. MUDr. Vladimír Viklický, CSc., Nuclear Research Institute, a.s., Husinec – Řež, the researcher on behalf of MBU is prof. RNDr. Blanka Říhová, DrSc.
- Project MEYS 1M0506 "Centre of molecular and cell immunology", 1/2005–12/2009, the researcher is prof. RNDr. Václav Hořejší, CSc., Institute of Molecular Genetics of AS CR, Praha, the researcher on behalf of MBU is Ing. Peter Šebo, CSc.

Experts/field

- prof. RNDr. Blanka Říhová, DrSc. – immunity system and the genetic regulations of the production of antibodies, tumour diseases
- RNDr. Marie Weiserová, CSc. – bionanotechnology, molecular motors
- doc. RNDr. Karel Bezouška, CSc. – molecular biology

- RNDr. Miroslav Flieger, CSc. – genetics and the physiology of microorganisms and the analytical chemistry

4.1.7. Technology Centre of AS CR (TC)

Rozvojová 135, 165 02 Praha 6, I.D. 60456540
www.tc.cz

Brief centre characteristics

Technology Centre of AS CR is an association of legal persons – 5 institutes of the Academy of Sciences of CR (they are: Institute of Physics of AS CR, Institute of Microbiology of AS CR, Institute of Chemical Process Fundamentals of AS CR, Institute Plasma Physics of AS CR, and the Institute of Molecular Genetics of AS CR) and Technology management s.r.o.

The Director of TC is Ing. Karel Klusáček, Ph.D., MBA.

The Technology Centre is the researcher of the MEYS project OK468 "National Information Centre for the European Research – NICER", 1/2006–12/2009. It provides, through its team of National Contact Points (NCP), information and consulting to Czech institutions about framework EU programmes, but it also monitors the Czech participation in these programmes for the needs of the Czech state administration or for the needs of the European Commission and it develops publishing activities, especially within its ECHO magazine and VADEMECUM series of books oriented on the framework programmes.

The project NICER is closely extended by another project of the Technology Centre OK08005 "Czech Liaison Office for Research and Development – CZELO", 1/2008–12/2012. CZELO headquarters are in Brussels and its goal is the support of the successful involvement of the Czech research in the European cooperation. TC prepares studies and projects focussing on the preparation of materials for strategic documents at the national and regional levels. They are mostly analytical and feasibility studies for the state administration, for the coordination of national projects of the foresight type in the areas of research, development and innovations, and the preparation of regional innovation strategies. The published ERGO magazine focuses on analyses and trends in research, technologies and innovations.

TC is one of the founding members of the association "Technological Innovation Centre CKD Praha", which prepared and is coordinating the project of reconstruction of the former manufacturing hall of CKD to become the Innovation Centre and the Incubator of Entrepreneurs in Praha 9.

Activities in the area of nanotechnologies/nanomaterials

- Information activities, consulting and monitoring with priorities of NMP of the 7th FP
- Preparation of studies from different areas of nanotechnologies and their applications
- Support of the international cooperation in the area of nanosciences and nanotechnologies
- Promotion of nanotechnologies
- Support of nanotechnology lecturing

Projects solved in the area of nanotechnologies

- Project of the 7th FP "FramingNano – International multi-stakeholder dialogue platform framing the responsible development of Nanosciences and Nanotechnologies", 2008–2009, the Technology Centre is a partner. See www.framingnano.eu.

- Project of the 7th FP "ObservatoryNANO – European observatory for science-based and economic expert analysis of nanotechnologies, cognisant of barriers and risks, to engage with relevant stakeholders regarding benefits and opportunities", 2008–2011, the Technology Centre is a partner.
- Czech project of the Operating Programme OP RLZ "Preparation of the new multidisciplinary course – NANOTECHNOLOGY", 6/2006–6/2008, the coordinator is doc. RNDr. Jitka Kubátová, CSc.

The objective of the project is the preparation of a single semester multidisciplinary course "Nanotechnology", including the textbook for the students in bachelor courses and the implementation of this course in four faculties of Czech universities which are the project partners.

Partners:

- Faculty of biomedicine engineering of CVUT in Praha
- Faculty of mechanical engineering VUT in Brno
- Faculty of science of the Palacky University Olomouc
- Faculty of mechanical engineering of the Technical University in Liberec
- Czech Society for New Materials and Technologies

Experts

- doc. RNDr. Jitka Kubátová, CSc. – information activities, consulting, coordination activities, promotion and international cooperation in the field of nanotechnologies
- Mgr. Alexandr Prokop – the National Contact Point (NCP) for the NMP priority (nanotechnology, materials, and the manufacturing technology), the 7th Framework Programme of EU: information activities, consulting, coordination activities, promotion and international cooperation
- Ing. Rudolf Fryček, Ph.D. – the national expert on the nanotechnology in DG Research of the European Commission
- MUDr. Jiří Vaněček, DrSc. – expertise in nanobiotechnologies

4.1.8. Institute of Analytical Chemistry of AS CR (UIACH)

Veveří 97, 602 00 Brno, I.D. 68081715
www.iach.cz/uiach

Brief Institute characteristics

The Institute was founded from the Laboratory for gas analyses of CSAV founded on 1 January 1956 and reorganised on 1 January 1966 to become the Institute of Instrumental Analytical Chemistry of CSAV. The name was changed to the Institute of Analytical Chemistry of CSAV on 1 January 1974. The Institute has become a public research institution on 1 January 2007.

Main activities of the Institute are based in the area of the methodology of capillare separation methods of the analytical chemistry. Research focuses on the bioanalysis, chiral substances, trace elements, and the environment. The separation techniques developed in the Institute include electromigration methods (isotachophoresis, zone electrophoresis, and isoelectric focussing), the fractionation by the field flow, liquid chromatography, super critical fluid chromatography, and the extraction by pressurised liquids. The Institute is also involved in the development and application methods of the analytical atom and mass spectrometry. The Institute is divided into 7 scientific departments:

- Bioanalytical instrumentations (the leader F. Foret)
- Electromigration methods (R. Boček)
- Analysis of the environment (Z. Večeřa)
- Separation in the liquid phase (K. Šlais)
- Proteomics and glycemics (J. Bobálová)
- Super critical liquid extraction and chromatography (M. Roth)
- Trace element analysis (the workplace in Praha – J. Dědina)

The Institute Director is doc. RNDr. Ludmila Křívánková, CSc.

Research and development focus

In the period 2005–2010, research focuses on the issues of a single research plan and, in 2008, on solutions of 28 programme projects.

Research plan AV0Z40310501 **“Modern analytical techniques in bioanalysis, ecology and nanotechnology”**, 1/2005–12/2010, the researcher is doc. RNDr. Ludmila Křivánková, CSc., the total costs CZK 340.241 million, thereof CZK 334.830 million from the state budget. The year 2008 – 16.958/16.958, the nomenclature – the area 7a, the nanotechnological research share – 40 %.

The plan objective is the gaining of theoretical and practical knowledge from the area of analytical chemistry for the use in also other fields, especially in bioanalysis (e.g. genomics, proteomics), ecology and in nanotechnologies. The attention is paid to the development of theoretical principles, instrumentation and applications of progressive separation and spectroscopic methods in the analytical chemistry. The separation branch of the research covers methods using separation of an electric field as a driving force as well as the sorption, liquid flows and the density dependency of its solvation ability, the field force or chemical reactions and their mutual combinations. The spectroscopic branch covers the mass spectrometry, atom spectroscopy and optic detection techniques, including new colour and fluorescence standards used in separation methods. The results should be, apart from new basic knowledge, applications for medicine, the protection of the environment, the food production, and for the preparation of highly pure materials.

Research Activities in the area of nanotechnologies

Many problems, which are solved by the above-presented departments, are related to the areas of nanoanalytics, bionanotechnologies and nanomedicine, even if they are not called as such. Research activities in the area of nanotechnologies focus on the microfluidity, fluorescence detection with the use of quantum dots, nanostructured surfaces for biosensors, the connection of microfluidity with the mass spectrometry, monolithic nanostructured materials, enzymatic microreactors utilising the immobilisation on surfaces of microchannels, polymer monoliths and magnetic nanoparticles, bioanalysis, etc.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN400310651 "Nanotechnology for the protein and genic diagnostics", 8/2007–12/2010, the head researcher is Ing. František Foret, CSc.
- Project of GA CR GA203/08/1680 "Nanotechnology in the functioning diagnostics of apoptotic and tumorous cells", 1/2008–12/2011, the researcher is Ing. Karel Klepárník, CSc.

Results in the area of nanotechnologies/cooperation

UIACH cooperates with the Institute of Biophysics of AS CR in Brno (prof. RNDr. Emil Paleček, DrSc., with the Currie Institute, Paris (prof. J. L. Viovy) and with the Dublin City University, Dublin (Dr. M. Macka).

Experts/field

- Ing. František Foret, CSc. – microfluidity, bioanalysis, laser detection connected with the mass spectrometry, and detection nanostructures
- Ing. Karel Klepárník, CSc. – microfluidity, bioanalysis, laser detection connected with the mass spectrometry, and detection nanostructures

4.1.9. Institute of Inorganic Chemistry of AS CR (UACH)

Husinec – Řež 1001, 250 68, I.D. 61388980

www.iic.cas.cz

Brief Institute characteristics

The Institute was founded on 1 January 1959 from the Laboratory of inorganic chemistry, which was founded on 1 April 1956. The current workplace was founded by merging with the former Institute of Inorganic Syntheses of CSAV, which took place on 1 March 1972. The Institute has become a public research institution on 1 January 2007. The Institute is involved in the basic research within inorganic chemistry, bordering fields of inorganic chemistry and physics of the solid phase, the ecology and the basic research within the bioinorganic chemistry. Research activities are conducted in 3 departments and 3 joint laboratories:

- Department of solid substances and intercalation compounds chemistry (the leader J. Šubrt)
- Department of syntheses (Z. Černý)
- Department of kinetics (K. Lang)
- Joint laboratory of low temperatures (together with the Institute of Physics of AS CR and the Faculty of Mathematics and Physics, Charles University in Praha)
- Inorganic materials laboratory (together with the University of Chemical Technology Praha, L. Němec)
- Laboratory for material research of pieces of arts (together with the Academy of Creative Arts, Praha)

The Institute Director is Ing. Jana Bludská, CSc.

Research and development focus

In the period 2005–2010, the research focuses on solution of a single research plan with partial tasks focussed on nanotechnologies. It solves 50 programme projects in 2008.

Research plan AV0Z40320502 **"Design, synthesis and characterising of clusters, composites, complexes and other compounds based on inorganic substances; mechanisms and kinetics of their interactions"**, 1/2005–12/2010, the researcher is Ing. Jana Bludská, CSc., the total costs CZK 404.898 million, thereof CZK 385.404 million from the state budget. The year 2008 – 14.065/14.065, the nomenclature – the area 1, the nanotechnological research share – 30 %.

The research plan relates to the design and preparation of composite and crystalline materials of defined particle sizes, borane clusters, special glasses, organometallic and intercalation compounds with properties targeted on the use in optoelectronics, magnetooptics, photocatalysis, medicine, and ecology. It covers static and kinetic approaches with the goal of defining the structure, reactivity and other properties of prepared substances. The non covalent interactions of metallic complexes are utilised for the molecular recognition. The description of interactions of crystalline and gaseous phases with solutions and melts will provide the know-how for new technologies.

Research focussing on nanotechnologies

The research in the area of nanotechnologies takes place especially in the Department of solid substances and intercalation compounds chemistry. This relates to the following:

- Synthesis of nanocomposites based on metal oxides' nanoparticles in the SiO_2 matrix by the sol-gel method. Characterising of structures, magnetic and optic properties of these materials.
- Synthesis of binary and multi element metal oxides' nanoparticles by the method of homogenous precipitation of watery solutions. The prepared materials are tested as photocatalysts and catalysts of detoxication (the disintegration into not toxic products) of chemical weapons.
- Synthesis, characterising and applications of "sandwich" pigments having the barrier anti-corrosion effects on the basis of mica covered with nanoparticles of metal oxides.
- Characterising of nanostructures created by the laser-initiated chemical reactions.
- Research of porphyrin nanostructures, their preparation and chemical and photophysical properties.
- Synthesis and characterising of gold nanoparticles and of other rare metals modified on their surfaces by the isotope 10B in a carbon skeleton for the use in the neutron treatments of tumour diseases.

There has been the only high resolution transmission electron microscope (HR-TEM) by JEOL in the Czech Republic in the Institute since April 2005.

Projects solved in the area of nanotechnologies

a) Projects solved in the Institute:

- Project MIT 1H-PK2/56 "Nanodispersive Ti, Fe, Al, Zn, and Zr oxides and hydroxides for the destruction of chemical weapons", 4/2005–12/2009, the researcher is RNDr. Snejana Bakardjieva, Ph.D.

- Project MIT FI-IM3/061 “Preparation of conducting and semiconducting polymers doped with carbon based nanoparticles and nanotubes”, 5/2006–12/2009, the researcher is Mgr. Václav Štengl, Ph.D.
- Project MIT FI-IM5/231 “Implementation of new nanostructures of nanodispersive Ti, Cd, and Zn oxido-bisulphides as the active materials for the degradation of chemical weapons”, 2008, the researcher is RNDr. Snejana Bakardjieva, Ph.D.

b) <u>Selected projects in which the Institute is also involved:</u>

Projects of the programme “Nanotechnology for the Society”:

- KAN100500651 “Preparation and studies of organic-inorganic nanocomposite material properties prepared in situ by the emulsive polymerisation”, 07/2006–12/2009, the head researcher is Ing. Zdeňka Sedláková, CSc., Institute of Macromolecular Chemistry of AS CR, the researcher on behalf of UACH is Ing. Kamil Lang, CSc.
- KAN400100653 “Self-organised magnetic nanostructures”, 7/2007–12/2010, the head researcher is Ing. Ján Lančok, Ph.D., Institute of Physics of AS CR, Praha, the researcher on behalf of UACH is Ing. Adriana Lančok, Ph.D.
- KAN300430651 “Nanocrystallisation of plasma coatings based on eutectic ceramic mixtures”, 7/2006–12/2009, the head researcher is Ing. Tomáš Chráska, Ph.D., Institute of Plasma Physics of AS CR, Praha, the researcher on behalf of UACH is doc. Ing. Jiří Hostomský, CSc.
- KAN400480701 “Nanostructures based on carbon and polymers for the use in bioelectronics and in medicine”, 01/2007–12/2011, the researcher is Mgr. Jiří Vacík, CSc., Nuclear Physics Institute of AS CR, Husinec – Řež, the researcher on behalf of UACH is Mgr. Tomáš Baše, Ph.D.
- KAN100400702 “Nanostructural materials for the catalytic, electrocatalytic and sorptive applications”, 01/2007–12/2011, the head researcher is prof. RNDr. Zdeněk Samec, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the researcher on behalf of UACH is Ing. Ivo Jakubec, CSc.
- KAN300100802 “Nanocomposite, ceramic and thin layer scintillators”, 01/2008–12/2012, the head researcher is Ing. Martin Nikl, CSc., Institute of Physics of AS CR, Praha, the researcher on behalf of UACH is Ing. Ivo Jakubec, CSc.

Other projects

- Project of AS CR 1QS401250509 “Ceramic materials of the hierarchy porous structure for the membrane separation technologies”, 1/2005–2/2008, the head researcher is doc. Ing. Bohumil Bernauer, CSc., Institute of Chemical Technology Praha, Faculty of Chemical Technology, the co-researcher on behalf of UACH is RNDr. Milan Kočiřík, CSc.
- Project GA of AS CR IAA400720619 “New laser-initiated process producing new carbon nanomaterials and nanomaterials incorporating N, B, and Si heteroatoms”, 1/2006–12/2010, the researcher is RNDr. Josef Pola, DrSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the researcher on behalf of UACH is RNDr. Snejana Bakardjieva, Ph.D.
- Project GA CR GA104/07/1093 “Preparation of composite nanoparticles by the aerosol process”, 1/2007–12/2010, the head researcher is Ing. Pavel Moravec, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of UACH is RNDr. Snejana Bakardjieva, Ph.D.

- Project GA CR GA104/07/1400 “Depositing of oxide catalysts for the VOC oxidation on shaped carriers and their modification by nanoparticles of precious metals”, 1/2007–12/2009, the head researcher is Ing. Květa Jirátová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of UACH is RNDr. Tomáš Grygar, CSc.
- Project GA CR GA203/06/1368 “Preparation and studies of amorphous chalcogenide layers and their potential application in optical recordings and memory”, 1/2006–12/2008, the researcher is prof. Ing. Tomáš Wágner, CSc., University of Pardubice, FCHT, the co-researcher on behalf of UACH is RNDr. Tomáš Grygar, CSc.
- Project GA CR GA203/07/0546 “Laser disintegration of cobalt and nickel carbonyls at the presence of acetylene for the preparation of metallic nanoparticles coated with carbon”, 1/2007–12/2009, the researcher is RNDr. Radek Fajgar, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the researcher on behalf of UACH is Ing. Jan Šubrt, CSc.
- Project GA CR GA203/08/0831 “Nanotextiles producing singlet oxygen”, 1/2008–12/2010, the researcher is RNDr. Jiří Mesinger, Ph.D., Charles University in Praha, Faculty of Science, the co-researcher on behalf of UACH is Ing. Kamil Lang, CSc.
- Project MEYS 1M0577 “Research centre of nanosurface engineering – NANOPIN”, 1/2005–12/2009, the accepting party is ATG s.r.o., Praha, the researcher is Ing. František Peterka, Ph.D., the researcher on behalf of UACH is Ing. Jan Šubrt, CSc.
- Project MEYS LC523 “Perspective inorganic materials”, 2/2005–12/2009, the head researcher is prof. Ing. Miloslav Frumar, DrSc., University of Pardubice, the researcher on behalf of UACH is Ing. Jan Šubrt, CSc.
- Project MEYS LC06041 “Preparation, modification and characterising of materials by energy radiation”, 3/2006-12/2010, the researcher is doc. Ing. Vladimír Hnatowicz, DrSc., Nuclear Physics Institute of AS CR, Husinec – Řež, the researcher on behalf of UACH is Ing. Jan Šubrt, CSc.
- Project MIT FT-TA4/126 “Research of semiconducting nanotubes for the implementation of cold-emission parts”, 1/2007–12/2010, the researcher is Ing. Stanislav Štarman, Ph.D., STARMANS electronics, s.r.o., Praha, the researcher on behalf of UACH is RNDr. Mariana Klementová, Ph.D.
- Project MIT 2A-1TP1/092 “Research of preparation of nanoforms of layered piezoelectrics for the implementation of the high temperature ultrasound transducers’ manufacture”, 7/2006–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D., STARMANS electronics, s.r.o., Praha, the researcher on behalf of UACH is RNDr. Jiří Plocek, Ph.D.

Experts/field

- Ing. Jan Šubrt, CSc. – inorganic powder oxide materials, applications of photocatalytically active TiO_2, pigments, electron microscopy
- Ing. Zbyněk Černý, CSc. – synthesis, characterising and applications of nanoparticles of metallic oxides combined with geopolymer materials
- Mgr. Václav Štengl, Ph.D. – synthesis, characterising and applications of nanoparticles of metallic oxides prepared by precipitating processes from watery solutions
- RNDr. Daniel Nižňanský, Ph.D. – synthesis of nanocomposites based on nanoparticles of metallic oxides in the SiO_2 matrix by the sol-gel method, characterising of structures, magnetic and optic properties of these materials

- Mgr. Tomáš Baše, Ph.D. – preparation, characterising and applications of metal nanoparticles
- RNDr. Snejana Bakardjieva, Ph.D. – electron microscopy
- RNDr. Mariana Klementová, Ph.D. – electron microscopy

4.1.10. Institute of Experimental Botany of AS CR (UEB)

Rozvojová 263, 165 02 Praha 6 – Lysolaje, I.D. 61389030

www.ueb.cas.cz

Brief Institute characteristics

The Institute was founded on 1 January 1962 from the departments of plant physiology and phytopathology of the Institute of Biology of CSAV. It was divided into two independent units on 1 July 1990: the Institute of Experimental Botany, with workplaces in Praha and Olomouc, and the Institute of Molecular Plant Biology, created from the UEB workplace in České Budějovice, which is now a part of the Biology Centre of AS CR. The Institute has become a public research institution on 1 January 2007. The main areas of scientific activities conducted within the Institute relate to plant genetics, physiology and biotechnology. The Institute solves, in the field of genetics, the DNA repairs in plants, the structure of large plant genomes and the molecular pollen genetics. It deals, in the field of physiology, mostly with the hormonal and ecological controls of plant growth and development, the growth effects of the growth plant regulators and with the physiological aspects of plant viruses' effects. It is involved, in the field of biotechnologies, in the production basics and in the biotransformation of biologically active substances by plant tissue cultures. Additional information is available in the Vesmír magazine[4].

The Institute works in 6 places (4 ones are in Praha and 2 workplaces are in Olomouc) and it is divided into 17 laboratories and 1 research station.

The Institute Director is doc. RNDr. Eva Zažímalová, CSc.

Research and development focus

In the period 2005–2010, the research focuses on a single research plan aimed at the plant biology. It solves 60 programme projects in 2008.

The research in the area of immunonanotechnology started in the Laboratory of growth regulators (the joint laboratory of UEB and the Faculty of Science of the Palacky University Olomouc).

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200380801 "Immunonanotechnology for the diagnostics of substances having the hormonal character", 01/2008–12/2012, the head researcher is prof. Miroslav Strnad, DrSc.

Expert/field

- prof. Ing. Miroslav Strnad, DSc. – plant physiology

[4] "Institute of Experimental Botany – Plant Biology for the future", Vesmír, 86, 11/2007, p. 720.

4.1.11. Institute of Experimental Medicine of AS CR (UEM)

Vídeňská 1083, 142 40 Praha 4, I.D. 68378041
www.iem.cas.cz

Brief Institute characteristics

The Institute was founded on 1 January 1975 by several CSAV laboratories, which were founded in the period 1953–1957, merging. The number of independent research groups was progressively increasing. Four new pharmacological departments were created in 2002 after the merging with the Institute of Pharmacology of AS CR. The Institute has become a public research institution on 1 January 2007. Main activities of this Institute relate to the scientific research conducted in biomedicine, especially in the areas of cell biology and pathology, genotoxicology, teratology, biochemistry, neuroscience, stem cells, tissue replacements, nanomedicine, but also to the development and verification of analytical, diagnostic and therapeutic methods based on results of the basic research. UEM of AS CR also develops research in the area of pharmacology, especially immunopharmacology and neuropsychopharmacology.

Other activities of the Institute relate to the manufacturing and sales of nanofibres and nanoparticles, hydrogels and artificial cell carriers, stem cells and preparations containing stem cells, cartilaginous implants, specific cultivation media, and support medical preparations.

The Institute has been a part of the EU Centres of Excellence, called MEDIPRA, since 2000.

The research activities take place in 10 departments and two independent laboratories, but they are also developed in cooperation with other institutes and institutions, especially hospitals and universities. The Institute Director is prof. MUDr. Eva Syková, DrSc.

Research and development focus

In the period 2005–2013, the research in the Institute focuses mostly on the area of two research plans. There are 37 programme projects solved in 2008.

AV0Z50390512 **"Molecular, cell and system mechanisms of serious illnesses of human organism, their diagnostics, therapy and pharmacoterapeutics"**, 1/2005–12/2010, the researcher is prof. MUDr. Eva Syková, DrSc., the total costs CZK 492.126 million, thereof CZK 490.463 million from the state budget. The year 2008 – 5.023/5.023, the nomenclature – the area 3, the nanotechnological research share – 10 %.

The objective of the solution is research in the area of biomedicine and the search for possible practical applications of gained results in the following fields: molecular and cell biology, molecular embryology and pharmacology, neurophysiology, neurochemistry, neuropathology, neuropharmacology, immunopharmacology, genotoxicology, and teratology. The research focuses on the study of mechanisms of functions of cells, sub cellular structures, receptors, mediators, the cell interactions, activities of cell tissues and organs, pathological changes caused in living organisms by effects of pollutants of the inner and outer environments. The objective is the finding of diagnostic and therapeutic ways for diseases and their practical applications. The application areas include healthcare (therapeutic processes in neurosurgery and traumatology, especially of spinal cord injuries, immunology, ophthalmology, plastic surgery, and otolaryngology), the pharmaceutical industry (medicine and diagnostic kits), and hygiene and epidemiology (the assessment of risks related to chemical substances for the human population). In the area of nanoscience and nanotechnologies, there are works conducted, which focus on:

- Marking of cells with superparamagnetic nanoparticles and their in vivo monitoring with the assistance of nuclear magnetic resonance (NMR).
- In vivo testing of nanofibre-based materials as the reconstruction matrices for tissues, especially the central nerve system and the cartilage tissues.

AV0Z50390703 **"New biotechnology, nanomaterials and stem cells for the use in the regenerative medicine"**, 1/2007–12/2013, the researcher prof. MUDr. Eva Syková, DrSc., the total costs CZK 448.891 million, thereof CZK 307.897 million from the state budget. The year 2008 – 10.650/10.650, the nomenclature – the area 3, the nanotechnological research share – 70 %.

The objective of this plan is the research in the field of modern medicine – the so-called regenerative medicine. The attention is focussed on the research and development of processes using adult and embryonal stem cells, biomaterials in the tissue engineering, nanomaterials, and new biotechnological and diagnostic methods. The goal is the finding of therapies for serious diseases now cured with difficulties. The research results will be utilised in the healthcare, mostly in the following fields: neurosurgery (artificial replacements and defect bridging), traumatology (injuries of brain or spine cord), neurology (the Parkinson disease and the disseminated sclerosis), immunology (immunity disorders), pediatrics (inborn defects and perinatal disorders), orthopaedics (cartilage and bone replacements), ophthalmology (cornea replacements), otolaryngology, dentistry (tooth replacements), plastic surgery, and dermatology. The goal is the development of specific products usable for clinical studies and treatments, in the pharmaceutical industry for the development of diagnostic sets, new medicine and their testing on cell lines. In the areas of nanoscience and nanotechnologies, there are works taking place, which are focussed on the marking of cells with superparamagnetic nanoparticles and on their in vivo monitoring with the assistance of nuclear magnetic resonance (NMR) and on the in vivo testing of nanofibre-based materials as reconstruction matrices for tissues, especially for the central nerve system and joining tissues (cartilages).

The research in the areas of nanomedicine and nanobiotechnology is mostly conducted by the Department of neuroscience (the leader prof. MUDr. E. Syková, DrSc.), in the Laboratory of tissue cultures and stem cells (RNDr. P. Jendelová, Ph.D.), in the Department of the audition neurophysiology (prof. MUDr. Josef Syka, DrSc.), and in the Department of tissue engineering (doc. RNDr. E. Amler, CSc.).

Projects in the area of nanotechnologies

a) Projects solved in the Institute:

- Project GA of AS CR IAA500390702 "The tissue carrier of nanofibre materials with the inbuilt liposomes", 1/2007–12/2011, the head researcher is doc. RNDr. Evžen Amler, CSc.

b) Selected projects in which the Institute cooperates:

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520801 "Targeted expression and transport of bioactive molecules", 01/2008–12/2012, the head researcher is Mgr. David Staněk, Ph.D., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of UEM is RNDr. Karel Kaberna, CSc.

- Project of AS CR, programme "Nanotechnology for the Society" KAN200520804 "Biocompatible nanofibrous constructions creating new medicinal forms for the application of biologically and pharmaceutically active substances", 01/2008–12/2012, the head researcher is doc. RNDr. Vladimír Holáň, DrSc., Institute of Molecular Genetics of AS CR, the co-researcher on behalf of UEM is prof. MUDr. Eva Syková, DrCs.
- Project of AS CR, programme "Nanotechnology for the Society" KAN201110651 "Combined contrast agents for the molecular MR imaging", 07/2006–12/2010, the head researcher is prof. RNDr. Ivan Lukeš, CSc., Charles University in Praha, Faculty of Science, the co-researcher is prof. MUDr. Eva Syková, DrSc.
- Project MEYS 1M0538 "Centre of the cell therapy and tissue replacements", 1/2005–12/2009, the researcher is prof. MUDr. Eva Syková, DrSc., Charles University in Praha, 2nd Faculty of Medicine, the co-researcher on behalf of UEM is doc. RNDr. Alexandr Chvátal, CSc. UEM is the co-founder of this research centre.
- Project MEYS 2B06130 "The utilisation of the newly synthetised biomaterials in combination with stem cells in the treatment of diseases affecting human tissues derived from mesoderm: the cartilage, bone, ligaments, and meniscus", 7/2006–6/2011, the head researcher is prof. MVDr. Alois Nečas, Ph.D., University of Veterinary and Pharmaceutical Sciences Brno, the co-researcher on behalf of UEM is prof. MUDr. Eva Syková, DrSc.
- Project GA CR GA309/06/1594 "Cellular contrast substances and their use in the MR imaging", 1/2006–12/2008, the researcher is Mgr. Vít Herynek, Ph.D., Institute of the Clinical and Experimental Medicine, Praha 4. The co-researcher on behalf of UEM is RNDr. Pavla Jendelová, Ph.D.

c) Projects within the international cooperation:

- DiMI/512146 "Diagnostic Molecular Imaging: A Network of Excellence for Identification of New Molecular Imaging Markers for Diagnostic Purposes", 4/2005–3/2010, the project coordinator is prof. Andreas Jacobs, University of Cologne, Germany. The network of excellence having 45 participants. The head researcher in UEM of AS CR is prof. MUDr. Eva Syková, DrSc.
- ANGIOTARGETING/504743 "Targeting-Tumour-Vascular/Matrix Interactions", 11/2004–10/2008, the coordinator is prof. Rolf Bjerkvig, University of Bergen, Norway. The integrated project of 13 participants. The head researcher in UEM of AS CR is prof. MUDr. Eva Syková, DrSc.
- RESCUE/518233 "From stem cell technology to functional resoration after spinal cord injury", STREP, the coordinator is Dr. Alain Privat, Institute of Neuroscience, Montpellier, France. The head researcher in UEM of AS CR is prof. MUDr. Eva Syková, DrSc.
- STEMS/037328 "Pre-clinical evaluation of stem cell therapy in stroke", the coordinator of the project is Dr. Brigitte Ontiente, INSERM UMR421, Creteil, France. The head researcher in UEM of AS CR is prof. MUDr. Eva Syková, DrSc.
- NMP4-CT-2006-02556: "3g-Nanotechnology based targeted drug delivery using the inner ear as a model target organ", 11/2006–10/2010, the coordinator is prof. Ilmari Pyykko, University of Tampere, Finland. The head researcher in UEM of AS CR is prof. MUDr. Josef Syka, DrSc. The project focuses on the development and utilisation of nanoparticles as carriers in the application of substances in the inner ear.

Results in the area of nanotechnologies/cooperation

Patents:

- D. Horák, E. Syková, M. Babič, P. Jendelová, M. Hájek: Superparamagnetic nanoparticles based on iron oxides, 2006, PV 1006-120
- E. Brynda, T. Riedel, J. Dyr, M. Houska, L. Bačáková, E. Filová, et al.: The way of preparation of regulated fibrin layers on solid surfaces. The Czech patent PV 2006-821 of 2006.
- P. Lesný, E. Syková, J. Michálek, M. Pradný, O. Jirsák, L. Martinová: Biomaterial based on nanofibre layers and the way of its preparation. The Czech patent PV 2007-54. 2007.

Experts/field

- prof. MUDr. Eva Syková, DrSc. – stem cells, nanoparticles, artificial biomaterials, neuroscience
- RNDr. Pavla Jendelová, Ph.D. – stem cells, nanoparticles, artificial biomaterials, neuroscience
- prof. MUDr. Josef Syka, DrSc. – the use of nanoparticles as carriers in the application of substances into the inner ear
- doc. RNDr. Evžen Amler, CSc. – stem cells, cartilage tissues

4.1.12. Institute of Photonics and Electronics of AS CR (UFE)

Chaberská 57, 182 51 Praha 8, I.D. 67985882
www.ufe.cz

Brief Institute characteristics

The Institute was founded on 1 January 1955 as the Institute for the Theoretical Radiotechnology of CSAV. The Institute changed its name to the Institute of Radiotechnology and Electronics on 1 January 1956. The current name was accepted on 1 January 2007, when the Institute has become a public research institution.

The research and development activities of UFE AS CR focus on the following three main areas: photonics, optoelectronics, and signals and systems. Research is organised in three sections which are further divided into 8 departments:

- Photonics Section (the leader J. Homola)
- Signals and Systems Section (J. Šimša)
- Material Section (V. Kuzmiak)

The Institute Director is Ing. Vlastimil Matějec, CSc.

Research and development focus

In the period 2005–2010, research focuses on the issue of a single research plan and, in 2008, on 28 programme projects.

Research plan AV0Z20670512 **"Materials, structures, systems and signals in electronics, optoelectronics and photonics"**, 1/2005–12/2010, the researcher is Ing. Vlastimil Matějec, CSc., the total costs CZK 644.661 million, thereof CZK 618.655 million from the state budget. The year 2008 – 23.350/23.350, the nomenclature – the area 2b, the nanotechnological research share – 30 %.

The research plan of the Institute focuses, within the basic research done in electronics, optoelectronics and photonics, on the three areas – photonic structures, materials for optoelectronics, and on the systems generating, transmitting and processing signals. The research in the area of photonic structures focuses on perspective passive, active and non linear photonic structures and on systems using the principles of fibrous and planar waveguides, diffractive structures and photonic crystals for applications in optical communications and sensors. The research of materials for optoelectronics targets the preparation and diagnostics of new materials, structures and nanostructures usable mostly for special optical waveguides, radiation sources, optic amplifiers, detectors, and solar cells. Workers in the area of systems and signals research processes of generation, transmission and processing of signals in relation to frequencies and time, in multi user communication networks, and in voice systems.

Research focussed on nanotechnologies is organised in the Photonics Section, in the Department of optical sensors (J. Homola), in the Material Section, in the Department of technology (D. Nohavica) and in the Department of diagnostics (P. Gladkov, J. Walachová, J. Zavadil, K. Žďánský).

Projects solved in the area of nanotechnologies

a) <u>Projects solved in the institute:</u>

- Project of AS CR, the programme "Nanotechnology for the Society", KAN200670701 "Surface plasmon resonance biosensors and protein chips for the medical diagnostics", 01/2007–12/2011, the researcher is Ing. Jiří Homola, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society", KAN400670651 "Research of the interface of metallic nanoparticles with InP for the monitoring of undesirable substances, gases and radiation in the environment", 7/2006–12/2008, the head researcher is RNDr. Jiří Zavadil, CSc.
- Project of GA GP102/07/P507 "Optic fibres having the nanostructured core for optical amplification", 1/2007–12/2009, the head researcher is Ing. Ondřej Podrazký, Ph.D.
- Project of MEYS, the programme COST OC08023 "Optic fibres modified by the nanostructured photocatalytic layers with the high activity within the visible spectrum area", the researcher is Ing. Vlastimil Matějec, CSc.

b) <u>Selected projects in which the institute is also involved:</u>

- Project of AS CR, the programme "Nanotechnology for the Society", KAN401220801 "Nanostructures of Controlled Size and Dimensions", 1/2008–12/2012, the researcher is Ing. Anton Fojtík, CSc., CVUT – Faculty of Nuclear Sciences and Physical Engineering, the co-researcher on behalf of UFE is RNDr. Jiří Zavadil, Ph.D.
- Project of GA CR GA203/07/0267 "Ternary skutterudites for the thermoelectric applications: from bulk samples to thin films", 1/2007–12/2009, the researcher is Ing. Jiří Navrátil, CSc., Institute of Macromolecular Chemistry of AS CR, Praha, the co-researcher on behalf of UFE is Ing. Jarmila Walachová, CSc.

Experts/field

- doc. Petar Gladkov, Ph.D. – porous semiconducting materials
- Ing. Jiří Homola, CSc. – optical chemical sensors and biosensors

- RNDr. Jan Lorinčík, CSc. – mass spectroscopy of secondary ions
- Ing. Ondřej Podrazký, Ph.D. – nanostructured optic fibres
- Ing. Jarmila Walachová, CSc. – characterising of nanostructures with the scanning tunnel microscopy, ballistic emission electron microscopy and spectroscopy
- Ing. Dušan Nohavica, CSc. – technology of epitaxial structures A3B5 and nanostructures, semiconducting lasers, LED(s), photodetectors and solar cells
- RNDr. Jiří Zavadil, CSc. – characterising of semiconductors and structures with the assistance of the low-temperature FL spectroscopy
- Ing. Karel Žďánský, CSc. – interface metal/semiconductor

4.1.13. J. Heyrovsky Institute of Physical Chemistry of AS CR (UFCH JH)

Dolejškova 3, 182 23 Praha 8, I.D. 61388955

www.jh-inst.cas.cz

Brief Institute characteristics

The Institute was founded on 1 March 1972 under the name of the J. Heyrovsky Institute of Physical Chemistry and Electrochemistry of CSAV. There was the merge of the Institute of Polarography, found in 1950 and included into CSAV on 1 January 1953, with the Institute of Physical Chemistry of CSAV, found on 1 January 1955 on the base of the former Laboratory for physical chemistry found on 1 January 1953. The current name of the Institute has been accepted on 1 August 1993. The Institute has become a public research institution on 1 January 2007.

The Institute develops its research activities in physical chemistry and chemical physics with the focus on relations between structures and substance reactivity. It focuses mainly on the theoretical and experimental research of chemical and physical-chemical phenomena at the atomic and molecular levels (substance structures and dynamics, reaction mechanisms) in the gaseous, liquid and solid phases, on their interfaces, especially in systems important for the chemical catalysis and for sorption, electrochemical and biological processes (including the preparation and characterising of new catalytic, sorption, electrode and other special materials).

Research activities take place in 7 departments:

- Department of theoretical chemistry (J. Bittner, P. Čárský)
- Department of chemical physics (S. Civiš, M. Fárník, Z. Bastl, P. Kubát, J. Plšek)
- Department of biophysical chemistry (M. Hof, T. Kral, B. Yosypchuk)
- Department of structures and dynamics in catalyses (Z. Sobalík, J. Rathouský, P. Hrabánek, M. Kočiřík, B. Wichterlová)
- Department of syntheses and catalyses (J. Čejka)
- Department of electrochemical materials (L. Kavan, J. Jirkovský, P. Janda)
- Department of electrochemical processes (Z. Samec, M. Gál, M. Hromadová)

The leaders are mentioned in the brackets first, while the others are researchers of nanotechnologies.

The Institute Director is prof. RNDr. Zdeněk Samec, DrSc.

Research and development focus

In the period 2005–2010, research in UFCH JH of AS CR focuses mostly on a single research plan and solution of 83 programme projects.

Research plan AV0Z40400503 **"Structure, reactivity and dynamics of molecular and biomolecular systems: the theory, experiments and applications"**, 1/2005–12/2010, the researcher is prof. RNDr. Zdeněk Samec, DrSc., the total costs CZK 842.972 million, thereof CZK 842.846 million from the state budget. The year 2008 – 70.351/70.351, the nomenclature – the area 3, the nanotechnological research share – 70 %.

The objective of the research plan is the identification and clarification of relations between structures and interactions in molecular and biomolecular systems and their chemical or electrochemical reactivity and physical dynamics. The new thing in the plan is the experimental approach at the atomic or molecular levels allowed by the fast development of spectroscopic and microscopic high resolution methods and of the synthesis techniques of nanoscale materials. The research subjects are as follows:

- Development and utilisation of quantum chemistry methods in chemical physics, catalysis and electrochemistry,
- Kinetics and dynamics of chemical processes in the gaseous phase and on surfaces,
- Structures and properties of molecules and their aggregates,
- Structure, functions and dynamics of biomembranes,
- Synthesis and the structural chemistry of nanoscopic materials,
- Mechanism of catalytic and electrocatalytic processes,
- Sorption and transportation processes,
- Structure and (photo)electrochemical reactivity of molecules and biomolecules in liquid phases and on interphases.

Projects solved in the area of nanotechnologies

a) <u>Projects solved in the institute:</u>

Projects within the programme "Nanotechnology for the Society"

- KAN400400651 "Experimental and theoretical studies of free nanoparticles: "Flying nanoreactors" for the research of processes taking place at the molecular level", 7/2007–12/2010, the coordinating researcher is Mgr. Michal Fárník, Ph.D.
- KAN100400701 – "Hybrid nanocomposite materials", 1/2007–12/2011, the coordinating researcher is prof. Ing. Jiří Čejka, DrSc.
- KAN100400702 – "Nanostructured materials for the catalytic, electrocatalytic and sorption applications", 1/2007–12/2011, the coordinating researcher is prof. RNDr. Zdeněk Samec, DrSc.

Other projects

- Project of MEYS, the programme "Basic Research Centres", LC06063 "Fluorescence microscopy in the biological and medical research", 3/2006–12/2010, the coordinating researcher is doc. Martin Hof, Dr. rer. nat.

- Project of AS CR 1ET400400413 “Development of the programme environment for mathematical simulations and predictions in catalyses and electrocatalyses”, 1/2004–12/2008, the researcher is Ing. Zdeněk Sobalík, CSc.
- Project GA of AS CR KJB400400603 “Redox reactions to cyclooxygenase-2 inhibitors and their reactive intermediators in nanocavities of the supramolecular type”, (1/2006–12/2008), the researcher is RNDr. Miroslav Gál, Ph.D.
- Project GA of AS CR KJB400400601 “Electrochemical and spectroelectrochemical studies of carbon nanostructures”, 1/2006–12/2008, the head researcher is RNDr. Martin Kalbáč, Ph.D.
- Project GA of AS CR IAA400720619 “New laser-initiated process producing new carbon nanomaterials and nanomaterials incorporating N, B, and Si heteroatoms”, 1/2006–12/2010, the researcher is RNDr. Zdeněk Bastl, CSc.
- Project GA of AS CR IAA400400621 “DNA condensation: the Monte-Carlo simulation, scattering of light, the correlation fluorescence spectroscopy in vitro and in vivo”, 1/2006–12/2010, the researcher is Teresa Kral, Dr.
- Project GA of AS CR IAA400400804 “Supramolecular assembliess with carbon nanotubes”, 1/2008–12/2012, the researcher is prof. RNDr. Ladislav Kavan, DrSc.
- Project of GA CR GA203/07/1424 “Self-assembled porphyritic nanotextures”, 1/2007–12/2009, the researcher is RNDr. Pavel Kubát, CSc.
- Project of GA CR GA104/06/1254 “From the dynamic analysis to the dynamic management of catalytic reactions on zeolites”, 1/2006–12/2008, the researcher is Ing. Zdeněk Sobalík, CSc.
- Project of GA CR GA203/07/PJ067 “Electronic interactions SWCNT and conducting polymers in composites of nanotube/polymer”, 2007–2010, the researcher is RNDr. Martin Kalbáč, Ph.D.
- Project of GA CR GA104/08/1501 “Preparation, characterising and chemical properties of supported gold-based bimetallic nanoparticles”, 1/2008–12/2010, the researcher is Ing. Jan Plšek, Ph.D.
- Project of GA CR GA104/08/0435 “Smart structured mesoporous TiO_2 layers with the antibacterial and controlled variable wetting properties”, 1/2008–12/2010, the researcher is Ing. Jiří Rathouský, CSc.
- Project of GA CR GA203/08/0604 “Advanced molecular sieves for capture and storage of CO_2 and H_2”, 1/2008–12/2012, the researcher is prof. Ing. Jiří Čejka, DrSc.
- Project of GA CR GA203/08/1157 “The use of the lock and key motive in new low-dimensional structures at the electrode interface”, 1/2008–12/2011, the researcher is Mgr. Magdaléna Hromadová, Ph.D.
- Project of MEYS, programme COST, 1P05OC069 “Nanocrystalline oxide semiconductors for the optoelectronic applications”, 1/2005–12/2008, the researcher is prof. RNDr. Ladislav Kavan, DrSc.
- Project of MEYS, programme COST, OC 104 “Physical-chemical characterising of photoactive materials and surface treatments on the basis of nanocrystalline titanium oxide – the development of standard testing methods”, 3/2006–12/2009, the head researcher is RNDr. Jaromír Jirkovský, CSc.

b) Selected projects in which the institute is also involved:

Projects within the programme "Nanotechnology for the Society"

- KAN100500652 "Heterogenous organic and hybrid nanocomposite materials for solar cells", 07/2006–12/2010, the head researcher is RNDr. Jiří Pfleger, CSc., Institute of Macromolecular Chemistry of AS CR, Praha, the researcher ob behalf of UFCH JH is doc. RNDr. Svatopluk Civiš, CSc.
- KAN400720701 "Hierarchy nanosystems for microelectronics", 01/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the researcher on behalf of UFCH JH is Ing. Pavel Hrabánek, Ph.D.
- KAN200100801 "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy", 01/2008–12/2012, the head researcher is prof. RNDr. Miloš Nesládek, CSc. HDR., Institute of Physics of AS CR, Praha, the researcher on behalf of UFCH JH is prof. RNDr. Ladislav Kavan, DrSc.

Other projects

- Project of MEYS, the programme "Research Centres", 1M4531433201 "Research centre for the nanosurface engineering – NANOPIN", 1/2005–12/2009, the coordinating researcher is Ing. František Peterka, Ph.D., ATG s.r.o., Praha, the researcher on behalf of UFCH JH is RNDr. Jaromír Jirkovský, CSc. Additional information is available on the web page of the NANOPIN Centre at the address www.nanopin.cz/cz/cz_page01.html.
- Project of MEYS, the programme "Basic Research Centres" LC510 "Centre of nanotechnologies and materials for nanoelectronics", 2/2005–12/2009, the head researcher is RNDr. Jan Kočka, DrSc., Institute of Physics of AS CR, Praha, the researcher on behalf of UFCH JH is prof. RNDr. Ladislav Kavan, CSc. Additional information is available on the web page of the Centre at the addresswww.fzu.cz/vyzkum/nanotech/home.php.
- Project GA of AS CR IAA400720619 "New laser-initiated process producing new carbon nanomaterials and nanomaterials incorporating N, B, and Si heteroatoms", 1/2006–12/2010, the researcher is RNDr. Josef Pola, DrSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of UFCH JH is RNDr. Zdeněk Bastl, CSc.
- Project GA of AS CR 1QS401250509 "Ceramic materials of the hierarchy porous structure for the membrane separation technologies", 1/2005–2/2008, the head researcher is doc. Ing. Bohumil Bernauer, CSc., Institute of Chemical Technology Praha, Faculty of Chemical Technology, the co-researcher on behalf of UFCH JH is RNDr. Milan Kočiřík, CSc.
- Project of GA CR GA203/07/0546 "Laser disintegration of cobalt and nickel carbonyls at the presence of acetylene for the preparation of carbon encapsulated metallic nanoparticles", 1/2007–12/2009, the researcher is RNDr. Radek Fajgar, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of UFCH JH is RNDr. Zdeněk Bastl, CSc.
- Project of GA CR GA203/07/1195 "Analysis of the DNA structure and of its interactions with the assistance of electrochemical techniques and chemical probes. The new methods and sensors for the detection of damaged DNA", 1/2007–12/2009, the researcher is doc. RNDr. Miroslav Fojta, CSc., the co-researcher on behalf of UFCH JH is Ing. Bogdan Yosypchuk, Ph.D.

- Project of GA CR GA203/08/0831 “Nanotextiles producing the singlet oxygen”, 1/2008–12/2010, the researcher is RNDr. Jiří Mesinger, Ph.D., Charles University in Praha, Faculty of Science, the co-researcher on behalf of UFCH JH is RNDr. Pavel Kubát, CSc.
- Project MIT FT-TA3/080 “Synthesis of titanium silicates and their applications”, 4/2006–12/2009, the researcher is Ing. Věnceslava Tokarová, CSc., Institute of Inorganic Chemistry AS CR, Husinec – Řež, the co-researcher on behalf of UFCH JH is prof. Ing. Jiří Čejka, CSc.
- Project MIT FT-TA5/005 “Progressive types of zeolites and their applications”, 4/2008–12/2010, the researcher is Ing. Věnceslava Tokarová, CSc., Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, the co-researcher on behalf of UMCH is prof. Ing. Jiří Čejka, CSc.

c) European projects solved within the 6th Framework Programme:
- Project FP6: ORGA PV NET – No. SES6-38889 “Coordination action towards stable and low-cost organic solar cell technologies and their application”, 2006–2009, the researcher is prof. RNDr. Ladislav Kavan, CSc.
- Project FP6: NDENS No. MRTN-CT-2004-005503J “Intelligent design of nanoporous sorbents”, 2005–2008 the researcher is prof. Ing. Jiří Čejka, DrSc. Additional information is available in the web application of the project at the address www.lpmc.univ-ntp2.fr/.
- Project FP6: DESANNS “Advanced Separation and Storage of Carbon Dioxide: Design, Synthesis and Application of Novel Nanoporous Sorbents”, 1/2006–12/2008, the coordinator is Dr. Philips Llewellyn, CNRS, France, the researcher on behalf of UFCH JH is prof. Ing. Jiří Čejka, DrSc. Additional information is available at the address www.desanns.univ-montp2.fr/.
- Project NMP3-CT-2005-516982 “Nanocrystalline Heterosupermolecular Materials for Optoelectronic Applications”, 2005–2008, the researcher is prof. RNDr. Ladislav Kavan, CSc. Additional information is available in the web application of the project at the address www.iciq.es/Heteromolmat/.
- Project NMP3-CT-2005-011730 “Integrated design of Catalytic Nanomaterials for Sustainable Production”, 2005–2010, the researcher is Ing. Blanka Wichterlová, DrSc. Additional information is available in the web application of the project at the address http://idecat.unime.it/.

Experts/field
- prof. RNDr. Zdeněk Samec, DrSc. – electrocatalyses, the Institute Director
- prof. RNDr. Ladislav Kavan, DrSc. – carbon and oxide nanostructures, electrochemistry, spectroelectrochemistry
- prof. RNDr. Petr Čárský, DrSc. – development of the quantum-chemical methods
- Mgr. Jiří Pittner, Dr. rer. nat. – development of the quantum-chemical methods
- RNDr. Jaromír Jirkovský, CSc. – photocatalyses, TiO_2 nanosurfaces, applications in the area of self-cleaning surfaces
- doc. Martin Hof, Dr. rer. nat. – fluorescence spectroscopy
- prof. Ing. Jiří Čejka, CSc. – zeolites and molecular screens
- Ing. Zdeněk Sobalík, CSc. – development of catalysts’ structures for important processes of NO_x transformations to nitrogen, selective oxidation of hydrocarbons

- RNDr. Zdeněk Bastl, CSc. – studies of nanostructured materials with the method of electron spectroscopy
- doc. RNDr. Svatopluk Civiš, CSc. – laser spectroscopy and photochemistry
- RNDr. Pavel Kubát, CSc. – laser spectroscopy and photochemistry
- Mgr. Michal Fárník, Ph.D. – molecular clusters, experimental and theoretical studies of free nanoparticles
- Ing. Pavel Janda, CSc. – studies of nanostructured materials with the AFM and STM methods
- RNDr. Martin Kalbáč, Ph.D. – carbon nanostructures and spectroelectrochemistry

4.1.14. Institute of Physics of Materials of AS CR (UFM)

Žižkova 22, 606 62 Brno, I.D. 68081723
www.ipm.cz

Brief Institute characteristics

The Institute developed from the Laboratory for studies of metal properties of CSAV, which was founded on 1 January 1995. It changed to the Institute of Metal Properties of CSAV on 1 January 1963 and it changed its name to the Institute of Physical Metallurgy of CSAV on 1 January 1969. The current name was accepted on 1 January 1994. The Institute has become a public research institution on 1 January 2007.

The Institute activities focus on the interdisciplinary area of material science. Most activities take place in the basic research of metal materials. The Institute focuses on the physical fundamentals of processes taking place in metal materials in creep, fatigue, and in the interaction of creep with fatigue, but also in other kinds of mechanical loading. It focuses also on structures of selected materials and their physical properties. Both these research areas aim at the clarification of the relation between materials' behaviour and properties and their structural characteristics. Research activities are organised in two departments which are divided into groups:

- Department of mechanical properties (the leader L. Kunz)
  - Group of the metal materials creep (K. Milička)
  - Group of progressive high-temperature materials (V. Sklenička)
  - Group of the high cycle fatigue (P. Lukáš)
  - Group of the low cycle fatigue (J. Polák)
  - Group of the brittle fracture (I. Dlouhý)

- Department of structures (M. Svoboda)
  - Group of diffusion and thermodynamics (J. Čermák)
  - Group of phase structures (M. Svoboda)
  - Group of electric and magnetic properties (O. Schneeweiss)

The Institute Director is doc. RNDr. Petr Lukáš, CSc.

Research and development focus

In the period 2005–2010, the research in UFM of AS CR focuses mostly on the single research plan. There are 48 programme projects solved in 2008.

Research plan AV0Z20410507 **“Physical properties of advanced materials, their dependency on microstructure and the preparation way”**, 1/2005–12/2010, the researcher is doc. RNDr. Petr Lukáš, CSc., the total costs CZK 561.855 million, thereof CZK 561.639 million from the state budget. The year 2008 – 20.590/20.590, the nomenclature – the area 1, the nanotechnological research share – 30 %.

The solution goals:

Physical properties of the following advanced materials are experimentally and theoretically studied in their relations to microstructure and the preparation way: ultrafine-grain, microcrystalline, nanocrystalline, and amorphous materials; intermetallics; super alloys’ nanocrystals; advanced steels; advanced alloys of Mg, Fe, and Ni; memory alloys; composites and nanocomposites; metallic laminates; lead-free soldering; magnetic semiconductors; semi metallic magnets; magnetic multilayers; transition metals’ silicides. The objective is to clarify, describe and quantify mechanisms in processes and in the development of a microstructure taking place in advanced materials during creep, fatigue, and fracture. Diffusion, thermodynamics, phase structures, electric and magnetic properties are studied within the relevant temperature range. This should contribute to the worldwide treasury of knowledge about advanced materials (process mechanisms, databases of experimental data and properties) and, consequently, to optimising of their preparation.

Research activities related to nanotechnologies are organised in the Group for advanced high-temperature materials (V. Sklenička, J. Dvořák, P. Král), the Group for the high-cycle fatigue (L. Kunz), the Group for phase structures (J. Buršík), the Group for diffusion and thermodynamics (V. Rothová), and in the Group for electric and magnetic properties (O. Schneeweiss, Y. Jirásková, M. Šob).

Projects solved in the area of nanotechnologies and nanomaterials

a) Projects solved in the institute:

- Project of GA CR GA106/08/1440 “Iron and iron oxides based nanoparticles for magnetic separation processes”, 1/2008–12/2011, the researcher is Ing. Oldřich Schneeweiss, DrSc.
- Project GA of AS CR KJB200410801 “Study of nano-structured materials consolidated from powder compacts by the ECAP technique”, 1/2008–12/2010, the researcher is Ing. Jiří Dvořák, Ph.D.
- Project of MEYS within the programme of international cooperation KONTAKT 1P05ME804 “Fatigue properties of ultrafine grain copper and magnesium alloys”, 1/2005–12/2008“, the researcher is prof. RNDr. Ludvík Kunz, CSc.
- Project of MEYS, the programme COST OC 147 “Multilevel model structures and properties of nanowires”, 3/2006–12/2009, the head researcher is prof. RNDr. Mojmír Šob, DrSc.

b) Selected projects in which the institute is also involved:

- Project of MEYS, the programme “Research Centres” 1M0512 “Research centre of powder nanomaterials”, 1/2005–12/2009, the head researcher is prof. RNDr. Miroslav Mašláň, CSc., Palacky University Olomouc. The co-researchers on behalf of UFM are Ing. Oldřich Schneeweiss, DrSc. and Ing. Bořivoj Million, DrSc.

- Project of GA CR GA202/08/0178 “Synthesis of magnetic Fe-based nanoparticles in low-temperature microwave plasma”, 1/2008–12/2010, the researcher is Mgr. Vít Kudrle, Ph.D., Masaryk University in Brno, Faculty of Science, the researcher on behalf of UFM is Ing. Bohumil David.
- Project GA of AS CR IAA100100616 “The electron structure and physical properties of materials for nanoelectronics”, 1/2006–12/2009, the head researcher is RNDr. Václav Drchal, CSc. Institute of Physics of AS CR, Praha, the co-researcher on behalf of UFM is RNDr. Ilja Turek, DrSc.

Experts/field

- prof. Ing. Václav Sklenička, DrSc. – ultrafine-grain materials prepared by the extreme plastic deformation (ECAP), nanocomposite materials and layers, mechanical properties and microstructured nanomaterials
- Ing. Oldřich Schneeweiss, DrSc. – nanocrystalline metallic, oxide and interstitial compound materials, nanocomposites, structure, phase composition, electric and magnetic properties
- Ing. Yvonna Jirásková, CSc. – nanocrystalline materials prepared by the controlled crystallisation of amorphous alloys, structure, phase composition, electric and magnetic properties
- RNDr. Jiří Buršík, CSc. – electron microscopy of nanostructures prepared by the plasma technologies

4.1.15. Institute of Plasma Physics of AS CR (UFP)

Za Slovankou 3, 182 00 Praha 8, I.D. 61389021
www.ipp.cas.cz

Brief Institute characteristics

The Institute was founded on 1 January 1959 under the name of the Institute of Vacuum Electronics of CSAV. Considering the further focus development, the current Institute name was accepted on 1 January 1964. The Development optical workshop of AS CR in Turnov has joined with the Institute on 1 January 2006. The Institute has become a public research institution on 1 January 2007.

The Institute organises research and development of controlled thermonuclear fusion, the utilisation of electric discharges, plasma generators, interactions of plasma with other mass states, the waste liquidation in plasma flows, plasma spray processes, and other problems related to plasma. Research takes place in 5 departments:

- Department of tokamak (the leader J. Stöckel)
- Department of impulse plasma systems (K. Koláček)
- Department of thermic plasma (M. Hrabovský)
- Department of materials engineering (P. Chráska sen.)
- Department of laser plasma (J. Ullschmied)
- Department of optic diagnostics (Z. Melich)

The Institute Director is prof. Ing. Dr. Pavel Chráska, DrSc.

Research and development focus

In the period 2005–2010, research focuses on the single research plan. There are 25 programme projects solved in 2008.

Research plan AV0Z20430508 **"Physical and chemical processes in plasma and their application"**, 1/2005–12/2010, the researcher is prof. Ing. Dr. Pavel Chráska, DrSc., the total costs CZK 610.147 million, thereof CZK 607.155 million from the state budget. The year 2008 – 7.575/7.572, the nomenclature – the area 7c, the nanotechnological research share – 10 %.

Research goals: Plasma grows in its importance and affects many areas of life in the 21st century. This relates to the nuclear fusion, plasma technologies, plasma chemistry, laser plasma, and the utilisation of discharges in plasma. There must be many basic physical and chemical processes better known to control these plasma applications. For this reason, there will be different kinds of plasma generated and new methods for their studies developed. The objective is the description of the behaviour of hot plasma in tokamaks, dense or not balanced plasma in discharges, thermic plasma and its interaction with other states. Experimental measurements will be confronted with theoretical calculations and the numeric modelling. The results will have a direct impact on a number of fields, starting with the participation in the project ITER, the ecological cleaning methods, and generation of the soft RTG radiation, plasma technologies and plasma liquidation of wastes, to the development of new materials for extreme utilisation conditions.

The nanotechnological research currently focuses on:

- Creation of amorphous and nanocrystalline coatings and self-contained particles from ceramic materials with the assistance of plasma spraying by water stabilised plasma heaters (WSP) which causes very fast solidification and creation of imbalanced structures
- Manufacture of nanocrystalline ceramic parts with the assistance of controlled crystallisation by suitable thermal processing from the originally amorphous parts containing a multicomponent ceramic material with the eutectic point.
- Production of general plasma coats the basic building block of which is a thin circular disk – the so-called splat, which is usually created by the parallel arranged column grains running across the splat thickness. The cross section of the column grains in the splat is typically of tens of nanometres.

Research focussing on nanotechnology takes place, within limited scope, in the Department of material engineering (T. Chráska) and in the Department of impulse plasma systems (K. Koláček).

Projects solved in the area of nanotechnologies

- Project of AS CR within the programme "Nanotechnology for the Society" KAN300430651 "Nanocrystallisation of plasma coatings based on eutectic ceramic mixtures", 7/2006–12/2009, the head researcher is Ing. Tomáš Chráska, Ph.D.
- Cooperation in the AS CR project, within the programme "Nanotechnology for the Society", KAN300100702 "Creation of nanostructures by X-ray lasers", 01/2007–12/2011, the researcher is Ing. Bedřich Rus, Dr., Institute of Physics of AS CR, Praha, the researcher on behalf of UFP is RNDr. Karel Koláček, CSc.

Experts/field

- Ing. Tomáš Chráska, Ph.D. – transmission electron microscopy, plasma sprayed layers (mostly nanocrystalline ceramics), semiconducting nanostructures
- prof. Ing. Dr. Pavel Chráska, DrSc. – structural and phase transformations

4.1.16. Institute of Chemical Process Fundamentals of AS CR (UCHP)

Rozvojová 135, 165 02 Praha 6

www.icpf.cas.cz

Brief Institute characteristics

The Institute was created from the Department of organic technology of the Institute of Chemistry of CSAV and the Laboratory for chemical engineering of CSAV on 1 January 1960. Its original name was the Institute of Chemical Technology Theoretical Fundamentals of CSAV. The current name was accepted on 1 July 1993. The Institute has become a public research institution on 1 January 2007.

The subject of UCHP main activities is research and development in the area of the theory of chemical processes, especially in the fields of chemical engineering, physical chemistry and bioengineering. The research focuses mainly on the chemical and statistical thermodynamics, separation processes, catalysis, reactor engineering, applied organic-metallic chemistry, multiphase chemical reactors and bioreactors, biotechnologies and technological processes utilised for the environment, but also on chemical reactions initiated or speeded by laser or microwave radiation, and processes of creation and transformation of aerosols. UCHP is divided into scientific departments and service units. Additional information is presented in the journal Vesmír[5].

Research activities are conducted by 5 departments and 4 laboratories:

- Department of separation processes (the leader V. Jiřičný)
- E. Hala thermodynamic laboratory (K. Aim)
- Department of catalyses and reaction engineering (O. Šolcová)
- Department of multiphase reactors (J. Drahoš)
- Department of new processes in chemistry and biotechnology (J. Čermák)
- Laboratory of processes within the protection of environment (M. Punčochář)
- Department of analytical chemistry (J. Schraml)
- Laboratory of the aerosol chemistry and physics (J. Smolík)
- Laboratory of the laser chemistry (J. Pola)

The Institute Director is prof. Ing. Jiří Hanika, DrSc.

Research and development focus

In the period 2005–2010, research focuses on the single research plan. There are 62 programme projects solved in 2008.

Research plan AV0Z40720504 **“Research of multiphase reacting systems for the design of processes in the areas of the synthesis and preparation of new materials, energy and the**

5 “Institute of Chemical Process Fundamentals of AS CR”, Vesmír, 87, 6/2008, p. 356.

protection of environment", 1/2005–12/2010, the researcher is prof. Ing. Jiří Hanika, DrSc., the total costs CZK 845.876 million, thereof CZK 801.205 million from the state budget. The year 2008 – 16.906/16.906, the nomenclature – the area 5, the nanotechnological research share – 20 %.

The research objective is the identification of properties of systems at the molecular level and their integration with phenomenological knowledge about system behaviours related to process conditions. Main research directions are as follows: the study of the balanced behaviour of multiphase systems in chemical reactions; thermo- and hydrodynamics of multiphase systems in extreme conditions; fundamentals of extraction, sorption and membrane separation processes, and the processes utilising supercritical liquids; dynamics of transportation processes in chemical, electrochemical, burning and biotechnological reactors; the clarification of mechanisms in catalysed reactions and in destructive reactions of organic toxic substances; the preparation of new materials by reactions induced by the microwave or laser radiation. The results should allow the quantitative description of behaviour of the reacting multiphase systems with the assistance of mathematical models usable for the optimal design of process facilities and satisfying requirements on the maximal environmental friendliness.

The research in the area of nanotechnologies focuses mostly on nanoporous materials, nanocatalysis and nanoparticle synthesis, e.g. by aerosol processes or the laser technique. The Research focussing on nanotechnologies is organised in the Department of separation processes (P. Uchytil), the Eduard Hála thermodynamic laboratory (I. Nezbeda, M. Lísal), the Department of catalysis and reaction engineering (O. Šolcová, K. Jirátová, V. Hejtmánek), the Department of new processes in chemistry and biotechnology (G. Kuncová), in the Laboratory for the aerosol chemistry and physics (J. Smolík, P. Moravec, V. Levdanski), and in the Laser chemistry laboratory (J. Pola, R. Fajgar).

Projects solved in the area of nanotechnologies

a) Projects solved in the institute:

- Project AS CR KAN400720701 "Hierarchy nanosystems for microelectronics", 01/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc.
- Project GA of AS CR 1ET400720409 "Application of advanced simulation methods for the study of the structures, physical-chemical properties and preparation of composite materials and nanomaterials", 7/2004–12/2008, the researcher is prof. RNDr. Ivo Nezbeda, DrSc.
- Project GA of AS CR IAA400720619 "New laser-initiated process producing new carbon nanomaterials and nanomaterials incorporating N, B, and Si heteroatoms", 1/2006-12/2010, the researcher is RNDr. Josef Pola, DrSc.
- Project GA of AS CR IAA400720804 "The effect of surface processes and the electromagnetic radiation on the transport phenomena in aerosol systems with nanoparticles and in porous units with nanopores", 1/2008–12/2011, the researcher is Ing. Valeri Levdanski (Levdansky), DrSc.
- Project of GA CR GA104/07/1093 "Preparation of composite nanoparticles by the aerosol process", 1/2007–12/2010, the head researcher is Ing. Pavel Moravec, CSc.
- Project of GA CR GA104/07/1400 "Depositing of oxide catalysts for the VOC oxidation on shaped carriers and their modification by nanoparticles of precious metals", 1/2007–12/2009, the head researcher is Ing. Květa Jirátová, CSc.

- Project of GA CR GA203/07/0546 “Laser disintegration of cobalt and nickel carbonyls at the presence of acetylene for the preparation of carbon encapsulated metallic nanoparticles”, 1/2007 – 12/2009, the researcher is RNDr. Radek Fajgar, CSc.
- Project of MEYS ME 892 “Monitoring and remedy of the polluted environment with the assistance of advanced organic-inorganic materials – MOREPIM”, 5/2007–12/2011, the researcher is Ing. Gabriela Kuncová, CSc.
- Project of MEYS ME 893 “Whole-cell optical sensors – WOCOS”, 5/2007–12/2011, the researcher is Ing. Gabriela Kuncová, CSc.

b) Selected projects in which the institute is also involved:
- Project AS CR 1QS401250509 “Ceramic materials of the hierarchy porous structure for the membrane separation technologies”, 1/2005–2/2008, the head researcher is doc. Ing. Bohumil Bernauer, CSc., Institute of Chemical Technology Praha, Faculty of Chemical Technology, the co-researcher on behalf of UCHP is Ing. Petr Uchytil, CSc.
- Project of GA CR GA203/08/0094 “Computer assisted modelling of structural, dynamic and transport properties of nano-size liquids”, 1/2008–12/2011, the researcher is Mgr. Milan Předota, Ph.D., University of South Bohemia in České Budějovice, Faculty of Science, the researcher on behalf of UCHP is doc. Ing. Martin Lísal, DrSc.

Experts/field
- prof. RNDr. Ivo Nezbeda, DrSc. – liquids’ molecular physics, intermolecular interactions
- doc. Ing. Martin Lísal, DSc. – applied statistical thermodynamics, computer-assisted simulations, molecular and multicomponent modelling
- Ing. Olga Šolcová, CSc. – texture of solid porous substances, mass transport in solid substances
- Ing. Gabriela Kuncová, CSc. – development of on enzymes-based biooptoelectronic sensors
- Ing. Květa Jirátová, CSc. – heterogenous catalysis, preparation of catalysts and the assessment of their properties
- Ing. Pavel Moravec, CSc – aerosol processes
- RNDr. Josef Pola, DrSc. – laser chemistry, organometallic chemistry

4.1.17. Nuclear Physics Institute of AS CR (UJF)

250 68 Husinec – Řež 130, I.D. 61389005

www.ujf.cas.cz

Brief Institute characteristics

The Institute was founded, on 1 January 1972, from the physical part of the Nuclear Research Institute of CSAV, which was founded in 1955. Its major part was transferred under the supervision of the Czechoslovak Atomic Energy Commission in 1972. The former Institute of Dosimetry Radiation of AS CR has joint UJF on 1 July 1994 as its detached workplace. The Institute has become a public research institution on 1 January 2007.

The Institute activities cover mainly nuclear physics in the area of low and medium energy, both theoretical and experimental physics. The Institute organises the nuclear beta radiation spectroscopy, studies of nuclear reactions, including collisions of heavy ions, and hyper-nuclear physics. The activities focus also on some related fields like the study of the solid phase and the material research with the assistance of neutron and charged ions' dispersion, mathematical physics, the theoretical sub nuclear physics, dosimetry of ionising radiation, including the biophysical aspects, and the development of radiopharmaceuticals. Additional information is available in the journal Vesmír[6].

Research activities are conducted in 7 departments:

- Department of theoretical physics (the leader J. Hošek)
- Department of nuclear spectroscopy (A. Kugler)
- Department of nuclear reactions (V. Kroha)
- Department of neutron physics (P. Mikula)
- Department radiopharmaceuticals (R. Mach)
- Department of dosimetry radiation (F. Spurný)
- Department of accelerators (J. Štursa)

The Institute Director is Ing. Jan Dobeš, CSc.

Research and development focus

In the period 2005–2010, research focuses on the single research plan and solution of programme projects in 2008.

Research plan AV0Z10480505 **"Nuclear physics and related fields in the basic, applied and interdisciplinary research"**, 1/2005–12/2010, the researcher is Ing. Jan Dobeš, CSc., the total costs CZK 1067.718 million, thereof CZK 1067.478 million from the state budget. The year 2008 – 12.760/12.760, the nomenclature – the area 6b, the nanotechnological research share – 10 %.

There are experimental studies organised of intensively inter-reacting mass in collisions of heavy ions, of the nuclei remote from the stability line, nuclear reactions for astrophysics, and of the neutrino weight in the electron spectroscopy. There is the utilisation of nuclear analytical methods and neutron diffraction expected in the research of condensed substances and materials, and in the living nature sciences. The research and development of radiopharmaceuticals also take place. The objective is the extension of knowledge about the intensively inter-reacting systems, the applications and implementation of nuclear methods in other areas of science and technologies.

Research focussed on nanotechnologies

The research related to nanotechnologies is organised in the Department of neutron physics (V. Hnatowicz, J. Vacík, A. Macková, V. Peřina), the Department of theoretical physics (P. Exner), and in the Department of radiopharmaceuticals (O. Lebeda).

The Department of neutron physics, the Laboratory of nuclear analytical methods, is involved in the area of micro and nano sciences in the following fields:

- Preparation and characterising of thin layers of hybrid materials based on carbon allotropes and transition metals, e.g. C60-Ni (the hybrid materials of the C60-Ni kind show

6 "Nuclear Physics Institute of AS CR", Vesmír, 87, 3/2008, p. 180.

interesting structural properties often in the form of spontaneously organised systems in the sub microscopic area).

- Preparation of LIPSS structures (the co-operation with FZU of AS CR).
- Utilisation of ion beams in studies of micro and nano structures – analytical methods (RBS) – the Rutherford reverse dispersion, ERDA and TOF-ERDA – the detection of forward pushed particles, PIXE – (the roentgen fluorescence) – the co-operation with VSCHT, FZU, MFF of UK, MU Brno, VUT Brno, CMU Brno, UPT, University in Pardubice, the West Bohemia University in Plzeň, Helsinki University, etc.).
- Modification and synthesis of new structures by the method of ion implantation, e.g. the implantation of glasses, crystals and polymers for optics, optoelectronics, magnetic recording media, etc. – the co-operation with VSCHT, Forschungszentrum Dresden--Rossendorf, University of Minsk, etc.

The Department studies also steel microstructures and other materials with the small angle neutron dispersion.

The Department of theoretical physics, the Group of mathematical physics, is involved in preparation of mathematical models of nanosystems of the quantum waveguide kind.

Projects solved in the area of nanotechnologies

a) Projects solved in the institute:

- Project AS CR KAN400480701 "Nanostructures based on carbon and polymers for the use in bioelectronics and in medicine", 01/2007–12/2011, the researcher is Mgr. Jiří Vacík, CSc.
- Project of MEYS LC06041 "Preparation, modification and characterising of materials by energy radiation", 3/2006–12/2010, the researcher is doc. Ing. Vladimír Hnatowicz, DrSc.
- Project GA of AS CR IAA200480702 "Metallic and semiconductor nanostructures prepared by the ionic implantation", 1/2007–12/2009, the researcher is Mgr. Jiří Vacík, CSc.
- Project GA of AS CR KJB100480601 "The use of ionic beams in studies of crystalline structures", 1/2006–12/2008, the researcher is RNDr. Anna Macková. Ph.D.
- Project GA of AS CR IAA400480616 "Thermoresponsive drug delivery systems for the local radiotherapy", 1/2006–12/2008, the researcher is Ing. Ondřej Lebeda, Ph.D.,

b) Selected projects in which the institute is also involved:

- Project of GA CR GA102/06/1106 "Metamaterials, nanostructures, and their applications", 1/2006–12/2008, the head researcher is prof. Ing. Ján Zehentner, DrSc., Czech Technical University in Praha, Faculty of Electrical Engineering, the co-researcher on behalf of UJF is doc. Ing. Vladimír Hnatowicz, DrSc.
- Project of GA CR GA202/07/1669 "Depositing of stable thermomechanical nanostructured diamond like thin layers in dual-frequency capacity discharges", 1/2007–12/2011, the researcher is RNDr. Vilma Buršíková, Ph.D., Masaryk University in Brno, Faculty of Science, the co-researcher on behalf of UJF is RNDr. Vratislav Peřina, CSc.
- Project of GA CR GA203/06/1368 "Preparation and studies of amorphous chalcogenide layers and their potential application in optical recordings and memory", 1/2006–12/2008, the researcher is prof. Ing. Tomáš Wágner, CSc., University of Pardubice, FCHT, the co-researcher on behalf of UJF is RNDr. Vratislav Peřina, CSc.

- Project of GA CR GA204/06/0225 “Adhesion, growth and differentiation of bone and vascular cells on carbon allotropes”, 1/2006–12/2008, the researcher is MUDr. Lucie Bačáková, CSc., Institute of Physiology of AS CR, Praha, the researcher on behalf of UJF is Jiří Vacík, CSc.
- Project GA of AS CR IAA400100701 “Nanocomposites metal-fullerene and metal-diamond: Preparation, characterising, and modification”, 1/2007–12/2009, the head researcher is RNDr. Vladimír Vorlíček, CSc., Institute of Physics of AS CR, Praha, the researcher on behalf of UJF is Jiří Vacík, CSc.

Experts/field

- doc. Ing. Vladimír Hnatowicz, DrSc. – experimental nuclear physics, analytical nuclear methods
- Jiří Vacík, CSc. – studies of metal oxides’ systems, of the metal-fullerene systems, spontaneous self-assembly, etc.
- prof. RNDr. Pavel Exner, DrSc. – not stable systems, quantum tube and surfaces’ mechanics, resonance phenomena, etc.
- RNDr. Vratislav Peřina, CSc. – growth, modification and element structures of thin layers and multilayers used in microelectronics and optics for implant surfaces and in the research of very hard and heat resistant layers, in optoelectronics, etc.
- RNDr. Anna Macková, Ph.D. – modifying of materials (polymers, glass, crystalline materials) by ion beams for applications in microelectronics and optics, analytical methods RBS, RBS-channeling, ERDA, ERDA-TOF for the element and structural analyses of amorphous, crystalline materials and complex multilayer systems
- RNDr. Vladimír Havránek, CSc. – PIXE analysis of aerosols, thin solid layers, biological materials, etc.

4.1.18. Institute of Macromolecular Chemistry of AS CR (UMCH)

Heyrovského nám. 2, 162 06 Praha 6, I.D. 61389013

www.imc.cas.cz

Brief Institute characteristics

The Institute was founded on 1 January 1959 from the Laboratory for high molecular substances founded in CSAV on 1 January 1957. The Institute has become a public research institution on 1 January 2007.

UMCH activities focus on the scientific research in the areas of macromolecular chemistry, organic chemistry, macromolecular physical chemistry, and macromolecular physics, including the related interdisciplinary fields resulting in knowledge and understanding of principles and relations between the structure and properties of macromolecular substances and the possibilities of controlled creation of supramolecular structures, focussed especially on the development of new synthetic and technological processes, new polymer materials and their utilisation in application practical technologies, on the study of the behaviour and resistance of macromolecular systems in ecologically demanding conditions, properties and structures of substances by newly developed methods, electronics, medical chemistry, and the study of mechanisms in the effects of biologically active polymer substances and interactions of polymer materials in living organisms, but also on the development of polymer systems useful in medicine, pharmacy, and biotechnology. Research takes place in 11 departments and some of them are divided into working groups.

- Department of managed polymerisations
- **Department of polymer networks and mechanical properties** (L. Matějka, K. Dušek, M. Špírková, J. Kotek)
- **Department of polymer materials**
  - **Working group for the development and recycling of polymer materials** (I. Kelnar)
  - **Working group for the morphology of polymers** (M. Šlouf)
  - Working group for thermodynamics and rheology
  - **Working group for electron phenomena** (J. Pfleger, M. Menšík, S. Nešpůrek, P. Toman, K. Podhájecká, H. Beneš)
- Department of hydrogels for the medical and technical practice
- **Department of biomedical polymers** (K. Ulbrich, M. Hrubý)
- **Department of bioanalogical and special polymers**
  - **Working group for the bioactive and degradable polymers (**F. Rypáček)
  - **Working group for special polymers** (D. Výprachtický, V. Cimrová)
  - **Working group for polymer particles** (D. Horák)
- **Department of polymer membranes**
  - **Working group for the polymer membrane materials** (E. Brynda, Z. Sedláková)
  - **Working group for polymer membranes and bioanalogical phase interfaces** (Z. Pientka, M. Bleha)
- **Department of solid substance chemistry**
  - Group – Intercalar compounds
  - Group – Semiconducting glasses
  - Group – Thermoelectric materials

This department is a joint laboratory for solid substance chemistry of UMCH and University of Pardubice, with headquarters in Pardubice.

- **Department of supramolecular polymer systems**
  - **Working group for optical phenomena** (P. Štěpánek, Č. Koňák, J. Stejskal)
  - Working group for transport and separation processes
  - Working group for photoelectric cells and paramagnetic phenomena
- **Department of structural analyses**
  - **Working group for the molecular spectroscopy** (J. Dybal, M. Trchová)
  - Joint NMR solid phase laboratory of UMCH and UFCH JH (J. Brus)
  - Working group for the roentgen and neutron analyses
  - **Working group for the structural analyses of molecules** (J. Hašek)
- **Department of analytical chemistry** (P. Holler)

The Institute Director is RNDr. František Rypáček, CSc.

The research of nanotechnologies takes place in departments or working groups marked in bold. Workers involved in the research are identified in brackets.

Research and development focus

In the period 2005–2010, research focuses on the single research plan. There are 74 programme projects solved in 2008.

Research plan AV0Z40500505 **"Progressive macromolecular materials and supramolecular systems: syntheses and studies of properties, phenomena and possible uses within special applications and modern technologies"**, 1/2005–12/2010, the researcher is RNDr. František Rypáček, CSc., the total costs CZK 1332.390 million, thereof CZK 1319.045 million from the state budget. The year 2008 – 50.375/50.375, the nomenclature – the area 6d, the nanotechnological research share – 30 %.

Research focuses on the controlled synthesis of polymer substances and on supramolecular systems of synthetic macromolecules and hybrid systems of synthetic and biological macromolecules resulting in products with a unified and defined structure and with specific utilities. The development is focussed on new theories explaining the physical and chemical behaviour of the studied systems. There is attention paid to studies of arranged systems created by the mutual interaction of synthetic, or synthetic and natural, macromolecules and low-molecular substances done at the atomic, molecular or supramolecular levels. The centre of attention, from the point of view of potential applications, is the development of new intelligent materials reacting to external impulses, materials for bioengineering and biomimetics, with the stress put on the tissue engineering, bioconjugates for the transport of medicine and for the gene therapy, materials applicable in membranes for separation processes, fuel cells, materials and systems for sensors, photonics and microelectronics. The research of technical polymers will focus on the development of hybrid organic-inorganic nanocomposites and polymer nanostructured materials, on the improvement of usable properties of polymer mixtures, and on the development of recyclable and biodegradable materials and materials created from renewable natural resources. The Institute organises relatively extensive research focussing on nanobiotechnologies, nanomedicine, organic nanoelectronics, nanomaterials (polymer nanocomposites and nanostructures), and on the development of nanoscience and experimental methods applicable in macromolecular nanotechnologies.

Research in the area of nanotechnologies covers the three main areas:

- ***Nanomaterials***
  - Organic-inorganic polymer composites containing nanofills.
  - Polymer nanocomposite membranes for the hydrogen and methanol fuel cells, gas separation, and ultra filtration.
  - Surface modifications of materials by conductive polymers.
  - Magnetic nanoparticles.
  - Development of new kinds of organic-inorganic structures, networks of precursors of the original molecular architecture, and liquid-crystal networks and "intelligent" gels.
  - Preparation of two-component mutually penetrated networks of hydrophilic polymers and supramolecular structures containing liquid-crystalline and amorphous areas.
  - Looking for the possibilities of a controlled self-assembly of molecules in supramolecular systems by the variation of external parameters like the temperature, pH, or the ion

strength and utilisation of the controlled self-assembly in the solid state, in inter phases, in a liquid and on the surface for the improvement or creation of usable polymer properties, which could be utilised in the biomolecular engineering, transportation of medicine, microelectronics, sensors, or membranes.

- ***Nanomedicine***

- Nanoparticle and supramolecular systems for the targeted transportation of medicine and gene information.
- Bioanalogic polymers for the tissue engineering. The preparation of new polymers and semisynthetic hybrid macromolecular structures containing nanostructural motives of biologically active biopolymers or their analogues and the study of their role in the creation of specific interactions of the polymer matrix with biomacromolecules, cells and tissues.
- Magnetic nanoparticles for selected applications in medicine, the imaging magnetic resonance and the magnetic hyperthermy.
- Biosensors and the preparation of functioning bioanalogic nanostructures on surfaces of artificial objects. There are detection layers of biosensors, affinity surfaces of separation media, coats of artificial blood compatible surfaces and coats stimulating cell and tissue growth prepared by the progressive deposition of biological and synthetic macromolecules, according to the before designed composition.

- ***Organic nanoelectronics*** (molecular electronics)

- Molecular nanosystems and nanoparts for electronics and photonics based on electron phenomena taking place in polymers, especially the electric conductivity, photo conductivity, generation and transportation of charge carriers, electroluminescence, heliochromy, the transistor phenomenon, and space charge effects.
- Heterogenous organic and hybrid nanocomposite materials for solar cells.

Projects solved in the area of nanotechnologies

a) <u>Projects solved in the institute:</u>

Projects within the programme "Nanotechnology for the Society"

- Project AS CR KAN100500651 "Preparation and studies of organic-inorganic nanocomposite material properties prepared in situ by the emulsive polymerisation", 07/2006–12/2009, the head researcher is Ing. Zdeňka Sedláková, CSc.
- Project AS CR KAN100500652 "Heterogenous organic and hybrid nanocomposite materials for solar cells", 07/2006–12/2010, the head researcher is RNDr. Jiří Pfleger, CSc.

Other projects

- Project of GA CR GA106/06/0044 "Polymer nanocomposite with multiphase polymer matrix; action of nanofiller as reinforcement and compatibiliser", 1/2006–12/2008, the head researcher is Ing. Ivan Kelnar, CSc.
- Project of GA CR GA203/06/0285 "Photoactive molecular electronic parts: the theoretical study and experimental modelling", 1/2006–12/2008, the researcher is RNDr. Petr Toman, Ph.D.
- Project of GA CR GA202/07/0643 "Electron transport in organic-inorganic nanoparts", 1/2007–12/2009, the researcher is Mgr. Miroslav Menšík, Dr.

- Project of GA CR GA203/08/06686 “Spectroscopic studies of the polyaniline nanostructures’ development”, 1/2008–12/2011, the researcher is doc. RNDr. Miroslava Trchová, CSc.
- Project of GA CR GA305/07/1073 “Molecular interaction of polymers for biological and medical applications”, 1/2007–12/2011, the researcher is RNDr. Jindřich Hašek, DrSc.
- Project of GA CR, the programme Eurocores, GESON/06/E005 “Biofunctional self-assembled nanostructures of amphiphilic copolymers, biopolymers, biomacromolecules, and nanoparticles: from bioinspired to biointegrated systems”, 1/2006–12/2009, the head researcher is RNDr. Petr Štěpánek, CSc.
- Project of GA CR GP203/06/P226 “Strengthening of the photoelectric conversion in polymer composites with metallic and semiconducting nanoparticles”, 1/2006–12/2008, the researcher is Mgr. Klára Podhájecká, Ph.D.
- Project GA of AS CR IAA4050409 “Polymers for photonics”, 1/2004–12/2008, the researcher is RNDr. Věra Cimrová, CSc.
- Project GA of AS CR IAA100500501 “Environment-responsive nanoparticles”, 1/2005–12/2008, the head researcher is doc. RNDr. Čestmír Koňák, DrSc.
- Project GA of AS CR IAA400500505 “New multicomponent auto-assembled nanocomposite materials”, 1/2005–12/2009, the head researcher is Ing. Milena Špírková, CSc.
- Project GA of AS CR IAA400500701 “Nanostructural organic-inorganic polymers”, 1/2007–12/2011, the head researcher is RNDr. Libor Matějka, CSc.
- Project GA of AS CR IAA500500701 “Internal organisation of macromolecular systems, crystallisation and the determining of the macromolecular system structures containing proteins”, 1/2007–12/2011, the researcher RNDr. Jindřich Hašek, DrSc.
- Project GA of AS CR KJB200500601 “Micromechanisms and nanomechanisms of the deformation and disruption of polymer nanocomposites”, 1/2006–12/2008, the researcher is Ing. Jiří Kotek, Dr.
- Project of MEYS, the programme COST, OC 138 “Molecular photoconductive and photorefractive systems: From macroscopic elements to nanostructures”, 3/2006–2/2010, the head researcher is prof. RNDr. Stanislav Nešpůrek, DrSc.
- Project of MEYS, the programme KONTAKT, ME 847 “Material surface modification by conductive polymers”, 3/2006–12/2010, the researcher is RNDr. Jaroslav Stejskal, CSc.

b) <u>Selected projects in which the institute is also involved:</u>

Projects within the programme “Nanotechnology for the Society”

- Project AS CR KAN400720701 “Hierarchy nanosystems for microelectronics”, 01/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of UMCH is prof. RNDr. Stanislav Nešpůrek, DrSc.
- Project AS CR KAN200200651 “Nanoparticle and supramolecular systems for the targeted transport of medication”, 07/2006–12/2010, the head researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of UMCH is prof. Ing. Karel Ulbrich, DrSc.
- Project AS CR KAN200520704 “New nanoparticles for the ultrastructural diagnostics”, 01/2007–12/2011, the researcher is doc. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of UMCH is RNDr. Miroslav Šlouf, Ph.D.

- Project AS CR KAN200520804 “Biocompatible nanofibrous constructions creating new medicinal forms for the application of biologically and pharmaceutically active substances”, 01/2008–12/2012, the head researcher is doc. RNDr. Vladimír Holáň, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of UMCH is Ing. Jiří Michálek, CSc.
- Project AS CR KAN200520804 “Biocompatible nanofibrous constructions creating new medicinal forms for the application of biologically and pharmaceutically active substances”, 01/2008–12/2012, the head researcher is doc. RNDr. Vladimír Holáň, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of UMCH is RNDr. Eduard Brynda, CSc.
- Project AS CR KAN401220801 “Nanostructures and nanomaterials of controlled size and dimensions”, 01/2008–12/2012, the head researcher is Ing. Anton Fojtík, CSc., Czech Technical University in Praha, Faculty of Nuclear and Physical Engineering, the co-researcher on behalf of UMCH is Ing. Daniel Horák, CSc.
- Project AS CR KAN401770651 “Molecular nanosystems and nanodevices: electric transport properties”, 7/2007–12/2010, the head researcher is Ing. Martin Weiter, Ph.D., Brno University of Technology, Faculty of Chemistry, the co-researcher on behalf of UMCH is prof. RNDr. Stanislav Nešpůrek, DrSc.

Other projects

- Project of GA CR GA203/07/0717 “Chemical processes supported by laser radiation affects in systems with plasmatic metallic nanoparticles”, 1/2007–12/2009, the researcher is doc. RNDr. Blanka Vlčková, CSc., Charles University, Faculty of Science, the co-researcher on behalf of UMCH is RNDr. Jiří Pfleger, CSc.
- Project of GA CR GA304/07/1129 “Polarised cultures of hepatocytes and mesenchyma cells on nanofibrous layers in the experimental bioreactor”, 1/2007–12/2011, the researcher is prof. MUDr. Miroslav Ryska, CSc., Charles University in Praha, 2nd Faculty of Medicine, the co-researcher on behalf of UMCH is Ing. Jiří Michálek, CSc.
- Project GA of AS CR IAA100100622 “Conjugated silicon polymers for resistors in nanotechnologies”, 1/2006–12/2009, the head researcher is RNDr. Josef Zemek, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of UMCH is prof. RNDr. Stanislav Nešpůrek, DrSc.
- Project GA of AS CR IAA400480616 “Thermoresponsive drug delivery systems for the local radiotherapy”, 1/2006–12/2008, the researcher is Ing. Ondřej Lebeda, Ph.D., Nuclear Physics Institute of AS CR, Husinec – Řež, the co-researcher on behalf of UMCH is Mgr. Martin Hrubý.
- Project GA of AS CR IAA401770601 “Electron processes at the molecular level in substances suitable for the photosensitive organic parts”, 1/2006–12/2009, the researcher is Ing. Martin Weiter, Ph.D., Brno University of Technology, Faculty of Chemistry, the co-researcher on behalf of UMCH is RNDr. Petr Toman, Ph.D.
- Project GA of AS CR 1QS100100553 “New hybrid magnetic nanocomposite materials for selected applications in medicine, for the magnetic imaging resonance and the magnetic hyperthermia”, 7/2005–12/2008, the head researcher is doc. Ing. Emil Pollert, DrSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of UMCH is Ing. Daniel Horák, CSc.

- Project MIT FT-TA3/048 “DPP and CPP compounds based nanomaterials and functional systems for electronic equipment”, 1/2006–12/2008, the researcher is Ing. Martin Kaja, Výzkumný ústav organických syntéz a.s., Pardubice, the co-researcher on behalf of UMCH is prof. RNDr. Stanislav Nešpůrek, DrSc.
- Project MIT FT-TA2/018 “High-tech energy beams technologies for deposition and treatment of films for electronics”, 1/2005–12/2008, the researcher is Ing. Karel Strobl, ELCERAM a.s., Hradec Králové, the researcher is Ing. Karel Strobl, the co-researcher on behalf of UMCH is prof. RNDr. Stanislav Nešpůrek, DrSc.
- Project MIT 1H-PK2/46 “Nanofibres and their composites for technical and biomedical application”, 5/2005–12/2008, the researcher is prof. RNDr. Oldřich Jirsák, CSc., TU Liberec, Faculty of Textiles, the co-researcher on behalf of UMCH is prof. Ing. Karel Ulbrich, DrSc.
- Project MIT 2A-2TP1/135 “New polyfunctional hybrid polymers from renewable and recyclable materials allowing the utilisation of enzyme catalysts and nanoparticles”, 7/2007–6/2011, the researcher is Ing. Tomáš Vlček, Ph.D., SYNPO, a. s., Pardubice, the co-researcher on behalf of UMCH is Ing. Hynek Beneš.
- Project of MEYS 1M0505 “Centre of targeted therapeutics”, 1/2005-12/2009, the researcher is doc. MUDr. Vladimír Viklický, CSc., Nuclear Research Institute Řež a.s., the co-researcher on behalf of UMCH is prof. Ing. Karel Ulbrich, DrSc.
- Project of MEYS 1M0538 “Centre of the cell therapy and tissue repair”, 1/2005–12/2009, the researcher is prof. MUDr. Eva Syková, DrSc., Charles University in Praha, 2nd Faculty of Medicine, the co-researcher on behalf of UMCH is RNDr. František Rypáček, CSc.

c) Selected projects of the international cooperation:
- Cooperation in problem solutions within the network of excellence FP6-NMP3 NANOFUN-POLY “Nanostructured and Multi-functional Polymer-based Materials and Nanocomposites”, 6/2004–5/2008, the network coordinator is prof. José María Kenny, University of Perugia, Italy, 12 participants, the co-researcher on behalf of UMCH is prof. Ing. Dr. Karel Dušek. Detailed information about the network activities is available at www.nanofun-poly.com.
- Cooperation in problem solutions within the network of excellence FP6-NMP3 NANOMEMPRO “Expanding Membrane Macroscale Applications by Exploring Nanoscale Material Properties”, 9/2004–8/2008, the coordinator is prof. Gilbert Marcel Rios, CNRS Montpellier, France, 13 participants, the cooperation on behalf of CR: VSCHT Praha. In UMCH – Ing. Miroslav Bleha, CSc. Information about the project is available at www.nanomempro.com.
- Cooperation in problem solutions within the network of excellence FP6-NMP3 EXPERTISSUES “Novel Therapeutic Strategies for Tissue Engineering of Bone and Cartilage Using the Second Generation of Biomimetic Scaffolds”, 10/2004–9/2009, the coordinator is prof. Riu L. Goncalves Reis, University Minho, Largo do Paco, Portugal, 20 participants, the co-researcher on behalf of UMCH is RNDr. František Rypáček, CSc. Information about the project is available at www.expertissues.org.
- Cooperation in problem solutions within the network of excellence FP6-LIFESCIHEALTH GIANT “Gene Therapy: An Integrated Approach for Neoplastic Treatment”, 1/2005–12/2009, the coordinator is prof. Norman J. Maitland, University of York, UK, 14 participants, the co-researcher on behalf of UMCH is prof. Ing. Karel Ulbrich, DrSc.

Information about the project GIANT is available at www.york.ac.uk/depts/biol/inits/cru//giant/contact.htm.

- Cooperation in problem solutions within the network Marie Curie FP6- BIMORE "Bio-inspired Molecular Optoelectronics", 10/2006–9/2010, the coordinator is Dr. Larry Luer, Consiglio Nazionale Delle Richerche ISMN Instituto per lo Studio dei Materiali Nano-strutturati, INFM Centre for Ultrafast and Ultraintense Optical Science (ULTRAS), Italy, 7 partners, the co-researcher on behalf of UMCH is prof. RNDr. Stanislav Nešpůrek, DrSc. www.bimore.eu

Experts/field

- RNDr. Eduard Brynda, CSc. – nanobiotechnology and nanomedicine (organised sets of biological and synthetic macromolecules for the tissue engineering and biosensors)
- RNDr. Jiří Dybal, CSc. – computer-assisted modelling of chemical structures
- Ing. Daniel Horák, CSc. – nanomedicine (polymer magnetic nanoparticles)
- doc. RNDr. Čestmír Koňák, DrSc. – nanomaterials, nanomedicine (optical methods for the supramolecular polymer materials, nanoclusters and nanoparticles)
- RNDr. Libor Matějka, CSc. – nanomaterials (nanocomposites, organic-inorganic and polymer nanostructured materials)
- prof. RNDr. Stanislav Nešpůrek, DrSc. – organic semiconductors, molecular electronics, development of single dimensional silicon
- RNDr. Jiří Pfleger, CSc. – nanoelectronics (organic molecular electronics, nanoparticles in polymer matrices for solar cells)
- Ing. Josef Pleštil, CSc. – X-ray and neutron structural analysis
- RNDr. František Rypáček, CSc. – nanomedicine (materials for the tissue engineering)
- RNDr. Miroslav Šlouf, Ph.D. – morphology, TEM
- RNDr. Petr Štěpánek, CSc. – nanomaterials (supramolecular nanostructured polymer materials)
- prof. Ing. Karel Ulbrich, DrSc. – nanomedicine (molecular systems for the targeted transport of medicine and genes)

4.1.19. Institute of Molecular Genetics of AS CR (UMG)

Vídeňská 1083, 142 20 Praha 4, I.D. 68378050

www.img.cas.cz

Brief Institute characteristics

The Institute was founded on 1 January 1962 and called the Institute of Experimental Biology and Genetics of CSAV. It was based on a department created within the former Institute of Biology of CSAV. There were parts of the Department of Molecular Biology and the Department of Protein Biochemistry transferred to the Institute from the Institute of Organic Chemistry and Biochemistry of CSAV in 1976. The Institute was renamed, at the same time, to the Institute of Molecular Genetics. The Institute has become a public research institution on 1 January 2007.

The subject of the UMG main activities is the scientific research in the area of molecular basis of serious illnesses (leukaemia, cancer, AIDS), the biology of normal and malign cells and immunity phenomena participating in the protection of organisms. In this connection, there has been research of selected retroviruses, oncogenes, surface cell receptors and cytoskeleton organised. The research also focuses on regulation processes in gene expression and in the transfer of signals within cells, and on molecular fertilisation mechanisms. The Section of Biotechnology of UMG has become independent on 1 January 2008 and the Institute of Biotechnology of AS CR has been founded in Praha. At the time of this publication elaboration, UMG got 22 research departments and a laboratory. Detailed information about activities of some departments was published in the journal Vesmír[7].

The following researchers, of the mentioned departments, solve programme projects focussed on nanotechnologies:

- Department of the cell core biology – Pavel Hozák
- Department of RNA biology – David Staněk
- Department of the cell signalling and apoptosis – Ladislav Anděra
- Department of molecular immunology – Václav Hořejší
- Department of molecular virology – Jarmila Králová
- Department of signal transduction – Petr Dráber
- Department of transplant immunology – Vladimír Holáň
- Laboratory for the structural biology – Milan Fábry

The UMG Director is prof. RNDr. Václav Hořejší, CSc.

Research and development focus

In the period 2005–2010, research focuses on the single research plan. There are 80 programme projects solved in 2008.

Research plan AV0Z50520514 **"Molecular genetic and cell foundations of key biological processes: the gene expression, oncogenesis, replication of viruses, immunity and organisms' development"**, the researcher is prof. RNDr. Václav Hořejší, CSc. The year 2008 – 34.505/34.505, the nomenclature – the area 3, the nanotechnological research share – 20 %.

There are studied life processes and pathological processes, disrupting the structural and functional integrity of live organisms at the molecular and cell levels. The objective of the research plan is to contribute mainly to the clarification of complex mechanisms regulating the gene expression, the roles of these genes' products in the management of basic cell functions in normal and pathologically changed cells, in gametogenesis and in the development of organisms, in the regulation of immunity processes during infectious, tumorous or auto immunity diseases. The learning about structures of the selected genes and general principles related to their regulation and functions in microorganisms, cell or animal models, is considered the unnecessary theoretical prerequisite for the design of processes determined for future diagnostics of pathological situations, but also for any targeted therapeutical interventions. The conducted research is based on the most modern molecular biological, cytological and genomic methodological approaches, on the bioinformation data analysis, and on the preparation and utilisation of target genetically modified organisms.

7 "Institute of Molecular Genetics of AS CR", Vesmír: 86, 6/2007, p. 360; 86, 12/2007, p. 770; 87, 6/2008, p. 354.

Research focussing on nanotechnologies

UMG is also involved, within the research plan and the programme projects, in the area of nanomaterials and nanotechnologies with the stress put on biosensors and new detection methods. Specific works cover:

- Development of a new system for the ultrasensitive detection of proteins on the basis of immuno-PCR.
- Development of new nanoparticles of the sizes 5–15 nm of different shapes or chemical composition, which would be useful for the detection with the assistance of the electron microscopy.
- Development of sensitive specific and robust nanoimmunosensors for the detection of biological ligands, especially cytokinins.
- Development very efficient diagnostics and treatment processes of neoplastic and cardiovascular diseases.
- Development of new generations of systems directing nanopharmaceuticals, medicine and medicaments and of magnetic nanoparticles for diagnostic and therapeutic purposes.
- Preparation of conjugates of golden nanoparticles, antibodies and oligonucleotides.

UFG has been well equipped for research in the area of nanomaterials and nanotechnologies. The Institute has put into operations a unique transmission electron microscope TECNAI T20, made by FEI Czech Republic s.r.o. from Brno, in March 2008.

Projects solved in the area of nanotechnologies

a) <u>Projects solved in the institute:</u>

Projects within the programme "Nanotechnology for the Society"

- Project AS CR KAN200520701 "Nano-PCR – the ultrasensitive test detecting specific proteins in body fluids", 01/2007–12/2011, the researcher is RNDr. Petr Dráber, DrSc.
- Project AS CR KAN200520704 "New nanoparticles for the ultrastructural diagnostics", 01/2007–12/2011, the researcher is doc. RNDr. Pavel Hozák, DrSc.
- Project AS CR KAN200520801 "Targeted expression and transport of bioactive molecules", 01/2008–12/2012, the head researcher is Mgr. David Staněk, Ph.D.
- Project AS CR KAN200520804 "Biocompatible nanofibrous constructions creating new medicinal forms for the application of biologically and pharmaceutically active substances", 01/2008–12/2012, the head researcher is doc. RNDr. Vladimír Holáň, DrSc.

Other projects

b) <u>Selected projects in which the institute is also involved:</u>

Projects within the programme "Nanotechnology for the Society"

- Project AS CR KAN200200651 "Nanoparticle and supramolecular systems for the targeted transport of medication", 07/2006–12/2010, the head researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of UMG is RNDr. Jarmila Králová, Ph.D.
- Project AS CR KAN200520702 "Nanoimmunosensors detecting cytokines", 01/2007–12/2011, the researcher is Ing. Peter Šebo, CSc., Biotechnology Institute of AS CR , Praha, the co-researcher on behalf of UMG is Ing. Radim Osička, Ph.D.

- Project AS CR KAN200520703 “The use of ultrasound in nanomedicine”, 01/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR, Praha, the co-researcher on behalf of UMG is RNDr. Ladislav Anděra, CSc.

Other projects

- Project of MEYS LC06063 “Fluorescence microscopy in the biological and medical research”, 3/2006–12/2010, the researcher is doc. Martin Hof, Dr. rer. nat., J. Heyrovsky Institute of Physical Chemistry, Praha, the co-researcher on behalf of UMG is prof. Pavel Hozák, DrSc.
- Project of MEYS 1M0505 “Centre of targeted therapeutics”, 1/2005–12/2009, the researcher is doc. MUDr. Vladimír Viklický, CSc., Nuclear Research Institute, Husinec – Řež, the co-researcher on behalf of UMG is RNDr. Milan Fábry, CSc.

Results in the area of nanotechnologies/cooperation

- Patent application: PV 2007-599, V. Král, J. Králová, P. Poučková, Z. Kejík, T. Bříza: “Combined approach to the treatment of tumorous diseases”, VSCHT, UMG, 1st Faculty of Medicine of the Charles University.

Experts/field

- RNDr. Ladislav Anděra, CSc. – Department of the cell signalling and apoptosis
- RNDr. Petr Dráber, DrSc. – Department of the signal transduction
- prof. RNDr. Pavel Hozák, DrSc. – Department of the cell core biology
- doc. RNDr. Vladimír Holáň, DrSc. – Department of the transplant immunology
- RNDr. Jarmila Králová, CSc. – Department of the molecular virology

4.1.20. Institute of Organic Chemistry and Biochemistry of AS CR (UOCHB)

Flemingovo nám. 2, 166 10 Praha 6, I.D. 61388963

www.uochb.cas.cz

Brief Institute characteristics

The Institute was founded in 1950 from the Central Institute of Chemistry and it became a part of CSAV on 1 January 1953. After the Institute of Chemistry of CSAV was divided, its major part created the Institute of Organic Chemistry and Biochemistry of CSAV on 1 January 1960. The Institute has become a public research institution on 1 January 2007.

The main activities of UOCHB focus on research in the areas of organic chemistry, biochemistry, molecular and cell biology, computing chemistry, physical organic chemistry and biochemistry, and on the related fields, i.e. medical chemistry, bioorganic chemistry, bioinorganic chemistry, and molecular pharmacology. Research focuses mainly on medical applications, applications targeted on the protection of plants and animals, the development of new synthetic, biotechnological, analytical, and calculation processes, the development of functional molecules, studies of structures, properties and of biological substance activities, peptide chemistry and biochemistry, proteins, nucleic acids, natural substances, their components, and analogues. Scientific activities in the Institute are organised in 6 areas within which there are currently active 24 research teams. The research service works are done in 6 laboratories of the Institute. Research of nanotechnologies takes place in the following fields (some of the programme projects' researchers are presented in brackets):

- Computing chemistry (Z. Havlas, P. Hobza, O. Bludský)
- Bioorganic and medical chemistry (I. Rosenberg)
- Organic syntheses (I. Starý, J. Michl, P. Holý)

The Institute Director is RNDr. Zdeněk Havlas, DrSc.

Research and development focus

In the period 2005–2010, research in the Institute focuses on a single research plan and there are 84 programme projects solved in 2008.

Research plan AV0Z40550506 **"Regulation of biological processes: Chemical modulators of selected systems important for medicine and agriculture"**, 1/2005–12/2010, the researcher is RNDr. Zdeněk Havlas, DrSc. The year 2008 – 33.575/33.575, the nomenclature – the area 3, the nanotechnological research share – 10 %.

The plan makes a part of the long-term research programme the objective of which is the utilisation of the basic research results in the creation of new or in improvements of the current therapeutical strategies, or in strategies protecting plants. The stress is put on the vertically integrated approaches to the studies of biomolecular structures and functions, while the research activities focus on the following four topical areas: (1) Chemistry of biologically important molecules related to serious diseases, (2) Chemistry of infochemicals important for the system plant-insect-microorganism, (3) Synthetic approaches to biologically active and functioning materials, and (4) Physical-chemical methods, spectroscopy and the molecular modelling concentrated on the learning about mechanisms of the effects of targeted molecules. The project has got the two main goals: (1) Support of the interdisciplinary research integrating chemistry, biochemistry and biology with medical and ecological sciences and (2) The training of students in interdisciplinary research methodologies.

The basic research in the area of nanotechnologies focuses on the area of molecular facilities, specifically nanorotors, their utilisation in non traditional energy sources, on the research of conductive polymers, namely carbons containing polyacetylenes and on the research in the area of SAM (self-assembled monolayers) on the basis of organometallic compounds. Nanoobjects are studied also theoretically within the programme of modelling the chemical properties of nano and bio structures.

Projects solved in the area of nanotechnologies

a) <u>Projects solved in the institute:</u>

- Project GA of AS CR IAA400550613 "Dynamics of molecules and ions in the complex molecular systems", 1/2006–12/2008, the researcher is RNDr. Ota Bludský, CSc.
- Project GA of AS CR IAA400550616 "Molecular rotors anchored on the phase surface", 1/2006–12/2009, the researcher is RNDr. Ivo Starý, CSc.
- Project GA of AS CR IAA400550704 "Fullerene containers. Design, synthesis, properties, and possible applications", 1/2007–12/2011, the researcher is Ing. Petr Holý, CSc.
- Project GA of AS CR IAA400550708 "Polyacetylenes containing carbon anions in lateral chains", 1/2007–12/2010, the researcher is prof. Josef Michl, DrSc.

b) Selected projects in which the institute is also involved:

- Project AS CR KAN200100801 "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy", 1/2008–12/2012, the researcher is prof. RNDr. Jiří Nesládek, CSc., HDR, Institute of Physics of AS CR, the co-researcher on behalf of UOCHB is RNDr. Miroslav Ledvina, CSc.
- Project AS CR KAN200200651 "Nanoparticle and supramolecular systems for the targeted transport of medication", 7/2006–12/2010, the researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of UOCHB is RNDr. Ladislav Kohout, DrSc.
- Project AS CR KAN200520703 "The use of ultrasound in nanomedicine", 1/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR , Praha, the co-researcher on behalf of UOCHB is RNDr. Miroslav Ledvina, CSc.
- Project AS CR KAN200520801 "Targeted expression and transport of bioactive molecules", 1/2008–12/2012, the researcher is Mgr. David Staněk, Ph.D., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of UOCHB is Ing. Ivan Rosenberg, CSc.

Experts/field

- RNDr. Zdeněk Havlas, DrSc. – theoretical quantum and computing chemistry and chemical physics
- prof. Ing. Pavel Hobza, DrSc. – theoretical quantum and computing chemistry and chemical physics
- prof. Josef Michl, DrSc. – nanochemistry, nanotechnology, physical chemistry, quantum chemistry, and chemical physics
- RNDr. Ivo Starý, CSc. – organic and supramolecular chemistry
- prof. Ivan Stibor, CSc. – organic and supramolecular chemistry

4.1.21. Institute of Scientific Instruments of AS CR (UPT)

Královopolská 147, 612 64 Brno, I.D. 68081731

www.isibrno.cz

Brief Institute characteristics

The Institute was founded on 1 January 1957 from the Development workshops of CSAV in Brno. The Institute has become a public research institution on 1 January 2007.

UPT is involved in the research of physical methods, special technologies and unique instrument principles in the scientific areas of electron microscopy, magnetic nuclear resonance and quantum light generators. It prepares top technological items and processes in the fields of ultrahigh vacuum, cryogenics and superconductivity. The objective of the interdisciplinary research of matter is the gaining of results usable in biology, chemistry, medicine, ecology, and physics. Research is done by 12 research groups topically associated in 3 departments:

- **Department of electron optics**

Research groups: **Detection systems** (P. Schauer); Electron optical designs; **Laboratory for the electron microscopy** (J. Matějková, A. Rek); **Microlithography** (V. Kolařík,

M. Horáček); **Microscopy by slow electrons** (I. Müllerová, L. Frank); **Special technology** (J. Sobota, T. Fořt, J. Grossmann);

- Department of magnetic resonance and bioinformatics

Research groups: Cryogenics and superconductivity; Measuring and processing of signals in medicine; Nuclear magnetic resonance;

- **Department of coherence optics**

Research groups: **Coherent lasers and interferometers I** (J. Lazar); **Coherent lasers and interferometers II** (O. Číp); **Optical micromanipulation techniques** (P. Zemánek, M. Šerý, M. Šiler).

The Institute Director is RNDr. Luděk Frank, DrSc.

The departments and research teams involved in nanotechnologies are marked in bold and workers working in this area are named in brackets.

Research and development focus

In the period 2005–2010, research focuses on a single research plan and there are 26 programme projects solved in 2008.

Research plan AV0Z20650511 **"Development of experimental methods studying physical properties of matter and their applications in advanced technologies"**, 1/2005–12/2010, the researcher is RNDr. Luděk Frank, DrSc., the total costs CZK 493.460 million, thereof CZK 469.879 million from the state budget. The year 2008 – 34.487/34.487, the nomenclature – the area 7a, the nanotechnological research share – 60 %.

The research plan focuses on the areas of applied physics and technological sciences. The objective is the development of methodologies for the gain of image and spectral information from atomic, molecular and cell structures, including the scanning and processing of biosignals, their selected applications in biology, medicine and material sciences. Electron beams, generated, controlled and detected by the newly developed processes, are utilised for the study of substances and holographic phenomena and in joining and micromachining of materials. The radiation of quantum light generators is utilised for the creation of varied kinds of optical tweezers for the non destructive handling of microobjects. There are also highly coherent lasers developed for the metrology of optic frequencies and for the interferometric measuring. The potential of magnetic nuclear resonance methods of living matter studies will be utilised and extended with the creation of an image contrast by a laser polarised by precious gases and with the technique of spectroscopic imaging.

The Institute has participated for many years in the development of varied methods used in the area of nanotechnologies. They are traditionally also new methods of imaging by electron microscopes, the microlithography technologies utilising an electron lithograph and the deposition of thin layers by the magnetron sputtering. The new original methods of the laser interferometry allow for the measurement of length changes in tenth of nanometres and there has been the equipment designed (the optic tweezers) which utilise the mechanical effect of focussed laser beams for the space catching and transfer of nanoobjects in liquid environments.

Projects solved in the area of nanotechnologies

a) Projects solved in the institute:

- Project GA of AS CR IAA100650803 "Coherent imaging of nanostructures in a low-energy scanning electron microscope with the flat electron detector", 1/2008–12/2010, the researcher is Ing. Miroslav Horáček, Ph.D.
- Project of MEYS, programme COST, OC08034 "Advanced techniques of interferometric optical micro-manipulations", 1/2008–5/2011, the researcher is doc. RNDr. Pavel Zemánek, Ph.D.

b) Selected projects in which the institute is also involved:

- Project AS CR KAN311610701 "Nanometrology using methods of the scanning probe microscopy", 1/2007–12/2011, the researcher is Mgr. Petr Klapetek, Ph.D. from the Czech Metrology Institute in Brno. Ing. Ondřej Číp, Ph.D., and Ing. Josef Lazar, Dr., cooperate on behalf of UPT SA CR.
- Project of MEYS KAN300100702 "Creation of nanostructures by X-ray lasers", 1/2007–12/2011, the researcher is Ing. Bedřich Rus, Dr., Institute of Physics of AS CR, Praha. Ing. Jaroslav Sobota, CSc., cooperates on behalf of UPT AS CR.
- Project GA of AS CR IAA100100622 "Conjugated silicon polymers for resistors in nanotechnologies", 1/2006–12/2009, the researcher is RNDr. Josef Zemek, CSc., Institute of Physics of AS CR. RNDr. Petr Schauer, CSc., cooperates on behalf of UPT.
- Project of GA CR GA202/07/1669 "Depositing of stable thermomechanical nanostructured diamond like thin layers in dual-frequency capacitive discharges", 1/2007–12/2011, the researcher is RNDr. Věra Buršíková, Ph.D., Masaryk University in Brno, Faculty of Science. Ing. Jaroslav Sobota, CSc., cooperates on behalf of UPT.
- Project of GA CR GA202/08/0178 "Synthesis of magnetic Fe-based nanoparticles in low-temperature microwave plasma", 1/2008–12/2010, the researcher is Mgr. Vít Kudrle, Ph.D., Masaryk University in Brno, Faculty of Science. Mgr. Jiřina Matějková cooperates on behalf of UPT.
- Project MIT FT-TA3/133 "Set of laser interferometers for the length nanometrology", 3/2006–12/2009, the researcher is Ing. Jan Kůr, Mesing, spol. s r.o, Brno. Ing. Ondřej Číp, Ph.D., and Ing. Josef Lazar, Dr., cooperate on behalf of UPT AS CR.
- Project of MEYS, the programme "Basic Research Centres" LC06007 "Centre of modern optics", 3/2006–12/2010, the researcher is doc. Mgr. Jaromír Fiurášek, Ph.D., Palacky University Olomouc, Faculty of Science, the co-researcher on behalf of UPT is doc. RNDr. Pavel Zemánek, Ph.D.
- Project of MEYS, the programme EUREKA, OE08012 "Contrast and detection in scanning electron microscopy", 1/2008–12/2010, the researcher is RNDr. Lubomír Tůma, FEI Czech Republic s.r.o., Brno, the co-researcher on behalf of UPT is RNDr. Luděk Frank, DrSc.

Experts/field

- Ing. Jaroslav Sobota, CSc. – deposition of thin layers by the magnetron sputtering
- doc. RNDr. Pavel Zemánek, Ph.D. – optic tweezers, optical micromanipulation
- doc. Ing. Vladimír Kolařík, CSc. – electron lithography, holography

- Mgr. Jiřina Matějková – high resolution REM and the EDS X-rays microanalyses, measuring of thin layers
- Ing. Antonín Rek, CSc. – EDS (energy dispersion) and WDS (wave dispersion) roentgen microanalyses
- Ing. Ilona Müllerová, DrSc. – electron microscopy
- RNDr. Luděk Frank, DrSc. – electron microscopy
- Ing. Ondřej Číp, Ph.D. – laser interferometry
- Ing. Josef Lazar, Dr. – nanometrology

4.1.22. Institute of Rock Structure and Mechanics of AS CR (USMH)

V Holešovičkách 41, 182 09 Praha 8, I.D. 67985891

www.irsm.cas.cz

Brief Institute characteristics

The Institute was founded on 1 January 1958 under the name of Mining Institute of CSAV. It merged with the Institute of Geology of CSAV on 1 March 1979 and became the Institute of Geology and Geotechnology of CSAV. However, it was divided again on 1 March 1990 and renewed as an independent Institute of Geotechnology of CSAV. The current name has been accepted on 1 January 1994. The Institute has become a public research institution on 1 January 2007.

Research activities of USMH range from the care after the local seismic networks and the prediction of seismic threats for important constructions, the finding about structures, tensions and rock damages, with the assistance of seismic wave spreading to the testing of minerals and soils for the purpose of stabilisation of underground constructions, the research of dangerous slope movements and disruptions, the finding of geological risks endangering historical objects, and the utilisation of carbon materials for the treatment of wastes and the preparation of carbon composites. Research is organised in 6 departments. Additional information was published in the journal Academic Bulletin[8].

Research in the area of nanotechnologies takes place, within limited scope, in the Department of composite and carbon materials (K. Balík) and in the Department of geochemistry (Z. Weishauptová).

The USMH Director is Ing. Karel Balík, CSc.

Research and development focus

In the period 2005–2010, research focuses on a single research plan and there are 30 programme projects solved in 2008.

Research plan AV0Z30460519 **"Research of geomaterial properties, development of methods for their ecological utilisation and the interpreting of geodynamic processes"**, 1/2005–12/2010, the researcher is Ing. Karel Balík, CSc., the total costs CZK 644.661 million, thereof CZK 618.655 million from the state budget. The year 2008 – 3.218/3.218, the nomenclature – the area 1, the nanotechnological research share – 5 %.

8 Z. Wieihauptová: "50 years of the Institute of Rock Structure and Mechanics of AS CR", The Academic Bulletin, 5/2008, p. 30.

The research deals with natural geomaterials (soils and mineral environments), artificially created geomaterials (geopolymers) and related materials based on carbon and silicon within the broad range of sizes of structural nanometric, micrometric, millimetre, metre, and kilometre items. The research covers chemical, mineralogical and petrographical composition, mechanical, physical and physical-chemical properties of selected materials, their heterogeneity, especially considering non connecting areas and their development in space and time. There are also thermal and force influences on material properties and behaviour researched. The multidisciplinary research focuses mostly on: 1) Evaluation of dangerous effects of natural and by human activities initiated geodynamic processes, 2) Dynamics in the Czech massive and in the earth crust structure, 3) Ecological utilisation of raw materials in connection with liquidation of hazardous wastes, and 4) The development of materials of the non traditional precursors: biomaterials, flame-resistant materials, construction materials, and sorption materials.

<u>Research in the area of nanotechnologies</u> focuses on the fibrous composite materials usable as bone replacements. Their mechanical properties must be attuned to properties of human bones. The matrix is modified by additives of bioactive nanocomponents like hydroxyapatite and calcium phosphate which support ingrowth of bone cells. Particle composites as the fills of inter body spacers for spine treatments are prepared on the basis of carbonised natural seeds and, again, nanoparticles of hydroxyapatite and calcium phosphate. There are mainly mechanical properties researched, i.e. the mechanical strength and the elastic module under pressure.

Projects solved in the area of nanotechnologies

a) <u>Projects solved in the institute:</u>

- Project of GA CR GA106/06/1576 "Porous composite materials with the polyamide lining and the siloxane matrix with nano-hydroxyapatite as biomaterials", 1/2006–12/2008, the researcher is Ing. Karel Balík, CSc.

b) <u>Selected projects in which the institute is also involved:</u>

- Project MIT FT-TA3/131 "Issues of spine diseases from the degenerative and after accident points of views with the utilisation of knowledge of the tissue engineering, vertebrae biomechanics, osseointegration, artificial replacements, and the study of their failure" 4/2006–12/2009, the researcher is Ing. František Denk, Medin Ortopaedics, a.s., the co-researcher on behalf of USMH is Ing. K. Balík, CSc. The project solution focuses, among other things, also on the research and development of osseointegration materials, based on nanoparticle composites, for the treatment of spine problems.
- Project of GA CR GA205/07/0772 "Behaviour of fullerenes in geological materials and environments", 1/2007–12/2009, the researcher is doc. RNDr. Jan Jehlička, DrSc., Charles University in Praha, Faculty of Science, the co-researcher on behalf of USMH is Ing. Zuzana Weishauptová, DrSc.

Experts/field

- Ing. Karel Balík, CSc. – composites as the biomaterials
- Ing. Zuzana Weishauptová, DrSc. – adsorption and absorption, porous structures, carbon materials

4.1.23. Institute of Systems Biology and Ecology of AS CR (USBE)

Na Sádkách 7, 370 05 České Budějovice, I.D. 67179843

www.usbe.cas.cz

Brief Institute characteristics

The Institute was founded on 1 April 1993. It continues a part of research activities of the former Institute of System and Ecological Biology of CSAV in Brno and of the Institute of Country Ecology of CSAV in České Budějovice. The Academic Council of AS CR changed the institute name, on the basis of evaluation and changes of main scientific activity fields, on 1 July 2005 to the Institute of Systems Biology and Ecology of AS CR. The Institute has become a public research institution on 1 January 2007.

The main subject of the Institute activities is the research focussed on the analysis of the flow of energy, substances and information inside biological systems. Research activities of USBE relate to the systemic approach strongly connected with the methodological contents of the broader term system biology/ecology. Research takes place in three sectors (the sector of physical biology, the sector of integral ecology, and the sector of ecosystem processes) which are divided into departments and laboratories. The research of nanotechnologies is organised within the Sector of physical biology.

The Institute Director is prof. RNDr. Michal V. Marek, DrSc.

Research and development focus

In the period 2005–2010, research focuses on the single research plan. There are 35 programme projects solved in 2008.

Research plan AV0Z60870520 **"Space and functional dynamics in biological, ecological and social-economic systems in the interaction with the global climate change"**, 1/2005–12/2010, the researcher is prof. RNDr. Michal V. Marek, DrSc., the total costs CZK 234.120 million, thereof CZK 214.160 million from the state budget. The year 2008 – 1.571/1.571, the nomenclature – the area 3, the nanotechnological research share – 5 %.

The subject of the research plan is the study of the life environment as the natural-social system developing in space and time. Natural systems are characteristics with their space and functional dynamics which could be, with certain simplification, followed on the basis of the analysis of the flow of energy, substances and information given by the system. The impact of the global change is considered not only as an important environmental factor, but also as the impulse for the introduction of new biotechnologies and nanotechnologies.

The Department of biomagnetic techniques, in the Sector of physical biology, deals in the area of nanotechnologies with the preparation of biocompatible magnetic liquids, with the preparation, studies and utilisation of composite materials based on biological structures (e.g. microbial cells, lignocellulose materials) modified by magnetic liquids, the preparation and utilisation of magnetic biopolymer microparticles, where magnetic nanoparticles make the magnetic part, and the study of preparation of magnetic biocompatible polymer nanoparticles, as the potential medicine carriers. The main researchers are I. Šafařík and M. Šafaříková.

The Laboratory for nanobiology, in the Sector of physical biology, deals with the area of nanotechnologies when developing approaches and methods for the high resolution imaging of biological structures. The main researched topic is the imaging of structure dynamics and the functions of protein complexes under physiological conditions. The main research tools are the fluorescence and confocal microscopy, the microscopy of atomic forces, the dynamic force spectroscopy, and the scanning tunnelling microscopy. The main researcher is D. Kaftan.

Projects solved in the area of nanotechnologies

a) Projects solved in the institute:

- Project of GA CR GA206/06/0364 "Structural and functional dynamics of photosynthetic membranes", 1/2006–12/2008, the researcher is Mgr. David Kaftan, Ph.D.
- Project of MEYS, the programme COST OC 108 "Magnetic techniques for the detection and establishment of xenobiotics in waters", 3/2006–3/2009, (COST 636: Xenobiotics in the Urban Water Cycle, 2006–2008), the researcher is doc. Ing. Ivo Šafařík, DrSc. Magnetic nanoparticles are utilised in the research.
- Project of MEYS, the programme COST OC157 "Magnetic modification of renewable polymer materials and microbial cells", 3/2007–9/2010, (COST 868, Biotechnical functionalisation of renewable polymeric materials, 2007–2010), the researcher is doc. Ing. Ivo Šafařík, DrSc. Magnetic nanoparticles are utilised in the research.
- Project of MIT 2A-1TP1/094 "Magnetic composite materials", 11/2006–12/2011, the researcher is doc. Ing. Ivo Šafařík, DrSc.

Experts/field

- doc. Ing. Ivo Šafařík, DrSc. – biomagnetic techniques – preparation of magnetic nano- and microparticles and biocompatible magnetic carriers, the development of new methods and applications in the area of biochemistry, microbiology, (bio)analytical chemistry and biotechnology
- Ing. Mirka Šafaříková, Ph.D. – biomagnetic techniques – preparation of magnetic nano- and microparticles and biocompatible magnetic carriers, the development of new methods and applications in the area of biochemistry, microbiology, (bio)analytical chemistry and biotechnology
- Mgr. David Kaftan Ph.D. – spectroscopy, microscopy, scanning probe microscopy, photosynthesis

4.1.24. Institute of Theoretical and Applied Mechanics of AS CR (UTAM)

Prosecká 76, 190 00 Praha 9, I.D. 68378297

www.itam.cas.cz

Brief Institute characteristics

The Institute was founded on 1 January 1953 from a part of the Klokner Research and Constructional Materials Testing Institute founded in 1921. The Institute has become a public research institution on 1 January 2007. The Institute deals with the theoretical and experimental research in the field of construction theory (with the main focus on building constructions), the construction dynamics (the stochastic dynamics, aerodynamics, and aeroelasticity), the non linear mechanics, the mechanics of material and construction disruption, micromechanics, biomechanics, soil mechanics, and the experimental methods in mechanics and for the monitoring and evaluation of constructions reliability. It develops the analysis of historical materials and constructions and technologies for their protection and repairs. It also solves problems connected with the protection of historical buildings and settlements. The Institute is divided into 10 departments, the Centre of Experimental Mechanics, and other parts.

The Institute Director is doc. Ing. Miloš Drdácký, DrSc.

Research and development focus

In the period 2005–2011, research focuses on the single research plan which does not focus on nanotechnology. There are 21 programme projects solved in 2008. It started resolving the programme project described below in January 2008 in co-operation with the Faculty of Civil Engineering of CVUT.

Projects solved in the area of nanotechnologies

a) The project solved by the Institute:

- Project AS CR IAA200710801 "Conversion from micro-and nano-indentation instrumented measurements data to mechanical characteristics of visco-elastic materials", 1/2008–12/2010, the researcher is Ing. Jiří Minster, DrSc.

Expert/field

- Ing. Jiří Minster, DrSc. – rheonomous material mechanics

4.1.25. Institute of Thermomechanics of AS CR (UT)

Dolejškova 5, 182 00 Praha 8, I.D. 61388998

Brief Institute characteristics

The Institute was founded as the Mechanical engineering laboratory of CSAV on 1 January 1953. The workplace was renamed on 1 January 1955 and it became the Institute for the Research of Machines of CSAV. The current name was accepted on 1 January 1964. The Institute of Thermomechanics has merged with the Institute of Electrical Engineering on 1 January 2006. The Institute has become a public research institution on 1 January 2007.

The Institute develops its activities in selected areas of technical physics with the focus on traditional areas – the liquid dynamics, thermodynamics, dynamics of mechanical systems, mechanics of deformed objects, and the material diagnostics, but also on solution of interdisciplinary problems like the interactions of liquids with solid objects, aerodynamics of the environment, biomechanics, and mechatronics. The research of high voltage electromechanical systems focuses mainly on electric machines, instruments and other facilities from the point of view of their physical parameters, dynamics, management and working media. UT is divided into 8 departments at the address of the Institute in Praha 8 (liquid dynamics; thermodynamics; dynamics and vibrations; impacts and waves in objects; aerodynamics of the environment; electric machines, drives and the performance electronics; electrophysics of non destructive testing). UT has got 4 branches: in Plzeň (Material Diagnostics Centre), in Brno (Mechatronics Centre), in Praha 6 (Energy Centre), and in Ostrava (Intelligent Systems and Structures Centre).

The Institute Director is doc. RNDr. Zbyněk Jaňour, DrSc.

Research works in the area of nanotechnologies were identified only in the Material Diagnostics Centre in Plzeň.

Projects solved in the area of nanotechnologies

The Centre of Material Diagnostics in Plzeň solves the project of GA CR GA101/07/0789 **"Nanodiagnostics of defects within the 3D molecular dynamics"**, 1/2007–12/2009, the researcher is doc. Ing. Petr Hora, CSc., the Centre Manager. The project utilises the atomic simulation by the molecular dynamics method (MD) for the gain of information about possibilities of the detection of pre-existing cavities and precipitates of nanoscopic sizes with the assistance of comparisons of tension wave dispersion in perfect crystals and in crystals with the mentioned defects. The gained information could be useful for the acoustic non destructive detection of defects in nanostructured materials. There are also organised MD-studies of the impacts of Cu nanoparticles on the stability of cracks and nanocavities in 3D alpha-iron crystals. These results could be useful for the better understanding of the so-called copper embrittlement of structural ferritic steels, including older reactor steels.

Expert/field

- doc. Ing. Petr Hora, CSc. – spread of waves in solid bodies, acoustic emissions, signal processing

4.1.26. Institute of Animal Physiology and Genetics of AS CR (UZFG)

Rumburská 89, 277 21 Liběchov, I.D. 67985904

www.iapg.cas.cz

Brief Institute characteristics

The Institute was founded on 1 February 1973 under the name of the Institute of Farm Animal Physiology and Genetics of CSAV. The name was changed on 31 December 1992 to the Institute of Animal Physiology and Genetics of AV CR. The Institute has become a public research institution on 1 January 2007.

The main subject of UZFG of AS CR activities is the organisation of the basic scientific research mainly in the area of learning about physiological functions, genetic structures and interactions in the animal genome. It relates mainly to the research of species/populations which are important in medicine (model species), ecology (protected or otherwise important species), or in agriculture (farm animals), but also to the research in the area of food quality and safety. The result of all the Institute activities is the production of priority scientific results, with the impact on the area of the basic research, but also the creation of prerequisites on the fast application of the gained knowledge in medicine, ecology and agriculture. UZFG consists of four sections which are further divided into 11 laboratories placed in Liběchov, Praha, and Brno.

Research and development focus

In the period 2005–2010, research focuses on the single research plan. There are 41 programme projects solved in 2008.

Research plan AV0Z5040515 **"Genetic, functional and development potential of animal cells, tissues and organisms: their utilisation in medicine, ecology and agriculture"**, 1/2005–12/2011, the researcher is Ing. Jan Kopečný, DrSc., the total costs

CZK 422.330 million, thereof CZK 422.330 million from the state budget. The year 2008 – 3.224/3.224, the nomenclature – the area 3, the nanotechnological research share – 5 %.

The objective of the solution is the research of animal physiology and genetics in four basic areas:

1) The studies of growth and ripening of oocytes, including their proteom analysis, the research of gene expression in the early embryonic development, and the studies of organ--specific stem cells.
2) Research of the development, differentiation and functions of mammal cells and tissues and the monitoring of the role of the cell proliferation and the cell programmed death, including their signal routes both in the physiological development and in neoplasia.
3) The detailed phylogeographic studies with the goal of learning of evolution and distribution history, the population structure and the development stability of model groups of fishes and mammals, including studies of express and candidate genes influencing the utility features of farm animals.
4) Research of the digestive tract microflora and the studies of effects and detection of substances disrupting the function of endocrine system with the goal of gaining results for the area of food quality and safety.

The research related to nanotechnologies is done by workers from the Section of reproduction and the development mammal biology led by prof. MVDr. Jan Motlík, DrSc., and from the Section of animal embryology, cell and tissue differentiation led by prof. MVDr. Ivan Míšek, DrSc.

Projects solved in the area of nanotechnologies

Projects in which the institute cooperates:

- Project of MEYS 2B06130 "The utilisation of the newly synthesised biomaterials in combination with stem cells in the treatment of diseases affecting human tissues derived from mesoderm: the cartilage, bone, ligaments, and meniscus", 7/2006–6/2011, the researcher is prof. MVDr. Alois Nečas, Ph.D., University of Veterinary and Pharmaceutical Sciences Brno, Faculty of Veterinary Medicine, the co-researcher on behalf of UZFG is prof. MUDr. Jan Motlík, DrSc.
- Project of MEYS, the programme "Research Centres" 1M0538 "Centre of the cell therapy and tissue repair", 1/2005–12/2009, the researcher is prof. MUDr. Eva Syková, DrSc., Institute of Experimental Medicine of AS CR, Praha, the co-researcher on behalf of UZFG is prof. MUDr. Jan Motlík, DrSc.
- Project of GA CR GA203/08/1680 "Nanotechnology in the functional diagnostics of apoptotic and tumorous cells", 1/2008–12/2011, the researcher is Ing. Karel Klepárník, CSc., from the Institute of Analytical Chemistry of AS CR, Brno, the co-researcher on behalf of UZFG is MVDr. Ivan Míšek, DrSc.

Experts/field

- prof. MVDr. Jan Motlík, DrSc. – nerve stem/progenitoral cells, regeneration and renewal of the central nerve system with the focus on the spinal cord; stem cells of skin and the mesenchyme stem cells, and their controlled differentiation
- prof. MVDr. Ivan Míšek, DrSc. – development anatomy, odontogenesis and the morphogenetic dental system, the central nerve system, and sense organs.

4.2. UNIVERSITIES

4.2.1. Charles University in Praha

Ovocný trh 3–5, 116 36 Praha 1, I.D. 00216208

www.cuni.cz

Charles University, founded in 1348, belongs among the oldest universities in the world and it is today one of the most important educational and scientific institutions in the Czech Republic. It is also renowned within the European and the world context. Its scientific and pedagogical performance and its unique historical traditions make it also an important cultural institution.

The University has got currently 17 faculties (14 in Praha, 2 in Hradec Králové, and 1 in Plzeň), 3 university institutes, 6 other workplaces for the education, science, research, and development, including other creative activities or for the provision of information services, 5 all university purpose-oriented facilities, and the Chancellorship as the executive workplace managing UK. The University employs more than seven thousand workers, thereof four thousand academics and researchers.

There are more than 42 400 students studying (about one fifth of all students in the Czech Republic) within more than 270 accredited study programmes offering almost 600 fields of study. The undergraduate study programmes are studied by 7 200 students, while 29 000 students study the bachelor programmes and more than 6 200 students study within the master of doctoral programmes. More than 5 000 people participate every year in many life long educational courses.

The priority of the University relates to scientific and research activities which must be undertaken by students of bachelor and post gradual study courses. The scientific output of UK workplaces, measured by the volume of gained funds provided to universities in the Czech Republic, equals about one third of all these finances. The objective of UK is to profile itself as a research university that is competitive within the world university and research area.

The Charles University is, according to the valid legislature, a public university, i.e. an autonomous scientific and educational institution. UK is managed by its Rector and the highest academic self-administration body is the Academic Senate. Other authorities are the Scientific Council and a Bursar. The Administrative Board looks after the assertion of public interests in the UK activities. The advisory body of the Rector is his Consultative Body consisting of Pro-rectors, the Bursar and the Chancellor. Faculties are highly independent and they are headed by Deans. Other University parts are managed by their Directors.

The Rector of the Charles University is prof. RNDr. Václav Hampl, DrSc.

Research and development in the area of nanotechnologies has been identified in the following organisational university units:

- 1st Faculty of Medicine
- 2nd Faculty of Medicine
- 3rd Faculty of Medicine
- Faculty of Pharmaceuticals in Hradec Králové

- Faculty of Science
- Faculty of Mathematics and Physics

4.2.1.1. 1st FACULTY OF MEDICINE OF UK (1st LF)

Kateřinská 32, 121 08 Praha 2
www.lf1.cuni.cz

Brief faculty characteristics

The 1st Faculty of Medicine has been a part of the Charles University in Praha since 1348 and it is the oldest faculty of medicine in Central Europe. It trains future medicine doctors and doctors in the field of dentistry, but only within the form of the full-time studies. The Faculty also organises university graduate studies in the fields of nursing, ergotherapy, physiotherapy, healthcare technology and related studies in the fields of healthcare technology and informatics for the pedagogy of healthcare subjects at advanced educational schools. The Faculty is divided into 74 institutes and clinics. The biggest educational base of the 1st Faculty of Medicine is the General Teaching Hospital in the Karel Square. The Faculty has got its workplaces also in the Teaching Hospital Na Bulovce, and in its polyclinic, in the Teaching Thomayer Hospital, in the Central Military Hospital, and in the Teaching Hospital Motol.

Research works cover the entire scope of biomedicinal theoretical and pre-clinical fields and the issues of diagnostic, treatment and preventive methods, clinical processes used in medicine and dentistry. The Faculty now includes also the Institute of Dental Research and the joint workplace with the Institute of Rheumatology, the Rheumatological Clinic of 1st LF, the joint workplace with the Institute of Haematology and Blood Transfusion – the Institute of Clinical and Experimental Haematology.

Research and development focus

The 1st LF of UK has been currently resolving four research plans three of which include features of nanobiotechnology and nanomedicine. It also solves 93 programme projects in 2008.

Research plan MSM0021620806 **"Molecular cell biology and pathology of normal and selected clinically serious pathological processes"**, 1/2005–12/2011, the researcher is prof. MUDr. Milan Elleder, DrSc., the total costs CZK 1000.869 million, thereof CZK 961.775 million from the state budget. The year 2008 – 6.622/6.622, the nomenclature – the area 3, the nanotechnological research share – 5 %.

The research plan represents twelve basic biomedicine areas focussed on selected problems in normal and pathological states. The superior objective is the mutual convergency of research workplaces focussing on biomedicine at the common molecular and cell levels as the necessary prerequisite for the perspective biomedicinal research. Research oriented in this way is an important source of relevant information about cell processes taking place in normal and in pathological states and their understanding should allow the development of new therapeutical processes. The priorities are structural biological studies of the nuclear compartment, especially the description of the nucleus structure from the point of view of the rRNA synthesis and replication of ribosomal genes, the studies of chromosome territory dynamics in connection with their replication, the analysis of mutual chromosome positions in the nucleus, the analysis of the "linker" histone position in the chromatin fibre, the study of the function of the Cajal body and nuclei stains, the modification and remodulation of the chromatin within the regulation of transcription, the identification of new proteins, etc.

Research plan MSM0021620808 **“Molecular-biological, genetic and epigenetic aspects of the creation and development of model tumours in adults. The significance for epidemiology, early diagnostics and treatment”**, 1/2005–12/2011, the researcher is prof. MUDr. Pavel Klener, DrSc., the total costs CZK 281.412 million, thereof CZK 232.727 million from the state budget. The year 2008 – 8.014/8.014, the nomenclature – the area 3, the nanotechnological research share – 20 %.

Research works should bring new knowledge from the area of cell and molecular biology and physiology which is important from the point of view of the basic research (the understanding of some regulating growth mechanisms, cell differentiation and transformation), but also clinically (cells for the cytostatic treatment). Results of the research plan should allow the identification of molecular targets and cell regulating processes allowing for prediction, early diagnostics, continuous monitoring of diseases’ development, etc. Another goal is the design of new biologically active substances interfering with the tumorous progression at the level of the transformed cell itself and also by influencing the immunity system.

Research plan MSM0021620807 **“Metabolic, endocrine and genetic aspects in the prevention, diagnostics and therapy of cardiovascular, cerebrovascular and renovascular diseases”**, the researcher is prof. MUDr. Jan Škrha, DrSc., the total costs CZK 127.764 million, thereof CZK 102.924 million from the state budget. The year 2008 – 0.901/0.901, the nomenclature – the area 3, the nanotechnological research share – 5 %.

The subject of the research plan, its clinical part, is the definition, diagnostics and therapeutical influencing of threatening risks of vein damage (in the cardiovascular, cerebrovascular and renovascular areas) in the population with the higher endogenic and exogenic conditional tendency towards these damages. There is the analysis organised of genetic, metabolic, endocrine and humoral causes leading to the damaged vein walls in identified individuals in risk as well as the testing of new therapeutical processes. The research plan solves the issues of diseases resulting in vein complications, which influence the morbidity and mortality of the effected population. The results should relate to provisions leading towards the primary prevention of vein damages. The part related to the basic research analyses factors influencing the development of vein changes from the point of view of pathogenetic mechanisms.

Works having the character of biotechnologies and nanomedicine are organised in the following institutes and laboratories:

The Institute of Pathological Physiology organises the development of bioaffinity, imunoaffinity and enzyme reactors as parts of the microchip devices for searches of auto-antigen epitops. The preparation of enzyme reactors utilises magnetic micro or nano particles. The Laboratory of the gene expression in the Institute of Cell Biology and Pathology organises the research of functional organisation of the cell nucleus.

The Laboratory of the molecular haematology in the 1st Internal Clinic organises the molecular diagnostics of haematology malign diseases with the use of PCR (the polymer chain reaction).

The Institute of Pharmacology, the Department of clinical pharmacology, organises the DNA gene analyses for the metabolism and transport of xenobiotics.

The Research angiological laboratory in the 2nd Internal Clinic organises the separation of lipoproteins and the characterising of their sub fractions (5–1200 nm).

The Institute of Hereditary Metabolic Disorders uses techniques of the molecular biology, when studying hereditary metabolic diseases (the gene analyses connected to the studied disease – the PCR sequencing, the position cloning, the study of gene expression, and protein studies).

The Laboratory for endocrinology and metabolism in the 3rd Internal Clinic organises DNA analyses researching hyperlipoproteinaemia, arterial hypertension and diabetes.

Projects solved in the area of nanotechnologies

a) Projects in which faculty workers participate:

Projects within the programme "Nanotechnology for the Society"

- Project AS CR KAN200200651 "Nanoparticle and supramolecular systems for the targeted transport of medication", 7/2006–12/2010, the researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of 1st LF is prof. MUDr. Pavel Martásek, DrSc.
- Project AS CR KAN400100701 "Functional hybrid semiconductor and metal nanosystems with organic substances (FUNS)", 1/2007–12/2011, the researcher is RNDr. Bohuslav Rezek, Ph.D., Institute of Physics of AS CR, Praha, the co-researcher on behalf of 1st LF is Ing. Stanislav Kmoch, CSc.

Experts/field

- prof. MUDr. Milan Elleder, DrSc. – haematology, oncology
- prof. MUDr. Pavel Martásek, DrSc. – molecular medicine
- doc. MUDr. Karel Smetana, DrSc. – cell biology and the tissue engineering

4.2.1.2. 2nd FACULTY OF MEDICINE OF UK (2nd LF)

V Úvalu 84, 150 06 Praha 5

www.lf2.cuni.cz

Brief faculty characteristics

The 2nd Faculty of Medicine was founded by the division of the Faculty of Medicine of the Charles University. It was founded in 1953 as the Faculty of Child Medicine of the Charles University in Praha. The Academic Senate of the Charles University approved, on 7 September 1990, a proposal to change the Faculty name to the 2nd Faculty of Medicine of the Charles University in Praha. The main mission of the Faculty is the medicine teaching and research in medical sciences. The Faculty is divided into 3 centres, 27 institutes and 24 clinics. The sector of research and development at the 2nd LF UK is characteristic of scientific and research activities conducted in the Teaching Hospital Motol. One of the centres founded within the programme by MEYS "Research Centres" is the "Cell Therapy and Tissue Replacement Centre"[9]. Research is largely focussing on the area of nanomedicine. The works extend activities of a similar centre which was developing these activities in the period 2000–2004.

9 E. Syková: "Centre for cell therapies and tissue repairs – the cooperation of UK workplaces with AS CR and MH", Academic Bulletin, 2/2008, p. 8.

Research and development focus

There are currently two research plans solved within 2nd LF. One of them contains parts of nanobiotechnologies and nanomedicine. There are also 46 programme projects solved in 2008.

Research plan MSM0021620813 **"Molecular bases of children tumorous diseases and the treatment applications"**, 1/2005–12/2011, the researcher is prof. MUDr. Jan Starý, DrSc., the total costs CZK 166.742 million, thereof CZK 124.013 million from the state budget. The year 2008 – 0.506/0.506, the nomenclature – the area 3, the nanotechnological research share – 3 %.

A lack of functioning or surplus functioning of the immunity system leads to serious health consequences. There is about 40 % of the population suffering of some of diseases which result from the inappropriate reactions by the immunity system. This covers allergies, self-immune disorders, primunodeficiencies, tumorous diseases, and immunity-related reproduction disorders. This whole group of disorders is now called around the world by the term IMID – Immune-Mediated Inflammatory Disorders. The subject of the research plan is the study of common mechanisms resulting in the above-mentioned states and possibilities of their early diagnostics and treatments. There are studied selected genetic factors associated with the immunity disorders, the functional pathogenetic mechanisms resulting in damages to organisms, the early laboratory diagnostics, and immunotherapy possibilities. The whole project has been divided into several basic areas – allergies and anaphylaxis, primary and secondary immunodeficiencies, self-immunity system and organ specific diseases, tomorous immunology, etc. The research in the area of nanomedicine is probably conducted in several institutes of the Faculty, but we could not gain the necessary information.

Projects solved in the area of nanotechnologies

a) Projects the receiving party of which is the faculty:

- Project of MEYS 1M0538 "Centre of the cell therapy and tissue repair", 1/2005–12/2009, the researcher is prof. MUDr. Eva Syková, DrSc.
- Project of GA CR GA304/07/1129 "Polarised cultures of hepatocytes and mesenchyme cells on nanofibre layers in an experimental bioreactor", 1/2007–12/2011, the researcher is prof. MUDr. Miroslav Ryska, CSc.

b) Projects in which the faculty cooperates:

- Project of MIT FI-IM4/205 "Nanotechnologies in medicine – a tissue carrier for the reconstructions of connective tissues", 3/2007–9/2010, the researcher is Ing. Jiřina Knotková, CSc., CPN spol. s r.o., Dolní Dobrouč, the co-researcher on behalf of 2nd LF is MUDr. Milan Handl, Ph.D.

Experts/field

- prof. MUDr. Miroslav Ryska, CSc. – issue of the liver transfers, liver failures, and the use of a bioreactor
- prof. MUDr. Jan Starý, DrSc. – children malign and non malign haematology
- prof. MUDr. Eva Syková, DrSc. – stem cells, nanoparticles, artificial biomaterials, and neurosciences
- Other workers, especially from the "Centre for cell therapies and tissue repairs"

4.2.1.3. 3rd FACULTY OF MEDICINE OF UK (3rd LF)

Ruská 87, 100 00 Praha 10

www.lf3.cuni.cz

Brief faculty characteristics

Similarly as the other faculties of medicine at the Charles University in Praha, the 3rd Faculty of Medicine was founded by the division of the Faculty of Medicine of Charles University. It was founded in 1953 as the Faculty of Hygiene. There have been all-important reorganisation changes implemented since November 1989, which were necessary for the organisation of a new teaching plan and the utilisation of the reworked study conception. The name of the Faculty to the 3rd Faculty of Medicine of Charles University has been implemented and its primary general focus has been highlighted. Activities of 3rd LF are closely connected mostly with the Teaching Hospital Královské Vinohrady. 3rd LF is divided into 32 clinics and 23 institutes.

Research and development focus

Research activities by 3rd LF are currently focussing on a wide spectrum of medical problems. The activities follow three research plans and there are 32 grant projects solved in 2008. Research activities in the area of nanotechnologies have just started and they are based on cooperation in the solution of two projects.

Projects solved in the area of nanotechnologies

Projects in which the faculty cooperates:

- Project AS CR KAN200100801 “Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy”, 1/2008–12/2012, the researcher is prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics of AS CR, Praha, the co-researcher on behalf of 3rd LF is As. MUDr. Viktor Kočka, FESC.
- Project AS CR KAN200520701 “Nano-PCR – the ultrasensitive test detecting specific proteins in body fluids”, 1/2007–12/2011, the researcher is RNDr. Petr Dráber, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of 3rd LF is MUDr. Aleš Bartoš, Ph.D. The Neurology Clinic of 3rd LF participates and its role is the patients’ classification and the collection of cerebrospinal fluid and blood plasma from suitable persons.

Expert/field

- MUDr. Aleš Bartoš, Ph.D. – cognition neurology

4.2.1.4. FACULTY OF PHARMACEUTICALS IN HRADEC KRÁLOVÉ (FAF)

Heyrovského 1203, 500 05 Hradec Králové

www.faf.cuni.cz

Brief faculty characteristics

The Faculty of Pharmaceuticals (FaF) of the Charles University in Hradec Králové was founded in 1969. It extended the long traditions of pharmacology studies at UK, which go back to the beginnings of the almae matris. The Faculty has undergone many transformations. As from the academic year 1994/1995, there have been foreign students studying there in English. In addition to traditional graduate pharmacology studies, there is also the undergraduate programme for studies of healthcare bioanalytics which could be extended by the graduate studies. Both study programmes went through demanding accreditation processes and they have been set up to correspond with the current sciences and needs of our and the European practices. The studies fully correspond with study programmes in other countries of the European Union. Research activities make an inseparable part of the Faculty programme in pharmaceutical and related fields. The Faculty regularly gains a number of grants for research projects. The Faculty is divided into 11 departments. Additional information about the Faculty is available in the journal Vesmír[10].

Research and development focus

Research activities in FaF currently focus on the solution of the research plan MSM0021620822 **"Research of new medicine structures"**, 1/2005–12/2011, the researcher is prof. RNDr. Rolf Karlíček, DrSc., and on the solution of 23 programme projects related to the development of new medicine and processes.

There has been noted cooperation of the Department of pharmaceutical technologies in the solution of the applied research project which utilises also nanotechnologies.

Projects solved in the area of nanotechnologies

Projects in which the faculty cooperates:

- Project of MIT 2A-1TP1/015 "New procedures for microdispersion and nanodispersion lipid systems formulation as the transport systems for pharmaceutically effective substances", 7/2006–6/2011, the researcher is RNDr. Jan Mikeska, CSc., Biomedica, spol. s r.o., the co-researcher on behalf of FaF is doc. RNDr. Pavel Doležal, CSc.

Expert/field

- doc. RNDr. Pavel Doležal, CSc. – pharmaceutical technologies

4.2.1.5. FACULTY OF SCIENCE OF UK (PRF)

Albertov 5, 128 43 Praha 2

www.natur.cuni.cz

Brief faculty characteristics

The Faculty of Science was founded in 1920, at the time when it had become apparent that natural science could not be taught in faculties of philosophy or medicine. The Faculty is involved in biology, chemistry, geography, geology, and in studies of the environment. There are two institutions connected with the Faculty of Science: the Botanical Garden of the Charles University and the Hrdlička Museum of Man. Activities of PrF are extensive and focus on teaching and research of modern natural sciences characterised by their interdisciplinary and transdisciplinary nature. The best representation is the complex study of the human living environment. There are also teaching and research activities conducted

10 "Faculty of Pharmaceuticals – the centre of the pharmaceutical research at the Charles University", Vesmír, 87, 1/2008, p. 10.

in the area of biomedicinal sciences which are important for many life aspects. The complex area of geological-geographical studies of natural resources, their utilisation and protection, and the area of chemistry related to modern technological materials is also taught and researched.

The Faculty is divided by scientific fields into sections of biology, chemistry, geography, geology, and the Institute of the Environment. The sections are further divided into 27 departments and institutes.

Research and development focus

Research at PrF UK is currently focussed on the solution of 5 research plans one of which includes problem solutions related to nanotechnologies. There are also 225 programme projects solved in 2008.

Research plan MSM0021620857 **"New molecular systems for the advanced health beneficial and environmentally friendly applications"**, 1/2007–12/2013, the researcher is prof. RNDr. Karel Procházka, DrSc., the total costs CZK 214.275 million, thereof CZK 186.399 million from the state budget. The year 2008 – 6.645/6.645, the nomenclature – the area 6d, the nanotechnological research share – 20 %.

The research plan is a long-term plan for the research conducted by chemistry departments of PrF UK in the area of new material preparations and processes for ecologically sound technologies of advanced applications. The framework of the plan covers: (a) The development of synthetic environmentally friendly processes and the preparation of new compounds, (b) The preparation of sensitive analytical methods and their characterisation, (c) The study of the complex relations between structures and functions of prepared systems. The proposed topics include the study of multifunctional nanomaterials, the development and studies of functions of anti cancer medicine, and a number of other areas.

Research focussing on nanotechnologies is organised in the following sections, departments and institutes:

- Biology section – Department of genetics and microbiology (Z. Palková)
  Laboratory for the electron microscopy (J. Nebesářová)
- Chemistry section – Department of analytical chemistry (J. Barek)
  Department of inorganic chemistry (I. Lukeš, D. Nižňanský, J. Mosinger)
  Department of biochemistry (K. Bezouška)
  Department of the physical and macromolecular chemistry (K. Procházka, B. Vlčková, J. Vohlídal)
  Department of organic and nuclear chemistry (J. Hájíček)
- Geology section – Institute of geochemistry, mineralogy and mineral resources (J. Jehlička, O. Frank)

Projects solved in the area of nanotechnologies

a) Projects the receiving party of which is the faculty:

- Project AS CR KAN201110951 "Combined contrast agents for the molecular MR imaging", 1/2006–12/2010, the researcher is prof. RNDr. Ivan Lukeš, CSc.
- Project of GA CR GA104/06/1087 "Development of catalytic processes for the preparation of conjugated polymers with heteroatoms and their functional nanocomposites", 1/2006–12/2008, the researcher is prof. RNDr. Jiří Vohlídal, CSc.
- Project of GA CR GA106/07/0949 "New ways of magnetic nanocomposites (spinel ferrites) preparation and the study of their physical properties", 1/2007–12/2009, RNDr. Daniel Nižňanský, Ph.D.
- Project of GA CR GA203/07/0717 "Chemical processes supported by laser radiation affects in systems with plasmatic metallic nanoparticles", 1/2007–12/2009, the researcher is doc. RNDr. Blanka Vlčková, CSc.
- Project of GA CR GA203/08/0831 "Nanotextiles producing singlet oxygen", the researcher is RNDr. Jiří Mosinger, Ph.D.
- Project of GA CR GA205/07/0772 "Behaviour of fullerenes in geological materials and environments", doc. RNDr. Jan Jehlička, DrSc.
- Project of GA CR GP205/06/P348 "Creation and maintenance of fullerenes in rocks", 1/2006–12/2008, the researcher is Mgr. Otakar Frank, Ph.D.

b) Projects in which the faculty cooperates:

- Project AS CR KAN200200651 "Nanoparticle and supramolecular systems for the targeted transport of medication", 7/2006–12/2010, the researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of PrF is doc. Ing. Josef Hájíček, CSc.
- Project AS CR KAN100500652 "Heterogenous organic and hybrid nanocomposite materials for solar cells", 7/2006–12/2010, the researcher is RNDr. Jiří Pfleger, CSc., Institute of Macromolecular Chemistry of AS CR, Praha, the co-researcher on behalf of PrF is prof. RNDr. Jiří Vohlídal, CSc.
- Project AS CR KAN300100802 "Nanocomposite, ceramic and thin layer scintillators", the researcher is Ing. Martin Nikl, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of PrF is RNDr. Daniel Nižňanský, Ph.D.
- Project of MEYS LC06035 "Centre of biophysical chemistry, bioelectrochemistry and bioanalysis. New tools for genomics, proteomics, and biomedicine", 3/2006–12/2010, the researcher is doc. RNDr. Miroslav Fojta, CSc., Institute of Biophysics of AS CR, Brno, the co-researcher on behalf of PrF is prof. RNDr. Jiří Barek, CSc.
- Project of MEYS LC06063 "Fluorescence microscopy in the biological and medical research", the researcher is doc. Martin Hof, Dr. rer. nat., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of PrF is doc. RNDr. Zdena Palková, CSc.
- Project of MEYS 1M0505 "Centre of targeted therapeutic drugs", 1/2005–12/2010, the researcher is doc. MUDr Vladimír Viklický, CSc., Ústav nukleárního výzkumu a.s., Husinec – Řež, the co-researcher on behalf of PrF is doc. RNDr. Karel Bezouška, CSc.

- Project of MEYS 1M0506 “Centre of molecular and cellular immunology”, 1/2005–12/2009, the researcher is prof. RNDr. Václav Hořejší, CSc., Institute of Molecular Genetics of AS CR, Praha, the researcher on behalf of PrF is Mgr. Jan Černý, Dr.
- Project of GA CR GA203/07/1424 “Self-assembled porphyritic nanotextures”, 1/2007–12/2009, the researcher is RNDr. Pavel Kubát, CSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of PrF is RNDr. Pavel Mosinger, CSc.

Experts/field

- prof. RNDr. Karel Procházka, DrSc. – self-assembled polymers
- RNDr. Daniel Nižňanský, Ph.D. – nanocomposite magnetic and ferroelectric materials
- doc. RNDr. Blanka Vlčková, CSc. – nanomaterials and nanocomposite materials with Ag and Au nanoparticles, plasmonics
- prof. RNDr. Jiří Vohlídal, DrSc. – nanoporous heterogenous catalysts for polymerisation reactions

4.2.1.6. FACULTY OF MATHEMATICS AND PHYSICS (MFF)

Ke Karlovu 3, 121 16 Praha 1

www.mff.cuni.cz

Brief faculty characteristics

MFF was founded on 1 September 1952 by its separation from the Faculty of Science of UK. A characteristic feature of the Faculty activities is the closeness of educational activities in physics, informatics and mathematics with the creative scientific and research activities conducted in these areas. The Faculty is divided into three sections: physical, information, and mathematical. The sections are divided into 32 departments and institutes which are further divided.

Research and development focus

In the period 2005–2013, research at MFF UK focuses on six important research plans two of which contain tasks related to the research of nanotechnologies. There are 202 programme projects solved in 2008.

Research plan MSM0021620834 **“Physics of the condensed phase: new materials and technologies”**, 1/2005–12/2010, the researcher is prof. RNDr. Pavel Höschl, DrSc., the total costs CZK 563.401 million, thereof CZK 426.041 million from the state budget. The year 2008 – 66.676/66.676, the nomenclature – the area 6d, the nanotechnological research share – 70 %.

Research is focussed on the area of condensed phase physics and on a number of materials of unique physical properties, from highly pure materials for electronics, superconductors and materials with a low-dimension structure to synthetic diamond. There is also the related research of new technologies which utilise molecular beams in an ultrahigh vacuum, reactions taking place in plasma and in high performance microwave generators, or at high temperatures and pressures. Works are also focussed on materials not occurring in nature like, for example, super grids, delta-quantum structures, quantum wires, or quantum dots.

Research plan MSM 0021620835 **"Physics of molecular, macromolecular and biological systems"**, 1/2005–12/2010, the researcher is prof. RNDr. Jan Hála, DrSc., the total costs CZK 285.386 million, thereof CZK 249.942 million from the state budget. The year 2008 – 34.115/29.982, the nomenclature – the area 6b, the nanotechnological research share – 70 %.

The complex research of physical processes in molecular, macromolecular and biological systems extends the successfully resolved previous research plan MSM 113200001 "Biological systems and synthetic macromolecular structures' physics".

The research focus mostly on the physical behaviour of natural and modified nucleotides, natural and artificial photosynthetic systems, photosensitisers of yeasts, and polymer networks, including nanocomposites and polyelectrolytical hydrogels. The theoretical interpretation utilises quantum theories, quantum-chemical calculations and modelling during studies of physical properties of biologically important complexes, intercalates and macromolecular structures. The existing spectroscopic methods are further developed and applied, when researching structures, functions, interactions and dynamics of biological and macromolecular structures at the levels of molecules, macromolecules, membranes, and cells.

Research focussed on nanotechnologies is conducted by the Physical Section, but also in the following departments and institutes:

- Institute of Physics (Š. Višňovský, M. Kučera)
- Department of surface and plasma physics (V. Matolín, I. Ošťádal, P. Řepa)
- Department of materials physics (P. Málek, P. Lukáč, F. Chmelík, M. Cieslar, M. Janeček)
- Department of low temperature physics (I. Procházka, J. Čížek)
- Department of condensed matter physics (R. Kužel, V. Holý, V. Sechovský, K. Carva)
- Department of macromolecular physics (H. Biederman, I. Krakovský)
- Department of chemical physics and optics (P. Malý, J. Valenta, J. Dian, J. Pospíšil)

Projects solved in the area of nanotechnologies

a) Projects the receiving party of which is the faculty:

Project programme "Nanotechnology for the Society"

- Project AS CR KAN101120701 "Nanocomposite layers and nanoparticles created in the low pressure plasma for surface modifications", the researcher is prof. RNDr. Hynek Biederman, DrSc.

Other projects

- Project of GA CR GA106/06/0270 "Nanoceramic materials based on zircon oxide – the study of the microstructure by the positron annihilation spectroscopic method", 1/2006–12/2008, the researcher is RNDr. Ivan Procházka, CSc.
- Project of GA CR GA106/06/0327 "Crystallisation of amorphous and thin nanocrystalline layers", 1/2006–12/2008, the researcher is doc. RNDr. Radomír Kužel, CSc.
- Project of GA CR GA106/07/0303 "The role of grain boundaries in the high-temperature plastic deformation of fine-grain materials", 1/2007–12/2009, the researcher is doc. RNDr. Přemysl Málek, CSc.

- Project of GA CR GA202/06/0025 “Structure and magnetic properties of GaMnAs epitaxial layers”, 1/2006–12/2008, the researcher is prof. RNDr, Václav Holý, CSc.
- Project of GA CR GA202/06/0049 “The studies of atomic processes in growing metal nanostructures on Si(100) surfaces with the assistance of the in-vivo STM”, 1/2006–12/2008, the researcher is doc. RNDr. Ivan Ošťádal, CSc.
- Project of GA CR GA202/06/0531 “Reflection and wave guiding phenomena in magnetic nanostructures”, 1/2006–12/2008, the researcher is prof. Ing. Štefan Višňovský, DrSc.
- Project of GA CR GA202/07/0818 “Silicon nanophotonics – from individual nanocrystals to photonic structures”, 1/2007–12/2009, the researcher is doc. RNDr. Jan Valenta, Ph.D.
- Project of GA CR GA203/06/0786 “Modification of nanocrystalline silicon surfaces with diagnostic organic parts for the optical detection of chemical substances”, 1/2006–12/2008, the researcher is doc. RNDr. Juraj Dian, CSc.
- Project of GA CR GP202/08/P006 “Nanodimension assembly in transient metals and their compounds”, 1/2008–12/2010, the researcher is RNDr. Jana Peltierová-Vejpravová, Ph.D.
- Project of GA CR GP202/08/P158 “Nanocomposite layers metal/polyethylene oxide prepared by the plasma polymerisation for biomedical applications”, 1/2008–12/2010, the researcher is Ing. Andrey Shukurov.
- Project of GA of AS CR IAA101120803 “Structural stability of fine-grain materials prepared by the intensive plastic deformation”, the researcher is doc. RNDr. Miloš Janeček, CSc.
- Project of GA of AS CR IAA101120804 “Silicon nanostructures for photonics”, 1/2008–12/2012, the researcher is prof. RNDr. Petr Malý, DrSc.
- Project of GA of AS CR KJB101120803 “Electron structure and transport properties of non collinear magnetic nanostructures”, 1/2008–12/2010, the researcher is Mgr. Karel Carva, Ph.D.

b) Projects in which the faculty cooperates:

Projects within the programme “Nanotechnology for the Society”

- Project AS CR KAN100400702 “Nanostructural materials for the catalytic, electrocatalytic and sorption applications”, 1/2007–12/2011, the researcher is prof. RNDr. Zdeněk Samec, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of MFF is prof. RNDr. Vladimír Matolín, DrSc.
- Project AS CR KAN100500651 “Preparation and studies of organic-inorganic nanocomposite material properties prepared in situ by the emulsive polymerisation”, 7/2006–12/2009, the researcher is Ing. Zdeňka Sedláková, CSc., Institute of Macromolecular Chemistry of AS CR, Praha, the co-researcher on behalf of MFF is RNDr. Ivan Krakovský, CSc.
- Project AS CR KAN300100801 “Multifunctional metallic bulk materials with nanocrystalline and ultrafine grain structures”, 1/2008–12/2012, the researcher is prof. Ing. Pavel Lejček, DrSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is RNDr. Ivan Procházka, CSc.
- Project AS CR KAN400100652 “Structures for spintronics and quantum phenomena in nanoelectronics created with the electron beam lithography”, 7/2006–12/2010, the researcher is Ing. Ludvík Smrčka, DrSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is prof. RNDr, Václav Holý, CSc.

- Project AS CR KAN400100653 “Self-assembled magnetic nanostructures”, 7/2006–12/2010, the researcher is Ing. Ján Lančok, Ph.D., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is prof. RNDr. Vladimír Čechovský, DrSc.
- Project AS CR KAN400720701 “Hierarchy nanosystems for microelectronics”, 1/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of MFF is doc. RNDr. Radomír Kužel, CSc.
- Project AS CR KAN300100802 “Nanocomposite, ceramic and thin layer scintillators”, 1/2008–12/2011, the researcher is Ing. Martin Nikl, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is doc. RNDr. Miroslav Kučera, CSc.
- Project AS CR KAN400100701 “Functional hybrid semiconductor and metal nanosystems with organic substances (FUNS)”, 1/2007–12/2011, the researcher is RNDr. Bohuslav Rezek, Ph.D., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is prof. RNDr. Petr Malý, DrSc.

Other projects

- Project of MEYS LC 510 “Centre of nanotechnologies and materials for nanoelectronics”, 1/2005–12/2009, the researcher is RNDr. Jan Kočka, DrSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is doc. RNDr. Jan Valenta, Ph.D.
- Project GA of AS CR IAA100100729 “Development of new hybrid deposition techniques for the preparation of thin nanostructural fluoride layers of distinct fluorescence properties”, 1/2007–12/2010, the researcher is Ing. Ján Kančík, Ph.D., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is doc. RNDr. Radomír Kužel, CSc.
- Project GA of AS CR IAA200100701 “Magnetic nanocomposites based on 3d-metals for the high-frequency and sensor applications prepared with the assistance of the UHV plasma jet”, 1/2007–12/2009, the researcher is Ing. Bc. František Fendrych, Ph.D., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is doc. RNDr. Petr Řepa, CSc.
- Project of GA CR, the programme EUROCORES, GEFON/06/E001 “Spin-dependent transport and electron correlations in nanostructures”, the researcher is Ing. Vít Novák, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of MFF is prof. RNDr, Václav Holý, CSc.

Experts/field

- prof. RNDr. Vladimír Matolín, DrSc. – surface and thin layer physics, research of structures and reactivity of single and multi-component metallic systems
- doc. RNDr. Ivan Ošťádal, CSc. – heteroepitaxial growth of metals on silicon surfaces, the STM technique
- doc. RNDr. Petr Řepa, CSc. – vacuum technique and technology, measuring of nanomaterial properties, methods of nanostructures’ creation
- doc. RNDr. František Chmelík, CSc. – acoustic emissions in solid substances, structures and physical properties of aluminium or magnesium-based alloys and composites, plastic instability (doubling, Portevin–Le Châtelier phenomenon), materials with sub microcrystalline and nanocrystalline structures
- prof. RNDr. Pavel Lukáč, DrSc. – material physics, nanostructures

- doc. RNDr. Radomír Kužel, CSc. – X-ray diffraction study of polycrystalline materials (nanostructured materials)
- prof. RNDr. Hynek Biederman, DrSc. – plasma polymerisation
- prof. RNDr. Vladimír Sechovský, DrSc. – condensed matter physics, electron structures and properties of new materials, magnetism
- doc. RNDr. Přemysl Málek, CSc. – ultrafine-grain and nanostructured materials
- doc. RNDr. Petr Malý, DrSc. – quantum optics and optoelectronics, ultrafast laser spectroscopy, semiconducting nanocrystals, spintronics
- RNDr. Miroslav Pospíšil, Ph.D. – development of nanocomposite polymer/clay-based materials
- doc. RNDr. Jan Valenta, Ph.D. – semiconducting nanocrystals, nanophotonics, optical spectroscopy of individual molecules and nanocrystals
- prof. Ing. Štefan Višňovský, DrSc. – optics of magnetic nanostructures (nanostructures with ferromagnetic metals, multilayers of magnetic oxides with colossal magnetoresistance)

4.2.2. Masaryk University in Brno (MU)

Žerotínovo nám. 9, 601 77 Brno, I.D. 00216224

www.muni.cz

Masaryk University is the second biggest public university in the Czech Republic and the biggest one in Moravia. It employs 4 000 workers and there are about 31 000 students studying. It currently consists of nine faculties with more than 200 departments, institutes and clinics. It is one of the most important educational and scientific institutions in the Czech Republic and a renowned Central European university founded in 1919. It is also an important social and cultural player in the region of South Moravia. One of the basic priorities of the Masaryk University is research. The University has recently ranked among leaders in tenders supporting research projects and it invests a lot into the development of research and educational capacities in its new university campus. It develops activities in the area of knowledge dissemination and support of innovation and science. The Masaryk University provides university education within the wide spectrum of traditional and modern disciplines and it is one of the fastest growing educational institutions in Europe. The University is intensively involved in mobility activities of researchers within research programmes of the European Union and of other countries thanks to which undergraduates or graduates can extend their studies with graduate or postgraduate studies either at the Masaryk University or at some other university. Students from the Masaryk University can also study abroad and then return back to their home university. The offer of study opportunities is based on disciplines covered by the following faculties: law, medicine, natural sciences, philosophy, pedagogy, economic-administration, informatics, social, and sports.

Research in the area of nanotechnologies is conducted by the Faculty of Science.

4.2.2.1. FACULTY OF SCIENCE (PrF MU)

Kotlářská 2, 611 37 Brno

www.muni.cz/sci

Brief faculty characteristics

The Faculty of Science, founded in 1919, has been currently profiling itself as a research faculty which provides for university education closely interconnected with the basic and applied research done in the areas of mathematical, physical, chemical, biological, and earth sciences. In physical sciences, the research focuses on thin layers and lateral structures on surfaces of semiconductors and there are plasma-chemical reactions' studies in low-temperature plasma. The area of theoretical physics researches optics of charged particles' beams, the string theory and the general theory of relativity. The research in areas of chemistry focuses on structures and bond relations, properties and analysis of synthetic and natural molecules and their groupings. The biological sciences research the time and space dynamics of the biodiversity within ecosystems in Central Europe, but also the issue of genomes and their functions in different organisms, including humans. PrF MU is divided into 11 institutes and 2 centres.

Research of nanotechnologies is organised in the Department of physical electronics (J. Janča, I. Ohlídal, L. Zajíčková) and in the Institute of condensed matter physics (J. Humlíček, D. Munzar).

Research and development focus

In the period 2005–2011, PrF MU solves eight research plans three of which focus on nanotechnologies, nanomaterials and nanobiotechnologies in selected topics. There are also 153 programme projects solved in 2008.

Research plan MSM0021622410 **"Physical and chemical properties of advanced materials and structures"** 1/2005–12/2011, the researcher is prof. RNDr. Josef Humlíček, CSc., the total costs CZK 88.203 million, thereof CZK 86.203 million from the state budget. The year 2008 – 8.585/8.585, the nomenclature – the area 1, the nanotechnological research share – 70 %.

The subject of the research plan covers studies of new materials and phenomena requiring complex physical and chemical approaches. The plan focuses on (1) self-assembled nanostructures, super grids, quantum wells, wires, and dots, (2) high-temperature superconductors, (3) technologically important bulk materials and their additives, (4) polymers with a silicon spine, (5) thermodynamic properties, phase transformations, diffusion, and assembly processes in advanced intermetallic compounds and thin layers, (6) the preparation of materials by non conventional methods, and the studies of these processes' mechanisms.

Research plan MSM0021622411 **"Studies and applications of plasma-chemical reactions in non isothermal low-temperature plasma and the interactions with solid substance surfaces"**, 1/2005–12/2010, the researcher is prof. RNDr. Jan Janča, DrSc., the total costs CZK 105.482 million, thereof CZK 92.985 million from the state budget. The year 2008 – 6.203/6.172, the nomenclature – the area 7c), the nanotechnological research share – 30 %.

The research plan focuses on the studies of kinetics in plasma-chemical processes by optical, mass and microwave diagnostic methods, on the research and methodology for the technology of plasma-chemical application of thin polymer, nanocomposite, super hard, semipermeable, and semi-sorption layers and on the research of mechanical, chemical and electric properties of prepared depositions. Further activities cover: new technologies of the low-temperature plasma powder manufacturing methods for W, WC, TiC, WTi and chemical catalysts based on these metals. The design and construction of individual kinds of plasma-chemical reactors. The study of new diagnostic ways for the used plasma and the monitoring of plasma-chemical processes. The utilisation of different plasma kinds for the restoration and conservation of historical artefacts and museum items. The utilisations of a pulse enhanced radiofrequency and microwave plasma for the disintegration of undesirable substances.

Research plan MSM0021622415 **"Molecular substance of cell and tissue regulation"**, 1/2005–12/2011, the researcher is doc. RNDr. Jiří Fajkus, CSc., the total costs CZK 105.482 million, thereof CZK 92.985 million from the state budget. The year 2008 – 11.199/11.199, the nomenclature – the area 3, the nanotechnological research share – 25 %.

A cell is the system in which each molecule makes a part of the network of mutual interactions. Thanks to this highly complex interconnection, functions of cells and organisms are relatively resistant to failures of individual components within this network. The convergence of ideas and methodical approaches, which is characteristic for the current postgenomic era, makes the base for the interconnection of research capacities of MU workplaces focussing on molecules and biology within the solved research plan. Its solution takes place in four programme areas: 1. Regulation mechanisms of living cells, 2. Functional domains of eucaryotic chromosomes, 3. Genomics and proteomics of plant regulation circles, 4. Functional analysis of clinically and biotechnologically important genomes. The objective of the plan is the utilisation of approaches of the structural biology, functional genomics, proteomics, and bioinformatics for the clarification of molecular substance of processes which are important from the point of view of perspective biomedical and biotechnological applications.

The Research focussed on nanotechnologies is organised in the following institutes:

- National Centre for the Research of Biomolecules (J. Přibyl)
- Institute of Experimental Biology (J. Fajkus)
- Institute of Physical Electronics (J. Janča, M. Černák, L. Buršíková, I. Ohlídal, V. Kudrle, L. Zajíčková)
- Institute of Condensed Matter Physics (J. Humlíček, D. Munzar)
- Institute of Geological Science (J. Zeman)
- Institute of Chemistry (J. Pinkas)

Projects solved in the area of nanotechnologies

a) <u>Projects the receiving party of which is the faculty:</u>

The project within the programme "Nanotechnology for the Society"

- Project AS CR KAN101630651 "Creation of nano-layers and nano-coatings on textiles with the use of surface plasma treatment under atmospheric pressure", 7/2006–12/2010, the researcher is prof. RNDr. Mirko Černák, CSc.

Other projects:

- Project of MEYS 2B06056 "Diagnostics of by polyaromatic compounds damaged DNA with the use of nanotechnological and bioanalytical methods for the early detection of cancers" 7/2006–6/2010, the researcher is Mgr. Jan Přibyl, Ph.D.

- Project of GA CR GA202/07/1669 "Depositing of stable thermomechanical nanostructured diamond like thin layers in dual-frequency capacitive discharges", 1/2007–12/2011, the researcher is RNDr. Vilma Buršíková, Ph.D.
- Project of GA CR GA202/08/0178 "Synthesis of magnetic Fe-based nanoparticles in low-temperature microwave plasma", 1/2008–12/2010, the researcher is Mgr. Vít Kudrle, Ph.D.
- Project of GA CR GP202/07/P523 "Plasma enhanced chemical vapour deposition (PECVD) of carbon nanotubes", 1/2007–12/2009, the researcher is Mgr. Marek Eliáš, Ph.D.
- Project of GA CR GP202/08/P038 "Study of hybrid deposition process and its application for thin film deposition", 1/2008–12/2010, the researcher is Mgr. Petr Vašina, Ph.D.
- Project GA of AS CR KJB401630701 "Protein resistant surfaces and highly adherent surfaces – the new nanotechnological and bioanalytical methods testing their quality", 1/2007–12/2009, the researcher is Mgr. Jan Přibyl, Ph.D.

b) Projects in which the faculty cooperates:

Projects within the programme "Nanotechnology for the Society"

- Project AS CR KAN108040651 "Research of the manufacturing and the utilisation of nanoparticles based on zero-valent iron for the treatment of contaminated underground waters", 7/2006–12/2008, the researcher is Dr. Ing. Miroslav Černík, CSc., Technical University in Liberec, Faculty of Mechatronics and Interdisciplinary Engineering Studies, the co-researcher on behalf of PrF MU is doc. RNDr. Josef Zeman, CSc.
- Project AS CR KAN311610701 "Nanometrology using methods of the scanning probe microscopy", 1/2007–12/2011, the researcher is Mgr. Petr Klapetek, Ph.D., Czech Metrology Institute, Brno, the co-researcher on behalf of PrF MU is RNDr. Vilma Buršíková, Ph.D.
- Project of MIT 2A-3TP1/126 "Continual plasma and nanoplasma treatments of non-woven textiles", 4/2008-12/2011, the researcher is Ing. Zdeněk Mečl, PEGAS NONWOVENS s.r.o., Znojmo, the co-researcher on behalf of PrF MU is prof. RNDr. Mirko Černák, CSc.

Other projects:

- Project of GA CR GA202/06/0718 "Quantum dots' engineering", 1/2006–12/2008, the researcher is Ing. Jiří Oswald, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of PrF MU is doc. Mgr. Dominik Munzar, Dr.
- Project of MIT FT-TA4/126 "Research of semiconducting nanotubes for the implementation of cold-emission parts", 1/2007–12/2010, the researcher is Ing. Stanislav Štarman, Ph.D., STARMANS electronics, s.r.o., Praha, the co-researcher on behalf of PrF MU is prof. RNDr. Josef Humlíček, CSc.
- Project of MIT 2A-2TP1/147 "Research of semiconducting nanotubes for the completion of photoelectric parts", 5/2007–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D., Starman electronics, s.r.o., Praha, the co-researcher on behalf of PrF MU is prof. RNDr. Josef Humlíček, CSc.

Experts/field

- prof. RNDr. Jan Janča, DrSc. – plasma-chemical preparation of thin nanocomposite layers, plasma diagnostics
- prof. RNDr. Josef Humlíček, CSc. – thin layers and nanostructures' physics, spectroscopy, ellipsometry

- prof. RNDr. Mirko Černák, CSc. – plasma technologies
- doc. Mgr. Dominik Munzar, Dr. – theory of electron structures
- prof. RNDr. Ivan Ohlídal, DrSc. – optics of thin layers and surfaces of solid matter, AFM
- Mgr. Lenka Zajíčková, Ph.D. – preparation of carbon nanostructures and the studies of their properties
- doc. RNDr. Jiří Pinkas, Ph.D. – sonochemical synthesis of nanoparticles, water-free sol-gel methods
- RNDr. Vilma Buršíková, Ph.D. – nanostructures of carbon materials

4.2.3. Czech Technical University in Praha (CVUT)

Zikova 4, 166 36 Praha 6, I.D. 68407700

www.cvut.cz

The Czech Technical University in Praha (CVUT) is the oldest civil technical university in Central Europe. It was founded in 1707. CVUT currently supports scientific activities, educates new scientists and concentrates on other activities of scientific and pedagogic fields within technical disciplines. It develops the scientific and pedagogic research and creative technological activities in accordance with social requirements, worldwide trends and principles of liberty in intellectual activities. There were 24 000 students studying in 2007. CVUT has got 7 faculties, 3 university institutes and other workplaces. Research in the area of nanotechnologies is organised, within different scopes, in the following faculties:

- Faculty of Civil Engineering
- Faculty of Mechanical Engineering
- Faculty of Electrical Engineering
- Faculty of Nuclear Sciences and Physical Engineering
- Faculty of Biomedical Engineering

4.2.3.1. FACULTY OF CIVIL ENGINEERING (FSv CVUT)

Thákurova 7, 166 23 Praha 6

www.fsv.cvut.cz

Brief faculty characteristics

The Faculty of Civil Engineering was founded thanks to the initiative of Josef Christian Willenberg and on the basis of the Czech written founding document (a rescript) by the Emperor Josef I of 18 January 1707 as the first public engineering school in the Central Europe under the name Professional Engineering School in Praha. It was preceded by the Public Construction and Metallurgical School in Praha – by its nature the first school of construction in the country. After the necessary co-workers' qualifications were acquired, it was founded in 1344, four years before the Charles University was founded, by Master Matyas of Arras, who came from France by the initiative of Prince Václav, the later Emperor Charles IV. The then Czech Polytechnical Regional Institute (including also constructions) was renamed to the C.k. Czech Technical University in Praha in 1879. This University has changed its name to the Czech Technical University in 1920. After the forceful closing of all universities, during occupation by Nazi

Germany in the period 1939–1945, the University was liberated and open again. The University had associated, since 1920, seven universities (independent faculties): civil engineering, architecture, ground constructions, mechanical engineering, electrical engineering, chemical and technological engineering, agricultural and forestry engineering, special sciences, and trade. The current Faculty of Civil Engineering has been assigned the task, in its status, of asserting the cooperation of fields, departments and workplaces for the education of construction engineers in all forms of studies, to teach them all necessary knowledge for the solution of the technical and technical-economic development in construction, to ensure the high level of scientific works, their complexity and the focus on important tasks within the scientific and construction development. It must be a centre for cultural activities in the area of construction. The Faculty is divided into 26 departments and other workplaces.

The research, which has the character of nanotechnologies, was identified only in the Department of mechanics (Z. Bittnar, L. Kopecký, and J. Němeček).

Research and development focus

In the period 2005–2011, FSv CVUT solves four research plans. One of them includes partial research of nanotechnologies in its topics. There are also 80 programme projects solved in 2008.

Research plan MSM6840770003 **"Development of algorithms for computer simulations and their applications in the engineering"**, 1/2005–12/2011, the researcher is prof. Ing. Zdeněk Bittnar, DrSc., the total costs CZK 160.986 million, thereof CZK 160.986 million from the state budget. The year 2008 – 1.179/1.179, the nomenclature – the area 6b, the nanotechnological research share – 5 %.

The main topic of the research plan is the multilevel modelling and simulation (VMS). The primary applications of VMS are in the material engineering. VMS serves for the understanding of the most important material and structure properties. The description of materials (the constitutive relations) starts at the nano level and progressively transfers to the macro level. In addition to descriptions of mechanical behaviour of materials, there are also descriptions of structure behaviours and of their mutual interactions. Not even very advanced mathematical model can predict well the reality, when it does not get reliable entry data. VMS will get non standard data about mechanical properties at the micro to nano levels and other information.

The Department of mechanics organises research of possibilities in the application of nanotechnologies in the manufacture of concrete and of other construction materials. It develops the methodology of nanoindentation, e.g. when researching cement paste properties.

Projects solved in the area of nanotechnologies

- Project of GA CR GA103/06/1856 "Determining the physical properties of the cement with nanoindentation", 1/2006–12/2008, the researcher is prof. Ing. Zdeněk Bittnar, DrSc.
- Project of GA CR GA103/08/1639 "Microstructures of inorganic alumosilicate polymers", 1/2008–12/2010, the researcher is prof. Ing. Zdeněk Bittnar, DrSc.

Experts/field

- prof. Ing. Zdeněk Bittnar, DrSc. – applications and development of numerical methods in the construction mechanics, research of quasi-brittle materials with the assistance of unique experimental equipment

- Ing. Jiří Němeček, Ph.D. – nanoindentation and micromechanics, concrete structures and bridges, numerical simulations and modelling
- RNDr. Lubomír Kopecký – optical polarisation microscopy, electron microscopy, microanalyses, nanoindentation (micromechanics of cement paste, concrete and composite materials)

4.2.3.2. FACULTY OF MECHANICAL ENGINEERING (FS CVUT)

Technická 4, 166 07 Praha 6
www3.fs.cvut.cz/web/

Brief faculty characteristics

Mechanical engineering as an independent field at CVUT started to be taught in 1864 and this has been the reason why this year is considered the year of the Faculty of Mechanical Engineering founding. The Faculty has got currently 16 institutes and 7 scientific centres.

Research and development focus

In the period 2005–2013, research and development in FS focus mainly on the solution of four research plans, but none of them relates to nanotechnologies. There are 93 programme projects solved in 2008.

Research of nanotechnologies is organised in the following faculty institutes:

- Institute of Physics (B. Sopko, R. Novák, F. Černý, M. Solar)
- Institute of Mechanics, Biomechanics and Mechatronics (M. Růžička, M. Sochor)
- Institute of Materials Engineering (J. Steidl, V. Starý, J. Rybníček, P. Jurči)
- Institute of Mechanical Engineering Technology (J. Suchánek)

Projects solved in the area of nanotechnologies

a) Projects the receiving party of which is the faculty:

- Project of MEYS, the programme KONTAKT ME 837 "Treatment of machine parts and tools surfaces with the aim of the service live increase by surface modification and deposition of nanostructured thin films and coatings dispersively strenghtened with nanoparticles", 3/2006–9/2009, the researcher is doc. Ing. Jan Suchánek, CSc.
- Project of MEYS, the programme KONTAKT ME 862 "Biocompatible nanostructured coatings of implants for heavy duty load-bearing joints", 3/2006–12/2008, the researcher is doc. RNDr. Rudolf Novák, DrSc.

b) Projects in which the faculty cooperates:

- Project AS CR KAN101120701 "Nanocomposite layers and nanoparticles created in the low pressure plasma for surface modifications", 1/2007–12/2011, the researcher is prof. RNDr. Hynek Biederman, DrSc., Charles University in Praha, Faculty of Mathematics and Physics, the co-researcher on behalf of FS CVUT is doc. RNDr. Vladimír Starý, CSc.
- Project GA of AS CR KJB201240701 "Nanocomposite layers and nanoparticles created in the low-pressure plasma for surface modification", 1/2007–12/2009, the researcher is

Ing. Tomáš Polcar, Ph.D., CVUT, Faculty of Transportation Sciences, Ing. Tomáš Vítů is the co-researcher on behalf of FS CVUT.

- Project of GA CR GA101/08/0299 "Research of intelligent composite parts, made of ultra-high-module fibres, in manufacturing machines and the matrices modified by nanoparticles", 1/2008–12/2011, the researcher is doc. Ing. Václava Lašová, Ph.D., University of West Bohemia in Plzeň, Faculty of Mechanical Engineering, the co-researcher on behalf of FS CVUT is prof. Ing. Milan Růžička, CSc.
- Project of GA CR GA106/06/1486 "Impacts of nanoparticles on the disruption and life-span of thermoplastic composites", 1/2006–12/2008, the CVUT is Ing. Jan Rybníček.
- Project of GA CR GA106/06/1576 "Porous composite materials with the polyamide lining and the siloxane matrix with nano-hydroxyapatite as biomaterials", 1/2006–12/2008, the researcher is Ing. Karel Balík, CSc., Institute of Rock Structure and Mechanics of AS CR, Praha, the co-researcher on behalf of FS CVUT is doc. Ing. Miroslav Sochor, CSc.
- Project of MIT FT-TA2/018 "High-tech energy beams technologies for deposition and treatment of films for electronics", 1/2005–12/2008, the accepting party is ELCERAM a.s., Hradec Králové, the researcher is Ing. Karel Strobl, prof. RNDr. Bruno Sopko, DrSc., cooperates on behalf of FS CVUT.
- Project of MIT FI –IM5/124 "Research of technologies for the application of new material nanolayers allowing the construction of economic and high performance sensors, regulators and action parts", 3/2008–12/2010, the researcher is Ing. František Veselý, SAFINA, a.s., Vestec, cooperating, on behalf of CVUT-FS, is prof. RNDr. Bruno Sopko, DrSc.
- Cooperation with the Excellence Network of the 6th FP EU NMP 515846 NAPOLYDE "Control and Smart Devices", 4/2005–3/2009, the coordinator is P. Chequet, Recherche e Développment du Groupe Cockerill Sambre, Liege, Belgium, 23 participants, the co-researcher on behalf of FS CVUT is prof. Ing. František Černý, DrSc., the topic "Processes for the deposition of nanostructured layers for energy and intelligent systems".

Experts/field

- prof. RNDr. Bruno Sopko, DrSc. – semiconductors' physics, Chairman of TNK "Nanotechnology"
- prof. Ing. František Černý, DrSc. – thin layers, modification of surface material properties
- doc. RNDr. Ing. Rudolf Novák, DrSc. – physics of thin layers, plasma deposition of coatings, coating parameters' assessment
- prof. Ing. Josef Steidl, CSc. – plastics and composites (nanocomposites)
- doc. RNDr. Vladimír Starý, CSc. – materials for biomedical applications
- RNDr. Michael Solar, CSc. – thin layers, nanotechnologies – standardisation (a member of TNK "Nanotechnology"), semiconducting parts and their technology

4.2.3.3. FACULTY OF ELECTRICAL ENGINEERING (FEL CVUT)

Technická 2, 166 27 Praha 6

www.fel.cvut.cz

Brief faculty characteristics

The Czech Technical University in Praha was founded in 1920 with six independent faculties. One of them was the University for Mechanical Engineering and Electrical Engineering. It was divided into two departments – mechanical engineering and electrical engineering. The current Faculty of Electrical Engineering of CVUT is considered a prestige university workplace. It develops scientific works, trains new scientists and works as a centre of scientific and educational activities in the areas of electrical engineering, communication technology, automation, informatics, and computing technology. The Faculty structure consists of 20 departments and centres.

Research and development focus

In the period 2005–2011, research and development in FEL CVUT focus mainly on the solution of four research plans, but none of them relates to nanotechnologies. There are 93 programme projects solved in 2008.

The research of nanotechnologies is conducted by the following Faculty departments:

- Department of mechanics and materials (V. Bouda, J. Sedláček, A. Mlích)

  The research of composite materials containing colloid functional particles for electronics and electrical engineering focuses on the spontaneous growth of conductive and semiconductive aggregates of carbon nanoparticles in the non conductive environment and on its management by an electric field and by the composition of surroundings. There is the modelling of functions of muscle cells and the nanotechnology prepared for implementation. There are thin layers prepared and their properties are studied. Also, there is cooperation in relation to the research plan MSM6840770021 "Material diagnostics", 1/2005–12/2010, the researcher is prof. Ing. Stanislav Vratislav, CSc., FJFI CVUT.
- Department of microelectronics (M. Husák, J. Voves, P. Hazdra)

  There are the following activities taking place: designing of microelectronic and nanoelectronic semiconducting structures utilising commercial, but also own design systems and programmes; designs, simulations and characterising of nanometric quantum structures (resonance tunnel diodes, lasers, etc.); the characterising of nanometric semiconducting layers and quantum dots prepared by the MOVPE and MBE methods, designs and characterising of spintronic materials and structures; research and development of sensors for applications in electronics.
- Department of electrical engineering (P. Mach)

  The works focus on the research and development of conductive glues. The Department cooperates in the research plan MSM6840770021 "Material diagnostics", 1/2005–12/2010, the researcher is prof. Ing. Stanislav Vratislav, CSc., FJFI CVUT.
- Department of measuring (P. Ripka)

  There is research and development organised of sensors for applications in electronics and in electrical engineering. Studies include nanostructured magnetic layers.
- Department of electromagnetic field (J. Macháč)

- Department of controlling technology, Group for the theory of controls (T. Polcar)

  There is the research organised of preparation of gradient optical layers in nanosizes and of nanocomposite wearproof coatings etc.

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of GA CR GA102/06/0381 "Spintronic applications of ferromagnetic semiconductor nanostructures", 1/2006–12/2008, the researcher is doc. RNDr. Jan Voves, CSc.
- Project of GA CR GA102/06/1106 "Metamaterials, nanostructures and their applications", 1/2006–12/2008, the researcher is doc. Ing. Jan Macháč, DrSc.
- Project of GA CR GA102/06/1624 "MINASES – Micro and nano sensor structures and systems with the inbuilt intelligence", 1/2006–12/2008, the researcher is prof. Ing. Miroslav , Husák, CSc.
- Project of GA AS CR KJB201240701 "Nanocomposite coatings with higher wear resistance at higher temperatures", 1/2007–12/2009, the researcher is Ing. Tomáš Polcar, Ph.D.

b) Projects in which the faculty cooperates:

- Project of AS CR KAN400100652 "Structures for spintronics and quantum phenomena in nanoelectronics created with the electron beam lithography", 7/2006–12/2010, the researcher is Ing. Ludvík Smrčka, DrSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FEL CVUT is doc. RNDr. Jan Voves, CSc.
- Project of GA CR GA202/06/0718 "Quantum dots' engineering", 1/2006–12/2008, the researcher is Ing. Jiří Oswald, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FEL CVUT is doc. Ing. Pavel Hazdra, CSc.

Experts/field

- prof. Ing. Václav Bouda, CSc. – nano-electro-mechanical systems
- doc. Ing. Pavel Hazdra, CSc. – nanoelectronics
- prof. Ing. Miroslav Husák, CSc. – nanosensors for MEMS
- doc. Ing. Pavel Mach, CSc. – research of electrically conductive glues
- prof. Ing. Pavel Ripka, CSc. – magnetic sensors, nanostructured magnetic layers
- doc. RNDr. Jan Voves, CSc. – nanoelectronics
- doc. Ing. Jan Macháč, DrSc. – metamaterials, nanostructures
- Ing. Tomáš Polcar, Ph.D. – hard layers, magnetic sputtering, gradient optic layers at nanoscale

4.2.3.4. FACULTY OF NUCLEAR AND PHYSICAL ENGINEERING (FJFI CVUT)

Břehová 7, 115 19 Praha 1

www.fjfi.cvut.cz

Brief faculty characteristics

FJFI CVUT was originally founded within the Czechoslovak nuclear programme in 1955. However, it progressively extended its activities to a wide spectrum of mathematical, physical and chemical fields. The Faculty, as the first one in the Czech Republic, implemented lecturing and research of nanomaterials and organised studies of this prestige area, according to foreign workplaces.[11]

The Faculty has organised international contacts and cooperation and that has helped FJFI CVUT in the achievement of the current good results in the research and teaching and of the study conditions comparable with foreign institutions. Within this field, there are also foreign students studying, who are very interested in the research in this area. Research and training in the area of nanostructures has got very high prestige citation level and FJFI CVUT belongs among the world leaders.

The Faculty is divided into 10 departments, and thereof at least four are involved in the research of nanotechnologies.

Research and development focus

In the period 2005–2012, research and development in FJFI CVUT focus mostly on the solution of five research plans two of which have aspects related to nanotechnologies and nanomaterials. There are 53 programme projects solved in 2008.

Research plan MSM6840770021 **"Materials diagnostics"**, 1/2005–12/2010, the researcher is prof. Ing. Stanislav Vratislav, CSc., the total costs CZK 124.980 million, thereof CZK 110.172 million from the state budget. The year 2008 – 10.415/10.415, the nomenclature – the area 6b, the nanotechnological research share – 50 %.

The prerequisite for the gain of new knowledge related to the area of complex material diagnostics is the basic research of mechanical, electric, magnetic, optic, and other physical properties of solid substances and of their connections with structural and sub structural parameters. Diagnostic problems ask for the study of voltage fields and deformation in the interaction with material characteristics, with the goal of wider knowledge about the disrupting processes. The conducted research activities have got the interdisciplinary character – conclusions are based on the synthesis of new experimental and theoretical methods with an important share of the mathematical modelling. The complex material diagnostics cover the following areas within the project: applications of X-ray and neutron beams diagnostic methods on polycrystalline materials, research of relations between structure sensitive substance properties, their technological history and utility parameters. It includes the determination of electron defects' structures and additives with the goal of achieving material properties which would be suitable for technical applications in optoelectronics and laser technologies.

Within the research plan, the Department of material mechanics and the Department of electrical engineering, in the Faculty of Electrical Engineering of CVUT, cooperate in the area of nanotechnologies.

Research plan MSM6840770022 **"Laser systems, radiation and modern optical applications"**, 1/2005–12/2010, the researcher is prof. Ing. Pavel Fiala, CSc., the total costs CZK 121.200 million, thereof CZK 106.842 million from the state budget. The year 2008 – 2.020/2.020, the nomenclature – the area 2b, the nanotechnological research share – 10 %.

The subject of the solution relates to laser systems and studies of selected optical interaction processes of the coherent and non coherent electromagnetic radiation with the environment within the broad spectral scope (from XUV to IR). The goal requires new knowledge and understanding of new processes in optical methods, optoelectronics, technologies, medicine, but also in the other research of optical physics.

11 Kraus, L., Kubátová, J., Prnka, T., Shrbená, J., Šperlink, K.: "Nanotechnologies in the Czech Republic – 2005", published by Repronis Ostrava, 2005, p. 7.

The research plan is divided, according to topics, into several mutually related themes:

(1) Solid substance laser systems and their applications – coherent and non coherent spectral areas with the generation of short and ultra short impulses,

(2) Modelling of the dense high-temperature plasma and its utilisation in optics – as the plasma X-ray sources,

(3) The applied photonics of the X-ray area – focussed on the generation of pointed X-ray radiation and also to the X-ray diagnostics,

(4) Optic waves and their forming by the environment – studies of non linear photorefractive processes, space solitons and diffractive structures with the chance of their utilisation in optical applications, etc.

Research focussed on nanotechnologies

Four departments solve problems in the area of nanotechnologies within the two research plans and programme projects:

- Department of solid substance physics (S. Vratislav, N. Ganev)

The research focuses on:

1. Studies of macro and micro structures of technologically important materials and of optical properties of solid substances, but recently also of properties of polymers and polymer nanocomposites in connection with the technological processing and resulting properties.
2. Improvement of methodologies and diagnostics of technologically important materials, the studies which should result in the clarification of impacts on phase transfers in thin layers – the methodologies like, for example, TEM, SEM, XRD (the morphology of composites), diffraction of neutrons and X-ray radiation, light dispersion (also silicates, organic silicates and oxides of transient metals), the measuring of photoluminescence, thermoluminescence, and the optical absorption of pure and by spectroscopically active ions (Cr3+, Mn4+, Fe3+, etc.) doped thin layers and thin layered structures of $BaxSr1\text{-}xTiO_3$ and other materials of the perovskite kind.
3. Development of simulation programmes for studies of transport properties in semiconducting heterostructures.

- Department of physical electronics (P. Fiala, A. Fojtík, M. Kálal, A. Jančárek)

The Department of physical electronics covers training and research of quantum nanostructures and nanotechnologies. It participates in education in this area also in other university workplaces. There has been a research laboratory for nanostructures and nanotechnologies installed in the Department (www.nanolab.cz). It actively cooperates with a number of leading academic and research workplaces in the country and abroad (e.g. the nanotechnological institute CAESAR and TU Bonn – Germany, the University in Rennes – France, Technical University Delft – the Netherlands, Hahn-Meitner Institut in Berlin – Germany, and others). Founders of this field, both domestic and foreign, or their successors built there nanotechnological centres which guarantee the continuity of the most advanced trends in the research done in this area.

The main objectives are as follows:

1. Studies and preparation of structures and their mutual handling which could manage physical properties and, consequently, allow for their utilisation in optical and optoelectric applications. The *periodic assemblies* utilise the method of molecular lithography

in combination with other methods like, for example, (as an alternative) ion implantations, steaming, sputtering, electrolytic methods, iontophoresis, and sedimentation.

2. Studies and preparation of metallic nanostructures for the construction of a detector for the protection of the environment and for catalytic applications. *The controls of particle sizes utilise* processes of the chemical preparation in the limited space by the use of structures of molecular lithography of organic layers, micellar systems, growth stabilisers, and chemical ablation, i.e. by solution in two-component organic systems. There are specifically studied and prepared metallic nanostructures (Ni, Ag, Au, and other suitable ones), semiconducting ones (Si, CdS, and other suitable ones), or dielectric ones.
3. Metal magnetic and other special semiconductor nanostructures for biological and medical applications.

The Department has implemented, within the new focus on nanostructural physics, training in the following subjects: particle nanostructures, nanochemistry, nanophysics, nanoelectronics, semiconductor nanostructures, nanoscopy, and nanocharacterising.

There has been prepared a programme for the undergraduate and graduate studies in this area. It has just started running.

- Department of materials (J. Siegl)

Works within the area of nanomaterials could be divided into two main groups:

1. Studies of connections between microstructural parameters and mechanical properties of different kinds of construction materials (the preparation of materials with ultrafine grains, hardened alloys, and studies of the disintegration of a solid solution in a model alloy, the utilisation of transmission electron microscopy methods of the atomic resolution and of the auto-emission ion microscopy with a tomographic atomic probe).
2. Studies of the first growth stages in fatigue cracks in connection with characteristic structural parameters of monitored construction materials in the nanostructural area.

- Department of nuclear chemistry (V. Múčka)

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:
- Project of AS CR KAN401220801 “Nanostructures of Controlled Size and Dimensions”, 1/2008–12/2012, the researcher is Ing. Anton Fojtík, CSc.
- Project of MEYS, the programme KONTAKT ME 933 “Special nanostructures – manufacture, study of the basic physical properties and practical implementations”, 5/2007–12/2009, the researcher is doc. Ing. Milan Kálal, CSc.

b) Projects in which the faculty cooperates:
- Project of AS CR KAN400100802 “Nanocomposite, ceramic and thin layer scintillators”, 1/2008–12/2011, the researcher is Ing. Martin Nikl, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FJFI CVUT is prof. Ing. Viliam Múčka, DrSc.
- Project of AS CR KAN400670651 “Research of metal nanoparticles interfaces with InP for the monitoring of undesirable substances, gas and radiation in the environment”, 7/2006–12/2008, the researcher is RNDr. Jiří Zavadil, CSc., Institute of Photonics and Electronics of AS CR, Praha, the co-researcher on behalf of FJFI CVUT is Ing. Anton Fojtík, CSc.

- Project of GA of AS CR IAA100100718 “Metal-dielectric nanostructures for optics”, 1/2007–12/2009, the researcher is Dr. Ing. Jiří Bulíř, Dr., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FJFI CVUT is prof. Ing. Pavel Fiala, CSc.
- Project of GA CR GA106/07/0805 “Complex structural analysis of the property gradients of surface layers of important technological materials after their mechanical treatment”, 1/2007–12/2009, the researcher is Ing. Marian Čerňanský, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FJFI CVUT is doc. Ing. Nikolaj Ganev, CSc.
- Project of GA CR GA202/07/0818 “Silicon nanophotonics – from individual nanocrystals to photonic structures”, 1/2007–12/2009, the researcher is doc. RNDr. Jan Valenta, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FJFI CVUT is Ing. Anton Fojtík, CSc.
- Project of MIT FT-TA3/112 “X-ray multilayer mirrors’ replication technology”, 4/2006–12/2009, the researcher is doc. Ing. Ladislav Pína, DrSc., REFLEX s.r.o., Praha, the co-researcher on behalf of FJFI CVUT is Ing. Alexandr Jančárek, CSc.

Experts/field

- prof. Ing. Pavel Fiala, CSc. – laser and optic technologies, diffractive optics and applications
- Ing. Anton Fojtík, CSc. – nanostructures and nanotechnologies, their engineering and mutual manipulation with controlled physical properties, identification and modelling of nanoparticles’ properties.
- doc. Ing. Nikolaj Ganev, CSc. – X-ray diffraction, material research
- doc. Ing. Milan Kálal, CSc. – interactions of the laser radiation with plasma and their diagnostics, high performance lasers, complex interferometry
- prof. Ing. Viliam Múčka, DrSc. – physical chemistry, radiation chemistry
- Ing. Jan Siegl, CSc. – mechanical properties of structural materials, failure analysis, SEM, plasma applied layers
- prof. Ing. Stanislav Vratislav, CSc. – neutron diffraction, material research

4.2.3.5. FACULTY OF BIOMEDICAL ENGINEERING (FBMI CVUT)

Sítná 3105, 272 01 Kladno

www.fbmi.cvut.cz

Brief faculty characteristics

The Faculty of Biomedical Engineering (FBMI) is the youngest faculty in the Czech Technical University in Praha. It was founded in 2005 by the transformation of the Institute of Biomedical Engineering. Its history goes back to 1996, when there was a Centre of Biomedical Engineering (CBMI) founded at CVUT in Praha with the goal of establishing a central coordinating workplace for research and teaching activities in the field of biomedical engineering. The Faculty has got currently 4 departments and a joint workplace for the biomedical engineering of FBMI and the 1st LF UK.

Research and development focus

The progressively developing research activities mostly relate to the solution of a part of the research plan MSM6800770012 **"Transdisciplinary research in the area of biomedical engineering II"**, it relates to the part "Engineering problems in biology and medicine". The coordinator of the research conducted in FBI is prof. Ing. Peter Kneppo, DrSc. The commencing research activities in the field of bionanotechnologies were found in the Department of natural sciences (J. Kuba, M. Vrbová, M. Jelínek). Problems related to thin nanocrystalline and nanocomposite thin biocompatible layers are now studied in the joint workplace of the 1st LF UK and CVUT FBMI in Praha.

Projects solved in the area of nanotechnologies

b) Projects in which the faculty cooperates:

- Project of AS CR KAN300100702 "Creation of nanostructures by X-ray lasers", 1/2007–12/2011, the researcher is Ing. Bedřich Rus, Dr., Institute of Physics of AS CR, Praha, the co-researchers on behalf of FBMI CVUT are Dr. Ing. Jaroslav Kuba, Ph.D., prof. Ing. Miroslava Vrbová, CSc., Ing. Přemysl Fitl and others.

Experts/field

- doc. Ing. Miroslav Jelínek, DrSc. – nanomaterials, nanolayers, nanocomposites
- prof. Ing. Miroslav Vrbová, CSc. – nano and XUV radiation
- Dr. Ing. Jaroslav Kuba, Ph.D. – nano and XUV radiation
- prof. Ing. Peter Kneppo, DrSc. – nano in robotics

4.2.4. Brno University of Technology (VUT)

Antonínská 548/1, 601 90 Brno, I.D. 00216305

www.vutbr.cz

Brno University of Technology is the oldest university in Brno. Its beginnings originate in the mid 19th century, the year 1849, when the German-Czech Technical School was founded in Brno. The Czech Brno University of Technology was opened in November 1899. The School has become the university in 1956 and this meant its extensive development. The decisive period for the existence of Brno VUT was in 1989, when faculties went through significant reorganisation and new faculties were established. Brno VUT, as the only technical university, currently covers the whole spectrum of technical science and a number of artistic disciplines. There are 24 500 students studying. Brno VUT consists of 8 faculties. Research in the area of nanotechnologies takes place, within varied scope, in the following faculties:

- Faculty of Electrical Engineering and Communication – FEKT
- Faculty of Chemistry – FCH
- Faculty of Civil Engineering – FAST
- Faculty of Mechanical Engineering – FSI

4.2.4.1. FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION (FEKT VUT)

Údolní 53, 602 00 Brno

www.feec.vutbr.cz

Brief faculty characteristics

The first electrical engineering disciplines were taught at VUT in 1905. There was an independent Faculty of Energy founded in 1959 and it was consequently transformed to the Faculty of Electrical Engineering. The Faculty structure was changed in 1993 and the Faculty has become known as the Faculty of Electrical Engineering and Communication (FEI). This Faculty was the third biggest faculty of the then seven faculties of Brno VUT after the Faculty of Technology and the Faculty of Management separated at the beginning of 2002 and created the new Tomáš Baťa University in Zlín. In 2001, there were preparations started in FEI VUT for the founding of the Faculty of Information Technologies (FIT) and for the transformation of the Faculty of Electrical Engineering and Informatics to the Faculty of Electrical Engineering and Communication (FEKT). Both faculties have been active independently since 1 January 2002. FEKT VUT focuses on the training and research in the field of electrical engineering and communication technologies. This relates mostly to microelectronic systems, electronic communication systems and technologies, optimal utilisation of electric power, automation of technological and manufacturing processes, information and control systems, applied cybernetics, etc. In 2004, the students in the 2nd year of the graduate course, studying the fields microelectronics and telecommunication and information technologies, got the chance to study one semester subject Nanotechnologies. In 2007, the Institute of Physics got accredited the four-year study course Physical Electronics and Nanotechnologies within the full-time and combined study forms.

Activities in the Faculty are distributed among 12 institutes and some of them are divided into laboratories.

Research and development focus

In the period 2005–2010, there are four research plans solved in FEKT VUT. One of them partly focuses on nanotechnologies. The faculty solves 111 programme projects in 2008.

Research plan MSM0021630503 **“New trends in microelectronic systems and nanotechnologies (MIKROSYN)”**, 1/2005–2010, the researcher is prof. Ing. Radimír Vrba, CSc., the total costs CZK 134.700 million, thereof CZK 118.740 million from the state budget. The year 2008 – 11.225/11.225, the nomenclature – the area 2a, the nanotechnological research share – 50 %.

The research plan stresses the issue of advanced microelectronic circuits, microsystems, and structures of a chip. All problem areas of this research plan are focussing on new and perspective micro and nanosystems and technologies feasible by the end of 2010. The objective of the basic and applied research relates to five research areas: 1. Theory, design and diagnostics of low-voltage and low-intake integrated circuits in sub micron technologies, 2. Modelling and simulation of integrated circuits, 3. Microsystems and nanosystems, 4. Hi-tech technologies for microelectronics and nanoelectronics, and 5. Modern material and parts’ diagnostics. Goals of the research plan in individual areas relate to the gaining of original results within the research of new microelectronic systems, progressive methods of their solutions and optimising, to the applied research of new micro and nanotechnologies for the preparation of new electronic structures and semiconductor parts of new generations.

Research of nanotechnologies is conducted in the following Faculty institutes:

The Institute of Physics, where it has been developed for a long time under the leadership of prof. RNDr. Pavel Tománek, CSc., in the Laboratory for optic nanometrology. The Laboratory deals with the non contact and non destructive research of material surfaces with cross running super resolution. It utilises the scanning tunnelling microscopy working in the reflection and permeable modes. The main objectives are topographies, local spectroscopy, the fluorescence of semiconductor surfaces, and the manufacture of probes for microscopes. The involved workers are P. Tománek and L. Grmela.

The Institute of Microelectronics, the Laboratory of research and development of microsensors, deals with applications of nanomaterials in chemical sensors and biosensors for the detection of heavy metals, biologically interesting substances, specific conductivity, and gases. In the area of thin layers, the Laboratory focuses also on the research of techniques creating MEMS and NEMS. Workers: R. Vrba, J. Hubálek, V. Musil, M. Adámek, L. Fujcik, M. Horák, R. Kuchta, J. Prášek, P. Šteffan, and others.

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of AS CR KAN208130801 “New constructions and use of nanobiosensors and nanosensors in medicine (NANOSEMED)”, 1/2008–12/2012, the researcher is Ing. Jaromír Hubálek, Ph.D.
- Project of GA CR GA102/08/1474 “Local optical and electrical characterising of optoelectronic structures having the nanometric resolution”, 1/2008–12/2010, the researcher is prof. RNDr. Pavel Tománek, CSc.
- Project of GA CR GA102/08/1546 “Miniaturised intelligent systems and nanostructured electrodes for chemical, biological and pharmaceutical applications (NANIMEL)”, 1/2008–12/2010, the researcher is Ing. Jaromír Hubálek, Ph.D.
- Project of GA of AS CR 1QS201710508 “Impedimetric chemical microsensors with the nanomachined surfaces of electrodes”, 1/2005–12/2009, the researcher is Ing. Jaromír Hubálek, Ph.D.

b) Projects in which the faculty cooperates:

- Project of MIT FT-TA3/027 “Inorganic nanoparticle-based multifunctional composites of extraordinary properties”, 6/2006–5/2010, the researcher is Ing. Miroslav Svoboda, Výzkumný ústav stavebních hmot, a.s., Brno, the co-researcher on behalf of FEKT VUT is prof. Ing. Radimír Vrba, CSc.
- Project of GA CR GA102/06/1624 “Micro and nano sensor structures and systems with the inbuilt intelligence (MINASES)”, 1/2006–12/2008, the researcher is prof. Ing. Miroslav Husák, CSc., CVUT – Faculty of Electrical Engineering, Praha, the co-researcher on behalf of FEKT VUT is prof. Ing. Radimír Vrba, CSc.

Experts/field

- prof. RNDr. Pavel Tománek, CSc. – optic nanometrology, studies of local optical and electrical properties
- prof. Ing. Radimír Vrba, CSc. – microelectronics
- Ing. Jaromír Hubálek, Ph.D. – self-assembling nanostructures, nanoporous membranes, metal nanowires and nanotubes, chemical microsensors and nanosensors, MEMS and NEMS

4.2.4.2. FACULTY OF CHEMISTRY (FCH VUT)

Purkyňova 118, 612 00 Brno

www.fch.vutbr.cz

Brief faculty characteristics

The Faculty of Chemistry of Brno VUT has been developing its activities since 1992 and extending thus the long traditions of university chemical education in Brno, started by the founding of the Chemistry Section of the Czech Technical University in November 1911 and interrupted in 1951 by the transformation to the Military Technical Academy. The renewal of the Faculty of Chemistry at the Brno Technical University was necessary because the University had to complement its education with this field, but also because of the needs of industrial development of Moravian regions, which felt a big shortage of university-educated chemists. The research activities have been, together with the pedagogical activities, an inseparable part of the University mission. Specific activities in this field are based on the professional focuses of four Faculty institutes. The Institute of Physical and Consumer Chemistry focuses mostly on the issue of physical chemistry of colloid and macromolecular systems, photochemistry, plasma chemistry and physics, the computer applications in chemistry, and chemical technology and physics. The Institute of Material Chemistry focuses its research on the studies of chemistry, technologies and properties of silicate, metal, polymer, and composite materials with the direct utilisation of knowledge gained within the technology of their manufacture and processing, according to the required material applications. The professional research interests of the Institute of Chemistry and Technology of the Protection of the Environment focus on the areas of chemistry and technology protecting and treating water, protecting soils and air. The Institute deals also with problems of the special industrial toxicology and ecotoxicology, but also with issues of waste liquidation and recycling. The Institute of Food Chemistry and Biotechnologies researches issues in the areas of biology, theoretical and experimental biochemistry, microbiology, bioengineering, and technologies of the food manufacture. The research of nanotechnologies was identified in the Institute of Physical and Consumer Chemistry (M. Weiter), the Institute of Material Chemistry (V. Čech, J. Jančář), and in the Institute of Food Chemistry and Biotechnologies (M. Fišera).

Research and development focus

In the period 2005–2009, FCH VUT solves the research plan which is partly focussing on nanotechnologies and in which all FCH institutes are involved. There are also 35 programme projects solved in 2008.

Research plan MSM0021630501 **"Multifunctional heterogenous synthetic polymer and biopolymer-based materials"**, 1/2005–12/2009, the researcher is prof. RNDr. Josef Jančář, CSc., the total costs CZK 134.700 million, thereof CZK 118.740 million from the state budget. The year 2008 – 6.090/6.090, the nomenclature – the area 1, the nanotechnological research share – 20 %.

The research plan focuses on the research of advanced preparation methods and on the characterising of heterogenous materials, especially polymer mixtures, nanostructures and composites, but also on the research of low-dimension structures like ultrafine layers/ /multilayers. The research requires the designing of new and the modification of existing methods characterising structures at different size levels and the development of a theoretical explanation of the observed phenomena on the basis of processing the gained information. The subject of activities is the research of preparation of functional heterogenous polymer materials, the quantification of relations between their structures, properties and functions and the finding of control ways determining their life span at the molecular or supramolecular levels. The main objective is the preparation of advanced heterogenous polymer materials with structures and properties controlled by the preparation methods and the quantification of relations between the structure and properties, which would allow the utilisation of modelling in the designing of new materials.

Research focussed on nanotechnologies

VUT in Brno participates, through the Faculty of Chemistry, **the Institute of Physical and Consumer Chemistry** (the leader doc. Ing. Miloslav Pekař, CSc.), in the medicine-pharmaceutical cluster *Nanomedic* (www.nanomedic.cz). The cluster associates companies and academic workplaces with the interest in further development of medical nanobiotechnologies. The cluster works on several specific research projects, including nanosystems for the targeted distribution of active substances (e.g. medicine) or for the regenerative medicine. The cluster initiated a new interdisciplinary and inter-university study programme with the working name "Medicine nanobiotechnologies". The Institute activities focus also on studies of properties of organic materials suitable for the molecular electronics. This issue is solved within the project *"Molecular nanosystems and nanoparts: electric transport properties"* (the researcher is doc. Ing. Martin Weiter, Ph.D.) within the programme "Nanotechnology for the Society". There are studied the switching processes at the molecular level, especially the processes of photoinduced switching of the electric conductivity and photoluminescence. The institute is also involved in the MIT project FI-IM4/205 *"Nanotechnologies in medicine – a tissue carrier for the reconstructions of connective tissues"* and in the action COST D43 – Colloid and Interface Science for Nanotechnology. The workers involved in the nanotechnological research are M. Pekař, M. Weiter, O. Zmeškal, and M. Vala.

Some activities in **the Institute of Material Chemistry** (the leader prof. RNDr. Josef Jančář, CSc.) belong to the area of nanotechnologies focussed on the preparation, characterising, computer modelling and applications of polymer nanocomposites. Their preparation covers the synthesis of nanofills based on $Mg(OH)_2$, hydroxy apatite and $CaCO_3$, but also the use of varied processes of polymer mixing with nanofills in melts (extrusions) and solutions supplemented by effects of ultrasound. The research of relations between the structure and properties of polymer nanocomposites utilises the modern measuring and characterising methods in combination with computer and theoretical physical models. A large number of achieved results find its utilisation, for example, in tumescent and low abrasive paints. The workers involved in the research of nanotechnologies are J. Jančář, V. Čech, J. Kalfus, and J. Žídek.

The Institute of Food Chemistry and Biotechnologies (the leader doc. Ing. Jiřina Omelková, CSc.) organises research works belonging to the area of nanobiotechnologies. They are, for example, the isolation and characterising of plant and bacterial enzymes suitable for the industrial use (pectinases, glucanases, and proteases) and their possible immobilisation and utilisation in enzyme reactors. In the area of proteomics, they study the utilisation of microbial expression systems for the production of metabolites, food materials and components at the laboratory level with the possibility of semioperational adjustments. The workers involved in the research of nanotechnologies – M. Fišera.

Projects solved in the area of nanotechnologies

a) <u>Projects the accepting party of which is the faculty:</u>

- Project of AS CR KAN401770651 "Molecular nanosystems and nanodevices: electric transport properties", 7/2006–12/2010, the researcher is doc. Ing. Martin Weiter, Ph.D.
- Project of GA CR GA104/06/0437 "Development of plasma-chemical processes for the development of intelligent polymer nanostructures", 1/2006–12/2008, the researcher is prof. RNDr. Vladimír Čech, Ph.D.

b) <u>Projects in which the faculty cooperates:</u>

- Project of AS CR KAN101120701 "Nanocomposite layers and nanoparticles created in the low pressure plasma for surface modifications", 1/2007–12/2011, the researcher is prof. RNDr. Hynek Biederman, DrSc., Charles University in Praha, MFF, the co-researcher on behalf of FCH VUT is prof. RNDr. Vladimír Čech, Ph.D.
- Project of MEYS 2B06130 "The utilisation of the newly synthesised biomaterials in combination with stem cells in the treatment of diseases affecting human tissues derived from mesoderm: the cartilage, bone, ligaments, and meniscus", 7/2006–12/2011, the researcher is prof. MVDr. Alois Nečas, Ph.D., University of Veterinary and Pharmaceutical Sciences Brno, Faculty of Veterinary Medicine, the co-researcher on behalf of FCH VUT is prof. RNDr. Josef Jančář, CSc.
- Project of MIT FI-IM4/205 "Nanotechnologies in medicine – a tissue carrier for the reconstructions of connective tissues", 3/2007–9/2010, the researcher is Ing. Kateřina Knotková, Ph.D., CPN spol. s r.o., Dolní Dobrouč, the co-researcher on behalf of FCH VUT is doc. Ing. Miloslav Pekař, CSc.
- Project of MIT FT-TA3/048 "DPP and CPP compounds based nanomaterials and functional systems for electronic equipment", 1/2006–12/2008, the researcher is Ing. Martin Kaja, Výzkumný ústav organických syntéz a.s., Pardubice, the co-researcher on behalf of FCH VUT is doc. Ing. Oldřich Zmeškal, CSc.
- Project of MIT FT-TA3/055 "Intelligent polymer coatings containing nanoparticles", 3/2006–12/2009, the researcher is Ing. Jiří Zelenka, CSc., SYNPO, a. s., Pardubice, the co-researcher on behalf of FCH VUT is prof. RNDr. Josef Jančář, CSc.

Experts/field

- prof. RNDr. Josef Jančář, CSc. – synthetic polymers and biopolymers
- Ing. Jan Kalfus, Ph.D. – polymer nanocomposites, deformation behaviour and morphology of polymers
- Mgr. Jan Žídek, Ph.D. – computer-assisted modelling, strengthened polymer composites, material interfaces, composite interphases
- doc. Ing. Miloslav Pekař, CSc. – physical chemistry of colloid and macromolecular systems
- doc. Ing. Martin Weiter, Ph.D. – studies of optoelectronic properties of organic semiconducting materials
- Ing. Martin Vala, Ph.D. – studies of optoelectronic properties of organic semiconducting materials
- doc. Ing. Miroslav Fišera, CSc. – component and species analysis with the AAS, AFS, ICP-AES, and ICP-MS methods, sensor-assisted analysis of food
- prof. RNDr. Vladimír Čech, Ph.D. – preparation, characterising and use of thin layers, with fibres strengthened polymer composites, material interfaces, and composite interphases

4.2.4.3. FACULTY OF CIVIL ENGINEERING (FAST VUT)

Veveří 331/95, 602 00 Brno

www.fce.vutbr.cz

Brief faculty characteristics

The history of FAST VUT is closely related to the history of the Brno Technical University. The Czech Technical University was founded by the Emperor František Josef I in 1899 and the first studied field was the civil engineering. The Technical University was closed down in 1951 and the Military Technical Academy was established in its place. However, there was the University of Civil Engineering established in Brno in 1956 and VUT was renewed in Brno. After efforts of many years, the University was re-established in 1961 in its current form. FAST VUT is divided organisationally into 22 institutes.

Research and development focus

In the period 2005–2012, FAST VUT solves two research plans not focussing on the area of nanotechnology or nanomaterials utilisation in construction. The Faculty solves 74 programme projects in 2008. In relation to the Institute of Structural Mechanics, we have identified the cooperation related to one project within the programme TANDEM (MIT) which focuses on the utilisation of nanomaterials in multifunctional composites.

Projects solved in the area of nanotechnologies

Projects in which the faculty cooperates:

- Project of MIT FT-TA3/027 "Inorganic nanoparticle-based multifunctional composites of extraordinary properties", 6/2006–5/2010, the researcher is Ing. Miroslav Svoboda, Výzkumný ústav stavebních hmot, a.s., Brno, the co-researcher on behalf of FAST VUT is prof. Ing. Drahomír Novák, DrSc.

Experts/field

- prof. RNDr. Tomáš Ficker, DrSc. – cement composites
- prof. Ing. Rostislav Drochytka, CSc. – polymer-cement composites
- prof. Ing. Marcela Fridrichová, CSc. – cement composites
- doc. Ing. Jiří Bydžovský, CSc. – polymer-cement composites
- doc. Ing. Rudolf Hela, CSc. – concrete
- doc. Ing. Radomír Sokolář, CSc. – ceramics

4.2.4.4. FACULTY OF MECHANICAL ENGINEERING (FSI VUT)

Technická 2, 616 69 Brno

www.fme.vutbr.cz

Brief faculty characteristics

The Faculty is an institution currently well known in the area of research, beside its basic obligations related to the provision of high quality education. In addition to traditional fields of mechanical engineering having the constructional and technological character, there are applied sciences developed in disciplines like, for example, applied mechanics, precise mechanics and optics, quality management, engineering informatics, material engineering, etc. The Faculty is divided into 14 institutes which all are involved in research activities. Some of the institutes are further divided into departments.

Research and development focus

In the period 2005–2010, FSI VUT solves three research plans one of which is fully focussing on nanotechnologies. It solves 98 programme projects in 2008.

Research plan MSM0021630508 **"Inorganic nanomaterials and nanostructures: preparation, analysis, and properties"**, 1/2005–12/2010, the researcher is prof. RNDr. Jaroslav Cihlář, CSc., the total costs CZK 120.873 million, thereof CZK 106.554 million from the state budget. The year 2008 – 21.132/21.132, the nomenclature – the area 1, the nanotechnological research share – 100 %.

The research plan focuses on the preparation and research of nanoparticle and nanostructured materials, especially inorganic non metallic materials and their composites with metals and polymers, but also on the preparation and research of low-dimension structures like nanowires and nanodots. The subject of the research plan is the description of physical and chemical interactions in nanoparticle and nanostructured systems and the gaining of new knowledge about unique properties resulting from these relations, especially in multiphase ones from the point of view of behaviour of nanomaterials and nanostructures, their surfaces and interfaces. The solution of this requires research and development of processes and facilities preparing the required structures, the design of new and modifying the existing methods of the experimental study of nanostructures and the creation of theoretical explanations of the observed phenomena on the basis of the processed gained information.

There have been 2 research centres established in FSI VUT one of which fully focuses on the research of nanotechnologies:

- Project of MEYS, the programme "Basic Research Centres", LC06040 **"Structures for nanophotonics and nanoelectronics"**, 3/2006–12/2010, the researcher is prof. RNDr. Tomáš Šikola, CSc.

Research in the area of nanotechnologies is conducted in the Institute of Physical Engineering (T. Šikola, J. Pokluda, P. Šandera, M. Ohlídal, P. Bábor, M. Černý), the Institute of Material Science and Engineering (J. Cihlář, J. Švejcar, M. Trunec, K. Maca), and, within a lesser scope, in the Institute of Designing (M. Hartl, I. Křupka) and the Institute of Metrology and Testing (L. Bumbálek).

Works in the **Institute of Physical Engineering** focus on the preparation of nanostructures with the assistance of SPM for nanoelectronics and plasmonics, the preparation and characterising of ultrafine layers, multilayers, and 1D-0D nanostructures with the assistance of PVD. The Institute also organises the analyses of microstructures by the optical microscopy (BF, DF, DIC, and polarisation microscopy), confocal microscopy and LCIM. There is the development of photoluminescence/reflection optical microscopy and spectroscopy conducted.

Works in the **Institute of Material Science and Engineering**:

The Department of ceramics is involved in the following works: synthesis of inorganic nanoparticles in non conventional conditions (the hydrothermal syntheses, syntheses in the ultrasound and microwave fields), the preparation of nanostructured coatings, the preparation of nanostructured balk ceramics, the studies of surface nanoparticle properties, the studies of microstructures and properties of nanostructured coatings and objects.

The Department of structural and phase analysis organises the structural analyses TEM, STEM, SEM, X-ray, etc.

One of the research topics in the Institute of Designing is the study of very thin lubricating films of the micrometre or nanometre thickness.

The **Institute of Metrology and Testing** conducts measuring with the nanometric preciseness.

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of GA CR GA101/06/0490 "Scanning and analyses of surface textures of advanced materials for the highly precise managed technological methods", 1/2006–12/2008, the researcher is doc. Ing. Leoš Bumbálek, Ph.D.
- Project of GA CR GP202/07/P486 "In-depth profiling of 2D nanostructures by the SIMS, TOF-LEIS and XPS methods with the assistance of low-energy ion separation", 1/2007–12/2009, the researcher is Ing. Petr Bábor, Ph.D.
- Project of MEYS, the programme COST OC 102 – Action COST 539 "Preparation of electroceramics of nanopowders", 3/2006–12/2009, the researcher is doc. RNDr. Karel Maca, Dr.
- Project of MEYS, the programme COST OC 105- Action COST 540 "Photocatalytic ceramic nanomaterials and layers for the photochemical disintegration of water and polar substances", 3/2006–12/2009, the researcher is prof. RNDr. Jaroslav Cihlář, CSc.

- Project of MEYS, the programme COST OC 180 – Action COST D-41 “Heterogenous catalysts for the oxidation of organic substances based on composite perovskite oxides”, 1/2007–12/2010, the researcher is prof. RNDr. Jaroslav Cihlář, CSc.
- Project of MEYS, the programme COST OC 148 “Two-level analysis of the voltage distribution under the nano-indentor’s tip”, 3/2006–12/2009, the researcher is doc. Mgr. Miroslav Černý, Ph.D.

b) Projects in which the faculty cooperates:
- Project of AS CR KAN400100701 “Functional hybrid semiconductor and metal nanosystems with organic substances (FUNS)”, 1/2007–12/2011, the researcher is RNDr. Bohuslav Rezek, Ph.D., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FSI VUT is prof. RNDr. Tomáš Šikola, CSc.
- Project of GA of AS CR IAA1010413 “Nanoscience and nanotechnology with probe microscopy: From phenomena at the atomic level to material properties”, 1/2004–12/2008, the researcher is Ing. Vladimír Cháb, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FSI VUT is prof. RNDr. Tomáš Šikola, CSc.
- Project of GA CR GEFON/06/E001 “Spin-dependent transport and electron correlations in nanostructures”, 1/2006–12/2009, the researcher is Ing. Vít Novák, Institute of Physics of AS CR, Praha, the co-researcher on behalf of FSI VUT is prof. RNDr. Tomáš Šikola, CSc.

c) Cooperation in international projects:
- Project of the 7th FP EU – Marie Curie Actions (FP7-PEOPLE-2007-1-1-ITN) “Factory of European Young Nanotechnologists Mastering Applications of Nanostructures (FEYNMAN)”, 2008–2010, the co-researcher is prof. RNDr. Tomáš Šikola, CSc.
- Project of the 7th FP EU – Capacities-RP (FP7-REGPOT-3) “Reinforcement of Research Potential of the Department of Materials Engineering in the Field of Processing and Characterization of Nanostructured Materials”, 2008-2010, the co-researcher is doc. RNDr. Karel Maca, Dr. Characteristics: Nanoscience applies varied nanotechnological processes in such a way that it modifies and consequently studies nanoobjects’ properties. The utilisation of quantum phenomena is especially attractive in these sizes. The conducted research concentrates on several areas: structural, electron and spectroscopic properties at the atomic level, characterising of nanoclusters, nanolithography with SPM, macroscopic and topographic data combined with the local spectroscopy of electric conductivity, electroluminescence, local states’ densities, diffusion, outcome works, and photovoltaic phenomena. The physical properties are studied also theoretically.

Experts/field
- prof. RNDr. Jaroslav Cihlář, CSc. – synthesis of nanoparticles of ceramic oxide materials, nanoceramic layers and bulk materials, catalytic electrochemical and coordination systems
- prof. RNDr. Tomáš Šikola, CSc. – ultra fine layers, ion and molecular beam technologies, ion beam etching of micro/nanostructures, preparation of nanostructures by the SPM methods, development and application methods for the in situ and ex situ analyses of surfaces, thin layers and nanostructures (UHV STM/AFM, TOF-LEIS, XPS, SIMS, ellipsometry/reflectometry, LEED/AES)

- prof. RNDr. Jaroslav Pokluda, CSc. – mechanical properties of materials, physics and micromechanics of deformation and fraction
- prof. Ing. Jiří Švejcar, CSc. – structural analytics (TEM, AEM, SPM, etc.)
- prof. RNDr. Pavel Šandera, CSc. – limit material states, computer-assisted modelling and simulations, ab initio calculations of mechanical properties of solid substances
- doc. RNDr. Karel Maca, Dr. – high temperature processes in hi-tech ceramic materials, technologies of nanoceramic materials, high temperature interactions of alloys melted with ceramic materials
- doc. Ing. Martin Trunec, Dr. – technologies and properties of hi-tech ceramic materials and nanoceramics
- prof. Ing. Martin Hartl, Ph.D. – optical methods in studies of thin liquid films, very thin (nanometric) lubricant films, lubrication under high contact pressures
- doc. Ing. Leoš Bumbálek, Ph.D. – assessment of surface texture, assessment of surface layers' effects on functional properties of parts, nanometrology

4.2.5. Institute of Chemical Technology in Praha (VSCHT)

Technická 5, 166 28 Praha 6 – Dejvice, I.D. 60461373

www.vscht.cz

The Institute of Chemical Technology in Praha was founded in 1952. It is the biggest educational institution of its kind in the Central and Eastern Europe. It extends more than 170 years long traditions of technological chemistry in the country. Research and development takes place in all chemical fields. VSCHT has got 4 faculties. The nanotechnological research is conducted in the Faculty of Chemical Technology and in the Faculty of Chemical Engineering.

4.2.5.1. FACULTY OF CHEMICAL TECHNOLOGY (FCHT VSCHT)

Technická 5, 166 28 Praha 6 – Dejvice

www.vscht.cz

Brief faculty characteristics

The Faculty of Chemical Technology was founded in 1969, when the Faculty of Inorganic Technology merged with the Faculty of Organic Technology. These two faculties were, together with the Faculty of Food Technology, founding faculties of the independent Institute of Chemical Technology in Praha. FCHT has been following two basic directions in the areas of the basic and applied research – organic and inorganic technologies and materials. The Faculty is divided into 10 institutes and a laboratory.

Research and development focus

In the period 2005–2009, FCHT VSCHT solves two research plans one of which is partly focussing on nanotechnologies. There are also 68 programme projects solved in 2008.

Research plan MSM6046137302 **"Preparation and research of functional materials and material technologies with the utilisation of micro- and nanoscopic methods"**, 1/2005–12/2009, the researcher is doc. Ing. Aleš Helebrant, CSc., the total costs CZK 154.418 million, thereof CZK 139.650 million from the state budget. The year 2008 – 15.796/15.796, the nomenclature – the area 1, the nanotechnological research share – 50 %.

The main problem in the research plan relates to the study of relations between preparation material conditions and their composition, structure and properties which should allow the targeted preparation and development of new material kinds with defined properties, improved functional properties and utilisation in applications. From the point of view of applications, the research plan covers the three main following areas: 1) materials for technological applications, 2) materials for human health, 3) materials and the protection of the environment. The research has been moving into the areas of nanomaterials and nano and microscopic layers in accordance with European and worldwide trends. Objectives of individual partial areas could be made general and divided into groups going across individual parts of the research plan:

- Finding and generalisation of relations between the composition and structures and preparation conditions of special materials and substances with beforehand selected chemical, pharmacological, physical, or physical-chemical properties, and the development of chemical methodologies,
- Preparation of surface modifications and secondary surface layers on materials, and their transfer to the technological practice,
- Optimising of technological processes, the applied research in the area of new techniques and technologies with the utilisation of computer-assisted simulations,
- Clarification of physical-chemical processes taking place in contacts of materials with the environment and proposals and the ways of material corrosion and degradation suppression,
- Modelling of material structures and processes during their preparation at the microscopic and nanoscopic levels, the development of analytical methods allowing their verification.

Research in the area of nanotechnologies is conducted by almost all institutes. They are:

- Institute of inorganic chemistry (D. Sedmidubský, O. Smrčková, D. Sýkorová)
- Institute of inorganic technology (B. Bernauer, J. Krýsa)
- Institute of metal materials and corrosion engineering (D. Vojtěch, J. Šerák)
- Institute of glass and ceramics (A. Helebrant, J. Matoušek, V. Hulínský)
- Institute of solid substances' chemistry (F. Kovanda, B. Doušová)
- Institute of organic technology (P. Klusoň, J. Pašek)
- Institute of polymers (J. Roda, J. Brožek)
- Institute of solid substances' engineering (V. Švorčík, P. Slepička, J. Leitner, I. Hüttel, V. Myslík).

The workers involved in research of nanotechnologies and nanomaterials are presented in brackets.

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of GA of AS CR 1QS401250509 "Ceramic materials of the hierarchy porous structure for the membrane separation technologies", 1/2005–12/2008, the researcher is doc. Ing. Bohumil Bernauer, CSc.
- Project of GA CR GA104/06/0642 "Thin layers of magnetically doped semiconductors A(III)N for applications in spin electronics", 1/2006–12/2008, the researcher is prof. Ing. David Sedmidubský, Dr.
- Project of GA CR GA106/07/1149 "Bioactive and photocatalytic sol-gel nanolayers", 1/2007–12/2009, the researcher is prof. Ing. Josef Matoušek, DrSc.
- Project of GA of AS CR IAA401250701 "Modified aluminosilicates – the effective nano-sorbents of arsenic, antimony and selen oxoanions: mechanics and kinetics of reactions on solid phase surface", 1/2007–12/2009, the researcher is Ing. Barbora Doušová, CSc.
- Project of GA of AS CR IAA401250703 "Porous ceramics, ceramic composites and nanoceramics", 1/2007–12/2009, the researcher is doc. Dr. Dipl.-Min. Willi Pabst.

b) Projects in which the faculty cooperates:

- Project of AS CR KAN100500651 "Preparation and studies of organic-inorganic nano-composite material properties prepared in situ by the emulsive polymerisation", 7/2006–12/2009, the researcher is Ing. Zdeňka Sedláková, CSc., Institute of Macromolecular Chemistry of AS CR, Praha, the co-researcher on behalf of FCHT is doc. Ing. František Kovanda, CSc.
- Project of AS CR KAN400720701 "Hierarchy nanosystems for microelectronics", 1/2007–12/2009, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the researcher on behalf of FCHT is doc. Ing. Petr Klusoň, Dr.
- Project of AS CR KAN300100801 "Multifunctional metallic bulk materials with nanocrystalline and ultrafine grain structures", 1/2008–12/2012, the researcher is prof. Ing. Pavel Lejček, DrSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of FCHT is doc. Dr. Ing. Dalibor Vojtěch.
- Project of MEYS, the programme Basic Research Centres, LC06041 "Preparation, modification and characterising of materials by energy radiation", 3/2006–12/2010, the researcher is doc. Ing. Vladimír Hnatowicz, DrSc., Nuclear Physics Institute of AS CR, Husinec – Řež, the co-researcher on behalf of FCHT is prof. Ing. Václav Švorčík, DrSc.
- Project of MEYS, the programme Research Centres, 1M0577 "Research centre of nanosurface engineering", 1/2005–12/2009, the researcher is Ing. František Peterka, Ph.D., ATG s.r.o, Praha, the co-researcher on behalf of FCHT is doc. Dr. Ing. Josef Krýsa.
- Project of MIT FT-TA4/025 "Nanomaterials of the new generation and their industrial applications", 3/2007–12/2010, the researcher is Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, the co-researcher on behalf of FCHT is doc. Dr. Ing. Josef Krýsa.
- Project of GA CR GA102/06/1106 "Metamaterials, nanostructures, and their applications", 1/2006–12/2008, the researcher is doc. Ing. Jan Macháč, DrSc., FEL CVUT, the co--researcher on behalf of FCHT is prof. Ing. Václav Švorčík, DrSc.
- Project of GA CR GA104/07/1400 "Depositing of oxide catalysts for the VOC oxidation on shaped carriers and their modification by nanoparticles of precious metals", 1/2007–12/2009,

the researcher is Ing. Květa Jiráková, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the researcher on behalf of FCHT is doc. Ing. František Kovanda, CSc.
- Project of GA CR GA104/08/0435 "Intelligently structured mesoporous TiO_2 layers with the antibacterial and controlled variable wetting properties", 1/2008–12/2010, the researcher is Ing. Jiří Rathouský, CSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of FCHT is doc. Dr. Ing. Josef Krýsa.
- Project of MIT 2A-2TP1/136 "Utilisation of nanotechnologies in the surface treatment of ropes", 6/2007–5/2010, the researcher is Ing. Libor Ganzer, LANEX a.s., the co-researcher on behalf of FCHT is doc. Dr. Ing. Josef Krýsa.

Experts/field
- prof. Ing. Václav Švorčík, DrSc. – biocompatibility of modified polymers, thin metallic films
- prof. Ing. Josef Matoušek, DrSc. – glass chemistry and technologies, bioactive nanolayers
- doc. Dr. Ing. Dalibor Vojtěch – nanocrystalline metals and their alloys, nanocrystalline surface layers, light alloys of Al, Mg, and Ti, metal composite materials
- Ing. Jan Šerák, Ph.D. – nanocrystalline materials, plasma nitriding of tool steels, optimising and management of aluminium alloys' quality, issues of the intermetallic phases in aluminium alloys
- doc. Ing. Bohumil Bernauer, CSc. – chemical technology, reactor engineering, membrane reactors and processes, process modelling
- doc. Dr. Ing. Josef Krýsa – photocatalysis, electrochemical and material engineering
- doc. Ing. Václav Hulínský, CSc. – electron microscopy and microanalysis of inorganic materials (glass, ceramics), TEM, SEM, nanoporous membranes
- prof. Ing. Josef Pašek, DrSc. – organic technologies, catalysis, zeolites
- doc. Ing. Ivan Hüttel, DrSc. – preparation technology for passive and active components and integrated optical structures (semiconductor lasers, optical waveguides, optical sensors)
- prof. Ing. Jindřich Leitner, DrSc. – thermodynamic properties of mixture oxides, nitrides of components in the 3rd sub group for applications in electronics and optoelectronics
- doc. Ing. Vladimír Myslík, CSc. – laser technologies for the modification and transfer of inorganic and organic substances, preparation of thin layers sensitive to the reduction and oxidation atmosphere, studies of chemical and electrophysical properties of deposited layers, preparation of chemically conductive sensors and their testing
- doc. Ing. František Kovanda, CSc. – monocrystals, technology of crystal cultivation, nanocomposite materials
- prof. Ing. David Sedmidubský, Dr. – spintronics

4.2.5.2. FACULTY OF CHEMICAL ENGINEERING (FCHI VSCHT)

Technická 5, 166 28 Praha 6 – Dejvice

www.vscht.cz

Brief faculty characteristics

The Faculty of Chemical Engineering was founded as an independent faculty of the Institute of Chemical Technology in Praha in 1960. Then, it was called the Faculty of Automation and

Economics of the Chemical Manufacture (FAE). The Faculty had 4 basic professional departments (of processes and apparatuses, of economics and the management of the chemical and food industries, of mathematics, and of physics). It has been renamed, in 1969, to the Faculty of Chemical Engineering (FCHI). The Faculty consists of 7 institutes.

Research and development focus

In the two research plans solved by the Faculty in the period 2005–2009, the biggest part of nanotechnological research relates to the research plan MSM6046137307 **"Physical-chemical methods in the analysis and description of chemical systems and biosystems"**, 1/2005–12/2009, the researcher is prof. Ing. Karel Volka, CSc. The year 2008 – 6.125/6.125, the nomenclature – the area 5c, the nanotechnological research share – 30 %.

The subject of research activities, within the research plan, relates to the gain of new or of better quality physical-chemical data characterising chemical and biochemical or biological systems with the goal to describe or predict their thermodynamic properties and phase behaviour, to clarify their chemical composition or structures, design systems of defined analytical or other utility properties, or the proposition of new analytical methods. The research focuses on several areas. The following ones relate to nanotechnologies:

- Phase balances, fluid phase balances in systems of the technological importance, theoretical, pseudo-experimental and experimental studies of balanced and metastable phase transitions in macroscopic and nanostructured systems.
- Processes in phase interfaces and membranes, on the interface between two fluid bulk phases, and between the solid and the fluid phases, the sorption of long-term biotoxic radionuclides on natural sorbents, the transport of gaseous mixtures and vapours through polymer membranes, interactions on nanoparticles and films' surfaces.

FCHI focuses its research on the process engineering, molecular engineering, bioengineering, analytical and physical chemistry, process management, and measuring and controlling technologies. The nanotechnological research relates mostly on the preparation and characterising of analytical, diagnostic and therapeutic nanoparticles, but also on the preparation and characterising of nanostructured surfaces and polymer materials. The research of nanotechnologies is conducted in the following institutes:

Research of nanotechnologies is conducted in the following institutes:

- Institute of Analytical Chemistry (V. Král, B. Dolenský)
- Institute of Chemical Engineering (P. Hasal, M. Přibyl, J. Kosek, D. Šnita, J. Lindner, P. Kočí)

Workers involved in the research of nanotechnologies and nanomaterials are presented in brackets.

Research Activities in the area of nanotechnologies

The Team of molecular recognition in the analytical chemistry within the **Institute of Analytical Chemistry** deals with the preparation and characterisation of nanoparticles, modification of nanoparticles by selective receptors, the preparation of nanoparticles of metal-boron nanoclusters, the preparation of porphyrin nanoparticles for the use in medicine, ceramic nanoparticles with photosensors and functions of dendrimers.

The Laboratory of microsystems within the **Institute of Chemical Engineering** studies transport phenomena in nanostructured systems and conducts the theoretical and experimental analyses of chemical and biological processes, which could be completed at the nanoscale. There are studied the preparations of structured nanolayers of biologically active molecules and nanostructures of polymer materials. The studies utilise the atomic forces microscopy (AFM).

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of MIT 1H-PK/24 "Microtechnology and nanotechnology in the chemical, process and biological engineering: Study methods of micro-and nano-structured materials and of designing microchemical equipment", 7/2004–12/2008, the researcher is doc. Ing. Dalimil Šnita, CSc.
- Project of GA CR GA104/07/1127 "Mathematic modelling and the experimental study of the mesoscopic structure creation in polymer materials", 1/2007–12/2009, the researcher is Ing. Juraj Kosek, Dr.
- Project of GA CR GA203/08/1445 "Functional molecular tweezers on the principle of bis Tröger bases", 1/2008–12/2010, the researcher is Ing. Bohumil Dolenský, Ph.D.
- Project of GA CR GP104/06/P301 "Multilevel modelling of reactions and transport in structured porous catalytic agents", 1/2006–12/2008, the researcher is Ing. Petr Kočí, Ph.D.

b) Projects in which the faculty cooperates:

- Project of AS CR KAN208240651 "Studies of interactions of biological macromolecules and nanolayers focussed on the research of polymeric microfluid biosensors and therapeutic nanoparticles", 7/2006–12/2010, the researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of FCHI is doc. Ing. Pavel Hasal, CSc. The task of FCHI is the study of interactions of biological macromolecules and nanolayers with the focus on the research of polymer microfluid biosensors and therapeutic nanoparticles
- Project of AS CR KAN200100801 "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy", 1/2008–12/2012, the researcher is prof. RNDr. Miloš Nedbálek, CSc., HDR, Institute of Physics of AS CR, Praha, the co-researcher on behalf of FCHI is prof. RNDr. Vladimír Král, DrSc.
- Project of GA CR GA203/06/0786 "Modification of nanocrystalline silicon surfaces with diagnostic organic parts for the optical detection of chemical substances", 1/2006–12/2008, the researcher is doc. RNDr. Juraj Dian, CSc., Charles University in Praha, MFF, the co-researcher on behalf of FCHI is prof. RNDr. Vladimír Král, DrSc.

Experts/field

- prof. RNDr. Vladimír Král, CSc. – molecular recognition
- doc. Ing. Dalimil Šnita, CSc. – manufacture and characterising of nanostructured materials and systems
- Ing. Juraj Kosek, Ph.D. – characterising and modelling of nanostructured materials
- doc. Ing. Pavel Hasal, CSc. – nanostructured microfluid and polymer systems

4.2.6. University of West Bohemia in Plzeň (ZCU)

Univerzitní 8, 306 14 Plzeň, I.D. 49777513

www.zcu.cz

The University of West Bohemia in Plzeň (ZCU) was founded on 28 September 1991. It merged the existing University of Mechanical Engineering and Electrical Engineering and the Pedagogical Faculty in Plzeň. The first mentioned university was founded in 1949 as a part of the Czech Technical University in Praha. It became independent in 1953 and developed very fast. In 1960, it was divided into two faculties – mechanical engineering and electrical engineering. The other two new faculties were founded in 1990 – of applied science and of economy. ZCU has got currently 7 faculties. It is the only university in the region of West Bohemia and it trains experts in the following fields: mechanical engineering, electrical engineering, informatics, applied mathematics, physics and mechanics, economy, pedagogy, philosophy, philology, the social and cultural anthropology, archaeology, law, and public administration. The University organises research in the presented fields within its capacity. The research of nanotechnologies is conducted, within limited scope, by the Faculty of Applied Science and the Faculty of Mechanical Engineering.

4.2.6.1. FACULTY OF APPLIED SCIENCE (FAV ZCU)

Univerzitní 22, 306 14 Plzeň

www.fav.zcu.cz

Brief faculty characteristics

FAV ZCU, founded in 1990, is the faculty of the engineering-natural science kind. The research activities take place in informatics and mathematical technology, mathematics, cybernetics, physics, and mechanics. The Faculty is divided into 5 departments. Nanotechnologies are dealt with in the Department of physics (the leader J. Vlček) and, within limited scope, the Department of mechanics (the leader V. Laš).

Research and development focus

In the period 2005–2010, FAV ZCU solves 3 research plans two of which are partly focussing on nanotechnologies. There are 37 programme projects solved in 2008.

Research plan MSM4977751302 **“Processes in discharge plasma and new thin layered materials of unique properties”**, 1/2005–12/2010, the researcher is prof. RNDr. Jaroslav Vlček, CSc., the total costs CZK 76.379 million, thereof CZK 67.330 million from the state budget. The year 2008 – 2.628/2.628, the nomenclature – the area 6b, the nanotechnological research share – 20 %.

The subject of the research plan is the solution of basic problems in the area of physics of discharging plasma, plasma chemistry, physics and surface engineering, thin layers’ physics, solid substances’ physics, electrical engineering and vacuum technology in connection with the utilisation of thin layered materials of unique physical and functional properties. These materials are prepared mostly by non conventional processes in the discharging plasma of different kinds, especially by magnetron and microwave discharges. The main attention is paid to modelling and diagnostics of imbalanced discharging plasma, studies of layers' growing processes, modification of surfaces, designs and research of new plasma sources for the deposition of thin layers and modification of surfaces, the characterising of created surfaces, and studies of thermomechanical processes taking place in materials. The research activities focus mostly on new nanostructured thin layered materials, new thin layered materials based on ternary and quaternary systems of carbon, silicon, boron, nitrogen, and other materials.

Research plan MSM4977751303 **"Prediction of defects in heterogenous materials and components of mechanical and biomechanical systems"**, 1/2005–12/2009, the researcher is prof. Ing. Vladimír Zeman, DrSc., the total costs CZK 62.846 million, thereof CZK 60.346 million from the state budget. The year 2008 – 0.636/0.636, the nomenclature – the area 6b the nanotechnological research share – 5 %.

The research plan focuses on the research of deterioration processes of heterogenous materials and selected components of mechanical and biomechanical systems. The deterioration processes are researched with complex analytical, numerical and experimental methods, from the macroscopic to the microscopic ones in such a way that their interconnection is achieved within the calculated model. In the case of macroscopic scales, there are disruption causes looked for with the goal of minimising the risk of defect occurrence. The subject of the research plan is as follows: a) deterioration of constructions under dynamic loads, b) deterioration of living tissues of organisms by interventions into their cohesiveness at the cell level, according to macro loading, or in chemical and physiological processes, c) dynamic properties of selected complex mechanical systems.

Problems of nanostructured materials (layers) have been determining one of the main directions taken by the Department of physics already for about 15 years. The Department organises research of the layers' preparation technology (magnetron sputtering, non conventional plasma processes) and the research of these layers' properties. The objective of these works is the application of solution results. The main researchers are J. Musil, J. Vlček, and P. Zeman.

Ing. Olga Bláhová, Ph.D. in the Department of mechanics, the Section of microstructures' mechanics, deals with mechanical properties of micro and nano layers.

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:
   There are no programme projects solved in 2008.

b) Projects in which the faculty cooperates:
- Project of GA CR GA106/06/0327 "Crystallisation of amorphous and thin nanocrystalline layers", 1/2006–12/2008, the researcher is doc. RNDr. Radomír Kužel, CSc., Charles University in Praha, MFF, the co-researcher on behalf of FAV is prof. Ing. Jindřich Musil, DrSc.

Experts/field

- prof. RNDr. Jaroslav Vlček, CSc. – plasma physics, plasma chemistry, thin layers' physics and solid substances' physics

- prof. Ing. Jindřich Musil, DrSc. – nanostructured and nanocomposite layers, the PVD and PVD+CVD methods of sputtering, preparation technology for layers with the controlled sizes of grains within the scope of 1–10 nm
- Ing. Petr Zeman, Ph.D. – nanocrystallisation from the solid state
- Ing. Olga Bláhová, Ph.D. – mechanical properties of micro- and nanolayers, nano-indentation

4.2.6.2. FACULTY OF MECHANICAL ENGINEERING (FST ZCU)

Univerzitní 22, 306 14 Plzeň

www.fst.zcu.cz

Brief faculty characteristics

FST ZCU Plzeň belongs among the biggest and oldest faculties of universities in Plzeň. It was founded in 1949. It conducts education and research of a number of mechanical engineering disciplines. The Faculty is currently divided into 5 professional departments and two research centres.

Research and development focus

Research in FST is focussed, in the period 2005–2009, on the solution of a number of mechanical engineering problems, mostly within MEYS projects, the programme "Research Centres". The Faculty solves 13 programme projects in 2008.

- 1M0507 "Research of mechanical engineering manufacturing techniques and technologies", 1/2005–12/2009, the researcher/coordinator is prof. Ing. Jaromír Houša, DrSc.
- 1M0519 "Rail vehicle research centre", 1/2005–12/2009, the researcher/coordinator is doc. Ing. Petr Heller, CSc.
- 1M06032 "Research centre of forming technologies – FORTECH", 3/2006–12/2009, the researcher/coordinator is prof. Dr. Ing. Bohuslav Mašek. Issues solved in this Centre partly relate to nanotechnologies (the creation of ultrafine-grain structure by the extreme plastic deformation).

The research of nanotechnologies is conducted, within limited scope, in the Department of materials and mechanical engineering metallurgy (the leader doc. Ing. Václav Mentl, CSc.). Research activities by the Department focus on the structure of metal and other materials, their mechanical properties, thermal processing, forming of difficult materials, including the numeric simulation of forging and thermal processing, special welding methods, non conventional casting ways, and the engineering of thin layers and surfaces. The last mentioned area relates to the research of nanotechnologies. They mostly assess mechanical properties of thin layers and of nanostructured materials by the nanoindentation method. This workplace pays also attention to balk materials containing structure phases of nanosizes. The following selected workers are involved in the research of nanotechnologies: J. Zrník, A. Kříž, O. Bláhová, and P. Štěpánek.

The Department of machine designs (the leader doc. Ing. Jaroslav Krátký, Ph.D.) has been solving, since the beginning of 2008, a project focussed on the utilisation of nanocomposites in designs of manufacturing machines within the research plan "Research of applications of non conventional materials in machine designs". The worker involved in the research of nanotechnologies is doc. Ing. V. Lašová, Ph.D.

Projects solved in the area of nanotechnologies

- Cooperation in the solution of the research plan MSM2631691901 "Metal materials with structures in the sub micron and nanometric areas prepared by the methods of intensive plastic deformation", 1/2004–12/2009, the researcher is prof. Ing. Jozef Zrník, CSc., COMTES FHT s.r.o., Dobřany.
- Project of GA CR GA101/08/0299 "Research of intelligent composite parts, made of ultra-high-module fibres, in manufacturing machines and the matrices modified by nano-particles", 1/2008–12/2011, the researcher is doc. Ing. Václava Lašová, Ph.D.

Experts/field

- prof. Ing. Jozef Zrník, CSc. – metal forming by extreme plastic deformations (ECAP), metallic alloys
- doc. Dr. Ing. Antonín Kříž – thin wear-resistant layers, their analysis (tribology, micro-hardness, structure, adhesion-cohesive properties) and industrial applications
- Ing. Olga Bláhová, Ph.D. – mechanical properties and microstructure of thin layers, material properties in the micro- and nano- volumes, nanoindentation
- RNDr. Ivo Štěpánek – optimising of the deposition of this layers, especially by the PVD technologies, properties and behaviour (especially the mechanical) of systems thin layer–substrate and in localities on the material surfaces in micron, sub micron down to nanometric areas, especially the nanoindentation measuring, nanoindentation

4.2.7. Technical University in Liberec (TUL)

Studentská 2, 461 17 Liberec, I.D. 46747885

www.tul.cz

The Technical University in Liberec continues traditions of the Mechanical Engineering University that was founded in Liberec in 1953. That University offered studies in only one faculty – the Faculty of Mechanical Engineering. There was the Faculty of Textiles founded in 1960 and the University name changed to the University of Mechanical Engineering and Textiles in Liberec. The then VSST thus became unique with its education of university-educated experts for the textile fields. The current Technical University in Liberec has still maintained this expertise and uniqueness today.

The former University transformation brought significant changes. The original two faculties (of mechanical engineering and of textiles) were supplemented with four other faculties (pedagogical, economics, of architecture, and of mechatronics and interdisciplinary engineering studies) in the period 1990–1995. In 2004, there was the Institute of Healthcare Studies founded as an independent unit. This has fundamentally extended the spectrum of study programmes. The Technical University in Liberec has progressively changed from a purely technical university to the renowned university combining forms of the technical education with forms of humanities and education in natural sciences. It offers undergraduate, graduate and postgraduate study programmes. The research of nanotechnologies is organised in the following faculties:

- Faculty of Mechanical Engineering
- Faculty of Textiles
- Pedagogical Faculty
- Faculty of Mechatronics and Interdisciplinary Engineering Studies

4.2.7.1. FACULTY OF MECHANICAL ENGINEERING (FS TUL)

Studentská 2, 461 17 Liberec

www.fs.tul.cz

Brief faculty characteristics

The Faculty of Mechanical Engineering is the oldest faculty at the Technical University in Liberec. It provides education and research in the fields of mechanical engineering technologies, applied mechanics, machine and facility and manufacturing systems and processes' designs. The Faculty has got 11 departments.

Research and development focus

Research and development in FS TUL focus on the solution of a single research plan and on the coordination of two research centres (neither the centres, neither the plan is focussed on nanotechnologies). The Faculty solves 17 programme projects in 2008.

Research of nanotechnologies, within narrow scope (the nanosurface engineering), is conducted in the Department of materials (the leader doc. Ing. František Stuchlík, CSc.). The other workers involved in nanotechnologies are A. Kolouch, P. Špatenka, and P. Louda.

The Department of machinery parts and mechanisms cooperates in the designing of textile machines manufacturing nanofibres (the leader doc. Ing. Ladislav Ševčík, CSc.).

Projects solved in the area of nanotechnologies

- Project of MEYS, the programme "Research Centres", 1M0577 "Research centre of nanosurface engineering", 1/2005–12/2009, the researcher is Ing. František Peterka, Ph.D., ATG s.r.o., Praha, the co-researcher on behalf of FS TUL is Ing. Aleš Kolouch, Ph.D.
- Project of MIT, 2A-1TP1/113 "Design of special textile machines manufacturing nanofibres", 11/2006–12/2009, the researcher is Ing. Jan Čmelík, ELMARCO s.r.o., Liberec, the co-researcher on behalf of FS TUL is doc. Ing. Ladislav Ševčík, CSc.
- Project of MIT 2A-3TP1/120 "Equipment for the preparation of nanofibres from polymer melts", 4/2008–12/2011, the researcher is Ing. Jan Čmelík, ELMARCO, s.r.o., Liberec, the co-researcher on behalf of FS TUL is doc. Ing. Ladislav Ševčík, CSc.

Experts/field

- prof. RNDr. Petr Špatenka, CSc. – plasma technologies, deposition of biocompatible layers
- prof. Ing. Petr Louda, CSc. – plasma technologies, properties of thin layers
- Ing. Aleš Kolouch, Ph.D. – surface engineering

4.2.7.2. FACULTY OF TEXTILES (FT TUL)

Studentská 2, 461 17 Liberec

www.ft.tul.cz

Brief faculty characteristics

FT TUL was founded in 1960 within the local traditions of the textile industry. It currently organises education and research of complex textile issues. The Faculty has got 8 departments. Workers in the Department of non woven textiles are involved in the research of nanotechnologies.

Research and development focus

Research and development in FT TUL takes currently place within two research centres ("Textile II" and "Centre for Quality and Reliability") and 7 programme projects focussing on nanotechnologies (the research and manufacture of nanofibres and nanotextiles).

The research of nanotechnologies takes place in the Department of non woven textiles (the leader prof. RNDr. David Lukáš, CSc., the workers are O. Jirsák, J. Hrůza, and K. Kalinová) and, within a smaller scope in the Department of textile chemistry (the leader Ing. Jakub Wiener, Ph.D.).

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of MIT 1H-PK2/46 "Nanofibres and their composites for technical and biomedical application", 3/2005–12/2008, the researcher is prof. RNDr. Oldřich Jirsák, CSc.
- Project of GA CR GP106/07/P044 "Transport and absorption of sound in nanofibres assemblies", 1/2007–12/2009, the researcher is Ing. Klára Kalinová, Ph.D.

b) Projects in which the faculty cooperates:

- Project of AS CR KAN101630651 "Creation of nano-layers and nano-coatings on textiles with the use of surface plasma treatment under atmospheric pressure", 7/2006–12/2010, the researcher is prof. RNDr. Mirko Černák, CSc., Masaryk University in Brno, Faculty of Science, the co-researcher on behalf of FT TUL is doc. Ing. Jakub Wiener, Ph.D.
- Project of GA of AS CR IAA500390702 "The tissue carrier of nanofibre materials with the inbuilt liposomes", 1/2007–12/2011, the researcher is doc. RNDr. Evžen Amler, CSc., Institute of Experimental Medicine of AS CR, Praha, the co-researcher on behalf of FT TUL is prof. RNDr. David Lukáš, CSc.
- Project of GA CR GA203/08/0831 "Nanotextiles producing singlet oxygen", 1/2007–12/2010, the researcher is RNDr. Jiří Mosinger, Ph.D., Charles University in Praha, Faculty of Science, the co-researcher on behalf of FT TUL is prof. RNDr. Oldřich Jirsák, CSc.
- Project of GA CR GA304/07/1129 "Polarised cultures of hepatocytes and mesenchyme cells on nanofibre layers in the experimental bioreactor", 1/2007–12/2009, the researcher is prof. MUDr. Miroslav Ryska, CSc., Charles University in Praha, the 2nd Faculty of Medicine, the co-researcher on behalf of FT TUL is prof. RNDr. Oldřich Jirsák, CSc.
- Project of MIT FT-TA5/007 "Advanced research of nanomaterials for textiles", 3/2008–11/2010, the researcher is Ing. Antonín Mlčoch, České technologické centrum pro

anorganické pigmenty a.s., Přerov, the co-researcher on behalf of FT TUL is doc. Ing. Jakub Wiener, Ph.D.

Experts/field

- prof. RNDr. Oldřich Jirsák, CSc. – non woven textiles, technical textiles, fibres, nanofibres
- prof. RNDr. David Lukáš, CSc. – material engineering of non woven textiles, healthcare textiles
- Ing. Jakub Hrůza – fibrous filters, filtration properties of fibrous materials
- doc. Ing. Jakub Wiener, Ph.D. – dyeing – theoretical and practical aspects, optical behaviour of textile systems

4.2.7.3. PEDAGOGICAL FACULTY (FP TUL)

Studentská 2, 461 17 Liberec

www.fp.tul.cz

Brief faculty characteristics

Teachers' education in Liberec has got more than two decades long traditions. Teachers have been trained there since 1779 in the so-called "preparands" and the first year of the Teachers' Institute was ceremonially opened on the Keil Hill on 16 September 1892. After the War, there was the Pedagogic Gymnasium (an advanced secondary educational institution) founded, then the Pedagogical School and, in 1959, the Pedagogical Institute. However, it was abolished soon after the Pedagogical Institute in Ústí nad Labem was transformed to the Pedagogical Faculty. The last graduations took place there in June 1966. The founding of the Pedagogical Faculty as a part of the Technical University in Liberec (originally VSST) in 1990 has meant the renewal of traditions in teachers' training in Liberec. In addition, this has combined in this country not traditionally, but very effectively the university forms and education contents with technical study fields and teaching processes. Apart from training, FP significantly pays attention to the research and exploratory activities. FP is divided into 15 departments and three other units.

Research and development focus

The Department of chemistry, led by doc. Ing. P. Exnar, CSc., researches sol-gel-based sensors of the nanometric sizes. It is a part of the cooperation within international research projects.

Projects solved in the area of nanotechnologies

- Project of MEYS, the programme EUREKA, OE 222 (E!3653 SENSIT) "Sensor systems for intelligent textiles", 3/2006–12/2010, the researcher is Ing. Pavol Ozaňák, TESLA BLATNÁ, a.s., the co-researcher on behalf of FP TUL is doc. Ing. Petr Exnar, CSc. FP TUL develops sensor layers for the indication of humidity and hazardous gases and it measures properties of sensors with these layers.
- Cooperation in the project of the 6th Framework Programme of EU NAPOLYDE "Nano-Structured Polymer Deposition Processes for Mass Production of Innovative Systems for Energy Production & Control and for Smart Device", the coordinator is Patrick Chequet,

Recherche e Développment du Groupe Cockerill Sambre, Liege, Belgium, through ELCERAM a.s. FP TUL organises the development of substrates and the manufacture of sensors, the co-researcher is doc. Ing. Petr Exnar, CSc.

Expert/field

- doc. Ing. Petr Exnar, CSc. – sensor systems utilising nanolayers

4.2.7.4. FACULTY OF MECHATRONICS AND INTERDISCIPLINARY ENGINEERING STUDIES (FM TUL)

Studentská 2, 461 17 Liberec

www.fm.tul.cz

Brief faculty characteristics

The Faculty of Mechatronics and Interdisciplinary Engineering Studies was founded in 1995 as a faculty focussed mostly on fields combining technical disciplines (electronics, controls, and measuring) with informatics and natural sciences (the mathematic modelling). FM TUL is divided into 4 institutes.

Research and development focus

Research and creative activities in the Faculty focus on the basic and applied research. The key areas of the Faculty interest are as follows: electrical engineering, electronics, controlling technologies, measuring technologies, information technologies, artificial intelligence, mechatronics, mathematic modelling of processes, and natural science engineering. Research centres play an important role in research activities conducted by the Faculty. They concentrate the bulk of research activities. In addition to these big tasks, the Faculty workers solve 15 programme projects in 2008.

The research of nanotechnologies focuses on the research of elementary nanoiron and its utilisation in water cleaning, the research of possibilities in the surface functions of nanofibres and their utilisation as filters, catalysts, or biological material carriers, and risks and toxicity related to nanomaterials. The University trains students also for the practice in the area of nanomaterials, within a specialised field of nanomaterials since 2008.

The research of nanotechnologies is conducted in the Institute of New Technologies and the Applied Informatics (the leader prof. Dr. Ing. Jiří Maryška).

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of AS CR, the programme “Nanotechnology for the Society”, KAN108040651 “Research of the manufacturing and the utilisation of nanoparticles based on zero-valent iron for the treatment of contaminated underground waters”, 7/2006–12/2008, the researcher is doc. Dr. Ing. Miroslav Černík, CSc.
- Project of MEYS, the programme “Research Centres” 1M0554 “Advanced remedial technologies and processes (ARTEC)”, 1/2005–12/2009, the researcher is prof. Dr. Ing. Jiří Maryška. There is the utilisation of elementary nanoiron studied for the in situ remedies.

b) Projects in which the faculty cooperates

- Project of MEYS 2B08062 “Genetic and physiological handling of bacterial degradation agents in aromatic pollutants and their utilisation”, 1/2008–12/2011, the researcher is Ing. Miroslav Pátek, CSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of TUL-FM is doc. Dr. Ing. Miroslav Černík, CSc.

Expert/field

- doc. Dr. Ing. Miroslav Černík, CSc. – the use of nanoiron and surface treated nanofibres for water cleaning, remedial technologies

4.2.8. University of Jan Evangelista Purkyně in Ústí nad Labem (UJEP)

Hoření 13, 400 96 Ústí nad Labem, I.D. 44555601

www.ujep.cz

The University of Jan Evangelista Purkyně in Ústí nad Labem carries the name of the well-known native of Libochovice Jan Evangelista Purkyně. The history of the University in Ústí nad Labem started in 1954, when there was the Advanced Pedagogical School founded. This School changed in 1959 to the Pedagogical Institute and, consequently, in 1964, there was the Pedagogical Faculty in Ústí nad Labem founded. The University of J.E. Purkyně was ceremonially opened in Ústí nad Labem together with three faculties and one institute. The University has got currently 7 faculties. The research and development of nanotechnologies take place only in the Faculty of Science.

4.2.8.1. FACULTY OF SCIENCE (PrF UJEP)

České mládeže 8, 400 96 Ústí nad Labem

http://sci.ujep.cz

Brief faculty characteristics

The Faculty of Science was founded on 4 November 2005. It was founded by the transformation of the former Institute of Science of UJEP. Its mission covers education and development of knowledge in natural sciences. The main attention is paid to the plasma physics, plasma chemistry, the thin layers’ physics, computers’ physics, computing methods, biotechnologies, microbiology and the biology of plants and animals, applied geography, the environmental geography synthesising physical-geographical and social-geographical landscape aspects, inorganic chemistry, modelling, chemical computing, instrumental methods for the analytical chemistry, the computer-assisted simulations and numerical analyses of problems in the compressible flows, radio biological processes in living cells, and self-assembled imaging. The Faculty has got 6 departments (of biology, physics, geography, chemistry, informatics, and mathematics).

Research and development focus

Research and development in PrF currently focus mostly on problems of one Basic Research Centre (LC60041) and three projects within the programme “Nanotechnology for the Society”. It solves also 6 programme projects. The research of nanotechnologies is conducted in the Department of physics (the workers focussed on the research of nanotechnologies: S. Novák, J. Pavlík, J. Lörinčík, and M. Švec) and in the Department of biology (the worker involved in the research of nanotechnologies is J. Malý).

Projects solved in the area of nanotechnologies

- Project of GA of AS CR 1ET400720409 "Applications of advanced simulation methods for the study of structures, physical-chemical properties and the preparation of composite materials and nanomaterials", 7/2004–12/2008, the researcher is prof. RNDr. Ivo Nezbeda, DrSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of PrF UJEP is doc. RNDr. Stanislav Novák, CSc.
- Project of MEYS, the programme "Basic Research Centres" LC60041 "Preparation, modification and characterisation of materials by the energy radiation", 3/2006–12/2010, the researcher is doc. Ing. Vladimír Hnatowicz, DrSc., Nuclear Physics Institute of AS CR, Husinec – Řež, the co-researcher on behalf of PrF ÚJEP is doc. RNDr. Jaroslav Pavlík, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN101120701 "Nanocomposite layers and nanoparticles created in the low pressure plasma for surface modifications", 1/2007–12/2011, the researcher is prof. RNDr. Hynek Biederman, DrSc., Charles University in Praha, MFF, the co-researcher on behalf of PrF UJEP is doc. RNDr. Stanislav Novák, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520702 "Nanoimmunosensors detecting cytokines", 1/2007–12/2011, the researcher is Ing. Petr Šebo, CSc., Institute of Biotechnology of AS CR, Praha, the co-researcher on behalf of PrF UJEP is Mgr. Jan Malý, Ph.D.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN400720409 "Hierarchy nanosystems for microelectronics", 1/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of PrF UJEP is doc. RNDr. Jaroslav Pavlík, CSc.

Experts/field

- doc. RNDr. Stanislav Novák, CSc. – the computer-assisted modelling, morphology of thin layers, composites, nanocomposites, plasma chemistry
- doc. RNDr. Jaroslav Pavlík, CSc. – plasma physics, plasma chemistry, thin layers' physics (plasma oxidation of Al), processing of physical measurements and the computer-assisted management of experiments, the probe and optic plasma diagnostics
- Mgr. Jan Malý, Ph.D. – development of the photosynthetic biosensor for the detection of herbicides, research of new processes immobilising biological components on the surface of electrodes, the preparation and research of properties of self-assembling monolayers of natural and recombinant proteins and the research of utilisation of new microscopic techniques in the atomic force microscopy (AFM, STM) for the studies of biological materials
- RNDr. Martin Švec, Ph.D. – computer-assisted modelling (nanocomposite materials, interactions of particles with solid substance surfaces)

4.2.9. University of Pardubice (UPCE

Studentská 95, 532 10 Pardubice, I.D. 00216275

www.upce.cz

The University of Pardubice was founded as the University of Chemistry in Pardubice in 1950. In 1953, it was transformed into University of Chemical Technology in Pardubice. The University structure has changed by the founding of new faculties after 1990. The single faculty university with the chemistry focus has become an institution providing the university education of broader scope. It has got the current name since 1994 and it consists of 7 faculties. In addition to education, it conducts also rich research activities which brought to it respect of both domestic and foreign scientists. It has been assisted by a number of specialised workplaces and other organisations, institutions and associations working in cooperation with the University of Pardubice. The research of nanotechnologies is organised by the Faculty of Chemical Technology.

4.2.9.1. FACULTY OF CHEMICAL TECHNOLOGY (FCHT UPCE)

nám. Čs. legií 565, 532 10 Pardubice

www.upce.cz/fakulty/fcht

Brief faculty characteristics

FCHT is a faculty of more than fifty-five years' long traditions and high credit in the Czech Republic and abroad. It has developed into an important centre of education and research of chemistry and technical chemistry, material engineering, chemical technologies, biological and biological-chemical fields, chemical-engineering and management processes. The Faculty is divided into 14 departments and 2 institutes. There are several joint workplaces of other legal entities associated with the Faculty, e.g. the Joint laboratory for chemistry of solid substances of the Institute of Macromolecular Chemistry of the Academy of Sciences of the Czech Republic and the University of Pardubice (the abbreviation SLChPL), the Joint laboratory for the NMR spectroscopy of the Výzkumný ústav organických syntéz, a.s., Pardubice-Rybitví and the University of Pardubice (SLNMR), the Joint laboratory for analyses and polymer assessment of SYNPO, a. s., Pardubice and the University of Pardubice, Faculty of Chemical Technology (SLAP), and others.

Research and development focus

In the period 2005–2011, there are two research plans solved by FCHT UPCE. One of them is partly focussing on nanotechnologies. There are 58 programme projects solved in 2008.

Research plan MSM0021627501 **"Targeted preparation of special compounds and materials and their physical-chemical properties and supramolecular structures"**, 1/2005–12/2011, the researcher is prof. Ing. Jaromír Šňupárek, DrSc., the total costs CZK 307.960 million, thereof CZK 259.451 million from the state budget. The year 2008 – 8.941/7.710, the nomenclature – the area 1, the nanotechnological research share – 20 %.

The subjects of the plan's solution are as follows: The synthesis and characterising of new inorganic, organic-metallic, polymer, and composite materials of specific properties, including energy materials; The targeted synthesis of materials having specific catalytic characters and the clarification of mechanisms and kinetics of catalysed organic reactions; Studies of physical-chemical and physical-mechanic properties of supramolecular material structures and the utilisation of research results in the technological practice.

The research in the area of nanotechnologies is relatively extensive and it is conducted in the following departments and workplaces:

- Department of general and inorganic chemistry (M. Frumar, M. Vlček, T. Wágner, P. Němec)
- Joint solid substance chemistry laboratory of UMCH of AS CR and the University of Pardubice (L. Beneš, P. Knotek, L. Tichý, V. Zima)
- Institute of polymer materials (P. Kalenda, A. Kalendová, D. Veselý, J. Šňupárek)
- Department of inorganic technology (L. Svoboda, P. Šulcová, Ž. Dohnalová)
- Department of physics (J. Mistrík)
- Institute of energy materials (S. Zeman, P. Vávra)
- Department of chemical engineering (P. Mikulášek)

The main researchers are presented in brackets.

Research and development in the area of nanotechnologies

The main activities in the research of nanotechnologies relate to the solution of the project within the MEYS programme "Basic Research Centres" – LC 523 – "Perspective inorganic materials" and to other projects. The subject of these activities is the basic research of new inorganic materials, organometalloid and organometallic compounds offering perspective utilisation in electronics, optics, optoelectronics, in the glass and ceramics' industries, in nanotechnologies, and as pigments. There are studied oxides and chalcogenides of both transient and not transient metals for the use in nanotechnologies. Other studies cover nanoparticles of varied metallic oxides, photocatalytically active TiO_2-based materials, microstructures and preparation of new phases in the system RuO_2-TiO_2. The main efforts will focus on the preparation of these materials, and their characterising. They will look for possibilities of the synthesis of the photocatalytically active TiO_2 from industrially available raw materials and intermediate products occurring in the manufacture of TiO_2-based pigments. In the areas of information recording and materials for optics and optoelectronics, they will study thin layers of amorphous and crystalline semiconductors, their phase transformations, luminescence, non linear optical properties, thermic properties, and their preparation. Within the participation of the Institute of Inorganic Chemistry of AS CR in activities of the Centre, there is also studied the sol-gel method for the preparation of highly homogenous materials necessary for the preparation of very small (nm) particles used in the synthesis of photoelectric, magnetic and semiconducting materials, materials for non linear optics and for information recordings. There are new kinds of magnetic nanocomposites with the spinel structure (e.g. $CoFe_2O_4$, $NiFe_2O_4$) and new matrices (TiO_2, Al_2O_3, and others) prepared and studied. The sol-gel method will be applied also on the preparation of photonic materials, the area which promises new physical properties and new applications. The values of limits of the resolution abilities of researched materials (nominally in nm) are studied with the use of electron lithography in close cooperation with the Lehigh University, Bethlehem, PA, USA and with the International Materials Institute with headquarters at the University of Pennsylvania and the Lehigh University.

The research in the area of protection of metal materials covers also the studies of inhibition of corrosion processes with the assistance of organic coatings containing functional inhibitors based on nanoparticles or nanolayers. The main focus is on the studies of influences of inorganic anticorrosion pigments and their interaction with organic contact materials, the metallic sub layer materials and the corrosion environment. It is the ecologically focussed research directed towards the replacement of anticorrosion lead and Cr^{VI}-based pigments. The research has been recently focussed on the surface treatment of lamellar pigment particles with nanolayers and the creation of highly effective anticorrosion pigments for organic coats. There are properties of surface particle treated oxide or polyaniline layers studied. It is about the use of the synergy effect of the barrier carrier with the corrosion-inhibition nanolayers. Other studies relate to the passivating nanolayers occurring by effects of anticorrosion pigments on the interface of the protective polymer coating with the protected metal base.

In the area of nanocomposite materials, there is the research conducted for the purpose of optimising the mechanical properties of these materials, while the potential utilisation of these composites mostly focuses on construction and building materials. In the area of new nanostructured composites, for applications in medicine and pharmacology, the research mainly focuses on better functions of implants determined for human bodies (stents, joint replacements, etc.). In the area of energy materials, there have been preparation processes prepared for nanomaterials based on oxidation agent-fuel by the sol-gel method, including the determination of this method's limits for technologies of energy materials, and the determination of basic physical-chemical and explosion-related properties of the gained xero-gels.

The research of pressure membrane processes focuses on the gaining of knowledge about the utilisation of membrane separation for the waste water liquidation, which otherwise contaminate the environment (including the methods for liquidation of, for example, by heavy metals or solvents contaminated flows), for the treatment of process and drinking waters (the removal of inorganic salts and impurities because of the application and ecological reasons), and in biotechnological processes utilising, for example, processes combining solid phase sorption with nanofiltration.

Projects solved in the area of nanomaterials and nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of MEYS "Basic Research Centres" LC523 – "Perspective inorganic materials", 2/2005–12/2009, the researcher is prof. Ing. Miloslav Frumar, DrSc.
- Project of GA CR GA203/06/1368 "Preparation and studies of amorphous chalcogenide layers and their potential application in optical recordings and memory", 1/2006–12/2008, the researcher is prof. Ing. Tomáš Wágner, CSc.
- Project of GA CR GA104/08/0229 "Thin layers deposited by pulse lasers", 1/2008–12/2010, the researcher is doc. Ing. Petr Němec, Ph.D.

b) Projects in which the faculty cooperates:

- Project of AS CR KAN101120701 "Nanocomposite layers and nanoparticles created in the low pressure plasma for surface modifications", 1/2007–12/2011, the researcher is prof. RNDr. Hynek Biederman, DrSc., Charles University in Praha, MFF, the external specialist on behalf of FCHT is Dr. Mgr. Jan Mistrík, Ph.D.
- Project of AS CR KAN200100801 "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy", 1/2008–12/2012, the

researcher is prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics of AS CR, Praha, the co-researcher on behalf of FCHT UPCE is Dr. Mgr. Jan Mistrík, Ph.D.
- Project of MIT FI-IM3/061 “Preparation of conducting and semiconducting polymers doped with carbon based nanoparticles and nanotubes”, 2/2006–12/2009, the researcher is Mgr. Václav Štengl, Ph.D., Institute of Inorganic Chemistry of AS CR, Husinec – Řež, the co-researcher on behalf of FChT UPCE is doc. Ing. Andréa Kalendová, Dr.
- Project of MIT FT-TA2/006 “New paints for selected construction technologies”, 7/2005–12/2008, the researcher is Ing. Libuše Hochmanová, Ph.D., SYNPO, a. s., Pardubice, the co-researcher on behalf of FCHT UPCE is doc. Ing. Andréa Kalendová, Dr.
- Project of MIT 2A-1TP1/014 “Calcined kaolin-based fills and their utilisation in the manufacture of paints”, 11/2006–12/2010, the researcher is Ing. Petr Koutník, Výzkumný ústav anorganické chemie, a.s., Pardubice, the co-researcher on behalf of FCHT UPCE is doc. Ing. Andréa Kalendová, Dr.
- Project of MIT FT-TA4/064 “Paints fulfilling the new environmental requirements of EU”, 7/2007–12/2010, the researcher is Ing. Libuše Hochmanová, Ph.D., SYNPO, a. s., Pardubice, the co-researcher on behalf of FChT UPCE is doc. Ing. Andréa Kalendová, Dr.

c) Projects organised within the international cooperation
- Project of the 6th FP (STREP) CAMELS “Chalcogenide Memory with multilevel Storage” 2005–2008, the researcher is prof. Ing. Miloslav Frumar, DrSc.
- Project of NSF USA “International Materials Institute” and the University of Pennsylvania, Lehigh University and others in EU, Japanese and US universities “New Functionalities of Glasses”, the researchers are prof. Ing. Miloslav Frumar, DrSc., and prof. Ing. Miroslav Vlček, CSc.

Experts/field
- prof. Ing. Miloslav Frumar, DrSc. – amorphous chalcogenides, chemistry of solid substances, photostructural phenomena, new kinds of nano-optic and nano-electric memories
- prof. Ing. Tomáš Wágner, CSc. – material engineering, chemistry of solid substances, studies of the preparation and of properties of amorphous and glassy chalcogenides, photostructural phenomena, reactions in the solid phase, physical and chemical methods in the preparation of this layers, new kinds of nano-optic and nano-electric memories, artificial photonic crystals
- doc. Ing. Petr Němec, Ph.D. – amorphous chalcogenides, optical properties, luminescence
- prof. Ing. Miroslav Vlček, CSc. – amorphous chalcogenides, preparation of high resolution photoresistors and memory components, optoelectronic applications, diffraction optics
- prof. Ing. Jaromír Šňupárek, DrSc. – macromolecular chemistry, polyacrylate solution and polymer colloids – water dispersions of synthetic polymers (latexes), the study of their synthesis and properties, development of manufacture technologies and applications
- doc. Ing. Petr Kalenda, CSc. – paints and organic coatings
- doc. Ing. Andréa Kalendová, Dr. – synthesis and studies of effects of anticorrosion pigments in paints, pigment particles, dispersion processes, properties of heterogenous mixtures
- Dr. Mgr. Jan Mistrík, Ph.D. – spectroscopic magnetooptics, optic ellipsometry
- prof. Ing. Petr Mikulášek, CSc. – nanofiltration

4.2.10. VŠB – Technical University of Ostrava (VSB)

17. listopadu15, 708 33 Ostrava – Poruba, I.D. 61989100

www.vsb.cz

VSB-TU Ostrava extends activities of the original training centre, the Mining Academy and the Mining University in Příbram. This kind of education was renewed in the Czech lands in the mid 19th century, when there were two training centres founded in Příbram and Leoben by the Emperor's Decree of 23 January 1849. The training centre in Příbram received the name Mining Academy in 1865. The consequently issued statuses suggest that the process was going in the direction of recognition of the Mining Academy as a fully-fledged university. In 1904, there were two state examinations implemented, which provided for the granting of the title Dr. mont. and the extension of rector's rights, who could use the traditional title "Magnificence". The new name of the Mining University corresponded with the importance of this institution. In the period 1918–1938, the university trained mining specialists as the only university in Czechoslovakia. In 1945, the University moved to Ostrava and at the beginning of the 1950s it started to be divided into individual faculties. After 1989, the Mining University – Technical University of Ostrava has been transformed into a modern technical university with the full offer of studies in the Faculty of Economy. There have been three new faculties founded during the past 13 years: the Faculty of Electrical Engineering and Informatics, Faculty of Civil Engineering, and the Faculty of Safety Engineering. They have thus extended the studies of technical fields. The VSB – TU is currently a university with the polytechnical and economical focus. Research activities make a substantial part of the University activities. They have been developed in the areas of metallurgy, material engineering, mechanical engineering, electrical engineering and electronics, information technologies, mining and geology, civil engineering, economy, and in other fields. The University has got seven faculties. In addition to the faculties, there are also university institutes, all-university workplaces and task-oriented facilities. The research of nanotechnologies is conducted in the Faculty of Metallurgy and Material Engineering, in the Faculty of Mechanical Engineering, in the Institute of Physics in the Faculty of Mining and Geology, and especially in the Nanotechnological Centre.

4.2.10.1. FACULTY OF METALLURGY AND MATERIALS ENGINEERING (FMMI VSB)

17. listopadu 15, 708 33 Ostrava – Poruba

www.fmmi.vsb.cz

Brief faculty characteristics

The Faculty of Metallurgy and Materials Engineering, using this name since 1991, developed from the Faculty of Metallurgy founded in 1951, after the VSB division into faculties. It has got its historical roots in the era of Příbram and before. The Faculty of Metallurgy and Materials Engineering is the only Czech university institution looking after the field of material engineering in the complex way, from the manufacture to the use. The Faculty is divided into 13 departments and some of them are further divided into institutes. Projects having the character of nanotechnologies were identified in the Department of material forming and in the Department of material engineering.

Research and development focus

In the period 2005–2011, the research in FMMI focuses mostly on the solution of two research plans. One of them is partly focussing on nanotechnologies, especially on the issue of utilisation of the intensive plastic deformation (SPD) for the preparation of ultrafine-grain structure of metal materials. It also solves 51 programme projects.

Research plan MSM6198910013 **"Preparation processes and properties of highly pure and in structure defined special materials"**, 1/2005–12/2011, the researcher is prof. Ing. Miroslav Kursa, CSc., the total costs CZK 85.342 million, thereof CZK 78.40 million from the state budget. The year 2008 – 1.231/1.144, the nomenclature – the area 1, the nanotechnological research share – 10 %.

The research plan focuses on the complex solution of preparation processes and studies of properties and degradation of highly pure and structurally defined special materials. It covers and interconnects all stages related to the preparation of materials by crystallisation processes, their refining, concentration and thermal homogenisation, thermal processes taking place during the crystallisation, diffusion and segregation phenomena, and strength properties of materials at high temperatures. Diagnostics of any defects, microstructures, liquation processes, and the determination of chemical compositions, physical metallurgic parameters, and mechanical properties make an inseparable part of the preparation processes related to the selected materials. Results of these evaluations and their correct interpretation related to the material preparation are ensured by the feedback for the consequent optimising of the crystallisation process of individual material kinds. The solution focuses on the studies of processes taking place in the phase interface melt-crystal, the description of these processes from the points of view of physical chemistry, thermodynamics and kinetics in the material structure creation, etc.

The above-mentioned research of the preparation of a ultra fine structure of metal materials (Fe, Mg) by the intensive plastic deformation is conducted by workers from the Department of material forming (M. Greger, R. Kocich, and B. Kuřetová) and from the Department of material engineering (V. Vodárek and L. Čížek) in cooperation with the Department of mechanical technology in the Faculty of Mechanical Engineering (S. Rusz).

Projects solved in the area of nanotechnologies

None was found.

Experts/field

- doc. Ing. Miroslav Greger, CSc. – forming of metal materials by intensive plastic deformation
- prof. Ing. Vlastmil Vodárek, CSc. – electron microscopy

4.2.10.2. FACULTY OF MECHANICAL ENGINEERING (FS VSB)

17. listopadu 15, 708 33 Ostrava – Poruba

www.fs.vsb.cz

Brief faculty characteristics

The Faculty of Mechanical Engineering (the former Faculty of Mining Mechanical Engineering) was founded in 1951 by the merge of the Mechanical Engineering University in Ostrava, with the address in Brušperk, with the Mining University Ostrava. The current educational and research activities focus mostly on designs of machines, robotics and manufacturing processes, innovation of manufacturing technologies, materials and their properties, and on controls of machines and processes. The Faculty is divided into 11 departments, 11 institutes, 2 laboratories, and a centre. The research of nanotechnologies takes place in the Department of mechanical technology (S. Rusz) and in the Laboratory of loose materials (J. Zegzulka).

Research and development focus

Research in FS VSB focuses on the solution of 25 programme projects. The nanotechnological research has been identified in:

The Department of mechanical technology, the Institute of Forming, where doc. Ing. Stanislav Rusz, CSc., has been involved in the research of technologies related to the intensive plastic deformation for a long time with the goal of achieving ultrafine-grain structure of formed metals. There is mostly the ECAP method used.

Experts (J. Zegzulka and A. Slíva) in the Laboratory of loose materials solve problems encountered in the nanoparticles' storing, microparticle surface modifications of the corn starch by hydrophobic SiO_2 nanoparticles for the purpose of their interaction properties, and the measuring of geometric and mechanical-physical properties of nanoparticles, etc.

Projects solved in the area of nanotechnologies

- Project of GA CR GA101/08/1110 "Development of a new technology utilising the high level of deformation for the manufacturing of ultrafine grained materials", 1/2008–12/2010, the researcher is prof. Ing. Stanislav Rusz, CSc.
- Project of MIT 2A-1TP1/124 "Research of the effects of extreme deformation conditions on the metal sub microstructure and of testing methods for the diagnostics of their technological properties", 11/2006–3/2011, the researcher is Ing. Karel Malaník, CSc., VÚHŽ, a.s., Dobrá, the co-researcher on behalf of FS VSB is prof. Ing. Stanislav Rusz, CSc.

Experts/field

- prof. Ing. Stanislav Rusz, CSc. – mechanical forming, superplasticity, forming of powder materials, non conventional forming methods, development of new manufacturing technologies for ultrafine-grain materials, mathematical modelling of non conventional forming technologies
- prof. Ing. Jiří Zegzulka, CSc. – operations and processes with particle mass, preparation, transport and storage of micro and nano powders, designs of technologies, machines and processes

- doc. Ing. Aleš Slíva, Ph.D. – behaviour of nanoparticles, micro and nano interparticle bonds, surface modification of microparticles by nanoparticles for the improvement of flow properties in transport, handling and storage systems

4.2.10.3. FACULTY OF MINING AND GEOLOGY (HGF VSB)

17.listopadu 15, 708 33 Ostrava – Poruba

www.hgf.vsb.cz

Brief faculty characteristics

The HGF history goes back to the year 1716, when the oldest mining school was founded in Jáchymov. The education forms and length, addresses of institutions and the organisational form were changing during the centuries. The last important change in the address meant the moving of the Mining University to Ostrava in 1945, after which, in the 1950s, the University was divided into faculties. The current Faculty of Mining and Geology was founded in 1959, when the independent Mining Faculty was merged with the Faculty of Geology. HGF is divided into 7 institutes and the Institute of Physics, which organises education in physics and related subjects in six technical University faculties, focuses (in one of its departments) on the research of nanotechnologies.

Research and development focus

Research in HGF VSB focuses on the solution of 30 programme projects. The research of nanotechnologies is conducted in the Institute of Physics, in the Department of nanostructures' physics. The theoretical and experimental studies led by prof. Ing. Jaromír Pištora, CSc., focus on magnetic-optic phenomena occurring in magnetic nanostructures. The research relates to the practical utilisation of magnetic nanostructures for the magnetic and magnetooptic information recordings, in sensors of magnetic fields, and in components of spin electronics. The solution takes place in cooperation with MFF UK and several foreign workplaces.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN400100653 "Self-organised magnetic nanostructures", 7/2006–12/2010, the researcher is Ing. Ján Kančík, Ph.D., Institute of Physics of AS CR, Praha, the co-researcher on behalf of HGF VSB is doc. Mgr. Kamil Postava, Dr.
- Project of GA CR GA202/06/0531 "Reflection and wave guiding phenomena in magnetic nanostructures", 1/2006–12/2008, the researcher is prof. Ing. Štefan Višňovský, DrSc., Charles University in Praha, MFF, the co-researcher on behalf of HGF VSB is prof. Ing. Jaromír Pištora, CSc.

Experts/field

- prof. Ing. Jaromír Pištora, CSc. – magnetooptics, nanostructures, optics of planar structures
- doc. Mgr. Kamil Postava, Dr. – magnetooptics, ellipsometry
- doc. RNDr. Petr Hlubina, CSc. – fibre optics, interferometry
- doc. RNDr. Jiří Luňáček, Dr. – metallic structures
- Mgr. Karla Barčová, Ph.D. – Mössbauer phenomenon

4.2.10.4. NANOTECHNOLOGY CENTRE (CNT VSB)

17. listopadu 15, 708 33 Ostrava – Poruba

www.cnt.vsb.cz

Brief centre characteristics

The Nanotechnology Centre (CNT) was created from the University Institute of Material Chemistry (VUCHEM) on 1 February 2007 on the basis of the newly approved status of VSB TU Ostrava by the Ministry of Education, Youth and Sports of 28 December 2006. The Centre founding reflected changes occurring in the research focus in connection with the research initiative by MEYS in the area of nanomaterials and nanotechnologies. The founding of CNT has also reflected the accreditation and the implementation of a new study programme Nanotechnology at the University in the academic year 2007/8. CNT organises a substantial part of these programme teachings. The Centre is divided into the 5 following departments:

- Department of nanomaterial technologies and structures (P. Čapková, K. Barabaszová, G. Simha Martynková)
- Department of material testing and environmental risks of nanoparticles (V. Tomášek)
- Department of inorganic analysis (J. Seidlerová)
- Department of organic analysis and catalytic processes (Z. Lacný)
- Department of bionanotechnologies (G. Kratošová)

Research and development focus

In the period 2005–2011, CNT VSB, together with other University workplaces, solves the research plan which is fully focussing on nanotechnologies. Apart from this, there 4 programme projects solved.

Research plan MSM6198910016 **"Synthesis, structure and properties of nanomaterials based on intercalated sheet silicates and ferromagnetics"**, 1/2005–12/2011, the researcher is prof. Ing. Jaromír Pištora, CSc., the total costs CZK 83.389 million, thereof CZK 73.511 million from the state budget. The year 2008 – 8.857/8.857, the nomenclature – the area 1, the nanotechnological research share – 100 %.

The research plan targets the preparation and characterisation of nanoparticles of sheet silicates created by the delamination of precursors prepared in the intercalation way. They are consequently utilised for the preparation of nanocomposites polymer-layered silicate. There are direct delamination techniques tested (e.g. mechanical micronising or the microwave procedure), including the in-mixing. There are also other nanomaterials prepared with photofunctioning, luminescence, sorption and catalytic properties (for the envisaged utilisation as photofunctioning units, sorbents for the immobilisation of contaminants from gases or water) and catalytic effects (for the utilisation in the selective reduction of nitrogen oxides) prepared by the intercalation of organic molecules and polycations for the sheet silicate interlayers. A special attention is paid to the analysis of the structural arrangement. A part of the plan relates also to the roles of sheet silicates in friction composites. There are also mechanical-physical and geometrical properties tested and sheet silicate nanoparticles are studies. The knowledge will be utilised in the application of a model ideal loose material on plate structures. The research in the area of nanotechnologies focuses on nanomaterials based on intercalated and surface modified host structures, mostly layered silicates and hydrotalcites. These host structures are intercalated or surface modified by organic molecules (organic dyes, organic-ammonium surfactants), organic-metallic complexes, metal nanoparticles, or their oxides. The use of nanomaterials prepared in this way is directed into the following areas: catalysis, photocatalysis, sorption and degradation of organic pollutants, disintegration of nitrogen oxides, photofunctioning and antibacterial materials. A part of this research plan relates also to the methodology of the preparation of silicate nanoparticles by the combination of mechanical and physical-chemical processes for nanocomposites as the friction or constructional materials or protective coats. A special attention is also paid to the toxicity and health risks connected with nanoparticles. The experimental instruments used: the X-ray diffraction and spectroscopy, atomic absorption and emission spectroscopy, IR spectroscopy, the gaseous, liquid and ion chromatography, AFM microscopy, electron microscopy, the EDAX microanalysis, and the Sturtevant microniser. The design of nanomaterials utilises also the method of molecular modelling – the software by the Materials Studio.

Research in the area of nanotechnologies in CNT focuses on the following areas:

- Preparation and characterising of layered silicates and hydrotalcites by intercalated organic molecules,
- Preparation and characterising of metal nanoparticles, their oxides and sulphides anchored on surfaces of silicate matrices, nanocomposite coats on silicate matrices,
- Preparation of metal nanoparticles with the utilisation of biotechnologies and their characterising,
- Preparation and characterising of silicate nanoparticles by combination of mechanical and physical-chemical processes for nanocomposite materials,
- Analysis and characterising of nanoparticles occurring in friction processes
- Studies of the toxicity and health risks of nanoparticles.

Projects solved in the area of nanotechnologies

- Project of MEYS ME 08040 "Importance of minerals and their influence in the friction mechanism in friction composites for the automotive industry", 1/2008–12/2009, the researcher is Ing. Gražyna Simha Martynková, Ph.D.
- Project of MIT FT-TA4/025 "Nanomaterials of the new generation and their industrial applications", 3/2007–12/2010, the researcher is Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, the co-researcher on behalf of CNT VSB is prof. RNDr. Pavla Čapková, DrSc.

Experts/field

- prof. RNDr. Pavla Čapková, DrSc. – structural characterising of nanomaterials with the assistance of the combination of the molecular modelling, X-ray diffraction and the IR spectroscopy, the leader of the Institute
- doc. Ing. Vladimír Tomášek, CSc. – utilisation of electron microscopy and X-ray spectrometry in studies of nanostructured materials
- doc. Ing. Jana Seidlerová, CSc. – utilisation of the methods of atomic emission and absorption spectrometry for the analysis of chemical material compositions

- RNDr. Marta Valášková, CSc. – preparation technology for intercalated sheet silicates and their X-ray diffraction analysis
- Ing. Monika Šupová, Ph.D. and Ing. Vlastimil Matějka, Ph.D. – utilisation of the atomic force microscopy in studies of nanostructured materials
- Ing. Zdenek Lacný – utilisation of gaseous and liquid chromatography methods for the analyses of organic substances and the evaluation of sorption and catalytic properties

4.2.11. Plalacky University Olomouc (UPOL)

Křížkovského 8, 771 47 Olomouc, I.D. 61989592

www.upol.cz

The Palacky University Olomouc was founded in 1946 and extended thus the activities by the former Theological Faculty. It has currently got seven faculties: Cyril and Methodius Faculty of Theology, Faculty of Medicine, Faculty of Philosophy, Faculty of Science, Faculty of Physical Education, Pedagogical Faculty, and Faculty of Law. The research of nanotechnologies is conducted in the Faculty of Science and, within limited scope, in the Faculty of Medicine.

4.2.11.1. FACULTY OF SCIENCE (PrF UPOL)

Tř. Svobody 26, 771 46 Olomouc

www.upol.cz/fakulty/prf

Brief faculty characteristics

The Pedagogical University with faculties of science and social science was founded in Olomouc in 1953. The main role of this institution was the training of secondary school teachers. The 1st of September 1953 could be considered the date of founding of an independent faculty dealing with natural sciences. The Pedagogical University merged on 18 September 1958, with the effect on 1 September 1958, with the Palacky University. The names of the faculties were changed to the Faculty of Science and Faculty of Philosophy. The Faculty of Science currently provides for education in mathematics, physics, chemistry, biology, geography, and ecology. Research also deals with these disciplines. The Faculty is divided into 6 fields (mathematics, physics, chemistry, biology, earth sciences, and faculty facilities), which are further divided into departments and laboratories. The research of nanotechnologies is organised in the Department of experimental physics, the Department of inorganic chemistry, the Department of physical chemistry, the Department of optics, and in the Joint laboratory UPOL and FZU AS CR, Praha.

Research and development focus

In the period 2005–2011, PrF UPOL solves 6 research plans and one of them is partly focussing on nanotechnologies. There are also 65 programme projects solved in 2008.

Research plan MSM6198959218 **"Complex compounds and oxides of transient metals for the utilisation in bioapplications and nanotechnologies"**, 1/2005–12/2011, the researcher is prof. RNDr. Zdeněk Trávníček, Ph.D., the total costs CZK 146.769 million, thereof CZK 128.989 million from the state budget. The year 2008 – 12.090/11.867, the nomenclature – the area 1, the nanotechnological research share – 60%.

The research plan deals with the synthesis of complex compounds of transient metals, oxides of transient metals, and elementary metals with properties suitable for the utilisation in bio-applications (cancerostatics) and nanotechnologies (catalysis, biomagnetic separation, and nanopigments). Research activities consist of three basic steps and cover progressively the synthesis of complex compounds and nanomaterials, their complex physical-chemical characterising and the practical testing in selected areas of nanotechnologies and bioapplications. The partial tasks of the research activities relate to the studies of the mechanism in selected reactions in solutions and in the solid phase and to the study of effects of surface treatments and of interparticle interactions on the magnetic properties of nanoparticles.

Research of nanotechnologies and nanomaterials

The Department of experimental physics focuses its research activities on the solution of the MEYS project 1M0512 "Research Centre for powder nanomaterials", the researcher is prof. RNDr. Miroslav Mašláň, CSc. Within the Centre, there are also workers from the Department of inorganic chemistry and the Department of physical chemistry cooperating. They are: M. Mašláň, R. Zbořil, Z. Trávníček, L. Machala, M. Heřmánek, M. Miglierini, L. Kvítek, A. Panáček, R. Prucek, J. Tuček, R. Kubínek, M. Vůjtek, and others. The Centre has got its own Internet address: www.nanocentrum.upol.cz.

The Centre synthesises, in the form of nanoparticles by the way of thermically induced reactions in the solid phase, mostly amorphous and nanocrystalline oxides of transient metals and ferrimagnetic spinel structures, including ferrites (Ni, Co, Mn, Zn, and Cu). These thermic syntheses, controlled by reaction conditions and precursors' properties, are directed towards the achievement of a suitable combination of size, morphologic, surface, structural, magnetic, and other nanoparticle properties (catalytic, sorption, optic) allowing for their utilisation in the area of nanopigments, in the preparation of standards for microscopic techniques, in the area of sorption-purification processes, biomagnetic separations (the detoxicant processes, dialysis), in the ferrofluid technologies, magnetic cooling, or catalysis. There is the extensive use of precursors, including complexes of transient metals and salts of organic acids envisaged. Their structural properties and low conversion temperatures allow the preparation of nanopowders of a narrow size distribution, large surface area, and with desirable magnetic properties (superparamagnetism, ferrimagnetism). There will be also nanoparticles of elementary metals (Fe, Ag) synthesised in the reduction way in both solid phase and solution with the use of iron oxides and complex silver compounds in the role of precursors. The nanoparticles will be tested for their utilisation as antibacterial, sorption, catalytic, and magnetic agents.

The Department of experimental physics deals also with the development of analytical methods suitable for the research of nanotechnologies (Mössbauer spectroscopy – the development of modern automated measuring methods and systems and their applications for the substance structures analysis, the microscopy scanning with a probe, and the surface analysis at the submicroscopic level) – M. Mašláň, R. Kubínek, and M. Vůjtek.

The Department of inorganic chemistry conducts syntheses of complex compounds usable in varied industries as the high pressure lubricants, floating agents, antioxidation agents, insecticides, or as precursors for the preparation of nanoparticles (Z. Trávníček).

The Department of physical chemistry organises the syntheses of nanoparticles of iron oxides by the way of thermically induced reactions in the solid phase, including the preparation of rare structural forms of the amorphous Fe_2O_3, β-Fe_2O_3, and ε-Fe_2O_3 with defined properties (K. Zbořil, L. Kvítek, R. Orucek, and A. Panáček).

The one of research directions of the Joint laboratory of UPOL and FZU AS CR, Praha, is, within the Research Centre "Optical structures, detection systems and related technologies for low-photon applications" the preparation and application of nanostructured diamond layers and other super hard layers with the low inner tension for optical applications (M. Hrabovský).

The Department of optics researches, within the Research Centre "Centre of modern optics", some aspects of the nanometrology (J. Fiurášek).

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of MEYS, the programme "Research Centres" 1M0512 "Research centre of powdered nanomaterials", 1/2005–12/2009, the researcher is prof. RNDr. Miroslav Mašláň, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN115600801 "New preparation and use technologies related to nanoparticles based on iron oxides for the environmental, industrial and medical applications", 1/2008–12/2012, the researcher is doc. RNDr. Radek Zbořil, Ph.D.
- Project of MEYS, the programme "Research Centres" 1M06002 "Optical structures, detection systems and the related technologies for the low-photo number applications", the researcher is prof. RNDr. Miroslav Hrabovský, DrSc.
- Project of MEYS, the programme "Basic Research Centres" LC06007 "Centre of modern optics", 3/2006–12/2010, the researcher is doc. Mgr. Jaromír Fiurášek, Ph.D.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN301370701 "Nanostructured macroscopic systems – preparation technology and characterising", 1/2007–12/2011, the researcher is prof. RNDr. Miroslav Hrabovský, DrSc.

b) Projects in which the faculty cooperates:

- Project of AS CR, the programme "Nanotechnology for the Society" KAN100040651 "Creation of nano-layers and nano-coatings on textiles with the use of surface plasma treatment under atmospheric pressure", 7/2006–12/2010, the researcher is prof. RNDr. Mirko Černák, CSc., Masaryk University in Brno, Faculty of Science, the co-researcher on behalf of PrF UPOL is prof. RNDr. Miroslav Mašláň, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN200380801 "Research of the manufacturing and the utilisation of nanoparticles based on zero-valent iron for the treatment of contaminated underground waters", 7/2006–12/2008, the researcher is doc. Dr. Ing. Miroslav Černík, CSc., Technical University in Liberec, FM, the co-researcher on behalf of PrF UPOL is doc. RNDr. Radek Zbořil, Ph.D.
- Project of GA CR GA106/08/1440 "Iron and iron oxides based nanoparticles for magnetic separation processes", 1/2008–12/2011, the researcher is Ing. Oldřich Schneeweiss, DrSc., Institute of Physics of Materials of AS CR, Brno, the co-researcher on behalf of PrF UPOL is prof. RNDr. Miroslav Mašláň, CSc.

Experts/field

- prof. RNDr. Miroslav Mašláň, CSc. – Mössbauer spectroscopy, synthesis of magnetic nanoparticles

- prof. RNDr. Zdeněk Trávníček, Ph.D. – synthesis of new coordination substances
- doc. RNDr. Roman Kubínek, CSc. – microscopy of atomic forces (AFM), nanoparticles (ferric oxide)
- RNDr. Radek Zbořil, Ph.D. – synthesis of magnetic nanoparticles, structural, magnetic and morphological characterising of nanoparticles
- RNDr. Libor Kvítek, CSc. – electrochemistry of organometallic and coordination compounds, preparation and characterising of inorganic colloids (Ag, TiO_2)
- prof. RNDr. Miroslav Hrabovský, DrSc. – wave optics, holography

4.2.11.2. FACULTY OF MEDICINE (LF UPOL)

Tř. Svobody 8, 771 46 Olomouc

www.upol.cz/fakulty/lf

Brief faculty characteristics

The Faculty of Medicine of UP was founded in 1946 as one of the faculties of the renewed Palacky University Olomouc. It is divided into 24 clinics, 17 institutes, and other workplaces (laboratories, etc.). The Faculty is connected with the Teaching Hospital. The research and utilisation of nanotechnologies of limited scope were identified in the Institute of Microbiology, in the Institute of Immunology, and in the Institute of Pharmacology.

Research and development focus

In the period 2005–2011, LF UPOL solves 2 research plans. One of them is partly focussing on bionanotechnologies and nanomedicine. There are also 48 programme projects solved in 2008.

Research plan MSM6198959223 **"New possibilities of diagnostics and immunomodulation in infectious diseases and immunopathological states"**, 1/2007–12/2011, the researcher is prof. MUDr. Evžen Weigl, CSc., the total costs CZK 101.678 million, thereof CZK 101.678 million from the state budget. The year 2008 – 23.106/23.106, the nomenclature – the area 3, the nanotechnological research share – 10 %.

The research plan focuses on the following areas:

- Induction of a specific system immunity response as the prevention of system infections (borreliosis, the infection HIV-1) and surface skin infections (trichophytosis). The induction of a specific mucosa immunity as the prevention of mucosally localised infection (the vaginal candidiasis) and by mucosa transferred infections (infections HIV-1).
- Testing of fusion DNA vaccines for the modulation of an antigen specific immunity response for the targeted humoral induction, or cell responses as the prevention of infectious diseases, inflammatory or allergic situations.
- New possibilities in the diagnostics of disease-producing bacteria, virulence factors and resistance towards antimicrobial preparations. The work out and verification of new methods for the fast detection of pathogenic microorganisms with the use of physical and chemical methods based on the interaction of organised layers of metal nanoparticles with these pathogens, or their specific parts.

- Prevention of the occurrence and spreading of bacterial resistance in human and animal areas.

The Institute of Microbiology researches, within the above-presented research plan, possibilities in the use of metal nanoparticles for the fast detection of pathogenic microorganisms (M. Kolář).

The Institute of Immunology participates, within the international project, in research of a new nanovaccine against AIDS (M. Raška).

The Institute of Pharmacology participates in the solution of the project within the programme "Nanotechnology for the Society" (P. Anzenbacher).

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200200651 "Nanoparticle and supramolecular systems for the targeted transport of medication", 6/2007–12/2010, the researcher is prof. RNDr. Blanka Říhová, DrSc. Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of LF UPOL is prof. RNDr. Pavel Anzenbacher, DrSc.
- Project of the 6th FP, STREP, MUNANO VAC, "Mucosal Nano Vaccine Candidate for HIV", 1/2007–12/2009, 8 participants. There is the use of PLA nanoparticles researched as medicine carriers. The researcher on behalf of LF UPOL is MUDr. Mgr. Milan Raška, CSc.

Experts/field

- prof. RNDr. P. Anzenbacher, DrSc. – metabolism of medicine – enzymes in the metabolism of medicine, metabolic differences between species, medicine interactions
- prof. MUDr. Evžen Weigl, CSc. – immunology
- MUDr. Mgr. Milan Raška, CSc. – immunology
- prof. MUDr. Milan Kolář, Ph.D. – microbiology, microbial resistance

4.2.12. Tomáš Baťa University in Zlín (UTB)

Mostní 5139, 760 01 Zlín, I.D. 70883521

www.utb.cz

UTB is the top educational and research institution that could be characterised by a very fast development, openness towards the rest of the world, the stress put on science and research, and cooperation with the practical sphere. With its 11 000 students, it could be considered a medium-size university in the Czech Republic. The University carries the name of the genius entrepreneur Tomáš Baťa (1876–1932), who was the founder of the shoe industry in Zlín and who has become known all over the world. His son, the Canadian entrepreneur Tomáš Baťa junior (born in 1914), is the Chairman of the University Board. The University was founded on 1 January 2001 by the transformation of two faculties of the Brno Technical University. The City of Zlín has thus become a university city providing students with a wide spectrum of study fields.

UTB has got 5 faculties (of technology, management and economics, multimedia communications, applied informatics, and humanity studies) and a University Institute, which organises project activities and research activities in the following areas:

- Polymer materials, technologies and products with the special stress put on applications of polymers in the healthcare industry,
- Materials and technologies used in the food industry, with the focus on food additives.

The research in the field of nanotechnologies is conducted in the Faculty of Technology.

4.2.12.1. FACULTY OF TECHNOLOGY (FT UTB)

Náměstí T. G. Masaryka 275, 762 72 Zlín

www.ft.utb.cz

Brief faculty characteristics

The Faculty of Technology in Zlín has the main study field the technology of leather, plastics and rubber. It was founded on 15 April 1969 as a part of the Brno Technical University. In 2001, it was one of the founding UTB faculties. Research activities in FT UTB are based on long traditions and they reflect development trends in chemical engineering, chemical technologies, ecology, materials, management, automation, information and safety, manufacturing processes, mechanical engineering, and the related boundary fields. Science disciplines focus mostly on chemistry and technology of polymer materials, management of industrial processes, manufacturing economy, but also on the application of information technologies in the management of industrial manufacturing. FT UTB is divided into 7 institutes and one centre. The research of nanotechnologies takes place in the Centre of polymer materials (the leader prof. Ing. Petr Sáha, CSc.), in the Institute of polymer engineering (the leader Ing. Roman Čermák, Ph.D.), and in the Institute of physics and material engineering (the leader prof. Ing. Lubomír Lapčík, Ph.D.).

Research and development focus

In the period 2005–2011, FT UTB solves the research plan that is partly focussing on nanotechnologies. It solves also 23 programme projects in 2008.

Research plan MSM7088352101 **"Multifunctional composite systems based on natural or synthetic polymers"**, 1/2005–12/2011, the researcher is prof. Ing. Petr Sáha, CSc., the total costs CZK 240.898 million, thereof CZK 204.253 million from the state budget. The year 2008 – 24.080/23.170, the nomenclature – the area 1, the nanotechnological research share – 70 %.

The research plan focuses on the gaining of new knowledge from the area of natural and synthetic macromolecular composite systems with the stress put on the transfer of this knowledge to the sphere of applied science. The selected multifunction polymer composites with the inbuilt biocomponent, optical, magnetic or electric function, containing nanostructures, gel systems or additive components will be studied from the point of view of preparation, properties and processing. The outcome will be new basic information from the followed up areas, especially designs of innovative products and manufacturing processes, including complex designs of management systems. It is envisaged that the achieved results should find utilisation in the industries of plastics, food, and automotive products. Important contributions are also expected in the areas of healthcare materials and packing materials.

Research in the area of nanotechnologies in individual institutes

Centre for Polymer Materials:

Activities of the Centre in the area of nanotechnologies focus on systems of functional nanoparticles in biocompatible, biodegradable, and a natural polymer matrix for the use in medicine and packing technologies. There are also polymer materials with optical, magnetic or electric functions studied, which contain target-modified **nano or nanostructured** fills. The studies will also cover preparation and properties of layered and mesoporous intercalated nanofills. The part related to purely polymer nanosystems will research issues of electron resistors for the technology of nanoprinting.

Centre of Polymer Engineering:

The Institute of Polymer Engineering has been involved for a long time in studies of **nanofills** based on organophylic clays, especially of the montmorillonite and vermiculite kinds with the focus on the utilisation in varied polymer matrices. Experimental works are supplemented with the theoretical solutions of mathematical computer-assisted modelling and the prediction of arrangement and positions of organophylic agents in between clay layers and their relation to the agent's concentration. There are also mixing conditions of these treated and commercial nanofills for polymer matrices studied as well as the impacts of these conditions and nanofill kinds on properties of the prepared polymer **nanocomposites** with the expected utilisation in a number of fields.

Institute of Physics and Material Engineering:

Activities of the Institute focus on the area of modification of surface properties of **nanofills** for applications in polymers, gel systems, PUR foams, paints, and thin surface layers. The Institute is well equipped in personnel and also in materials and technology necessary for the studies and characterising of shapes, charges and zeta potential of **nanoparticles**, their synthesis and modification. The Institute participates in the international cooperation in this area in the form of research EU projects within FP5, FP6, and FP7 (the projects SUPER-WAFER, NENAMAT, MICRONANO, SCRATCH, AeroNet, and EnerPlast) in the Czech Republic with a number of both domestic and foreign companies. The Institute also actively participates in activities of EASN (Garching, Germany), where prof. Ing. L. Kapřík, Ph.D., works in the team Innovative Concepts and Scenarios – Pioneering Nanomaterials for Aerospace Applications, and in international advisory committees ELKIN (NL) and ICCE (USA). In the pedagogic area, the study of the Material engineering field focuses in FT UTB also on the field of nanomaterials. The Institute is currently active in the exchange programme SOCRATES ERASMUS with six European universities in France, Great Britain, Portugal, and Germany.

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is the faculty:

- Project of GA CR GP106/06/P189 "Adaptation of properties of carbonous nanotube based polymer nanocomposites from the temperature stability point of view", 1/2006–12/2008, the researcher is Ing. Petr Slobodian, Ph.D.

b) <u>Projects in which the faculty cooperates:</u>

- Project of GA of AS CR IAA100100622 “Conjugated silicon polymers for resistors in nanotechnologies”, 1/2006–12/2009, the researcher is RNDr. Josef Zemek, CSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of FT UTB is prof. Ing. Pavek Schauer, DrSc.
- Project of AS CR, the programme “Nanotechnology for the Society” KAN100400701 “Hybrid nanocomposite materials”, 1/2007–12/2011, the researcher is prof. Ing. Jiří Čejka, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of FT UTB is Ing. Dagmar Měřínská, Ph.D.
- Project of MIT FI-IM3/085 “Polyalkene based nanocomposites of extraordinary utility properties”, 3/2006–12/2009, the researcher is Ing. Ivan Dobáš, CSc., SYNPO, a. s., Pardubice, the co-researcher on behalf of FT UTB is Ing. Dagmar Měřínská, Ph.D.

c) <u>Projects within the international cooperation:</u>

- Project of MEYS 1P05ME735 (KONTAKT) “Photovoltaic cells based on polymer bulk heterotransitions”, 2005–2008, the researcher is prof. Ing. František Schauer, DrSc., Synthesis of AiiBvi nanoparticles, characterising of nanostructured materials.
- Participation in research works of the Excellence Network of the 6th FP NANOFUN-POLY “Nanostructured and Multi-Functional Polymer-Based Materials and Nanocomposites”, 2004–2008, the researcher is prof. Ing. Dr. Karel Dušek. The co-worker on behalf of FT UTB is Ing. Dagmar Měřínská, Ph.D.

Experts/field

- prof. Ing. Petr Sáha, CSc. – polymer processes, rheology and electrorheology, not stable flows of polymer melts and blends, physical aging of polymers
- prof. Ing. František Schauer, DrSc. – vacuum and plasmatic deposition of amorphous and nanocrystalline inorganic and organic semiconductors, characterising of deposition conditions with the assistance of electric methods, mass methods and optical spectroscopy, transport, optical and photoelectric properties of amorphous inorganic and organic semiconductors with the main stress put on the electron spectroscopy, especially the tunnel electron spectroscopy
- doc. Dr. Ing. Vladimír Pavlínek – rheology and electrorheology of nanoparticle and nanocomposite suspensions
- doc. Ing. Jarmila Vilčáková, Ph.D. – electric properties of nanocomposites, conductivity, dielectric spectroscopy
- doc. Mgr. Natalia Kazantseva, Ph.D. – electric properties of nanocomposites, electromagnetic shielding, applications in medicine, metamaterials
- doc. MSc. Nabanita Saha, Ph.D. – biodegradations, microbiology
- Ing. Petr Slobodian, Ph.D. – carbon nanotubes, nanocomposites, thermic analyses
- Ing. Vladimír Sedlařík, Ph.D. – biodegradable and biocompatible materials, nanocomposites containing silver and ZnO nanoparticles
- Mgr. He Ying, Ph.D. – hybrid nanosystems and nanocomposites, elastomer nanocomposites
- Ing. Ivo Kuřitka, Ph.D. – structural characterising, spectroscopy, polysilanes for nanoresistors
- MSc. Qilin Cheng – synthesis of nanostructured materials, mesoporous intercalates

- Ing. Alena Kalendová, Ph.D. – studies of nanocomposite materials of the type polymer/ clay with the focus on polyvinylchloride and polyolefins
- Ing. Dagmar Měřínská, Ph.D. – structure and morphology of polymers, treatment of clay minerals by intercalation and cointercalation, technology for composite and nanocomposite materials, studies of properties of nanocomposites, nanocomposites PO/clay
- doc. Ing. Jiří Maláč, CSc. – possible uses of clay nanofills in caoutchouc mixtures and their impact on rubber properties determined for different purposes

4.2.13. University of South Bohemia in České Budějovice (JU)

Branišovská 31, 370 05 České Budějovice, I.D. 60076658

www.jcu.cz

The University of South Bohemia in České Budějovice, founded in 1991, organises education and research mostly in the fields of biology, agriculture, fisheries and pedagogy. The University is divided into 7 faculties (of economy, philosophy, pedagogy, science, theology, healthcare and social care, and agriculture), the Institute of Physical Biology and the Research Institute of Fisheries and Hydrobiology. The research of nanobiotechnologies was identified in the Faculty of Science and in the Institute of Physical Biology.

4.2.13.1. FACULTY OF SCIENCE (PrF JU)

Branišovská 31, 370 05 České Budějovice

www.prf.jcu.cz

Brief faculty characteristics

The Faculty of Science of JU was founded from the Faculty of Biology JU on 1 August 2007. Professional studies, fundamentally focussed on biological fields, have been extended with chemical, physical and mathematical study programmes. The Faculty is divided into 9 departments and 3 institutes. Additional information is available in the journal Academic Bulletin[12].

Research and development focus

In the period 2005–2010, PrF JU solves the research plan not focussed on nanotechnologies. There are 47 programme projects solved in 2008. The research of nanotechnologies is conducted in the Department of molecular biology and biochemistry in the Laboratory of structural biology (L. Trantírek) and in the NMR spectroscopy of a single molecule laboratory (F. Vácha).

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200100801 "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy", 1/2008–12/2012, the researcher is prof. RNDr. Miloš Nesládek, DrSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of PrF JU is Mgr. Lukáš Trantírek, Ph.D.

12 L. Grubhoffer: "New Faculty of Science in South Bohemia", Academic Bulletin, 9/2007, p. 20.

- Project of GA CR GA203/08/0094 “Computer assisted modelling of structural, dynamic and transport properties of nano-size liquids”, 1/2008–12/2011, the researcher is Mgr. Milan Předota, Ph.D.

Experts/field

- prof. RNDr. František Vácha, Ph.D. – biochemistry, structural biology, spectroscopy, photosynthesis, spectroscopy of a single molecule, detection of a single molecule
- Mgr. Lukáš Trantírek, Ph.D. – structural biology

4.2.13.2. PHYSICAL BIOLOGY INSTITUTE (UFB JU)

Zámek 136, 373 33 Nové Hrady

www.ufb.jcu.cz

Brief Institute characteristics

The Physical Biology Institute, with the address in Nové Hrady, was founded in 2002, when it joined the University of South Bohemia. The main activities of UFB currently relate to the basic research of natural systems by physical, mathematical, biological, chemical, and other exact methods. In cooperation with JU faculties, it organises also teachings in the fields for which it has been authorised by the University, including the relevant habilitation procedures. The Institute is divided into 3 departments (of structures and functions of proteins, ecophysiology of autotrophic microorganisms, and biotechnology) which are further divided into laboratories. UFB JU has established several joint laboratories with the Institute of Systems Biology and Ecology of AS CR, a part of which is placed in the same building.

Research and development focus

In the period 2005–2011, UFB JU solves the research plan partly focussing on nanobiotechnologies. It also solves 8 programme projects in 2008.

Research plan MSM6007665808 **“Physical biology – new approaches in the biological research”**, 1/2005–12/2011, the researcher is prof. RNDr. František Vácha, Ph.D., the total costs CZK 146.818 million, thereof CZK 129.423 million from the state budget. The year 2008 – 2.097/1.950, the nomenclature – the area 3, the nanotechnological research share – 10 %.

The objective of the solution is the utilisation of exact physical, chemical and mathematical methods in studies of biology at the level of the whole organism, from the cell biology, molecular biology to the biochemistry of proteins and individual biologically active molecules. The subject relates to the studies of relations between the structure and protein functions, molecular ecophysiology of the photosynthesis, photosynthetic biotechnologies, the production of biologically active substances, applied photobiology, imaging techniques, and instrument development. The objective is the contribution to the clarification of basic processes, molecular principles and the regulation of energy transformation in organisms, from individual proteins to the whole organism.

The goal of the research by the Institute of Physical Biology JU is the study of biological systems by exact physical and chemical methods with the consequent critical evaluation. Works take place mostly at two levels.

The biology of systems – There is the study of living organisms and their communities functioning at different levels of regulation and adaptation to outside conditions. For this purpose, there are at random and target mutated organisms used. The development of new measuring techniques and of mathematical processing methods, applied on the results, and the development of biotechnologies also make parts of these research activities.

Structure and functions of key cell proteins – There are all methods utilised for the determination of protein structures and functions as well as of other biologically important molecules. Calculation methods of the molecule modelling, including ab initio calculations, make also parts of these activities.

The research of the nanobiotechnological character is conducted in the Laboratory for nanobiology (D. Kaftan). This Laboratory makes a part of the Department of protein structures and functions and it is a joint laboratory of UFB JU and the Institute of Systems Biology and Ecology of AS CR. As the key reactions in cells are catalysed by enzymes and molecular machines of the size from 1 to 100 nm, the study of which in situ and in vivo requires their precise localising in space and time, but also the characterising of forces stabilising protein complexes and the receptor – the ligand pairs participating in these reactions, the Laboratory is involved with the imaging of the surface structure and of the physical-chemical properties of isolated proteins and the proteins in the environment of a native membrane in the immobilised state, and during physiological process with the goal to describe the organisation of organelles, sub cell structures and membrane proteins in living cells under the physiological conditions in relation to internal and external biotic and abiotic factors. It tries for the simultaneous analysis of the function and of the localisation of protein complexes with the assistance of a combination of the confocal microscopy and the high resolution imaging and the detection at the molecular level with the assistance of AFM.

Project solved in the area of nanotechnologies

- Project of GA CR GA202/07/0818 "Silicon nanophotonics – from individual nanocrystals to photonic structures", the researcher is doc. RNDr. Jan Valenta, Ph.D., Charles University in Praha, MFF, the co-researcher on behalf of UFB JU is prof. RNDr. František Vácha, Ph.D.

Experts/field

- prof. RNDr. František Vácha, Ph.D. – biochemistry, structural biology, spectroscopy, photosynthesis, spectroscopy of a single molecule, detection of a single molecule
- Mgr. David Kaftan, Ph.D. – absorption and emission spectroscopy, fluorescence and confocal microscopy, microscopy with the scanning probe – imaging, dynamic force spectroscopy, isolation of soluble and membrane proteins, development and applications of new imaging and non imaging spectroscopic methods

4.2.14. University of Veterinary and Pharmaceutical Sciences Brno (VFU)

Palackého 1/3, 612 42 Brno

www.vfu.cz

The University of Veterinary and Pharmaceutical Sciences Brno was founded on 1 January 1995, when the Veterinary and Pharmaceutical University changed its name. VFU has got three faculties: of the veterinary medicine, pharmaceutical, and of veterinary hygiene and ecology. The research in the area of nanotechnologies is conducted, in limited scope, in the Faculty of Veterinary Medicine.

4.2.14.1. FACULTY OF VETERINARY MEDICINE (FVL)

Palackého 1/3, 612 42 Brno

http://fvl.vfu.cz

Brief faculty characteristics

The Faculty of Veterinary Medicine (FVL) is a successor of the Animal Medicine University founded in December 1918. It is the only university institution of its kind in the Czech Republic. The professional organisational FVL units are 4 sections (of pathobiology, small animals' diseases, big animals' diseases, morphology, and physiology) and the Central clinical laboratory. The sections are further divided into individual institutes and clinics. Education and research are conducted by 13 institutes and clinics within the Faculty of Veterinary Medicine within the integration of other institutes of other faculties.

Research and development focus

In the period 2005–2011, the research in FVL focuses mostly on a single research plan in which the focus on nanotechnologies has not been found. There are 10 programme projects solved in 2008. The research utilising nanotechnologies is done in the Department of surgery and orthopaedics, in the Clinic for dog and cats' diseases – in the Section of small animals' diseases (A. Nečas and M. Vlašín).

Projects solved in the area of nanotechnologies

- Project of MEYS 2B06130 "The utilisation of the newly synthesised biomaterials in combination with stem cells in the treatment of diseases affecting human tissues derived from mesoderm: the cartilage, bone, ligaments, and meniscus", 7/2006–6/2011, the researcher is prof. MVDr. Alois Nečas, Ph.D.
- Project of AS CR, the programme "Nanotechnology for the Society", KAN200520703 "The use of ultrasound in nanomedicine", 1/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR , Praha, the co-researcher on behalf of FVL is doc. MVDr. Michal Vlašín, Ph.D.

Experts/field

- prof. MVDr. Alois Nečas, Ph.D. – orthopaedics of small animals, artroscopy, neurosurgery
- doc. MVDr. Michal Vlašín, Ph.D. – surgery of soft tissues of dogs and cats, microsurgery and experimental surgery

4.2.15. Mendel University of Agriculture and Forestry in Brno (MZLU)

Zemědělská 1, 613 00 Brno, I.D. 62156489

www.mendelu.cz

The Mendel University of Agriculture and Forestry in Brno (MZLU) is the oldest university of its kind in the country. It was founded in 1919 as the University of Agriculture in Brno and it had existed with this name until 1994. Its founding achieved the long wished goal of having the agricultural education of the university kind in Moravia which has belonged among the areas with the most advanced agriculture in Central Europe. The University went through a number of organisational and other changes and it has educated almost twenty thousand engineers of agriculture, six and a half thousand forestry professionals and five and a half thousand economists for jobs in different sectors of the national economy. MZLU consists of four faculties and one institute. The Faculty of Agronomy, Faculty of Forestry and Wood Sciences, Faculty of Business and Economics, and the Institute of Lifelong Education (the university institute) have their addresses in Brno, while the Faculty of Horticulture is placed in Lednice. Cooperation in projects focussing on nanotechnologies has been identified in the Faculty of Agronomy.

4.2.15.1. FACULTY OF AGRONOMY (AF)

Zemědělská 1, 613 00 Brno

www.af.mendelu.cz

Brief faculty characteristics

The Faculty of Agronomy, together with the Faculty of Forestry and Wood Sciences, belongs to the oldest parts of the Mendel University of Agriculture and Forestry in Brno. During the existence of the faculty, there were new study fields and specialisations added. Among those, which still exist, are the fields of phytotechnics and the zootechnical field. The gardening and horticulture have separated and become parts of the independent Faculty of Horticulture. The field of melioration has been cancelled. The Faculty of Agronomy has introduced the special fields of animal breeding and feeding. The field of fisheries has had long traditions and it is one of the originally taught fields. The Faculty is divided into 15 institutes.

Research and development focus

In the period 2005–2011, the research in AF focuses mostly on a single research plan, which is not focussing on nanotechnologies. There are 26 programme projects solved in 2008. Cooperation in two programme projects, which partly focus on nanotechnologies, has been identified in the Institute of Chemistry and Biochemistry.

Projects solved in the area of nanotechnologies

- Project of AS CR KAN208130801 “New constructions and use of nanobiosensors and nanosensors in medicine (NANOSEMED)”, 01/2008–12/2012, the head researcher is Ing. Jaromír Hubálek, Ph.D., Brno University of Technology, Faculty of Electrical Engineering and Communication, the co-researcher on behalf of AF is doc. Ing. René Kizek, Ph.D.

- Project of GA CR GA102/08/1546 “Miniaturised intelligent systems and nanostructured electrodes for chemical, biological and pharmaceutical applications (NANIMEL)”, 1/2008–12/2012, the researcher is Ing. Jaromír Hubálek, Ph.D., Brno University of Technology, Faculty of Electrical Engineering and Communication, the co-researcher on behalf of AF is doc. Ing. René Kizek, Ph.D.

Experts/field

- doc. Ing. René Kizek, Ph.D. – utilisation of electrochemical methods in proteomics and genomics

4.3. ALLOWANCE SECTOR ORGANISATIONS

4.3.1. Institute of Clinical and Experimental Medicine (IK+EM)

Vídeňská 9, 140 21 Praha 4, I.D. 00023001

www.ikem.cz

Brief workplace characteristics

The Institute of Clinical and Experimental Medicine was founded in 1971 by the integration of six then independent research institutes – the Institute of Clinical and Experimental Surgery, Institute of Blood Circulation Diseases, Institute of the Research of Human Nutrition, Research Institute of Experimental Therapy, Research Institute of the Utilisation of Radioisotopes in Medicine, and the Research Institute of Electronics and Modelling in Medicine. Their integration has established the biggest research institute with three specialised centres – Cardio-Centre, Transplanting Centre, and Diabetes Centre. IK+EM is currently an allowance organisation directly managed by the Ministry of Health. It consists of the three expert centres, 8 clinics, 15 professional workplaces, bases and laboratories. There are 1 450 workers employed. The scientific and research activities in IK+EM are supported with the below described research plan. There are 66 programme projects solved in 2008.

Research and development focus

In the period 2005–2009, IK+EM solves the research plan of the Ministry of Health MZ0IKEM2005 **“Research of cardiovascular diseases, diabetes and transplants of vitally important organs”**, 1/2005–12/2009, the researcher is prof. R. Poledne, CSc. The project includes research of nanomedicine. The total costs CZK 319.530 million, thereof CZK 319.530 million from the state budget. The year 2008 – 3.907/3.907, the nomenclature – the area 3, the nanotechnological research share – 10 %.

The research plan is focussing on the clinical and experimental research of cardiovascular diseases, diabetes and transplanting, especially the improvement of surgery and catheterisation treatment of ventricular tachycardia and the treatment of failures, the implementation of invasive detection of vulnerable plates and the non invasive detection of arteriosclerosis for the better stratification of patients, the optimising of immunotherapy after transplanting, the monitoring of gene expression, and the immunodetection of complement fractions and infections in tissues. It also focuses on the gaining of new knowledge about the key role of lipid mediators in the pathogenesis of insulin resistance, and the implementation of the Langerhans islets method into the clinical practice. Applications of MR imaging and MR spectroscopy make parts of most partial projects.

The research plan includes features of the nanomedical research. Applications focus on molecular imaging in the area of in vivo MR spectroscopy and the use of specific nano-particle-based contrast substances.

Research in the area of nanotechnologies focuses on the application of nanoparticles in the area of molecular imaging. These methods are dealt with by the Department of magnetic resonance – spectroscopy (M. Hájek). This Department is a part of the Base for radiodiagnostics and intervention radiology. The MR spectroscopy department (MRS) cooperates in projects dealing with the molecular imaging with IK+EM, the Diabetes Clinic (F. Saudek) within the Centre of cell transplants and tissue replacements, with the Institute of Experimental Medicine of AS CR, and other partners.

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is IK+EM:

- Project of GA CR GA309/2006/1594 "Cellular contrast agents for MR imaging", 1/2006–12/2008, the researcher is Mgr. Vít Herynek, Ph.D.
- Project of GA of AS CR 2B06175 "Quantification of the insulin producing tissue with the assistance of magnetic resonance", 7/2006–6/2011, the researcher is doc. MUDr. František Saudek, DrSc.

b) Projects in which the faculty cooperates:

- Project of AS CR, the programme "Nanotechnology for the Society", KAN201110651 "Combined contrast agents for the molecular MR imaging", 7/2006–12/2010, the researcher is prof. RNDr. Ivan Lukeš, CSc., Charles University in Praha, PrF, the co-researcher on behalf of IK+EM is Ing. Milan Hájek, DrSc.
- Project of MEYS, the programme "Research Centres", 1M0538 "Centre of the cell therapy and tissue repair", 1/2005–12/2009, the researcher is prof. MUDr. Eva Syková, DrSc., Institute of Experimental Medicine of AS CR, Praha, the co-researcher on behalf of IK+EM is Ing. Milan Hájek, DrSc.

c) Projects within the international cooperation:

- Cooperation in the project of the 6th FP DiMI/512146 "Diagnostic Molecular Imaging: A Network of Excellence for Identification of New Molecular Imaging Markers for Diagnostic Purposes", 4/2005–3/2010, the project coordinator is prof. Andreas Jacobs, University of Cologne, Germany. The Network of Excellence consists of 45 workplaces. The head researcher in the Czech Republic is UEM AS CR – prof. MUDr. Eva Syková, DrSc., Ing. M. Hájek, DrSc., and his team cooperates on behalf of IK+EM.
- Cooperation in the project of the 6th FP ANGIOTARGETING/504743 "Targeting-Tumour-Vascular/Matrix Interactions", 11/2004–10/2008, the coordinator is prof. Rolf Bjerkvig, University of Bergen, Norway. It is an integrated project with 13 participants. The head researcher in the Czech Republic is UEM AS CR – prof. MUDr. Eva Syková, DrSc., Ing. M. Hájek, DrSc. and his team cooperates on behalf of IK+EM (the area for applications

of cell contrast substances – magnetic marking during the monitoring of cell migration in tumours).

Experts/field

- Ing. Milan Hájek, DrSc. – molecular imaging – studies of living tissues by the MR imaging and MR spectroscopy
- Mgr. Monika Dezortová – molecular imaging – the clinical MR spectroscopy and relaxometry
- Mgr. Vít Herynek, Ph.D. – molecular imaging – the MR spectroscopy and relaxometry

4.3.2. Institute of Hematology and Blood Transfusion (UHKT)

U nemocnice 1, 128 20 Praha 2, I.D. 00023736

www.uhkt.cz

Brief Institute characteristics

UHKT is an allowance organisation directly managed by the Ministry of Health of the Czech Republic. It was founded on 1 January 1952 together with a number of other sectoral research institutes of the Ministry of Health. The Institute connects the treatment haematology care, diagnostic and research laboratories and the Department of blood transfusion. The Institute presents an integration of highly specialised treatment care, research, the high standard blood transfusion expertise and the super consulting and educational activities. The most important part of the Institute consists of the following professional sections: Clinical Section, Section of Blood Transfusions, and Research Section.

Research and development focus

In the period 2005–2011, UHKT solves the research plan of the Ministry of Health that includes also the research of nanotechnologies. It solves also 29 programme projects in 2008.

Research plan MZ0UHKT2005 **"Importance of molecular biological examinations for the clarification of pathogenesis and for the diagnostics of blood creation disorders and the utilisation of blood creating cells in the treatment of blood creating diseases"**, 1/2005–12/2011, the researcher is MUDr. Jaroslav Čermák, CSc., the total costs CZK 279.063 million, thereof CZK 177.063 million from the state budget. The year 2008 – 1.258/1.258, the nomenclature – the area 3, the nanotechnological research share – 5 %.

The subject of the solution is the utilisation of molecular biological examinations for the clarification of pathogenesis, for diagnostics and the treatment of blood creation disorders, the monitoring of the importance of structural changes and functions of genome for diagnosis, prognosis and the treatment of inborn or gained blood creation disorders, the monitoring of the importance of activation of individual components of the coagulation system in tumour blood creation diseases, the clarification of the molecular base of rare phenotypes of erythrocytes and of some inborn erythropoiesis disorders, the utilisation of blood creating stem cells in the treatment of blood creation diseases and of other tissues, the handling of blood creating stem cells for the cell therapy, the monitoring of the role of transplanted blood creating cells in the treatment of tumour and non tumour blood creating diseases, the monitoring of safe mobilisation and separation of blood creating cells' donors gained from periphery blood, and the monitoring of genetic factors influencing the success of blood creating cells' transplants. The research plan includes the research of nanomedicine.

Research projects solved in the Institute focus on the development of new diagnostic and treatment methods and on the gaining of new knowledge, especially in the area of blood physiology and blood creation, tumour cell biology, and the tumour process.

The research which partly belongs, thanks to its character, to the area of nanobiotechnologies and nanomedicine was identified in the Blood Transfusion Section in the Department of cell therapy (the leader P. Kobylka) and in the Research Section in the Department of biochemistry (J. E. Dyr), in the Department of cell biochemistry (I. Kalousek), and in the Department of cell physiology (L. Doležalová).

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200670701 "Surface plasmon resonance biosensors and protein chips for the medical diagnostics", 1/2007–12/2011, the researcher is Ing. Jiří Homola, CSc., Institute of Photonics and Electronics of AS CR, Praha, the co-researcher on behalf of UHKT is prof. Ing. Jan Evangelista Dyr, DrSc.
- Project of MEYS, the programme "Research Centres" 1M0538 "Centre of the cell therapy and tissue repair", 1/2005–12/2009, the researcher is prof. MUDr. Eva Syková, DrSc., Institute of Experimental Medicine of AS CR, Praha, the co-researcher on behalf of UHKT is MUDr. Petr Kobylka, CSc.

Experts/field

- prof. MUDr. Pavel Klener, DrSc. – haematology, oncology
- prof. Ing. Jan Evangelista Dyr, DrSc. – biochemistry, molecular genetics, biomolecular sensors
- RNDr. Ivan Kalousek, CSc. – studies of interactions of proteins controlling the ribosomes synthesis with products of oncogenes and the tumour suppressing proteins

4.3.3. Masaryk Memorial Cancer Institute in Brno (MOU)

Žlutý kopec 7, 656 53 Brno, I.D. 00209805

www.mou.cz

Brief Institute characteristics

The history of the Masaryk Memorial Cancer Institute goes back to the second half of the 1920s, when the head surgeon MUDr. Jaroslav Bakeš, together with his mother Lucie Bakešová (a social worker), founded the "Consolation House" on 21 June 1928. The objective of this organisation was the improved care after patients with malign tumours and, at the same time, to allow research in this medical field. Another milestone in the history of MOU was the year 1935, when there was the institute called the Masaryk Sanatorium "Consolation House" founded. Since its beginnings, the institute has been trying to provide the complex oncological care. As it had exceeded the regional character, the partial centralisation of oncology patients presented suitable conditions for scientific works. Several directors were leading the Sanatorium during the past decades during which the Sanatorium was also changing its name and undergoing several reorganisations. MOU is currently an allowance organisation directly managed by the Ministry of Health of the Czech Republic. It is a complex oncology centre providing 230 beds. In addition to the treatment, there is also the research of all aspects of oncology diseases conducted. MOU is divided into 2 clinics, 13 professional departments, the Clinical Psychology Section, and other assisting workplaces.

Research and development focus

In the period 2005–2011, MOU solves the research plan by the Ministry of Health which includes also partly the research of nanobiotechnologies. It also solves 14 programme projects in 2008.

Research plan MZ0MOU2005 **"Functioning diagnostics of malign tumours"**, 1/2005–12/2011, the researcher is doc. MUDr. Rostislav Vyzula, CSc., the total costs CZK 279.063 million, thereof CZK 177.063 million from the state budget. The year 2008 – 2.274/2.274, the nomenclature – the area 3, the nanotechnological research share – 15 %.

The subject of the plan is the development and implementation of a new conception for the integrated functional diagnostics of solid malign tumours based on a number of applied molecular-biological, cytodiagnostic, histocultural and imaging methods which could efficiently supplement the current purely morphological diagnostics of tumours with new parameters presenting individual tumour properties at the beginning and in the course of the anti tumour treatment. The objective is the improvement of treatment results with targeted and individual-oriented therapy. The research plan includes partly the research of bionanotechnologies.

The research in the area of bionanotechnologies is probably conducted in several departments, especially in the <u>Department of oncological and experimental pathology</u> (in the Laboratory of molecular and experimental oncology – the leader is B. Vojtěšek) and in the <u>Department of laboratory medicine</u> (the leader D. Valík).

Projects solved in the area of nanotechnologies

- Project of GA CR GA301/07/0490 "Electrodes modified with proteins and DNA. New tools for biomedicine", 1/2007–12/2009, the researcher is prof. RNDr. Emil Paleček, DrSc., Institute of Biophysics of AS CR, Brno, the co-researcher on behalf of MOU is RNDr. Bořivoj Vojtěšek, DrSc.
- Project of GA CR GA203/08/1680 "Nanotechnology in the functional diagnostics of apoptotic and tumorous cells", 1/2008–12/2011, the researcher is Ing. Karel Klepárník, Ph.D., Institute of Analytical Chemistry of AS CR, Brno, the co-researcher on behalf of MOU is MUDr. Dalibor Valík, Ph.D.

Experts/field

- doc. MUDr. Rostislav Vyzula, CSc. – positron emission tomography
- RNDr. Bořivoj Vojtěšek, DrSc. – research of tumour biology
- MUDr. Dalibor Valík, Ph.D. – tumour markers

4.3.4. Institute of Endocrinology (ENDO)

Národní 8, 116 94 Praha 1, I.D. 00023761

www.endo.cz

Brief Institute characteristics

The Institute of Endocrinology in Praha is an independent allowance organisation directly managed by the Ministry of Health. It was founded in 1956. Its main task is the highly specialised prevention, diagnostics, and treatment and research activities in the area of endocrinology, the related metabolic disorders, and fields supplementing the endocrinology. ENDO is divided into 7 professional departments and 2 laboratories.

Research and development focus

ENDO solves 18 programme projects in 2008, mostly supported by the Ministry of Health.

It utilises for the research methodologies of the molecular genetics, biochemistry, immunology and oncology of hormone dependent tissues, including in silico analyses, especially:

- Microanalysis of nucleic acids with the use of capillary electrophoresis techniques with the laser induced fluorescence (sequencing and the fragment analysis) and the Real Time PCR techniques using different biological materials,
- Proteomic techniques, including the computer-assisted modelling of peptide or protein structures and their intercalations
- Determination of nano, pico-concentrations of steroid hormones with the assistance of the mass spectrometry,
- Determination of nanoconcentrations of hormones, proteohormones, biofactors, antibodies, and antigens with the radio and immunoanalysing techniques,
- Development of separation and analytical chromatographic methods for micro and nano analyses of hormones and other biocompounds,
- Microanalyses of selenium and of other essential trace elements,
- Microdialyses in vivo in fatty tissues,
- Collection, classification, evaluation, and storing of information about the research results and the participation in their implementation.

The Institute of Endocrinology closely cooperates with other health-oriented organisations for the increased number and quality and objectivity of diagnostic and treatment methods.

Projects solved in the area of nanotechnologies

It is very difficult to identify projects focussing on nanobiotechnologies and nanomedicine from the projects' contents. There has been just one selected:

- Project of IGA MH CR NR/7809 "Study of candidate genes and their roles in the pathogenesis of 2nd type of diabetes mellitus and the gestational diabetes", 1/2004–12/2008, the researcher is RNDr. Běla Bendlová, CSc.

Experts/field

- RNDr. Běla Bendlová, CSc. – molecular genetics, analysis of nucleic acids
- doc. Ing. Radovan Bílek, CSc. – protein modelling, chromatographic techniques

- Ing. Martin Hill, DrSc. – mass spectrometry of steroid hormones, development of separation methods
- RNDr. Jan Kvíčala, CSc. – microanalysis of biogenic trace elements
- RNDr. Jara Nedvídková, CSc. – microdialysis from the fatty tissues

4.3.5. Praha Psychiatric Centre (PCP)

Ústavní 91, 181 03 Praha 8 – Bohnice, I.D. 00023752

www.pcp.lf3.cuni.cz

Brief centre characteristics

Praha Psychiatric Centre, which is situated in the area of the Sanatorium in Bohnice, has got forty-five-year long traditions. There was the Research Institute of Psychiatry founded in 1961. The Psychiatric Centre has got its activities connected with psychiatry education by the 3rd LF UK in 1990.

PCP is divided into a Clinical Section, 4 professional laboratories and a Centre of Neuropsychiatric Studies (the project by MEYS). PSP, in addition of many other medical and research activities, provides the background for research in the area of normal and pathological aging (the AD Centre) within which some projects utilise nanotechnologies.

Research and development focus

In the period 2005–2011, PCP solves one research plan of the Ministry of Health and 15 programme projects in 2008. PCP also coordinates activities of a research centre 1M0557.

Research plan MZ0PCP2005 **"Finding the causes of psychiatric morbidity and the improved effectiveness of prevention and therapeutic processes in the care after the mental health of the population in the Czech Republic in the period 2005–2011"**, 1/2005–12/2011, the researcher is prof. MUDr. Cyril Höschl, DrSc., the total costs CZK 176.264 million, thereof CZK 176.264 million from the state budget. The year 2008 – 0.480/0.480, the nomenclature – the area 3, nanotechnological research share – 3 %.

The solution objectives are as follows:

- Detection, prevention and remedy of risk factors endangering mental health of individuals.
- Studies of aetipathogenesis, diagnostics and the therapy of serious mental disorders which belong, according to the World Bank and WHO, among ten main reasons of disabilities worldwide (schizophrenia, depression, bipolar disorder, dependencies, and the obsessive-compulsive disorder).

This is in addition to the research of dementia prevalence of which has been growing and which present the enormous social and economic burden.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520701 "Nano-PCR – the ultrasensitive test detecting specific proteins in body fluids", 1/2007–12/2011, the researcher is RNDr. Petr Dráber, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of PCP is RNDr. Daniela Řípová, CSc. The task of PCP in the role of the co-researcher is the collection of data about the normal aging

population and the ELISA examination of the three key proteins in diagnostics of the Alzheimer disease.
- Project of MEYS, the programme "Research Centres", 1M0557 "Centre of neuropsychiatric studies", 1/2005–12/2009, the researcher is prof. MUDr. Cyril Höschl, DrSc.
- The research tested effects of the static magnetic field on the high affinity transport of choline in synaptosomes isolated from the right and the left hippocampuses of Wistar species of rats. A part of synaptosomes was incubated by superparamagnetic nanoparticle-covered dextran before the exposure. After the internalisation of nanoparticles into synaptosomes, there are chains created which are oriented by the external static magnetic field and which regulate, through cytoskeleton, membrane proteins, including choline carriers.
- As the diagnosis of the Alzheimer disease is difficult, there are other indicators looked for. They could be biochemical indicators in the cerebrospinal fluid. These proteins make parts of complex clots in patients' brains suffering of the Alzheimer disease. As they are released into the cerebrospinal fluid, their concentration could be established by the ELISA method in the cerebrospinal fluid taken by the bloody tap. The bloody tap is an easy action based on the penetration of a thin acus between neighbouring vertebrae in the pelvis area of the patient. It is possible that similar proteins occur also in the patients' serum. It would be easier to examine the blood. The low sensitivity of detection methods has been preventing this so far. A highly sensitive and specific methodology, based on nanoparticles, could resolve this problem.

Experts/field

- RNDr. D. Řípová, CSc. – neurochemistry, pathophysiology of neuropsychiatric diseases, biological markers
- Ing. Z. Krištofiková, Ph.D. – normal and pathological aging, neurochemistry and the AD pathophysiology, transport of choline
- MUDr. A. Bartoš, Ph.D. – neurology, biological markers, immunochemistry of neuropsychiatric diseases

4.3.6. Veterinary Research Institute in Brno (VUVeL)

Hudcova 70, 621 00 Brno, I.D. 0027162

www.vri.cz

Brief Institute characteristics

VUVeL was founded on 10 September 1955 by the decision of the Minister of Agriculture as an institute of the then Czechoslovak Academy of Agricultural Sciences. It was established as a new workplace the main mission of which has been the research in the field of veterinary medicine. Its activities focus on exact experiments solving health problems of farm animals, protection of people against zoonosis and animal-based food safety. It has become a public research institution of the Czech Republic on 1 January 2007, while the role of a founder has been played by the Ministry of Agriculture of the Czech Republic. The Institute is the only professional research institute in the Czech Republic focussing on the research in the area of veterinary medicine with an important part of the applied research. However, it covers also the broad area of pre clinical fields of the veterinary medicine with some overlaps to the human medicine, ecology and other fields. These fields make up a compact whole providing a set of new knowledge in the area of infectious and non infectious diseases, hygiene, food safety, and ecotoxicology. The Institute is divided into 7 departments which are further divided into laboratories.

Research and development focus

The research in 2008 focuses on the solution of a single finishing research plan and 40 programme projects covering the extensive area of veterinary medicine. Research activities in the area of nanotechnologies focus on the utilisation of biodegradable nanoparticles for the development of vaccines and systems for the medicine targeting, on the production of binding biomaterials (antibodies, aptamers, and receptors), immobilisation of biomaterials, chips, and on the nanoextraction.

The Department of immunology, the Group for immunopharmacology and immunotoxicology (the leader J. Turánek), focuses on the preparation and development of targeted microbubbles and liposomes for the therapy of tumours and the design of vaccines. The Laboratory has got at its disposal the equipment for the preparation and characterising of nanoparticles – ultrasound, high pressure homogenisation and microfluidisation, the characterisation of nano and micro particles with the assistance of the static and dynamic light dispersion, the gel permeation chromatography and electrophoretic methods, the differential scanning nanocalorimetry, and electron microscopy. The biological in vitro and in vivo effects are researched with the assistance of fluorescence microscopy and the confocal microscopy on tissue cultures and histological chains. There have been tumour and immunity models implemented.

The Department of analytical biotechnology (the leader M. Fránek) focuses on the development and production of monoclonal antibodies for the detection of biomarkers and on diagnostics of diseases with the use of biosensors, on the development of micro (nano) technologies for bioanalytical methods (e.g. the microimmunoextraction).

Projects solved in the area of nanotechnologies

Projects in which the institute cooperates:

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520703 "Utilisation of ultrasound in nanomedicine", 1/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR , Praha, the co-researcher on behalf of VUVeL is RNDr. Jaroslav Turánek, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN200380801 "Immunonanotechnology for the diagnostics of substances of a hormone nature", 1/2008–12/2012, the researcher is prof. Ing. Miroslav Strnad, DSc., Institute of Experimental Botany of AS CR, České Budějovice, the co-researcher in VUVeL is Dr. Milan Fránek, DrSc.

Experts/field

- RNDr. Jaroslav Turánek, CSc. – vaccinology and immunotherapy, preparation of functional microbubbles, design of liposomes for the development of vaccines and targeted therapeutics
- Dr. Milan Fránek, DrSc. – analytical biotechnology

4.3.7. National Institute of Public Health (SZU)

Šrobárova 48, 100 42 Praha 10, I.D. 75010330

www.szu.cz

Brief Institute characteristics

The National Institute of Public Health is an allowance organisation of the Ministry of Health of the Czech Republic. Its history goes back to 1925, when the National Institute of Public Health of the Czechoslovak Republic was founded. The Institute was reorganised in 1949 and it changed its name to the Public Healthcare Institute. SZU currently organises the preparation of materials for the National Healthcare Policy, provides activities protecting and supporting health, organises methodological and referential activities in the area of public health protection, monitors and conducts the research of life conditions' relations with health, ensures the international cooperation, controls the quality of provided services related to the protection of public health, organises the post gradual education in medical fields, related to the protection and support of health, and looks after the health education of the population. The Institute is divided into 5 centres which are further divided into professional groups.

Research and development focus

The research in 2008 focuses on the solution of 33 programme projects. The research of nanotechnologies has been identified in the Centre of Epidemiology and Microbiology, in which MUDr. Marta Havelková, CSc., cooperates in a project within the programme "Nanotechnology for the Society" and in the Centre of Work-Related Medicine, where a working team has commenced its activities dealing with nanomaterials and nanotechnologies, especially from the point of view of their impacts on human health within professional or environmental exposures.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN 200520702 "Nanoimmunosensors detecting cytokines", 1/2007–12/2011, the researcher is Ing. Peter Šebo, CSc., Biotechnology Institute of AS CR , Praha, the co-researcher on behalf of SZU is MUDr. Marta Havelková, CSc.

Experts/field

- MUDr. Miroslava Hornychová, CSc., the leader of the expert group for chemical safety
- RNDr. Jaroslav Mráz, CSc., the worker in the expert group assessing exposures to chemical substances at work
- MUDr. Marta Havelková, CSc. – molecular epidemiology

4.3.8. Czech Metrology Institute (CMI)

Okružní 31, 638 00 Brno, I.D. 00177016

www.cmi.cz

Brief Institute characteristics

CMI is an allowance organisation directly managed by the Ministry of Industry and Trade. It was founded in 1993. The main function of the institute has been the fulfilling of roles of the public administration in the area of metrology, which were determined in the Act No. 505/1999 Coll. as amended. CMI organises services in all basic metrology areas: the fundamental metrology (the maintenance of the state etalons, etalon and measuring gauges' calibration) and the legal metrology (the approvals of gauges' types, the primary and the consequent gauges' verification, and the state metrologic supervision). CMI solves a set of technical development tasks, the character of which ranges from the applied research to the solution of specific technical roles in accordance with the medium-term development conception of the National Metrologic System. CMI activities are organised by departments managed directly by the General Director (P. Klenovský), 10 regional inspectorates, two specialised workplaces – the Laboratory for the primary metrology and the Inspectorate for ionising radiation, and 4 associated laboratories in different institutions.

Research and development focus

Research in CMI currently focuses on the solution of 5 programme projects. CMI measures precisely sizes in microns and nanometres, determines the surface topography (with the SPM methods), conducts the point spectroscopy, measures magnetic properties, etc. There is the research of new measuring methods conducted in these areas.

Activities related to nanotechnologies are conducted mainly in the Department of the technical length (V. Zelený), the Department of quantum length and laser metrology (P. Balling), the Laboratory for the primary metrology in Praha (M. Bartoš) and in the Department of nanometrology in Brno (P. Klapetek).

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN311610701 "Nanometrology using methods of the scanning probe microscopy", 1/2007–12/2011, the researcher is Mgr. Petr Klapetek, Ph.D.
- Project of GA CR GA203/07/1669 "Depositing of stable thermomechanical nanostructured diamond like thin layers in dual-frequency capacitive discharges", 1/2007–12/2011, the researcher is RNDr. Vilma Buršíková, Ph.D., Masaryk University in Brno, PrF, the co-researcher on behalf of CMI is Mgr. Petr Klapetek, Ph.D.
- Project of MIT FT-TA3/133 "Set of laser interferometers for the length nanometrology", 3/2006–12/2009, the researcher is Ing. Jan Kůr, MESING, spol. s r.o., Brno, the co-researcher on behalf of CMI is RNDr. Petr Balling.

Experts/field

- Ing. Vít Zelený, CSc. – length measuring
- Mgr. Petr Klapetek, Ph.D. – scanning probe microscopy and related methods
- RNDr. Petr Balling – interferometry

4.3.9. Textilní zkušební ústav, s.p. (TZU)

(Textiles Testing Institute Plc)

Václavská 6, Brno, 658 41, I.D. 0013251

www.tzu.cz

Brief Institute characteristics

The state-owned enterprise TZU is a workplace of long traditions in the area of textile products' testing. There are currently several hundreds of accredited tests conducted, according to many national and international standards. TZU is also a certifying authority for products (textile toys, geotextiles, and work clothes) and systems (ISO 9001, ISO 14001, ISO 13485, OHSAS 18001, and HACCP). In addition to that, there has been the research of utilisation of nanoparticle materials, for the modification of properties of textile material, organised within several projects.

The Institute Director is RNDr. Pavel Malčík.

Number of workers: 36 (2007)

Annual turnover: CZK 22 million (2006)

Activities in the area of nanotechnologies

There are possibilities of nanoparticle materials' incorporation (especially iron oxides and colloid silver) with textiles and their impacts on the textile properties, from the point of view of potential utilisation of the prepared composites, researched within two projects.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN 101630651 "Creation of nano-layers and nano-coatings on textiles with the use of surface plasma treatment under atmospheric pressure", 1/2006–12/2010, the researcher is prof. RNDr. Mirko Černák, CSc., Masaryk University in Brno, PrF, the co-researcher on behalf of TZU is Ing. Petr Benešovský, Ph.D. The task of TZU is the incorporation of nanoparticle materials into/on textiles, testing, on contacts with manufacturers.
- Project of MEYS, the programme "Research Centres" 1M0512 "Research centre of powdered nanomaterials", 1/2005–12/2009, the researcher is prof. RNDr. Miroslav Mašláň, CSc., Palacky University Olomouc, PrF, the co-researcher on behalf of TZU is RNDr. Pavel Malčík. The task of TZU is the research of the utilisation of plasma in the textile manufacturing ensuring additional properties, contacts with manufacturers, and the textile testing.

Research and development Results in the area of nanotechnologies/cooperation

- Finished products: NS AcousticWeb^{TM} – high performance sound absorption material for lower frequencies, NS AntimicrobWeb^{TM} – filtration material with antimicrobial effects
- Cooperation with MIT (Massachusetts Institute of Technology, USA), NCRC (Nonwovens Cooperative Research Centre, USA), and the concern BASF, Germany

Experts/field

- Mgr. Petr Benešovský, Ph.D. – general textile adjustments, antibacterial treatment
- Ing. Petr Nasadil – textile analyses (the mass spectrometry, atomic spectroscopy, etc.)

4.4. RESEARCH WORKPLACES IN THE PRIVATE SECTOR

4.4.1. COMTES FHT s.r.o.

Průmyslová 995, 334 41 Dobřany, I.D. 26316919
www.comtesfht.cz

Brief company characteristics

COMTES FHT s.r.o. is a private research and development company focussing on the applied research in the area of metal materials. It is equipped with a laboratory for forming and thermal processing, a metallographic laboratory (the light and electron microscopy) a laboratory for physical simulations, a mechanical testing place, and technologies for numeric simulations.

Number of workers: 32

Annual turnover: CZK 35 million

Activities in the area of nanotechnologies

The main subject of activities is the research in the area of preparation of ultrafine – sub microscopic and nanostructured materials by the application of intensive plastic deformation, the studies of deformation mechanisms, and the study of the structure with the electron-microscopic analysis. Research activities focus mainly on the research plan of MEYS

MSM2631691901 **"Metal materials with the structure in the sub micron or nanometric scales prepared by the intensive plastic deformation methods",** 1/2004–12/2009, the researcher is prof. Ing. Jozef Zrník, CSc., the total costs CZK 59.552 million, thereof CZK 56.490 million from the state budget. The year 2008 – 10.300/9.850, the nomenclature – the area 1, nanotechnological research share – 100 %.

The research plan deals with the preparation of ultrafine – sub microscopic and nanostructured materials, by the application of the intensive plastic deformation (ECAP, ARB, and HPT) with, at the same time, controlled thermal exposure of selected materials. There have been mostly steels and aluminium alloys selected for the experimental programme. There are varied kinds of deformation techniques applied in different thermal modes. In addition to the existing techniques, which are at the disposal to the workplace of COMTES FHT s.r.o., there are other ones developed and tested. They are designed and modified, according to the knowledge and experience gained in the course of this project. The processed materials are analysed in detail from the points of view of their microstructure and properties. The most important goals of the plan are the theoretical learning about mechanisms of making grains finer, down to the nanostructured form, the determining of limits, from the points of view of grain refinement and the structure stability, and the achievement of required mechanical properties of the materials.

Projects solved in the area of nanotechnologies

- Project of MEYS 1M06032 "Research centre of forming technologies – FORTECH", 3/2006–12/2009, the researcher is prof. Dr. Ing. Bohuslav Mašek, West Bohemia University in Plzeň, FS, the researcher on behalf of COMTES FHT is Dr. Ing. Zbyšek Nový.

Project within the international cooperation

- Integrated project of the 6th FP EU NMP 3.1. MASMICRO "Integration of manufacturing systems for mass-manufacture of miniature/micro-products", 7/2004–6/2008, the coordinator is YI. Quin, University of Strathclyde, UK, 35 partners, the co-researcher on behalf of COMTES FHT s.r.o. is Dr. Ing. Zbyšek Nový.

Experts/field

- prof. Ing. Jozef Zrník, CSc. – metal forming by extreme plastic deformation, metallic alloys, material engineering
- Dr. Ing. Zbyšek Nový – thermomechanic metal processing
- Ing. Libor Kraus – thermal processing, material analyses
- Ing. Michal Zemko, Ph.D. – numerical simulations

4.4.2. České technologické centrum pro anorganické pigmenty a.s.

(Czech Technology Centre for Inorganic Pigments Ltd.)

Nábřeží Dr. E. Beneše 24, 751 62 Přerov, I.D. 26834839

www.ctcap.cz

Brief company characteristics

The Centre is a subsidiary of PRECHEZA a.s. It was founded in 2004 and it deals with the development of titanium white manufacturing technology and the technology related to new kinds of titanium white and ferric pigments, the development of relevant application methodologies and applications used in the manufacture of paints, plastics, fibres, construction materials, in cosmetics and in catalysts. Technical assistance for the technology transfers to China makes a part of the Centre activities.

Number of workers: 54 (2007)

Annual turnover: CZK 48 million (2007)

Activities in the area of nanotechnologies

The development of technologies for the preparation of different forms of nanoTiO_2 and their applications in the manufacture of paints, construction materials, plastics, in cosmetics and catalysts.

Projects solved in the area of nanotechnologies

- Project of MIT FT-TA3/009 "Research and development of new high performance colour pigments for paints, plastics and construction materials", 1/2006–12/2008, the researcher is Ing. Václav Kokaisl.
- Project of MIT FT-TA4/025 "Nanomaterials of the new generation and their industrial applications", 3/2007–12/2010, the researcher is Ing. Pavel Hynčica.
- Project of MIT FT-TA5/007 "Advanced research of nanomaterials for textiles", 3/2008–11/2010, the researcher is Ing. Antonín Mlčoch,
- Project of MEYS, the programme "Research Centres" 1M0577 "Research centre of nanosurface engineering – NANOPIN", 1/2005–12/2009, the researcher is Ing. František

Peterka, Ph.D., ATG s.r.o., Praha, the co-researcher on behalf of the Centre is Ing. Antonín Mlčoch, CSc.
- Company project – Non pigment applications of TiO_2, 2006–2009

Experts/field
- Ing. Antonín Mlčoch, CSc. – marketing
- Ing. Pavel Kovář – research
- Ing. Pavel Hynčica – research

4.4.3. Český nanotechnologický klastr, družstvo (CNK)

(Czech Nanotechnology Cluster, the cooperative)

Mozartova 178/12, 779 00 Olomouc

www.nanoklastr.cz

Brief cluster characteristics

The objective of the Czech Nanotechnological Cluster is the organisation of a strong group of closely cooperating suppliers of nanoproducts, companies utilising nanotechnologies in their products, and research and educational institutions participating in this area in the region of Olomouc. It is a Centre supporting and utilising nanotechnologies, specifically in the area of information and technology transfers, consulting, education, research and development, promotion, and the networking. The cluster currently associates 12 Czech entities, mostly small and medium-size enterprises, which deal with the utilisation and promotion of nanotechnologies.

Activities in the area of nanotechnologies

Solved projects:
- Water purification with the aid of nanopowder iron (the implementation of a new cleaning technology)
- Studies of benefits associated with the nanotechnology-based additives (the verification of the benefits in relation to the lower consumption of fuels and lower emissions)
- Surface treatments utilising nanotechnologies (the innovative surface protection, the gaining of new properties like water repellency, UV resistance, wear resistance, antibacterial properties, etc.)
- Antibacterial treatments of textiles during washing (the gaining of antibacterial properties during the textile washing with the use of nanotechnologies)
- Education and promotion in the area of nanotechnologies (the dissemination of knowledge from the area of nanotechnologies among members, cooperating partners and broader public, the exchange of experience and knowledge with foreign institutions, organisations and clusters, the active project results' presentations, etc.)

Responsible workers
- prof. RNDr. Miroslav Mašláň, CSc. – Chairman of the cluster
- Ing. Ladislav Torčík – Cluster Manager

4.4.4. Molecular cybernetics, s.r.o.

Strážovská 65/7, 150 00 Praha 5, I.D. 49621386

Brief company characteristics

Research and development focussed on the synthesis of nanomaterials and their properties.

Activities in the area of nanotechnologies

Research and development of nanomaterials for micro and nano electronics.

Projects solved in the area of nanotechnologies

- Project of MIT FT-TA4/126 “Research of semiconducting nanotubes for the implementation of cold-emission parts”, 1/2007–12/2010, the researcher is Ing. Stanislav Štarman, Ph.D., the co-researcher on behalf of Molecular Cybernetics is RNDr. Zdeněk Kváča.
- Project of MIT 2A-1TP1/092 “Research of preparation of nanoforms of layered piezoelectrics for the implementation of the high temperature ultrasonic transducers manufacture”, 7/2006–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D., the co-researcher on behalf of Molecular Cybernetics is RNDr. Zdeněk Kváča.
- Project of MIT 2A-2TP1/147 “Research of semiconductive nanotubes for the implementation of photoelectric components”, 5/2007–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D., the co-researcher on behalf of Molecular Cybernetics is RNDr. Zdeněk Kváča.

Responsible workers

- RNDr. Zdeněk Kváča – Director

4.4.5. Nanomedic, a.s.

Dolní Dobrouč 401, 561 02 Dolní Dobrouč, I.D. 27502881

www.nanomedic.cz

Brief company characteristics

The Nanomedic cluster associates 16 commercial companies and 6 universities and research institutes in the total. They closely co-operate in the following areas of research and development: preparations for wound healing, tissue replacement, preparations for the controlled distribution of medications, and preparations for the gene therapy.

Activities in the area of nanotechnologies

1. Development and manufacture of new preparations for medicine:

- External wound and burns covers based on biologically active materials prepared by the use of nanotechnologies
- Internal wound covers, tissue separation materials and internal temporary patches based on biopolymers prepared by the use of nanotechnologies
- Materials and sets for the tissue engineering and the gene therapy

- Carriers for different medications, their controlled distribution based on nanoparticles, liposomes, etc.
2. Development of new technologies allowing industrial implementation of the above--presented preparations
3. Development of new analytical and testing processes for the tests and controls of the above-presented preparations

Projects solved in the area of nanotechnologies

They are the following research projects solved within the cluster and funded by means of its members:

- Development of nanofibres based on native or chemically modified biopolymers or their mixtures with other biodegradable substances
- Development of flat textiles containing structurally simple or derivative nanofibres or bioactive nanolayers
- Development of external biologically active bandages
- Development of scaffolds for cartilage replacements
- Development of carriers for controlled distribution of medications based on liposomes marked by a biopolymer
- Development of carriers for controlled distribution of medications based on the micelle-like structured polymer
- Polysaccharides as carriers for gene therapeutics.

Research and development results in the area of nanotechnologies

- Patent application related to a new type of biological bandages filed by one member of the cluster
- Patent application related to a special preparation process for nanofibres based on native or chemically modified polysaccharides filed by one member of the cluster

Responsible workers

- Ing. Ondrej Brejka – Výskumný ústav chemických vlakien, a. s. (Research Institute of Chemical Fibres Ltd.), Slovak Republic; microfibres
- RNDr. Martin Bunček, Ph.D., GENERI BIOTECH s.r.o.; molecular biology, genetics
- prof. Ing. Radim Hrdina, CSc. – University of Pardubice; organic chemistry of biopolymers
- doc. RNDr. Jiří Kanta, CSc. – Charles University in Hradec Králové, Faculty of Medicine; wound healing
- Mgr. Lukáš Kubala, Ph.D. – Institute of Biophysics of AS CR, Brno; molecular biology
- prof. PharmDr. Ing. Milan Lázníček, CSc. – Charles University in Hradec Králové, Faculty of Pharmaceuticals; biodistribution and pharmacokinetics
- Ing. Jan Marek, CSc. – INOTEX spol. s r.o., Dvůr Králové; textiles
- prof. MUDr. Luboš Sobotka, CSc. – Teaching Hospital in Hradec Králové; wound healing
- doc. Ing. Miloslav Pekař, CSc. – VUT Brno, Faculty of Chemistry, Institute of Physical and Consumer Chemistry; physical chemistry of biopolymers
- RNDr. Vladimír Velebný, CSc. – CPN spol. s r.o., Dolní Dobrouč; tissue engineering

4.4.6. SIGMA Výzkumný a vývojový ústav, s.r.o.

(Research and Development Institute SIGMA Ltd.)

Jana Sigmunda 79, 783 50 Lutín, I.D. 2535015

www.sigmagroup.cz

Brief company characteristics

SIGMA Research and Development Institute has been active since 1996 within the SIGMA GROUP Holding a.s. as a research-development, information and standardisation base the objective of which is research in the field of machinery hydraulics and implementation of scientific and development trends in the manufacture of pumping technology.

Number of personnel: 55

Annual turnover: CZK 65 million (2006)

Activities in the area of nanotechnologies

Research of polymer nanofibres' applications in protective filters.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA3/156 "Research and development of the new generation of protective filters", 6/2006–12/2008, the researcher is Ing. Jiří Šoukal, CSc.

Responsible worker

- Ing. Jiří Šoukal, CSc. – Statutory Representative

4.4.7. SPUR a.s.

Tř. T. Bati 299, 764 22 Zlín, I.D. 46900098

www.spur.cz

Brief company characteristics

The company was founded in 1992 by the privatisation of the Research Institute of Rubber and Plastics Related Technologies (VUGPT) – the successor of the Institute of Chemistry in Zlín founded in 1934 by the Baťa company. The main manufacturing activities are as follows: pressing of plastic piping systems, plates and profiles of PET, PE, PP, PS, ABS, and PVC, pressing of light insulation tubes and belts of PE and PP (distributed under the trade mark TUBEX®), the manufacture of retro reflection materials RETROX®, and the preparation of colouring concentrates and additives BARKOLEN®. The present quality certificates: ISO 9001:2001, IWAY, and 4SIP.

Number of personnel: 150 (2007)

Annual turnover: CZK 370 million (2006)

Activities in the area of nanotechnologies

Main activities:

- Preparation of flat assemblies of polymer nanofibres by the electro spinning process.
- Research and development in the area of nanotechnologies focussing on the preparation of nanofibres in the high voltage electric field, especially from solutions of polyurethane (PU) and polyurethane urea (PUU).
- Development of the manufacturing technology for non woven fibrous units and the verification of their utilisation in filtration, separation membranes, water resistant and steam permeable clothing materials, nanocomposites, etc.

Projects solved in the area of nanotechnologies

- Project of MIT 2A-1TP1/068 "Synthesis of optimised polymer solutions for the preparation of nanofibres, the manufacturing of nanofibres and the application of non-woven fibre assemblies made of nanofibres", 10/2006–9/2011, the researcher is Ing. Dušan Kimmer, CSc.
- Project within the programme EUREKA E!3778 MANGO – "Managing Contamination by Fibrous Product Systems", 1/2007–12/2009, the coordinator – the researcher is VTT – Technical Research Centre of Finland, 10 participants. SPUR a.s. is the co-researcher.

Experts/field

- Ing. Dušan Kimmer, CSc. – PU synthesis, application technologies, reactions on polymers
- Ing. Lenka Lovecká, Ph.D. – informatics, PU technologies
- Ing. Zdeněk Šenkeřík – application technologies
- Ing. Miroslav Tomášek – PU synthesis

4.4.8. SVÚM a.s.

Areál VÚ, Podnikatelská 565, Praha 9 – Běchovice, I.D. 25797000

www.svum.cz

Brief company characteristics

SVUM, a.s. has extended activities of the National Research Material Institute founded in 1949. The activities include the following areas: research-development and expertise activities, consulting, material testing in accredited laboratories, according to the CSN standards EN ISO/IEC 17025 (by CIA, the certificate also by GE Aircraft Engines), the certifying centre for welders, research and development related to the specialised manufacture in the field of surface treatment, the manufacture of self-greasing bearing foils METALOPLAST® and products of PTFE, and high performance permanent magnets.

Number of personnel: 56 (2007)

Annual turnover: CZK 45 million (2007)

Research and development focus

Research and development focus in the period 2004–2009 mostly on the solution of a single research plan. There are 17 programme projects solved in 2008.

Research plan MSM2579700001 **"Research of damage mechanisms and quantification of defects influence on life time of components utilised in heavy duty working conditions"**, 1/2004–12/2009, the researcher is Ing. Ivo Černý, Ph.D., the total costs CZK 66.488 million, thereof CZK 61.470 million from the state budget. The year 2008 – 1.111/1.017, the nomenclature – the area 1, nanotechnological research share – 10 %.

The subject of research activities within the plan is the research of mechanisms, threshold and growth conditions of cracks related to defects which are characteristics for structural materials and components of machines, machinery and energy equipment and piping systems in variable temperature conditions and in the environment with the variable corrosion activity with the special focus on specific complicated mechanisms under the static, fatigue or creep loading and in the environment of high temperature corrosion. One of the ten solved areas focuses on the research of properties of the nanocomposites polymer-clay. In the area of nanotechnologies, the Institute co-operates in regard to nanostructured coatings.

Projects solved in the area of nanotechnologies

- Project of GA CR GA106/06/1486 "Impacts of nanoparticles on the damage and life-span of thermoplastic composites", 1/2006–12/2008, the researcher is Ing. Robert Válek, Ph.D.
- Project of MIT FT-TA 3/151 "Research and development of the surface layers' technology for antifriction and sliding bearings", 3/2006–12/2009, the researcher is Ing. Vladimír Vansa, ZKL – Výzkum a vývoj, a.s., Brno, the co-researcher on behalf of SVUM a.s. is Ing. Jiří Krejčík, CSc. Activities of SVUM in this project focus on the development of nanostructured coatings for antifriction bearings based on metal and non metal nanopowders like, for example, Ni, SiC, or C (in the form of graphite) with a suitable binder. This liquid composite material is sprayed on the bearing's surface and the consequently created coating hardens at higher temperature. In addition to the described coatings, there are also DLC coatings researched. SVUM researches also tribologic properties of the mentioned coatings.
- Project of MEYS 1M06032 "Research centre of forming technologies – FORTECH", 3/2006–12/2009, the researcher is prof. Dr. Ing. Bohuslav Mašek, West Bohemia University in Plzeň, FS, the researcher on behalf of SVUM is Ing. Ivo Černý, Ph.D.

Experts/field

- Ing. Jiří Krejčík, CSc. – tribology, surface treatments
- Ing. Ivo Černý, Ph.D. – fatigue properties of surfaces, metal composites
- Ing. Ivan Furbacher, CSc. – contact fatigue
- Ing. Josef Cizner, CSc. – nanocoats, corrosion, high temperature oxidation
- Ing. Jiří Kadlec, CSc. – analyses of coatings, phase composition
- Ing. Jaroslav Hell, CSc. – material engineering of plastics and polymer composites
- Ing. Robert Válek, Ph.D. – material engineering of plastics and composites
- Ing. Vratislav Hlaváček, CSc. – surface treatments, nanostructures

4.4.9. SYNPO, a. s.

S. K. Neumanna 1316, 532 07 Pardubice, I.D. 46504711

www.synpo.cz

Brief company characteristics

SYNPO, joint stock company, was founded in 1952 as the Research Institute of Synthetic Resins and Varnishes. It has been always a leader in the applied research and development in the area of polymers. Since 1992, SYNPO is involved in:

- Contracted research and development and formulations in the area of synthetic polymers, paints, composites, glue, and polymers for applications in electronics
- Applied R&D
- Development of processes for semioperational and manufacturing facilities
- Manufacture of special products in the area of polymer chemistry
- Analyses and tests in accredited laboratories

Number of personnel: 137

Annual turnover: CZK 126 million (2006)

Activities in the area of nanotechnologies

The following activities are conducted:

- Preparation of organic, inorganic and hybrid nanoparticles specifically structured for specific polymer systems.
- Characterising of nanoparticles from the points of view of their sizes, chemical composition and surface properties, including the development of testing methods.
- Studies of relations between the structure and sizes of nanoparticles and properties of materials containing these nanoparticles.

Projects solved in the area of nanotechnologies

a) Projects the accepting party of which is SYNPO, a. s.

- Project of MIT 2A-2TP1/135 “New polyfunctional hybrid polymers from renewable and recyclable materials allowing the utilisation of enzyme catalysts and nanoparticles”, 7/2007–6/2011, the researcher is Ing. Tomáš Vlček, Ph.D.
- Project of MIT FT-TA3/055 “Intelligent polymer coatings containing nanoparticles”, 3/2006–12/2009, the researcher is Ing. Jiří Zelenka, CSc.
- Project of MIT FT-TA4/074 “Rubber-like nanocomposites of extraordinary properties for rubber products suitable especially for the automotive and defence industries”, 3/2007–12/2010, the researcher is Ing. Jiří Zelenka, CSc.
- Project of MIT FI-IM3/085 “Polyalkene based nanocomposites of extraordinary utility properties”, 3/2006–12/2009, the researcher is Ing. Ivan Dobáš, CSc.

b) Projects in which SYNPO, a. s., cooperates

- Project of MIT 1H-PK2/46 “Nanofibres and their composites for technical and biomedicinal application”, 2005–2008, the researcher is prof. Ing. Oldřich Jirsák, CSc., Technical

University in Liberec, Faculty of Textiles, the co-researcher on behalf of SYNPO a. s., is Ing. Jiří Zelenka, CSc.
- Project of the 6th FP EU, MULTIHYBRIDS "Innovative sensor-based processing technology of nanostructured multifunctional hybrids and composites", 1/2007–12/2010, Integrated project, 20 participants.

Experts/field
- Ing. Ivan Dobáš, CSc. – synthesis and transfer of technologies, coordination of international projects
- Ing. Jiří Zelenka, CSc. – nanomaterials, synthesis of structured polymers, preparation of nanoparticles, studies of relations between the structure and properties, the material research
- Ing. Kateřina Zetková – paints based on nanomaterials
- prof. Ing. Štěpán Podzimek, CSc. – Analysis of polymers and nanomaterials
- Ing. Petr Vlasák – studies of paint films with nanoparticles
- Ing. Pavla Švíglerová, Ph.D. – syntheses of polymers, preparation and assessment of nanocomposites
- Ing. Tomáš Vlček, Ph.D. – polymers based on renewable resources

4.4.10. Výzkumný ústav anorganické chemie, a.s. (VUAnCH)

(Research Institute of Inorganic Chemistry Ltd.)

Revoluční 84, 400 01 Ústí nad Labem, I.D. 62243136

www.vuanch.cz

Brief Institute characteristics

VUAnCH, a.s., is the central research and development organisation of the industrial Unipetrol Group. Research and development works focus on chemistry, technology and the utilisation of raw materials. There is also authorised measuring of emissions organised, water and waste liquor analyses, the determination of selected elements in fertilisers, composts, soils, sediments, sludges, and other similar materials, the identification and analyses of not known samples, analyses and evaluation of wastes, the reprocessing and liquidation of waste, etc. There has been research in the area of nanotechnologies conducted recently.

Number of personnel: 116

Annual turnover: CZK 111 million (2006)

Activities in the area of nanotechnologies/nanomaterials

The activities relate to the preparation of tricalcium-phosphate nanoparticles for the suspension styrene polymerisation and there are researched nanostructured based on zeolites and molecule sieves determined for the preparation of catalysts. There are nanoparticles Al_2O_3 prepared for the manufacture of special ceramics and nanofills for plastic and rubber-like materials based on the intercalation of exfoliated clay minerals.

Projects solved in the area of nanotechnologies

- Project of MIT FT-TA3/077 “Remedy for underground waters using permeable reactive barriers”, 5/2006–4/2010, the researcher is Ing. Josef Kozler, CSc. The project focuses on the use of elementary nanoiron as a fill in the reactive underground walls for the liquidation of chlorinated hydrocarbons in contaminated underground waters.
- Project of MIT FT-TA3/080 “Synthesis of titanium silicates and their applications”, 4/2006–12/2009, the researcher is Ing. Věnceslava Tokarová.
- Project of AS CR, the programme “Nanotechnology for the Society”, KAN100400701 “Hybrid nanocomposite materials”, 1/2007–12/2011, the researcher is prof. Ing. Jiří Čejka, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of VUAnCH is RNDr. Vojtěch Varga.
- Project of MIT FT-TA5/005 “Progressive types of zeolites and their applications”, 4/2008–12/2010, the researcher is Ing. Věnceslava Tokarová, CSc.

Experts/field

- Ing. Věnceslava Tokarová, CSc. – nanoceramics
- Ing. Gabriela Šťávová – nanocatalyses
- RNDr. Vojtěch Varga – nanocomposites

4.4.11. VÚHŽ a.s.

739 51 Dobrá 240 u Frýdku-Místku, I.D. 45193797

www.vuhz.cz

Brief company characteristics

VUHZ Dobrá was founded on 1 May 1992 by the coupon privatisation of the state-owned enterprise the Research Institute of Iron Metallurgy (originally the Research Steel Institute). Třinecké železárny, a. s., has become the 100% shareholder of VUHZ a.s. in 2007. VUHZ focuses on the small series manufacture and also on research and development. The production focuses mostly on exports of metallurgical products (centrifugal casting, hot profile rolling), the machinery manufacture (the small series machines and production lines, sound insulation and covers) and the manufacture of measuring, regulation and automated technologies for the industry. Research and development mostly focus on new materials and technologies, testing, consulting, and expertises.

Number of personnel: 350

Activities in the area of nanotechnologies

Research activities in the area of nanotechnologies are conducted in the Division of laboratories and testing facilities. They focus on the development in the area of the manufacture and quality assessment of bulk materials having the nanocrystalline structure manufactured by the method of multiplied extreme plastic deformation.

R&D activities by VUHZ a.s. in co-operation with VSB – TUO FS focus on the development of a new DRECE Technology (Double Roll Equal Channel Extrusion). It is based on knowledge of the existing conventional ECAP system with the objective of achieving the less intensive technological process which would also ensure more of the bulk material having the nanocrystalline structure. The research extends also to other material kinds. Within the assessment of material properties and structural stability, there is R&D of new testing methods organised – the development of a new complex qualitative assessment of technological materials manufactured by the above-described technology, the technological materials with the nanocrystalline structure generally respective. The stress is put especially on the higher technological readiness within compatibility with results gained by the classical testing methods.

Projects solved in the area of nanotechnologies

- Project of MIT 2A-1TP1/124 "Research of the effects of extreme deformation conditions on the metal sub microstructure and of testing methods for the diagnostics of their technological properties", 11/2006–3/2011, the researcher is Ing. Karel Malaník, CSc.

Experts/field

- Ing. Karel Malaník, CSc. – material testing, chemical phase analysis
- Ing. Michenka – testing of non standard properties
- Ing. Milan Gottwald – material engineering, expertises
- prof. Ing. Stanislav Rusz, CSc. – development of new technologies (VSB – TUO)

4.4.12. VÚK Panenské Břežany, s.r.o.

Panenské Břežany 50, 250 70 Odolená Voda, I.D. 25604716

www.volny.cz/vuk/

Brief company characteristics

VUK Panenské Břežany, s.r.o., was founded on 1 January 1998 by separation of the Division research, informatics and testing from the **Innovation Technological Centre – VUK, a.s.,** which has been a successor of the **Research Institute of Metals, s. p. (VUK)**, founded in 1946 as the research institute for non ferrous metals and co-operating directly with foundries. There is the applied research in the area of new materials organised, including materials with phases of the nanometric sizes (precipitates), the development, treatment and optimising of metals and their manufacturing/technological processes related to products made of non ferrous alloys, including the preparation methods for ultrafine-grain rolled materials by the ARB method (Accumulative Roll Bonding). VUK also tests mechanical properties (static, impact and fatigue ones) and conducts metallographic and chemical analyses. It also provides for a professional information centre in the area of non ferrous metals and for services of a professional library, technical consulting in the area of non ferrous metal standards and the utilisation and replacing of materials.

Number of personnel: 17 (2007)

Annual turnover: CZK 5.1 million (2006)

Activities in the area of nanotechnologies

There are especially preparation methods developed for ultrafine-grain materials based on aluminium, especially of the industrially manufactured alloys cast by the modern method of continual casting between rolls (AlFe1, 5Mn, AMg3, AlScZr, Al99.99).

Projects solved in the area of nanotechnologies

- Research plan of MEYS MSM2631691901 "Metal materials with structures in the sub micron or nanometric areas prepared by the methods of the intensive plastic deformation", 1/2004–12/2009, the researcher/coordinator is prof. Ing. Jozef Zrník, CSc., COMTES FHT s.r.o., Dobřany, the co-researcher on behalf of VUK is Ing. Vladivoj Očenášek, CSc. The task of VUK is the research and development of methods of the intensive plastic deformation by ARB and ECAP methods for the preparation of ultrafine-grain materials from highly pure aluminium and AlMg, AlZnScZr, AlFeMn, and AlMgScZr alloys.
- Project of GA CR GA106/07/0303 "Role of grain boundaries in the high temperature plastic deformation of ultrafine-grain materials", 1/2007–12/2010, the researcher is doc. RNDr. Přemysl Málek, CSc., Charles university in Praha, MFF, the co-researcher on behalf of VUK is RNDr. Margarita Slámová, CSc. VUK is responsible for the preparation of ultrafine-grain materials by the ARB method and for the studies of the grain microstructures and structures by the EBSD, EDS, and WDS on FEG-SEM methods.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN300100801 "Multifunctional metallic bulk materials with nanocrystalline and ultrafine grain structures", 1/2008–12/2012, the researcher/coordinator is prof. Ing. Pavel Lejček, DrSc., FZU AS CR, Praha, the co-researcher on behalf of VUK is RNDr. Margarita Slámová, CSc.

Experts/field

- RNDr. Margarita Slámová, CSc. – physical metallurgy, nano ferrous metals, metal nanomaterials, metallography
- Ing. Vladivoj Očenášek, CSc. – non ferrous metals, physical metallurgy, statistical methods in data processing

4.4.13. Výzkumný ústav organických syntéz a.s. (VUOS)

(Research Institute of Organic Syntheses Ltd.)

Rybitví čp. 296, 533 54 Rybitví, I.D. 60108975

www.vuos.com

Brief Institute characteristics

VUOS is one of the biggest Czech companies involved in the research and development in the area of organic chemistry and toxicology. The history of VUOS goes back to 1941, when the Society for the Chemical and Metallurgical Manufacturing founded research laboratories in a newly built plant in Rybitví close to Pardubice. VUOS is now a 100% subsidiary of Synthesia, a.s. The inclusion into the Synthesia Group allowed for the offering of unified services which start with research and development, including analyses and toxicology, pilot or small scale manufacturing to the manufacture of many hundreds of tons.

The main VUOS activities are as follows:

- Manufacture of special chemicals – from grams to tons (hundreds of tons in Synthesia, a.s.)
- Research and development
- Environmental services
- Process engineering.

Number of personnel: 280

Annual turnover: CZK 313.5 million (2006)

Activities in the area of nanotechnologies/nanomaterials

There have been research and development of precursors organised (monomers for conductive polymers, coloured modifiers) for electrochromic materials, the research of organic and organic-metallic compounds for high-tech applications in electronics, and for the utilisation in medicine, the research of photocatalytic systems and nanosystems for micro electrotechnology.

Projects solved in the area of nanotechnologies

a) <u>Projects the accepting party of which is VUOS</u>

- Project of MIT FT-TA3/048 "DPP and CPP compounds based nanomaterials and functional systems for electronic equipment", 1/2006–12/2008, the head researcher is Ing. Martin Kaja.
- Project of MEYS 2B06104 "Photosensibilisers in dental medicine", 7/2006–6/2010, the researcher is Ing. Marie Karásková.

b) <u>Projects in which VUOS cooperates</u>

- Project of AS CR, the programme "Nanotechnology for the Society" KAN400720701 "Hierarchy nanosystems for microelectronics", 1/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the co-researcher on behalf of VUOS is Ing. Jan Rakušan, CSc. The project in VUOS focuses on the studies of applications of phtalate-cyanine derivates on nanoparticles of metal oxides and the utilisation of composites in microelectronics.
- Project of the 7th FP EU, INNOSHADE "Innovative Switchable Shading Appliances Based on Nanomaterials and Hybrid Electrochromic Device Configurations", 2008–2011, Integrated project, VUOS is a partner.

Experts/field

- Ing. Miroslav Nečas, CSc. – chemical syntheses, nanomaterials
- Ing. Lubomír Kubáč – syntheses, UV stabilisation
- Ing. Jan Rakušan, CSc. – functional nanosystems
- Ing. Jan Vyňuchal – organic compounds for electronics

4.4.14. *Ústav jaderného výzkumu Řež a.s.*

(Nuclear Research Institute Řež Ltd.)

250 68 Husinec – Řež 130, I.D. 46356088

<u>www.nri.cz</u>

Brief Institute characteristics

The Nuclear Research Institute in Řež (UJV) was founded in 1955. It was transformed into a joint stock company in 1992. It currently provides a wide scope of expertises and services to operators of nuclear power stations in the Czech Republic and abroad, supports the central state institutions of the Czech Republic in the area of strategic management of the energy industry and the handling of nuclear wastes (the Ministry of Industry and Trade), organises independent professional expertises for the State Office for Nuclear Safety, organises the development of utilisation of the ionising radiation and of exposure services for the basic and the applied research, the health industry and for different industries, provides research and services related to the liquidation of radioactive wastes, organises the manufacture of radio pharmaceuticals, conducts education and training of professional and research workers, and organises a number of other activities. In addition to this, UJV is also active in non nuclear areas like, for example, in the area of the classic energy industry, chemical industry, and in the protection of the environment. The Institute is divided into 5 divisions and other units. The Division is further divided into 45 departments. The UJV Group include also the following organisations (with the capital participation of UJV): Ústav aplikované mechaniky Brno, s.r.o. (Institute of Applied Mechanics Ltd.), ŠKODA VÝZKUM s.r.o. (Research), Plzeň, LACOMED, spol. s r.o., Husinec – Řež, Centrum výzkumu Řež s.r.o. (Research Centre), Energoprojekt Slovakia, a. s., Bratislava, and the Nuclear Safety & Technology Centre s.r.o.

Number of personnel: 908

Annual turnover: CZK 1.359 billion

Activities in the area of nanotechnologies

The coordination of activities of the Centre of Targeted Therapeutics focussed on the nanomedicine and the co-operation in the solution of the below-presented programme projects.

Projects solved in the area of nanotechnologies

- Project of MEYS, the programme “Research Centres” 1M0505 “Centre of targeted therapeutic drugs”, 1/2005–12/2009, the researcher is doc. MUDr. Vladimír Viklický, CSc.
- Project of AS CR, the programme “Nanotechnology for the Society” KAN100400702 “Nanostructural materials for the catalytic, electrocatalytic and sorption applications”, 1/2007–12/2011, the researcher is prof. RNDr. Zdeněk Samec, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of UJV is Ing. Jiří Rais, CSc., DSc.
- Project of MIT FT-TA4/025 “Nanomaterials of the new generation and their industrial applications”, 3/2007–12/2010, the researcher is Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s. (Czech Technology Centre for Inorganic Pigments Ltd.), Přerov, the co-researcher on behalf of UJV is RNDr. Vladimír Balek, DrSc.

Experts/field

- doc. MUDr. Vladimír Viklický, CSc. – cell engineering, biotechnological preparation
- Ing. Leo Kronrád, DrSc. – research of radiopharmaceutical preparations
- RNDr. Vladimír Balek, DrSc. – diagnostics of nanocomposites with the assistance of the diffusion and the structural analysis
- Ing. Jiří Rais, CSc., DSc. – separation methods in the nuclear chemistry and the processing of nuclear waste

4.4.15. ZKL – Výzkum a vývoj, a.s.

(ZKL Research and Development Ltd.)

Jedovnická 8/4039, 628 00 Brno – Líšeň

www.zkl.cz

Brief company characteristics

It is a part of the ZKL concern manufacturing bearings. It extends activities by ZKL VUVL Brno with traditions going back more than 45 years. It is involved in the research and development of bearings manufactured under the trademark ZKL (of all kinds and sizes, from 1.5 mm to about 1.5 m). The company is also the main design office of the concern.

Activities in the area of nanotechnologies

Solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme Tandem FT-TA3/151 "Research and development of the surface layers' technology for antifriction and sliding bearings", 3/2006–12/2009, the researcher is Ing. Vladimír Vansa.

Responsible workers*:*

- Ing. Vladimír Zikmund – Director
- Ing. Libor Procházka – Development Manager

5. MANUFACTURING COMPANIES

5.1. LARGE COMPANIES (WITH MORE THAN 250 EMPLOYEES)

5.1.1. BARVY A LAKY HOSTIVAŘ, a.s.

(Paints and Varnishes Ltd.)

Průmyslová 1472/11, 102 19 Praha 15, I.D. 26765306

www.bal.cz

Brief company characteristics

The company was founded in 2003. It is involved in research, development and manufacture of dyes and paints for metals, wood, concrete, stens, indoor walls, and facades. It manufactures also solvents, special insulation lacquers and technological liquids.

Number of personnel: 263

Annual turnover: CZK 1.014 billion (2006)

Activities in the area of nanotechnologies

The utilisation of nanotechnologies in paints and lacquers. Cooperation in the solution of the below-presented project.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA4/064 "Paints fulfilling the new environmental requirements of EU", 7/2007–12/2010, the researcher is Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, the co-researcher on behalf of BARVY A LAKY HOSTIVAŘ is Ing. Dariusz Jakubowicz.

Responsible workers

- Ing. Dariusz Jakubowicz, General Director
- Ing. Jaroslava Úředníčková, Research and Development Manager

5.1.2. FEI Czech Republic s.r.o.

Podnikatelská 2956/6, 612 00 Brno, I.D. 46971629

www.feicompany.com

Brief company characteristics

The company is a subsidiary of FEI company originating in USA. It is involved in the development and manufacture of electron microscopes.

Number of personnel: 275

Annual turnover: CZK 2.5 billion (2007)

Activities in the area of nanotechnologies

The plant in Brno is involved in the development and manufacture of electron microscopes and equipment with a crossed beam of electrons and ions (DualBeam™). The microscopes work with the nanometric and sub nanometric resilution.

Projects solved in the area of nanotechnologies

- Project of MEYS, the programme EUREKA OE08012 "Contrast and detection in scanning electron microscopy", 1/2008–12/2010, the researcher is RNDr. Lubomír Tůma.

Responsible worker

- RNDr. Jiří Očadlík – Statutory Representative

5.1.3. Gumárny Zubří, a. s.

Hamerská 9, 756 54 Zubří, I.D. 00012122

www.guzu.cz

Brief company characteristics

It has been a traditional manufacturer of technological rubber since 1935. It is involved in the manufacture and development of technological rubber mainly for the automotive industry. The technological rubber is manufactured by the injecting or ejecting technologies. The manufacturing programme of Gumárny Zubří, a. s., includes also the manufacture of protective masks and the processing of thermoplastic elastomers.

Number of personnel: 837 (2006)

Annual turnover: CZK 811 million (2006)

Activities in the area of nanotechnologies

Development of rubber-like nanocomposites suitable for the rubber industry.

Projects solved in the area of nanotechnologies

- Project of MIT, the program TANDEM, FT-TA4//074 "Rubber-like nanocomposites of extraordinary properties for rubber products suitable especially for the automotive and defence industries", 3/2007–12/2010, the researcher is Ing Jiří Zelenka, CSc., SYNPO, a. s., Pardubice, the co-researcher on behalf of Gumárny Zubří, a. s., is Ing. Aleš Maceček.

Expert/field

- Ing. Aleš Maceček – preparation and assessment of rubber-like nanocomposites

5.1.4. Hexion Specialty Chemicals a.s.

Tovární 2093, 356 01 Sokolov, I.D. 00011771

www.hexion.com

Brief company characteristics

Hexion Specialty Chemicals a.s. (progressively the former Chemical Plants Sokolov, Eastman Sokolov, and RSM Chemacryl) is a part of the multinational group HEXION Specialty Chemicals, Inc. with the address in Columbus, OH, USA. Hexion Specialty Chemicals a.s. is involved in the manufacture and processing of products belonging to the area of acrylate chemistry. Acrylate acid and the four basic esters of acrylate acid (methyl acrylate, ethyl acrylate, butyl acrylate, and 2-ethyl-hexyacrylate) make up two thirds of the company manufacturing portfolio. The rest are polymers which are utilised, in the dispersion form, mostly in the manufacture of paints, glue and structural materials. Acrylate acid is used mostly as the super absorbing polymers (SAP), detergent polymers, flocculants, or copolymers.

Number of personnel: 475 (2007)

Annual turnover: CZK 3.9 billion (2006)

Activities in the area of nanotechnologies

The company cooperates in solution of two projects as a potential party interested in the implementation of the achieved results.

Projects solved in the area of nanotechnologies

- Project of MEYS, the programme “Research Centres” “Research Centre for the nanosurface engineering – NANOPIN”, 1/2005–12/2009, the researcher is Ing. František Peterka, Ph.D., ATG s.r.o., Praha, the co-researcher on behalf of Hexion is Ing. Pavel Holub. The activity objective of Hexion is the finding of commercially viable products utilising the photocatalytic phenomena of nanomaterials in products based on acrylate dispersions.
- Project of AS CR, the programme “Nanotechnology for the Society” KAN100500651 “Preparation and studies of organic-inorganic nanocomposite material properties prepared in situ by the emulsive polymerisation”, 7/2006–12/2009, the researcher is Ing. Zdeňka Sedláková, CSc., Institute of Macromolecular Chemistry of AS CR, Praha, the co-researcher on behalf of Hexion is Ing. Jan Nájemník.

Responsible worker

- Ing. Pavel Holub – technologist, EMEA dispersions

5.1.5. Interpharma Praha, a.s.

Komořanská 955, 143 00 Praha 12 – Modřany, I.D. 44265409

www.interphrarma-praha.cz

Brief company characteristics

It is a pharmaceutical company founded in 1932. It is involved in research, development and manufacture of generic medication, especially diagnostics, anti tumour and urology medicine and dermo-cosmetics. It is owned by INTERPHARMA WEST Inc., an American company registered on British Virgin Islands.

Number of personnel: 108

Annual turnover: CZK 213 million (2006)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN201110651 "Combined contrast agents for the molecular MR imaging", 07/2006–12/2010, the head researcher is prof. RNDr. Ivan Lukeš, CSc., Charles University in Praha, PrF, the co-researcher on behalf of Interpharma Praha is Ing. Ivan Hlaváček, CSc.

Responsible worker

- Ing. Ivan Hlaváček, CSc. – a member of the Board, research and development

5.1.6. LANEX a.s.

Hlučínská 1/96, 747 23 Bolatice, Opava, I.D. 42864071

www.lanex.cz

Brief company characteristics

The manufacturer of technological textiles – composite ropes, including maritime and mountain climbing ones, but also of large volume bags, flexi tanks, straps, technical fibres, etc.

Number of personnel: 670

Annual turnover: CZK 936 million (2006)

Activities in the area of nanotechnologies

The research of the utilisation of nanotechnologies to improve functional properties of ropes.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme "Permanent Prosperity", 2A-2TP1/136 "Utilisation of nanotechnologies for the surface rope treatment", 6/2007–2/2010, the researcher is Ing. Libor Ganzer. The project's objective is the improvement of rope hydrophilic properties and the textile nanoparticle resistance.

Responsible workers

- Ing. Rudolf Gregořica – General Director
- Ing. Libor Ganzer – development

5.1.7. Lasselsberger, a.s.

Adelova 2549/1, 320 00 Plzeň, I.D. 25238078

www.rako.cz

Brief company characteristics

LASSELSBERGER, a.s., is the biggest manufacturer of ceramic tiles in the Czech Republic and it also belongs among the biggest European manufacturers of facing materials. LASSELSBERGER, a.s., maintains and develops traditions of the Czech trademark RAKO offering the complete range of housing ceramics. Products carrying the trademark LB OBJECT provide system designs for commercial or heavy duty non commercial objects. The trademark RAKO, celebrating the 125th anniversary of its existence, represents the unified sets of tiles, including the rich assortment of decorative accessories for bathrooms, kitchens and floors used in housing interiors.

Number of personnel: 1920

Annual turnover: CZK 4.9 billion

Activities in the area of nanotechnologies

The manufacture of specially designed standard housing ceramics using the surface layer of photoactive titanium oxide. This layer allows for better cleaning of products and offers the antibacterial effect. This technology is owned by the Japanese company TOTO. Lasselsberger manufactures its products thanks to the purchased licence. The technology is based on the application and the consequent thermal fixation of a thin transparent layer of titanium oxide nanoparticles and of other inorganic components on the surface of ceramic materials. The layer improves the hygienic properties of ceramic tiles, thanks to the hydrophilic and antibacterial surface effects. Lasselsberger manufactures these products for its former owner – the German company DSCB which sells products under its trademark HYDROTEC.

Responsible worker

- Ing. Monika Zechovská – the leader of the technological development

5.1.8. SAFINA, a.s.

Vídeňská 104, 252 42 Vestec, I.D. 45147868

www.safina.cz

Brief company characteristics

SAFINA, a.s., extends traditions going back to 1860. The company was founded in 1992. It is currently a private enterprise with the decisive position in the area of processing of precious and non ferrous metals not only in the Czech Republic, but also all over Europe. The portfolio of products and services is very extensive:

- Refining of precious metals – to the purity 3N or 4N
- Manufacture of prefabricates and products of precious or general metals
- Manufacture of precious metal alloys for jewellery and dental purposes
- Chemical and physical analyses in own accredited laboratories

- Manufacture of pure chemicals containing precious metals for the pharmaceutical industry
- Manufacture of chemical compounds and catalysts containing precious metals
- Manufacture of contacts for the industry of electrical engineering
- Manufacture of targets of precious and non ferrous metals
- Manufacture of solders containing silver (both low and high purity ones)
- Manufacture of platinum parts for the glass industry
- Manufacture of platinum laboratory instruments and thermocouples
- Acquisition and refining of wastes containing precious metals
- Recycling of electric wastes from electric and electronic equipment
- Recycling of the chemical industry wastes

Number of personnel: 261

Annual turnover: CZK 1.245 billion (2006)

Activities in the area of nanotechnologies

The research of the utilisation of nanotechnologies in used technologies.

Projects solved in the area of nanotechnologies

- Project of MIT FI-IM5/124 "Research of technologies for the application of new material nanolayers allowing the construction of economic and high performance sensors, regulators and action parts", 3/2008–12/2010, the researcher is Ing. František Veselý.

Responsible worker

- Ing. Tomáš Plachý, CSc., Chairman of the Board

5.1.9. Saint – Gobain Advanced Ceramics, s.r.o.

Přepeřská 1302, 511 01 Turnov, I.D. 25763121

www.sgac-turnov.cz

Brief company characteristics

Saint – Gobain Advanced Ceramics, s.r.o., Turnov is the biggest manufacturer in the ceramic industry of the Saint – Gobain in Central Europe. It was founded in August 1999, when the Saint – Gobain Céramiques Advanceés Desmarquest purchased all activities related to ceramics (and R&D) from the Czech enterprise Dias Turnov, s.r.o. Activities of the enterprise focus mostly on:

- Manufacture of ceramic sealing plates for cartridges of water taps, assembly and sales of these complete taps' inserts.
- Manufacture of ceramic filters filtering melted metals in the foundry industry.
- Manufacture of ceramic cutting plates for metal working and tools forming steel pipes.
- Manufacture and assembly of parts within electroceramics.
- Development and the manufacture of prototypes, small and medium large series of drawn products of the high-tech ceramics.

Number of personnel: 200

Annual turnover: CZK 325 million

Activities in the area of nanotechnologies

The development and manufacture of prototypes of the high-tech ceramics (started with the sub micro or nanometric powders, suspensions of Al_2O_3, ZrO_2, etc.). The company conducts the so-called freeze and spray-dry granulation of ceramic sub micro and nanopowders and suspensions. These granulates are used for the creation of prefabricates by varied technologies, while the thermal processes try to keep at least the sub micrometric sizes of grains.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme "Permanent Prosperity", 2A-1TP1/087 "In situ research of strengthened nanocomposite ceramic materials", 11/2006–12/2010, the researcher is Ing. Vladimír Šída, CSc.

Responsible workers

- Ing. Vladimír Šída, CSc. – ceramic technologies
- Ing. Miroslav Liška – material research

5.1.10. SPOLEK PRO CHEMICKOU A HUTNÍ VÝROBU, a. s. (Spolchemie)

(Society for the Chemical and Metallurgical Manufacture Ltd.)

Revoluční 1930/86, 400 32 Ústí nad Labem, I.D. 00011789

www.spolchemie.cz

Brief company characteristics

Research, development, manufacture, and processing of chemical and biochemical products and the trading in them. Spolchemie manufactures about 500 kinds of products belonging to the field of synthetic resins, basic or special inorganic compounds like, for example, caustic soda and potash, chlorine, hydrochloric acid, hydrofluoric acid, sodium fluoride, potassium permanganate, and artificial corundum. The majority owner (38 % of shares) of Spolchemie has been Via Chem Group, of the EURO CAPITAL ALLIANCE Ltd., registered in Toronto (Canada) since 2005.

Number of personnel: 983

Annual turnover: CZK 4.9 billion (2007)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA4/064 "Paints fulfilling the new environmental requirements of EU", 7/2007–12/2010, the researcher is Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, the co-researcher on behalf of the Spolek pro chemickou a hutní výrobu is Ing. Jan Hyršl, CSc.

Responsible workers

- Ing. Martin Procházka, General Director and the Chairman of the Board
- prof. Ing. Söhnel Otakar, DrSc., Director

5.1.11. SYNTHOS Kralupy a.s.

O. Wichterleho 810, Kralupy nad Vltavou, I.D. 250532272

www.kaucuk.cz

Brief company characteristics

The chemical plant (until 2007 Kaučuk, a.s., now a part of the Polish enterprise SYNTHOS S.A. Oswiecim) specialising on the manufacture of styrene-butadiene rubbers for the rubber and boot-and-shoe industries and on the production of different kinds of polystyrene.

Number of personnel: 953 (2005)

Annual turnover: CZK 10.5 billion (2005)

Activities in the area of nanotechnologies

Research and development focussed on the improved utility properties of polystyrene and of other company products.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society", KAN100400701 "Hybrid nanocomposite materials", 1/2007–12/2011, the researcher is prof. Ing. Jiří Čejka, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the co--researcher on behalf of SYNTHOS Kralupy is Ing. Jiří Reiss, CSc.

Responsible worker

- Ing. Jiří Reiss, CSc. – research and development

5.1.12. Zentiva, a.s.

U kabelovny 130, 102 37 Praha 10 – Dolní Měcholupy, I.D. 49240030

www.zentiva.cz

Brief company characteristics

The pharmaceutical company focussed on the development, manufacture and sales of modern generic pharmaceutical products. One of the biggest manufacturers of medication in Central and Eastern Europe.

Number of personnel: 4700

Annual turnover: CZK 10.9 billion (2006)

Activities in the area of nanotechnologies

Nanomedicine – the development of breast cancer-targeted medicine in cooperation with UMG AS CR and MBU AS CR.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200200651 "Nanoparticle and supramolecular systems for the targeted transport of medication", 7/2006–12/2010, the researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of Zentiva is Ing. Jan Šotola, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society", KAN200100801 "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy", 1/2008–12/2012, the researcher is prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics of AS CR, Praha, the co-researcher on behalf of Zentiva is Ing. Jan Šotola, CSc.

Responsible workers

- Ing. Václav Rejholec, CSc. – Director of research and development
- Ing. Jan Šotola, CSc. – a researcher

5.2. SMALL AND MEDIUM SIZE ENTERPRISES (UP TO 250 EMPLOYEES)

5.2.1. ATG s.r.o. (Advanced Technology Group, spol. s r.o.)

Beranových 65, 199 02 Praha 9 – Letňany, I.D. 45314772

www.atg.cz

Brief company characteristics

It is a Czech engineering company with fifteen-year long traditions. It is active mainly in the area of classification and certification of technical personnel (the non destructive technologies – NDT, welding, and corrosion) and inspection and supervision, according to the ASME Code. It organises an independent supervision over the NDT testing. It is involved in the manufacture of equipment for NDT and supplies complete equipment for NDT workplaces using any of the methods. The subsidiary of ATG is LA composite, s.r.o., which is involved in the designing, development and manufacture of composite and glued structures mainly for aircraft technologies and autoclave technologies. A part of the enterprise is the Centre for TiO_2 photocatalytic applications.

Number of workers: 80

Activities in the area of nanotechnologies

Activities in the area of nanotechnologies focus on coordination works of the Centre for TiO_2 photocatalytic applications and coordination of actions 540 within the programme COST, and on the solution of programme projects.

Projects solved in the area of nanotechnologies

- Project of MEYS, the programme "Research Centres", 1M0577 "Research centre of nanosurface engineering – NANOPIN", 1/2005–12/2009, the researcher/coordinator is Ing. František Peterka, Ph.D.
- Project of MIT, the programme TANDEM, FT-TA4/025 "Nanomaterials of the new generation and their industrial applications", 3/2007–12/2010, the researcher is Ing. Pavel

Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, the co-researcher on behalf of ATG is Ing. František Peterka, Ph.D.
- Action within the programme COST 540 PHONASUM – "Photocatalytic technologies and novel nanosurface materials – critical issues", 10/2005–1/2010, ATG (Ing. František Peterka, Ph.D.). It researches, as a partial topic among other things, the synthesis of highly photoactive nanoparts of titanium oxide, including the doped or mix materials with the spectrum sensitivity extended into the visible area and the preparation of layers based on nanocrystalline titanium oxide from the gaseous phase by the technique of plasma deposition or from the solution with the assistance of different chemical processes. In addition to other advanced methods, there are micelles utilised as templates for the preparation of the defined porous structure.

Responsible worker
- Ing. František Peterka, Ph.D. – Director of the Centre for TiO_2 photocatalytic applications.

5.2.2. Altermed Corporation a.s.

Hněvotínská 711, 779 00 Olomouc, I.D. 2538827
www.altermed.cz

Brief company characteristics

The Alterned Corporation a.s. is a fast developing enterprise involved in the manufacture and sales of medical cosmetics, healthcare preparations and nutritional additives.

Activities in the area of nanotechnologies

The company has commenced its activities in the area of nanotechnologies by the solution of the below presented international project.

Projects solved in the area of nanotechnologies
- Project of MEYS, the programme EUREKA, OE08005 "Application of antimicrobial effects of nanotechnologically treated silver particles in medicine (human and veterinary), healthcare equipment and cosmetics", 1/2008–12/2010, the researcher is Ing. Tomáš Hradil.

Responsible worker
- Ing. Tomáš Hradil – development

5.2.3. Apronex s.r.o.

Nad Safinou II/365, Vestec, 252 42 Jesenice u Prahy, I.D. 27093123
www.apronex.com

Brief company characteristics

It is a biotechnological company, a spin-off of the Institute of Molecular Genetics of AS CR, founded in 2003. It manufactures biologically active recombinant proteins for varied applications and it conducts analyses of protein preparations.

Number of personnel: 4

Annual turnover: CZK 2.5 million (2006)

Activities in the area of nanotechnologies

The development, the biotechnological manufacturing and testing of biologically active protein preparations. Research in the area of bionanotechnologies.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society", KAN208240651 "Studies of interactions of biological macromolecules and nanolayers focussed on the research of polymeric microfluid biosensors and therapeutic nanoparticles", 7/2006–12/2010, the researcher is doc. Ing. Pavel Hasal, CSc., VSCHT Praha, the co-researcher on behalf of Apronex is RNDr. Vladimír Kořínek, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society", KAN200520701 "The use of ultrasound in nanomedicine", 1/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR, Praha, the co-researcher on behalf of Apronex is Ing. Jiří Špička.
- Project of MEYS 1M0506 "Centre of molecular and cellular immunology", 1/2005–12/2009, the researcher is prof. RNDr. Václav Hořejší, CSc., Institute of Molecular Genetics of AS CR, Praha, the researcher on behalf of Apronex is RNDr. Ladislav Anděra, CSc.

Responsible worker

- RNDr. Ladislav Anděra, CSc. – Statutory Representative

5.2.4. AQUATEST a.s.

Geologická 4, 152 00 Praha 5, I.D. 44794843

www.aquatest.cz

Brief company characteristics

The company was founded by the transformation of the former hydrogeological plant of the enterprise Stavební geologie (Constructional Geology). It provides consulting and engineering services in the area of protection of the environment and of water management, especially the purification and recycling technologies.

Number of workers: 207 (2007)

Annual turnover: CZK 236 million (2005)

Activities in the area of nanotechnologies

Research and development related to the use of nanomaterials in the purification practice, in the area of purification of contaminated underground, surface and waste industrial waters. The company currently applies nanoiron in the area of purification of contamination by chlorinated ethans, polychlorinated biphenyls, and experimentally the sexivalent chromium and arsenic.

Specific focuses of the research and development:

- Applications of elementary nanoiron for the purification of contaminated underground waters and the mineral environment
- The use of elementary nanoiron as a part of the fill of permeable reactive barriers
- Research of possibilities in the manufacture of nanoiron from mine waters
- Utilisation of elementary nanoiron in liquidation of industrial waste waters

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN108040651 "Research of the manufacturing and the utilisation of nanoparticles based on zero-valent iron for the treatment of contaminated underground waters", 07/2006–12/2008, the researcher is doc. Dr. Ing. Miroslav Černík, CSc., Technical University in Liberec, Faculty of Mechatronics and Interdisciplinary Engineering Studies, the co-researcher on behalf of AQUATEST is RNDr. Petr Kvapil, Ph.D. The research objective is the development and manufacture of a new nanomaterial based on the surface modified iron nanoparticles which would have specific properties for the use in oxidation-reducing reactions resulting in the removal of specified contaminants from underground waters (chlorinated hydrocarbons, heavy metals), while non toxic or substantially less toxic products would be created.
- Project of MIT, the programme TANDEM, FT-TA3/077 "Remedy for underground waters using permeable reactive barriers", 5/2006-4/2010, the researcher is Ing. Josef Kozler, CSc., Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, the co-researcher on behalf of AQUATEST is doc. Dr. Ing. Miroslav Černík, CSc. The project focuses on the use of elementary nanoiron as the fill in reactive underground walls for the liquidation of chlorinated hydrocarbons in contaminated underground waters.
- Project within the 7th FP EU, the Theme Environment, Integrated project, AQUAFIT4USE "Water in Industry, Fit-for-Use, Sustainable Water Use in Chemistry, Paper, Textile and Food Industry", 2008–2011, AQUATEST is a partner. The project solves the use of nanoparticles of zero-valent iron for the cleaning of waste water coming out of textile factories, and the development and optimising of the treatment reactor.

Results of Research and development in the area of nanotechnologies

Five pilot applications of nanoiron in purification works, the cooperation with Technical University in Liberec, VUAnCH in Ústí nad Labem and the international cooperation with Golder Associates (USA) and TODA (Japan).

Responsible workers

- doc. Dr. Ing. Miroslav Černík, CSc. – Director of the Division Research and Development, specialised on the research of nanoparticles of zero-valent iron for cleaning purposes
- RNDr. Petr Kvapil, Ph.D. – pilot application of nanoiron in cleaning technologies
- Ing. RNDr. Pavel Dusílek, Ph.D. – purification technologies

5.2.5. BARVY TEBAS s.r.o.

Poděbradská 195/7, 190 05 Praha 9, I.D. 45794316
www.barvytebas.cz

Brief company characteristics

The company was founded in 1992. It is owned by seven natural persons and it belongs among the biggest manufacturers of water soluble paints in the Czech Republic. Its production reaches about 2 500 tons a year and it ranks the 5th among the paints' manufacturers in the Czech Republic. The most important company product is the universal acrylate paint BALAKRYL Uni Mat V 2045.

Number of personnel: 97

Annual turnover: CZK 219 million (2006)

Activities in the area of nanotechnologies

The use of nanoparticles in paints and varnishes. Cooperation in the project mentioned below.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA4/064 "Paints fulfilling the new environmental requirements of EU", 7/2007–12/2010, the researcher is Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, the co-researcher on behalf of BARVY TEBAS is Ing. Jaroslav Prachař.

Responsible workers

- Ing. Tomáš Jelínek – General Director
- Ing. Jaroslav Prachař – Technical Director

5.2.6. BD SENSORS s.r.o.

Hradišťská 817, 687 08 Buchlovice u Uherského Hradiště, I.D. 49968416

www.bdsensors.cz

Brief company characteristics

BD SENSORS has focussed since its beginning (1993) only on the manufacture of electronic pressure measuring technology. They are the pressure sensors, level sensors, and their accessories. The company currently offers solutions for pressures from 0.1 mbar to 2 200 bar.

Number of personnel: 110

Annual turnover: CZK 201 million (2005)

Activities in the area of nanotechnologies

There is the applied research of fully intelligent pressure sensors utilising MEMS structures and the consequent nanostructures, including the research and experimental verification of new principles of the pressure detection.

Projects solved in the area of nanotechnologies

- Project of MIT, the program “Permanent Prosperity”, 2A-2TP1/143 “Research of new mechatronic MEMS structures suitable for the pressure measuring”, 11/2006–11/2011, the researcher is Ing. Karel Mareček.

Responsible worker

- Ing. Karel Mareček – Statutory Representative

5.2.7. Biomedica, spol. s r.o.

Pekařská 8, 158 00 Praha 5, I.D. 44265859

www.biomedica-prague.cz

Brief company characteristics

The manufacturer of medicine, nutritional additives and cosmetics containing vegetable extracts, volatile oils and vitamins.

Number of personnel: 75

Annual turnover: CZK 126 million (2005)

Activities in the area of nanotechnologies

Development of technological preparation processes related to the lipid emulsions and solid lipid nanodispersions and their utilisation as carriers of lipophilic medications, especially for oral or surface applications.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme “Permanent Prosperity”, 2A-1TP1/015 “New procedures for microdispersion and nanodispersion lipid systems formulation as the transport systems for pharmaceutically effective substances”, 7/2006–6/2011, the researcher is RNDr. Jan Mikeska, CSc.

Responsible workers

- Ing. Jaroslav Říha – Director
- RNDr. Jan Mikeska, CSc. – Research and Development Director

5.2.8. BVT Technologies, a.s.

Hudcova 78c, 612 00 Brno, I.D. 262343386

www.bvt.cz

Brief company characteristic

BVT Technologies, a.s., was founded in 1990 as the Division of biosensors Krejci Engineering. It specialises in the development and manufacture of miniature TFT (thick film technology) electrochemical sensors and biosensors' substrates.

Number of personnel: 7 (2007)

Annual turnover: CZK 2.5 million (2006)

Activities in the area of nanotechnologies

Development of custom-made electrochemical sensors and biosensors, the preparation of 3D structures by the thick film technology, and the development of nanostructured electrodes.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520702 "Nanoimmunosensors detecting cytokines", 1/2007–12/2011, the researcher is Ing. Peter Šebo, CSc., Biotechnology Institute of AS CR , Praha, the co-researcher on behalf of BVT is RNDr. Jan Krejčí, Ph.D.
- Project of the 6th FP EU BIO-MEDNANO "Integrating enzymes, mediators and nanostructures to provide bio-powered bio-electrochemical sensing systems", the project of the STREP kind No. 017350, 2005-2008, BVT is the co-researcher.

Results of Research and development in the area of nanotechnologies

- Patent application US11/913.086 "Nanostructured working electrode of an electrochemical sensor, method of manufacturing there of and sensor containing this working electrode"
- Patent CZ 297082 "Parts of the 3D structure prepared by the thick film technology and the way of their manufacturing", including the application for the European and US international phase PCT/CZ03/00031.

Responsible worker

- RNDr. Jan Krejčí, Ph.D. – Chairman of the Board

5.2.9. CENTRAL EUROPEAN BIOSYSTEMS s.r.o.

U Habrovky 247/11, 140 00 Praha 4, I.D. 27124762

www.cebiosys.com

Brief company characteristics

The company was founded in 2004 and its owner is the American firm FLEXBIO LLC with the address in New York. It is involved in the applied biological research.

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society", KAN200520704 "New nanoparticles for the ultrastructural diagnostics", 01/2007–12/2011, the researcher is doc. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics of AS CR, Praha, the total costs CZK 88.595 million, thereof CZK 73.525 million from the state budget. The co-researcher on behalf of the Central European Biosystems is MUDr. Zdeněk Kleibl, Ph.D.

Responsible worker

- MUDr. Zdeněk Kleibl, Ph.D. – ultrastructural diagnostics

5.2.10. CLEANTEX *a.s.*

Olomoucká 26, 796 01 Prostějov, I.D. 25302655

www.cleantex.cz

Brief company characteristics

CLEANTEX a.s. was founded in 1996 and it has been extending long traditions of the Research Clothing Institute. It focuses on research and development of special working clothes determined for clean rooms, the antistatic environment and explosive spaces. It manufactures clothes exclusively for the repeated use. CLEANTEX is the only research workplace in this area in Eastern Europe and, at the same time, the biggest manufacturer in this region.

Activities in the area of nanotechnologies

Utilisation of nanomaterials for the manufacture by the company.

Projects solved in the area of nanotechnologies

- Project within the programme EUREKA E!3778, MANGO "Managing Contamination by Fibrous Product Systems", 1/2007–1/2010, the coordinator/researcher is VTT – Technical Research Centre of Finland, 10 participants, CLEANTEX is the co-researcher.

Responsible workers

- Ing. Hana Kozlovská – Director
- Ing. Václav Kozlovský – research

5.2.11. Compo Tech PLUS, spol. s r. o.

Družstevní 159, 342 01 Sušice II, I.D. 63507412

www.compotech.com

Brief company characteristics

The company was founded in 1995 and it is involved in the development and manufacture of composite materials, specifically the composite tubes of carbon or glass fibres. The manufacture utilises the unique process of longitudinal fibre winding at the zero angle. The company prepares custom-made tubes of different lengths, diameters, wall thicknesses, shapes, and mechanical properties. Compo Tech has developed and designed its own machines for fibre positioning, including the controlling software, systems and supplementary machines.

Annual turnover: CZK 21.8 million (2005)

Activities in the area of nanotechnologies

Research and manufacture of nanocomposite tubes of carbon and glass fibres.

Projects solved in the area of nanotechnologies

- Project GA101/08/0299 "Research of intelligent composite parts, made of ultra-high-module fibres, in manufacturing machines and the matrices modified by nanoparticles", 1/2008–12/2011, the researcher is doc. Ing. Václava Lašová, Ph.D. University of West Bohemia in Plzeň, Faculty of Mechanical Engineering, the co-researcher on behalf of Compo Tech PLUS is Ing. Ondřej Uher, Ph.D.

Responsible workers

- Ing. Ondřej Uher, Ph.D. – Research and Development Director
- Ing. Vít Šprdlík – Technical Director

5.2.12. COLOR SPECTRUM a.s.

Anenská 1, 695 01 Hodonín, I.D. 25312944

www.colorspektrum.cz

Brief company characteristics

The company was founded in 1996 as the legal successor of Color Spectrum, s.r.o., and it is involved in the development and manufacture of industrial paints. The manufactured assortment covers a spectrum of products usable in corrosion environments for usual, but also special industrial applications. The main sub layer kinds are metals, wood, or concrete.

Number of personnel: 47

Annual turnover: CZK 97 million (2006)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM FT-TA4/064 "Paints fulfilling the new environmental requirements of EU", 7/2007–12/2010, the researcher is Ing. Libuše Hochmannová, Ph.D., SYNPO, a.s., Pardubice, the co-researcher on behalf of COLOR SPEKTRUM is Ing. František Drobný, CSc.

Responsible worker

- Ing. František Drobný, CSc. – development

5.2.13. CPN spol. s r.o.

Dolní Dobrouč 401, 561 02 Dolní Dobrouč, I.D. 25281844

www.contipro-group.cz

Brief company characteristics

CPN spol. s r.o. is a part of the Contipro Group Holding which focuses on research, development and manufacture of biopolymers and their derivates for the use in pharmacology and cosmetics. There are also research, development and manufacture of final pharmaceutical products. The Contipro Group Holding manufactures a number of biopolymers by the biotechnological way and it is one of the biggest manufacturers of the hyaluronic acid in the world (it is an active substance used in pharmacology, cosmetics and nutrition). CPN concentrates research and development within the Holding, including the top technological equipment. There are more than one third of the Holding personnel working there.

Number of personnel: 124 (2007)

Annual turnover: CZK 247 million (2006)

Activities in the area of nanotechnologies

The development of nanofibres and microfibres from biopolymers (polysaccharides and proteins), preparations for wound healing and the development of carriers for the controlled distribution of biologically active substances and preparations based on biopolymers for the tissue engineering.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme IMPULS, FI-IM4/205 "Nanotechnologies in medicine – a tissue carrier for the reconstructions of connective tissues", 3/2007–9/2010, the researcher is Ing. Kateřina Knotková, Ph.D.
- Project of AS CR, the program "Nanotechnology for the Society" KAN200520703 "The use of ultrasound in nanomedicine", 1/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR , Praha, the co-researcher on behalf of CPN is RNDr. Vladimír Velebný, CSc.

Experts/field

- Ing. Kateřina Knotková, Ph.D. – nanofibres from biopolymers
- Mgr. Lukáš Palek, Ph.D. – chemical modifications of biopolymers

5.2.14. CRYTUR, spol. s r.o.

Palackého 175, 541 01 Turnov, I.D. 25296558

www.crytur.cz

Brief company characteristics

The manufacture and development of scintillation materials and detectors, laser bars and components (mirrors), precise optics and mechanics, sapphire profiles, and monocrystals for lasers and electron microscopes.

Number of personnel: 46

Annual turnover: CZK 50 million

Activities in the area of nanotechnologies

Research and development of materials usable in nanotechnologies.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN300100802 "Nanocomposite, ceramic and thin layer scintillators", 1/2008–12/2012, the researcher is Ing. Martin Nikl, CSc., Institute of Physics of AS CR, Praha, the co-researcher on behalf of CRYTUR is Mgr. Jindřich Houžvička, Ph.D.

Responsible workers

- Mgr. Jindřich Houžvička, Ph.D. – Statutory Representative
- Ing. Karel Blažek – Director

5.2.15. DELONG INSTRUMENTS a.s.

Bulharská 48, 612 00 Brno, I.D. 46903879

www.discomps.com

Brief company characteristics

Development and manufacture of electron microscopes and medical equipment.

Number of personnel: 60

Annual turnover: CZK 86 million

Activities in the area of nanotechnologies

The development of instruments utilising electron beams for the studies or preparation of nanostructures; the method of low-voltage scanning electron microscopy allows the studies of structures of biological and macromolecular composites, but also of microelectronic (or micromechanical) products; these structures could be also created with the assistance of an electron beam. The company specialities are electron optical multi beam instruments. It is the only possible solution of the productivity problem of nanolithography and the mass inspection of semiconducting structures.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme "Permanent Prosperity", 2A-2TP1/147 "Research of semiconducting nanotubes for the implementation in photoelectric parts", 5/2007–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D., STARMANS Electronics, s.r.o., Praha, the co-researcher on behalf of DELONG INSTRUMENTS is RNDr. Michal Drštička.
- Project of MIT, the programme TANDEM, FT-TA4/126 "Research of semiconducting nanotubes for the implementation of cold-emission parts", 1/2007–12/2010, the researcher is Ing. Stanislav Štarman, Ph.D., STARMANS Electronics, s.r.o., Praha, the co-researcher on behalf of DELONG INSTRUMENTS is RNDr. Michal Drštička.
- Project of the 6th FP EU, the project of the kind STREP, RIMANA "Radical Innovation Maskless Nanolithography", 10/2005–9/2008, 7 participants, DELONG INSTRUMENTS is a cooperating organisation.

Responsible worker

- Ing. Tomáš Papírek – a member of the Board

5.2.16. DEKONTA, a.s.

Dřetovice 109, 273 42 Stehelčeves, I.D. 25006096

www.dekonta.cz

Brief company characteristics

The company specialises in the processing and removing of hazardous wastes and the cleaning of contaminated localities, including the biological purification.

Number of personnel: 190

Annual turnover: CZK 410 million

Activities in the area of nanotechnologies

Research and development of new nanomaterials for applications in decontaminating technologies, of processes applying nanomaterials into the mineral environment, and mathematical modelling of nanoparticle spreading in the contaminated mineral environment.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme IMPULS, FI-IM4/143 "Application of nanoparticles in decontaminating technologies", 6/2007–5/2010, the researcher is Ing. Lenka Veselá, Ph.D.
- Project of MEYS 2B08062 "Genetic and physiological handling of bacterial degradation agents in aromatic pollutants and their utilisation", 1/2008–12/2011, the researcher is Ing. Miroslav Pátek, CSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of DEKONTA, a.s., is Ing. Petra Žáčková.

Experts/field

- Mgr. Petr Dosoudil – cleaning of contaminated localities
- Ing. Martin Polák – purification technology for underground waters
- Ing. Robert Raschman – decontaminating technologies

- Ing. Lenka Veselá, Ph.D. – development of innovation methods for the cleaning of the mineral environment

5.2.17. Dr. Ing. Luděk Dluhoš Timplant

Sjednocení 77/1, 725 25 Ostrava – Polanka, I.D. 48417777

www.timplant.cz

Brief company characteristics

Development and manufacture of dental implants and nanoimplants, surgery equipment, accessories and alveolar distractors.

Number of personnel: 1

Activities in the area of nanotechnologies

Research of the bulk nanostructured materials for medical applications, the applications of nanostructured titanium in the area of the manufacture of dental implants, and the research and development of manufacturing technologies for nanocoating of dental implants.

Results of research and development in the area of nanotechnologies

The product – the dental implant Nanoimplant

Responsible workers

- Dr. Ing. Luděk Dluhoš – owner
- prof. Ing. Jiří Petrželka, CSc. – Manager of the Forming Institute of VSB – TU Ostrava, FS
- MUDr. Daniel Hrušák, Ph.D. – Deputy Head of the Stomatological Clinic and the head surgeon in FN Plzeň

5.2.18. ELCERAM a.s.

Okružní 1144, 500 03 Hradec Králové, I.D. 60108681

www.elceram.cz

Brief company characteristics

ELCERAM a.s. (the former Czech-Japanese joint venture TESLA-Y.S., a.s.) is the manufacturer of white and printed ceramic substrates (corundum ceramics) for the electrical engineering and the electronic industry.

Number of personnel: 135

Annual turnover: CZK 52 million (2006)

Activities in the area of nanotechnologies

Research and development of technologies for microelectronics and sensors based on the combination of technologies of energy beams (laser, UV radiation, ion beams, microwave radiation, etc.) and the technologies of micro and nano layers applied by vacuum techniques, plasma techniques, or wet processes.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA2/018 “High-tech energy beams technologies for deposition and treatment of films for electronics”, 1/2005–12/2008, the researcher is Ing. Karel Strobl.

Responsible worker

- Ing. Karel Strobl – Chairman of the Board

5.2.19. ELMARCO s.r.o.

V Horkách 76, 460 07 Liberec 9, I.D. 25421719

www.elmarco.com

Brief company characteristics

The development and manufacture of technologies for the semiconductor and nanofibre industries. It is about supplies of CDS systems for the dosing of chemicals, which make a part of the technology surface treating silicone plates. The company also develops and manufactures machines for the industrial manufacture of nanofibres with the assistance of the electrospinning technology.

Number of personnel: 170 (2007)

Annual turnover: CZK 500 million (2006)

Activities in the area of nanotechnologies

The manufacture and sales of machines Nanospider for the industrial manufacture of nanofibre non woven textiles, research and development of materials and final products of nanofibres. Applications: photocatalytic nanofibres, skin replacements, nanofibres for the thermal insulation applications, nanofibres of inorganic materials, and implementation of nanofibres in the cigarette filters.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme “Nanotechnology for the Society” KAN200100801 “Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy”, 1/2008–12/2012, the researcher is prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics of AS CR, Praha, the co-researcher on behalf of ELMARCO is Ing. Lukáš Rubáček, Ph.D.
- Project of AS CR, the programme “Nanotechnology for the Society” KAN200520804 “Biocompatible nanofibrous constructions creating new medicinal forms for the application of biologically and pharmaceutically active substances”, 1/2008–12/2012, the researcher is doc. RNDr. Vladimír Holáň, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of ELMARCO is Ing. Marcela Munzarová.
- Project of MIT, the programme “Permanent Prosperity”, 2A-1TP1/113 “Design of special textile machines manufacturing nanofibres”, 11/2006–12/2009, the researcher is Ing. Jan

Čmelík. The project's objective is the basic research of some functions of machines producing nanofibres.

- Project of MIT, the programme TANDEM, FT-TA3/156 "Research and development of the new generation of protective filters", 6/2006–12/2008, the researcher is Ing. Jiří Šoukal, CSc., SIGMA Výzkumný a vývojový ústav, s.r.o., Lutín, the co-researcher on behalf of ELMARCO is Ing. Ladislav Mareš.
- Project of MIT, the programme "Permanent Prosperity", 2A-3TP1/120 "Equipment for the preparation of nanofibres from polymer melts", 4/2008–12/2011, the researcher is Ing. Jan Čmelík.
- Project of MIT, the programme "Permanent Prosperity" 2A-3TP1/140 "Ion-exchangeable materials in the form of membranes and nanofibres prepared on the nanotechnological basis", 4/2008–12/2010, the researcher is Ing. Aleš Černín, Ph.D., MEGA a.s., Stráž pod Ralskem, the co-researcher on behalf of ELMARCO is Ing. Denisa Stránská.

Research and development results in the area of nanotechnologies/cooperation

- Finished products: NS AcousticWeb™ – sound absorbing materials with the excellent sound absorption properties
- Filtration materials with the antimicrobial effects
- Cooperation with MIT (Massachusetts Institute of Technology, USA), NCRC (Nonwovens Cooperative Research Centre, USA), and the concern BASF

Responsible workers

- Ing. Stanislav Petrík, CSc. – material physicist
- Dr. Ing. Lukáš Rubáček – physicist
- Ing. David Petráš – chemist
- Ing. Jan Čmelík – special textile machines
- Ing. Marcela Munzarová

5.2.20. Euro Support Manufacturing Czechia, s.r.o.

Záluží 1, 436 70 Litvínov, I.D. 25417681

www.eurosupport.nl

Brief company characteristics

The company is a subsidiary of the Dutch enterprise Euro Support BV. It is involved mostly in the research and manufacture of modern catalysts for chemical processes.

Activities in the area of nanotechnologies

Research of the utilisation of zeolite and mesoporous structures (nanostructures) in catalysts.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN100400702 "Nanostructural materials for the catalytic, electrocatalytic and sorption applications", 1/2007–12/2010, the researcher is prof. RNDr. Zdeněk Samec, DrSc., J. Heyrovsky

Institute of Physical Chemistry of AS CR, Praha, the co-researcher on behalf of Euro Support Manufacturing is Ing. Milan Říčánek, CSc.

- Project of MIT, the programme TANDEM, FA-TA3/080 "Synthesis of titanium silicates and their applications", 4/2006–12/2009, the researcher is Ing. Věnceslava Tokarová, Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, the co-researcher on behalf of Euro Support Manufacturing is Ing. Milan Říčánek, CSc.

Responsible worker

- Ing. Milan Říčánek, CSc. – Director

5.2.21. EUTIT s. r. o.

Stará Voda 196, 353 01 Mariánské Lázně, I.D. 47714930

www.eutit.cz

Brief company characteristics

The company founded in 1993 took over the state-owned enterprise EUTIT STARÁ VODA in 1995. It is a leading European manufacturer of melted basalt castings (tiles, pipes, and industrial products) which are characteristic with high wear and chemical resistance.

Number of personnel: 190

Annual turnover: CZK 161 million (2004)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR within the programme "Nanotechnology for the Society" KAN300430651 "Nanocrystallisation of plasma sprayed coatings based on eutectic ceramic mixtures", 7/2006–12/2009, the head researcher is Ing. Tomáš Chráska, Ph.D., Institute of Plasma Physics of AS CR, Praha, the co-researcher on behalf of EUTIT is Vladimír Havlíček.

Responsible worker

- Vladimír Havlíček – Confidential Clerk

5.2.22. EXBIO PRAHA, a.s.

Nad Safinou II 366, 252 42 Vestec, I.D. 25548611

www.exbio.cz

Brief company characteristics

The company was founded in 1990 as the spin-off company of the Academy of Sciences of the Czech Republic. It is currently a well-known manufacturer of monoclonal antibodies and other immunological reagents. It manufactures about 200 own unique monoclonal antibodies and develops and introduces into the market tens of new products every year. In addition to the manufacture of own antibodies, the company represents a number of foreign enterprises which offer products for the immunology and molecular biology, in the Czech and Slovak markets.

Number of personnel: 25

Annual turnover: CZK 30 million (2007)

Activities in the area of nanotechnologies

Development and manufacture of monoclonal substances, proteins, etc., and bionano-technologies.

Projects solved in the area of nanotechnologies

- Project of MEYS 2B06056 “Diagnostics of by polyaromatic compounds damaged DNA with the use of nanotechnological and bioanalytical methods for the early detection of cancers”, 7/2006–6/2010, the researcher is Mgr. Jan Přibyl, Ph.D., Masaryk University in Brno, Faculty of Science, the co-researcher on behalf of EXBIO is Ing. Miloslav Suchánek, Ph.D.
- Project of MEYS, the programme “Research Centres” 1M0505 “Centre of targeted therapeutic drugs”, 1/2005–12/2009, the researcher is doc. MUDr. Vladimír Viklický, CSc., ÚJV Řež a.s., Husinec – Řež, the co-researcher on behalf of EXBIO is Ing. František Škrob.
- Project of MEYS 1M0506 “Centre of molecular and cellular immunology”, 1/2005–12/2009, the researcher is prof. RNDr. Václav Hořejší, CSc., Institute of Molecular Genetics of AS CR, Praha, the researcher on behalf of EXBIO is Ing. Miloslav Suchánek, Ph.D.

Responsible worker

- Ing. Miloslav Suchánek, Ph.D. – research, development & transfers of technologies

5.2.23. GENERI BIOTECH s.r.o.

Machkova 587, 500 11 Hradec Králové, I.D. 63221667

www.generi-biotech.com

Brief company characteristics

The Czech biotechnological company focussing on the molecular genetic diagnostics in medicine, on the development and manufacture of biotechnological components for the molecular biology, and on the research of means of the gene therapy.

Number of personnel: 26 (2007)

Annual turnover: CZK 20 million (2006)

Activities in the area of nanotechnologies

Research and development in the area of nanobiotechnologies – nanomedicine.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme “Nanotechnology for the Society” KAN401770651 “Molecular nanosystems and nanodevices: electric transport properties”, 7/2006–12/2010, the researcher is Ing. Martin Weiter, Ph.D., Brno University of Technology, Faculty of Chemistry, the co-researcher on behalf of GENERI BIOTECH is RNDr. Martin Bunček, Ph.D.

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200100801 "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy", 1/2008–12/2012, the researcher is prof. RNDr. Miloš Nesládek, CSc., HDR., Institute of Physics of AS CR, Praha, the co-researcher on behalf of GENERI BIOTECH is RNDr. Martin Bunček, Ph.D.

Responsible workers

- RNDr. Radovan Haluza, Ph.D. – Director
- RNDr. Martin Bunček, Ph.D. – researcher

5.2.24. HET spol. s r.o.

417 65 Ohníč u Teplic 14, I.D. 43223168

www.het.cz

Brief company characteristics

The company was founded in 1991. It manufactures interior and HET brick and concrete paints, putties and construction materials.

Number of personnel: 105

Annual turnover: CZK 333.6 million (2006)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below. Applications of nanomaterials in paints.

Projects solved in the area of nanotechnologies

- Project of MIT FT-TA4/025 "Nanomaterials of the new generation and their industrial applications", 3/2007–12/2010, the researcher is Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, the co-researcher on behalf of HET is Ing. Martin Rozhon.

Responsible workers

- Ing. Vlastimil Výborský – Technical Director
- Ing. Martin Rozhon – Chief technologist

5.2.25. HVM PLASMA, spol. s r.o.

Na Hutmance 347/2, 158 00 Praha 5 – Jinonice, I.D. 45309787

www.hvm.cz

Brief company characteristics

The company is involved in the coating methods PVD and PACVD on order (the hard layers, tribologic coats – DLC, and decorative coats). The Research and development focus on coating technologies, the development of particle sources (magnetrons, arc and ion sources), and the modelling and analysis of thin layers and the plasma diagnostics.

Number of personnel: 65

Annual turnover: CZK 245 million (2006)

Activities in the area of nanotechnologies

Research and development of technologies creating nanolayers, and research of their properties.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN 200040651 "Electrochemical and optical analyses of biomacromolecules on microelectrodes covered with nanolayers of electroactive materials", 7/2006–12/2010, the researcher is Mgr. Stanislav Hasoň, Ph.D., Institute of Biophysics of AS CR, Brno, the co-researcher on behalf of HVM PLASMA is Ing. Jiří Vyskočil, CSc.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN101120701 "Nanocomposite layers and nanoparticles created in the low pressure plasma for surface modifications", 1/2007–12/2011, the researcher is prof. RNDr. Hynek Biederman, DrSc., Charles University in Praha, MFF, the co-researcher on behalf of HVM PLASMA is Ing. Jiří Vyskočil, CSc.

Responsible worker

- Ing. Jiří Vyskočil, CSc. – Director

5.2.26. H+A Eco Cz s.r.o.

Tř. 1. máje 816/13, 77 200 Olomouc, I.D. 26862662

Brief company characteristics

The company was founded in 2005. It is involved in liquid purification technologies, including water.

Activities in the area of nanotechnologies

The utilisation of iron oxide nanoparticles for the water purification.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society", KAN115600801 "New preparation and use technologies related to nanoparticles based on iron oxides for the environmental, industrial and medical applications", 1/2008–12/2012, the researcher is doc. RNDr. Radek Zbořil, Ph.D., the co-researcher on behalf of H+A Eco Cz is Ing. Oleg Lysytchuk, CSc.

Responsible worker

- Ing. Oleg Lysytchuk, CSc. – the co-owner, research and production of nanoparticles

5.2.27. INOTEX s.r.o.

Štefánikova 1208, 544 01 Dvůr Králové n. L., I.D. 47451963

www.inotex.cz

Brief company characteristics

INOTEX, s.r.o. is a successor of the Research Institute of Textile Improvements. The company was founded in 1992 and it has purchased the then VUTZ, s. p., in 1996. It extends its traditions. It conducts the technological research, innovations and technological transfers in the area of wet processes taking place in the manufacture of textiles. The company development is supported by the low ton manufacture of (bio)chemical specialities – aid textile preparations, the small scale capacity for improvements and coating of textiles, and the manufacture of supplementary machinery. The company has got an accredited testing laboratory.

Number of personnel: 68 (2007)

Annual turnover: CZK 160 million (2006)

Activities in the area of nanotechnologies

- Research of the possible utilisation of nanosystems and biotechnologies in the development and verification of new (multi)functional textile materials (protective clothes, technical barrier textiles, non woven textiles with the value-added). It is specifically about the activation of surfaces of textile substrates for the better effectiveness and longer life spans (silanes, plasma, biotechnology), hydrophilisation/hydrophobisation of surfaces, photoactivation and photocatalysis, textile-based bioactive materials, finishes and coating
- Development of improving technologies for the cleaner manufacture
- Membership in the research cluster NANOMEDIC – nanomaterials for medicine, and in the professional cluster CLUTEX – the cluster of technological textiles.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme "Permanent Prosperity", 2A-3TP1/126 "Continual plasma and nanoplasma treatments of non-woven textiles", 4/2008–12/2011, the researcher is Ing. Zdeněk Mečl, PEGAS NONWOVENS a.s., Znojmo, the co-researcher on behalf of INOTEX is Ing. Jan Marek.
- Project of MIT, the programme TANDEM, FT-TA5/007 "Advanced research of nanomaterials for textiles", 3/2008–11/2010, the researcher is Ing. Antonín Mlčoch, České technologické centrum pro anorganické pigmenty a.s., Přerov, the co-researcher on behalf of INOTEX is Ing. Lenka Martínková.

- Project of the 6th FP EU of the STREP kind, PhotoNanoTech "Photozyme nanoparticle applications for water purification, textile finishing, photodynamic biomineralization and biomaterials coating", 4/2007–3/2011, 11 participants, INOTEX is a partner.
- Project within the programme EUREKA E!3778, MANGO "Managing Contamination by Fibrous Product Systems", 1/2007–1/2010, the coordinator/researcher is VTT – Technical Research Centre of Finland, 10 participants, INOTEX is the co-researcher.
- Participation in the Action of the programme COST 868 "Biotechnological Functionalization of Renewable Polymeric Materials", 9/2006–9/2010, 24 countries, a partner. For additional information see www.cost868.TUGraz.at.
- Project of the 7th FP EU of the CSA kind, the topical priority NMP- NAPOLYNET, "Setting up research – intensive clusters across the EU on characterization of polymer nanostructures", 2008–2009, 15 partners from 10 countries, the coordinator is Clara Silvestre, ICTP-CNR (Italy), INOTEX is a partner.

Results of the research and development conducted in the area of nanotechnologies
- Participation in the coordination of TEG 3 "Bio-based materials, biotechnology and environmental cleaner processes" within ETP for textile and clothing (EURATEX Brussels).

Responsible workers
- Ing. Jan Marek, CSc. – textile chemistry, biotechnologies, functional textiles
- Ing. Lenka Martinková – textile chemistry, improvements, functional (nano)materials
- Ing. Viktor Antonov – textile biotechnology

5.2.28. Institute of Applied Biotechnologies a.s.

Služeb 4, 108 52 Praha 10, I.D. 27225712
www.iabio.cz

Brief company characteristics
IAB is involved in research and development in the area of molecular biotechnologies, genomics and the in vitro diagnostics.

Activities in the area of nanotechnologies
Bionanotechnology.

Projects solved in the area of nanotechnologies
- Project of AS CR, the programme "Nanotechnology for the Society", KAN200520801 "Targeted expression and transport of bioactive molecules", 1/2008–12/2012, the researcher is Mgr. David Staněk, Ph.D., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of Institute of Applied Biotechnologies is MUDr. Josef Fišer.

Responsible workers
- Milan Hrouda – Director
- MUDr. Josef Fišer – a member of the Board

5.2.29. KRD–obchodní společnost s.r.o.

Pekařská 12, 155 00 Praha 5, I.D. 26424991

www.krd.cz

Brief company characteristics

A distribution company focussing on sales of instruments, equipment and the molecular biology. The applied biological research is conducted in the own laboratory.

Activities in the area of nanotechnologies

Cooperation in the solution of the programme project. The company offers also quantum dots – fluorescence nanocrystals for the microscopy and detection by Invitrogen (www.invitrogen.com).

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520703 "The use of ultrasound in nanomedicine", 1/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR, Praha, the co-researcher on behalf of KRD is MUDr. Zdeněk Kleibl, Ph.D.

Responsible workers

- Mgr. Viktor Krivjanský – Statutory Representative
- MUDr. Zdeněk Kleibl, Ph.D. – research

5.2.30. LAO – průmyslové systémy, s.r.o.

Na Floře 1328/4, 143 00 Praha 4 – Modřany, I.D. 25705512

www.lao.cz

Brief company characteristics

The laser technologies for cutting, welding, marking, and resolution of customers' systems in the area of nanotechnology and microtechnology. The manufacture of laser machines and laser accessories (optics and optomechanics). They look also after consumable supplies and spare parts, custom-made and single purpose systems, integration in production lines, including automation.

Number of personnel: 8 (2007)

Annual turnover: CZK 60 million (2006)

Activities in the area of nanotechnologies

- Lasers in the UV area and the relevant optical systems, excimer lasers from 157 nm, solid substance lasers from 266 nm, supplies of nanopositioning desks and systems, which are manually or motor controlled.
- Measuring instruments for the area of nanostructures – atomic forces microscopes, optical profile metres, mechanical tip profile metres, ellipsometres, nanoindentors, and supplies of lasers to research workplaces and universities.

Responsible workers

- Ing. Martin Klečka – laser systems for research workplaces, measuring equipment
- Ing. Pavel Kořán – laser technologies for cutting, welding, and marking

5.2.31. LIFETECH s.r.o.

Chládkova 24 c, 602 00 Brno, provozovna Brno, Šumavská 15

www.lifetech

Brief company characteristics

The company was founded in 1997 and it does business in the fields of development, designing, implementation and distribution of ozone generators, UV reactors and other equipment serving for the treatment and purification of water and air and technological systems used for these purposes. The company provides also service. It has started manufacturing its first chemical product in 2006 – the patented preparation BlueSpark®.

Number of personnel: 16

Annual turnover: CZK 18.1 million (2005)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN101630651 "Creation of nano-layers and nano-coatings on textiles with the use of surface plasma treatment under atmospheric pressure", 07/2006–12/2010, the head researcher is prof. RNDr. Mirko Černák, CSc., Masaryk University, PrF, Brno, the co-researcher on behalf of LIFETECH is doc. RNDr. Jiří Dřímal, CSc.

Responsible worker

Doc. RNDr. Jiří Dřímal, CSc. – the owner and Statutory Representative

5.2.32. MEDIHOPE s.r.o.

Address: Dobšická 33, 193 00 Praha 9, I.D. 26710617

Workplace: Mathonova 1, 796 04 Prostějov

www.medihope.cz

Brief company characteristics

MEDIHOPE, s.r.o. was founded in 2002 and it operates magnetic resonance in the region of Olomouc. Thanks to its owners and the needs of the biggest hospital running by the region, this top diagnostic instrument has been placed in Prostějov. The equipment has been in full operations since 1 May 2005.

Number of personnel: 15

Annual turnover: CZK 16.6 (2005)

Activities in the area of nanotechnologies

Research of the utilisation of nanomaterials in the magnetic resonance.

Projects solved in the area of nanotechnologies

– Project of AS CR, the programme "Nanotechnology for the Society", KAN115600801 "New preparation and use technologies related to nanoparticles based on iron oxides for the environmental, industrial and medical applications", 1/2008–12/2012, the researcher is doc. RNDr. Radek Zbořil, Ph.D., Palacky University Olomouc, Faculty of Science, the co-researcher on behalf of MEDIHOPE is prim. MUDr. Pavel Novák.

Responsible worker

- prim. MUDr. Pavel Novák – magnetic resonance

5.2.33. MEGA a.s.

Drahobejlova 1452/54, 190 00 Praha 9, I.D. 44567146

Pod Vinicí 87, 472 27 Stráž pod Ralskem

www.mega.cz

Brief company characteristics

MEGA a.s. was founded in 1992. Its profile and traditions have developed since 1975, when the Czechoslovak Uranium Industry (CSUP) founded an independent organisational unit – the Central CSUP Laboratories. MEGA a.s. is currently a flexible and dynamic enterprise activities of which focus on the following basic areas:

- Purification and treatment of water and industrial solutions, membrane technologies, and the manufacture of ion-exchanging membranes
- Complete supplies and service for PPG products
- Complex services in the area of the environment

The company is divided into 3 divisions: of membrane processes, surface treatment and ecology and cleaning. The research related to nanotechnologies is conducted within the Division of membrane processes.

Number of personnel: 115

Annual turnover: CZK 413.5 (2006)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme "Permanent Prosperity", 2A-3TP1/140 "Ion-exchangeable materials in the form of membranes and nanofibres prepared on the nanotechnological basis", 4/2008–12/2010, the researcher is Ing. Aleš Čmelík.

Responsible worker

- Ing. Libor Nejedlý – Director of the Division

5.2.34. *MEGA SYSTEM spol. s r.o.*

Skyřická 8, 434 01 Most – Velebudice, I.D. 44222343

www.volny.cz/megasystem

Brief company characteristics

The manufacture of water drench systems (dusting off), services in the area of water treatment (filtration stations, treatment of industrial waste water).

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme IMPULS, FI-IM3/061 "Preparation of conducting and semiconducting polymers doped with carbon based nanoparticles and nanotubes", 5/2006–12/2009, the researcher is Mgr. Václav Štengl, Ph.D., Institute of Inorganic Chemistry AS CR, Husinec – Řež, the co-researcher on behalf of MEGA SYSTEM is Ing. Josef Beneš.

Responsible worker

- Ing. Josef Beneš – Statutory Representative

5.2.35. *MESING, spol. s r.o.*

Mariánské náměstí 1, 617 00 Brno, I.D. 25579835

www.mesing.cz

Brief company characteristics

The development, design and manufacture of special custom-made measuring systems controlling the highly precise parts, especially for the automotive and bearing industries, the development and manufacture of special induction sensors, including devices for their controls, calibration measuring devices and, newly, also instruments for the surface defect revelation, and straightening presses.

Number of personnel: 35 (2007)

Annual turnover: CZK 56 million (2006)

Activities in the area of nanotechnologies

Methods and equipment for finding of hardly visible surface defects and errors caused by the finishing technologies. They are based on the dispersed laser light and they are utilised for the automotive and the bearing industries. There are also methods and equipment controlling the highly sensitive sensors, including laser interferometers for the length nanometrology for measuring laboratories of large companies looking after the highly precise manufacture.

Projects solved in the area of nanotechnologies

- Project of MIT FT-TA3/133 "Set of laser interferometers for the length nanometrology", 3/2006–12/2009, the researcher is Ing. Jan Kůr.

Responsible workers

- Ing. Jan Kůr – Statutory Representative of MESING, coordination of works
- Ing. Boris Kůr – surface defectometry
- Ing. Daniel Smutný – surface defectometry
- Ing. Pavel Konečný – equipment controlling sensors and the interferometry for the length nanometrology

5.2.36. MikroChem LKT, spol. s r.o.

Přeseka 52, 376 01 Třeboň, I.D. 49060007

www.mikrochem.cz

Brief company characteristics

MikroChem LKT was founded in 1991 and it has specialised on the area of the environment, especially on the development and applications of special technologies, ecotoxicologic analyses and, in cooperation with AS CR, also on chemical analyses of samples collected in the environment, the development of technologies liquidating hazardous wastes, expert activities and consulting in the area of the environment, removal of brownfields, liquidation of hazardous liquid wastes, and composting of other biologically degradable wastes. A part of the important programme relates also to the development and applications of biodegradable technologies. MikroChem LKT supported, in 2002, especially the area of maintenance works and the liquidation of liquid hazardous wastes. It has been a subsidiary of AWAST a.s. since 2003.

Number of personnel: 22

Annual turnover: CZK 43.5 million (2006)

Activities in the area of nanotechnologies

Cooperation in the solution of projects described below. Cleaning with the use of zero-valent nanoiron.

Projects solved in the area of nanotechnologies

- Project of MIT FT-TA3/077 “Remedy for underground waters using permeable reactive barriers”, 5/2006–4/2010, the researcher is Ing. Josef Kozler, CSc., Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, the co-researcher on behalf of MikroChem LKT is Ing. Karel Koranda.
- Project of MEYS 2B08062 “Genetic and physiological handling of bacterial degradation agents in aromatic pollutants and their utilisation”, 1/2008–12/2011, the researcher is Ing. Miroslav Pátek, CSc., Institute of Microbiology of AS CR, Praha, the co-researcher on behalf of MikroChem LKT is Mgr. Marian Byss.

Responsible worker

- Ing. Karel Koranda – Director

5.2.37. MIKROPUR, s. r. o.

Wonkova 799, 500 02 Hradec Králové, I.D. 60111623

www.mikropur.cz

Brief company characteristics

Research, development and sales of equipment – filtration, membrane separation, microfiltration, nanofiltration, reverse osmosis, centrifugation, analyses of solved and not solved substances, photocatalysis, laboratory filtration equipment, and liquid decontamination.

Number of personnel: 3

Annual turnover: CZK 2 million (2005)

Activities in the area of nanotechnologies

- Development of (nano)filtration equipment
- Laboratory and testing equipment for separation and filtration
- Engineering designs of filtration processes (including nanofiltration) and membrane separations
- Research of the process of photocatalytic destruction of organic pollutants in watery solutions

Projects solved in the area of nanotechnologies

- Project of the 6th FP EU, the Network of Excellence, NanoMemPro "Expanding membrane macroscale applications by exploring nanoscale material properties", 9/2004–8/2008, 13 participants, MIKROPUR cooperates. The targeted solution is the integration of research capacities within the membrane separation, the creation of a strategy for this research and the founding of a non profit organisation European Membrane House serving to this purpose.

Responsible worker

- Ing. Jaroslav Přidal, CSc. – Director

5.2.38. NanoTrade s.r.o.

Mozartova 178/12, 779 00 Olomouc, I.D. 45307971

www.nanotrade.cz

Brief company characteristics

The company was founded in 2004 and it has provided for the applied Research and development in the area of nanotechnologies, promotion of nanotechnologies, research results' promotion, and the manufacture and trading activities.

Number of personnel: 6 (2008)

Annual turnover: CZK 4 million (2006)

Activities in the area of nanotechnologies

The antibacterial silver-based applications, nanotechnological protection of surfaces, and nanotechnologies in the energy industry. It is the founder and a member of the Czech Nanotechnological Cluster.

Results of Research and development in the area of nanotechnologies

The manufacture of antibacterial socks and underwear – the trademark “Nanosilver”.

Responsible worker

- RNDr. Jiří Oborný – Statutory Representative

5.2.39. OlChemIm s.r.o.

Šlechtitelů 241/27, 770 10 Olomouc, I.D. 47154845
www.olchemim.cz

Brief company characteristics

The company was founded in 1992. It is a supplier of reagens for the laboratory research (antibodies, cytokinins, anticytokinins, auxines, and others).

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme “Nanotechnology for the Society” KAN200380801 “Immunonanotechnology for the diagnostics of substances having the hormonal character”, 01/2008–12/2012, the head researcher is prof. Miroslav Strnad, DrSc., Institute of Experimental Botany of AS CR, the co-researcher on behalf of OlChemIm is RNDr. Luděk Fröhlich.

Responsible worker

- RNDr. Luděk Fröhlich – Statutory Representative and the co-owner

5.2.40. OPTAGLIO s.r.o.

Husinec – Řež 199, 250 68 Praha-východ, I.D. 48950076

www.optaglio.cz

Brief company characteristics

Optaglio s.r.o. is a member of the Optaglio Group, together with Optaglio Limited (Great Britain) and Metallic Security (Czech Republic). It is involved in the development and manufacture of top security optic components and holograms. It is about the technology of electron lithography, or the optic holographic recording.

Number of personnel: 45

Annual turnover: CZK 60 million

Activities in the area of nanotechnologies

- Structures suitable for the RFID applications: the development of optic variable hologram components and the relief diffraction structures.
- Design, calculations, optimising, and implementation of relief structures (with the typical resolution 254 000 dpi, the relief depth usually 150–190 nm), custom-made masks (4” substrates, details at least 500 nm).

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme “Nanotechnology for the Society” KAN400100701 “Functional hybrid semiconductor and metal nanosystems with organic substances (FUNS)”, 2007–2011, the researcher is RNDr. Bohoslav Rezek, Ph.D., Institute of Physics of AS CR, Praha, Praha, the co-researcher on behalf of Optaglio is Ing. Libor Kotačka, Ph.D.

Responsible workers

- Ing. Tomáš Těthal, CSc. – Statutory Representative
- Ing. Roman Houha – Director for research and development
- doc. Ing. Vladimír Kolařík, Ph.D. – electron lithography
- Ing. Libor Kotačka, Ph.D. – optics
- Mgr. František Matějka – electron lithography
- Mgr. Svatopluk Kokrhel, Ph.D. – electron lithography
- Dr. Igor Jermolajev, CSc. – theoretical physics, methods of pressing and galvanising
- Prom. fyz. Čestmír Hradečný, CSc. – physics and chemistry

5.2.41. PEGAS NONWOVENS s.r.o.

Přímětická 86, 689 04 Znojmo, I.D. 25478478

www.pegas.cz

Brief company characteristics

The company was founded in 1990 as the exclusively Czech private company. It is involved in the manufacture of non woven textiles. This manufacture has been extended, in 2002, with the manufacture of bi-component non woven textiles based on polypropylene and polyethylene.

Number of personnel: 189

Annual turnover: CZK 4.4 billion (2006)

Activities in the area of nanotechnologies

Utilisation of nanotechnologies in the manufacture of non woven textiles.

Projects solved in the area of nanotechnologies

- Project of MIT 2A-3TP1/126 “Continual plasma and nanoplasma treatments of non-woven textiles”, 4/2008–12/2011, the researcher is Ing. Zdeněk Mečl.

Responsible workers

- Ing. Miloš Bogdan – General Director
- František Klaška, MBA – Technical Director

5.2.42. PIEZOCERAM, s.r.o.

Školní 86, 503 44 Libřice, I.D. 25932888

www.piezoceram.com

Brief company characteristics

The manufacture and testing of piezoceramics – the highly precise piezoceramic transducers, disks, rings, bars, plates, and tubes. There are also piezoceramic materials and microwave dielectric coaxial sensors, dielectric resonators and dielectric substrates manufactured. The majority in the company belongs to the Danish company OLIAC A/S.

Number of personnel: 20

Activities in the area of nanotechnologies

Cooperation in the programme projects described below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN301370701 "Nanostructured macroscopic systems – preparation technology and characterising", 1/2007–12/2011, the researcher is prof. RNDr. Miroslav Hrabovský, DrSc., Palacky University Olomouc, Faculty of Science, the co-researcher on behalf of PIEZOCERAM is Ing. Miroslav Boudyš, CSc.
- Project of MIT 2A-1TP1/092 "Research of preparation of nanoforms of layered piezoelectrics for the implementation of the high temperature ultrasonic transducers manufacture", 7/2006–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D., STARMANS electronics, s.r.o., Praha, the co-researcher on behalf of PIEZOCERAM is Bořivoj Tylš.

Responsible worker

- Ing. Miroslav Boudyš, CSc. – Statutory Representative

5.2.43. Proteix s.r.o.

Nad Safinou II 365, Vestec, 252 42 Jesenice, I.D. 27386091

www.proteix.cz

Brief company characteristics

The company was founded in 2005 and it manufactures highly pure and biologically active recombinant proteins.

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520702 "Nanoimmunosensors detecting cytokines", 1/2007–12/2011, the researcher is Ing. Peter Šebo, CSc., Biotechnology Institute of AS CR, Praha, the co-researcher on behalf of Proteix is Ing. Jiří Špička.

Responsible worker

- Ing. Jiří Špička – Statutory Representative

5.2.44. RADANAL s.r.o.

Okružní 613, 530 03 Pardubice, I.D. 49813994

www.radanal.cz

Brief company characteristics

The company was founded in 1993. It has been active in the field of application of gas and liquid chromatography for studies and monitoring of impacts of natural substances, especially vitamins and other antioxidants, on the behaviour, aging, look, and the mental and physical performance. The company conducts its own research activities the priority of which belongs to the development of analytical methods allowing the monitoring of nutrition impacts on the human aging and physical and mental performance. It deals also with the research of antibacterial effects of silver.

Number of workers: 6

Annual turnover: CZK 10.2 million (2006)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN208130801 "New constructions and use of nanobiosensors and nanosensors in medicine (NANOSEMED)", 01/2008–12/2012, the head researcher is Ing. Jaromír Hubálek, Ph.D., Brno University of Technology, Faculty of Electrical Engineering and Communication, the co-researcher on behalf of RADANAL is doc. Ing. Aleš Horna, CSc.

Responsible workers

- doc. Ing. Aleš Horna, CSc. – the owner, research in the area of analytical chemistry, spectroscopy

5.2.45. REFLEX s.r.o.

Novodvorská 994, 142 21 Praha 4 – Braník, I.D. 25082124

www.reflex-co.cz

Brief company characteristics

The design, development and manufacture of precise X-rays instruments for industrial and research purposes. REFLEX is a subsidiary of the British company Bede plc.

Annual turnover: CZK 16 million (2004)

Activities in the area of nanotechnologies

Cooperation in the below described programme projects.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA3/112 "X-ray multilayer mirrors replication technology", 4/2006–12/2009, the researcher is doc. Ph.Dr. Ing. Ladislav Pína, DrSc.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN300100702 "Creation of nanostructures by X-ray lasers", 1/2007–12/2012, the researcher is Ing. Bedřich Rus, Dr., Institute of Physics of AS CR, Praha, the co-researcher on behalf of REFLEX is doc. Ph.Dr. Ing. Ladislav Pína, DrSc.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN401220801 "Nanostructures of Controlled Size and Dimensions“, 1/2008–12/2012, the researcher is Ing. Anton Fojtík, CSc., Czech Technical University in Praha, Faculty of Nuclear and Physical Engineering, the co-researcher on behalf of REFLEX is doc. Ph.Dr. Ing. Ladislav Pína, DrSc.

Responsible worker

- doc. Ph.Dr. Ing. Ladislav Pína, DrSc. – Statutory Representative

5.2.46. ROKOSPOL a.s.

Dolní Valy 893, 688 01 Uherský Brod, I.D. 25521446

Manufacturing plant: Kaňovice 101, 763 41 Biskupice u Luhačovic

www.rokospol.cz

Brief company characteristics

The Czech manufacturer of construction materials and paints. The own research and development.

Number of personnel: 90 (2007)

Annual turnover: CZK 230 million (2005)

Activities in the area of nanotechnologies

The utilisation of nanoparticles in construction materials and paints for the improvement of their utility properties.

Results of research and applications in the area of nanotechnologies

Paints Detoxy Color with the content of photocatalyticly active nanoparticles which can liquidate hazardous chemicals in the air. This product has been the result of the joint research and development with UACH AS in Řež.

Projects solved in the area of nanotechnologies

- Project of MIT FI-IM4/175 "Research and development of a dispersion carrier in the non conducting environment for the new series of environmentally friendly paints", 4/2007–10/2009, the researcher is Ph.Dr. Antonín Kočař, CSc.
- Project of MIT, the programme IMPULS, FI-IM5/231 "Implementation of new nanostructures in nanodispersions of Ti, Cd, and Zn oxido-bisulphides as the active materials for the degradation of chemical weapons", 6/2008–12/2010, the researcher is Mgr. Václav Štengl, Ph.D., Institute of Inorganic Chemistry AS CR, Husinec – Řež, the co-researcher on behalf of ROKOSPOL is Ph.Dr. Antonín Kočař, CSc.

Results/cooperation

ROKOSPOL a.s. has finished the development of the product **Detoxy Color** that causes the reduction of air pollutants by the photocatalytic reaction. The invention of this substance has been the achievement of long efforts of the expert team in the Institute of Inorganic Chemistry of AS CR, Husinec – Řež, and ROKOSPOL a.s. in the area of reduction of toxic and hazardous substances in the environment. The substance has been verified both under laboratory and under practical conditions and passed the test of practical effectiveness. It is about the utilisation of spheric nanodispersion particles of TiO_2.[13]

Responsible workers

- Ph.Dr. Antonín Kočař, CSc. – Chairman of the Board
- Ing. Pavel Kaszonyi – General Director

5.2.47. SEVAPHARMA a.s.

Průmyslová 1472/11, 102 19 Praha 10 – Hostivař, I.D. 25107305

www.sevapharma.cz

Brief company characteristics

It is a manufacturer of immunology preparations – diagnostic and hyposensitive allergens, normaliser of the weakened immunity Immodin, bacterial and virus vaccines, mostly of those utilised within the compulsory vaccination of children. The company finalises pharmaceutical products on order by other subjects.

Number of personnel: 157

Annual turnover: CZK 157 million (2006)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

13 Štengl, V.: "Kouzelný oxid titaničitý" (Magic titanium oxide), Vesmír, 87, 6/2008, p. 402.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society", KAN200520704 "New nanoparticles for the ultrastructural diagnostics", 01/2007–12/2011, the researcher is doc. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of SEVAPHARMA is RNDr. Marek Moša, Ph.D.

Responsible workers

- Ing. Tibor Bílý – General Director
- Ing. Lubomil Vrba – Director

5.2.48. SHM, s. r. o.

Průmyslová 3, 787 01 Šumperk, I.D. 47976519

www.shm-cz.cz

Brief company characteristics

The coating centre, applications of wear resistant layers, especially on cutting, forming, pressing, or shearing tools. The preparation of nanostructured and nanocrystalline PVD coats.

Number of workers: 54 (2007)

Annual turnover: CZK 68 million (2006)

Activities in the area of nanotechnologies

Research and development of nanostructured wear resistant layers prepared by the PVD technologies, the development and design of equipment for the preparation of nanostructured PVD layers.

Projects solved in the area of nanotechnologies

None has been found.

Results of research and applications in the area of nanotechnologies

- Applications of nanostructured coats on more than 3 million exchangeable cutting tips and 100 thousand axial tools.
- Manufacturing implementation and sales of nanocomposite layers developed by SHM within the project of the 6th FP EU MACHERENA "New tools and processes for improving machining of heat resistant alloys used in aerospace applications", 1/2004–6/2007.

Responsible workers

- Mojmír Jílek – development of coating technologies
- RNDr. Pavel Holubář – development of coats
- RNDr. Michal Šíma – development of coats
- Ondřej Zindulka – development of coating technologies and coats

5.2.49. Solartec s. r. o.

Televizní 2618, 756 61 Rožnov pod Radhoštěm, I.D. 49610040

www.solartec.cz

Brief company characteristics

The company was founded in 1993 by research and development workers of the former Tesla. The company specialises on the photovoltaic area and apart from the manufacture of solar cells from the nanocrystalline silicon and panels, it is involved also in the designing and implementations of photovoltaic systems and power stations (FVS, FVE), supplies of photovoltaic panels and components, the solutions of industrial application feeding, and power deliveries to not yet electrified places.

Number of workers: 77

Annual turnover: CZK 147 million (2006)

Activities in the area of nanotechnologies

Cooperation in the solution of the project presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN100500652 "Heterogenous organic and hybrid nanocomposite materials for solar cells", 07/2006–12/2010, the head researcher is RNDr. Jiří Pfleger, CSc., Institute of Macromolecular Chemistry of AS CR, the co-researcher on behalf of Solartec is Dr. Ing. Aleš Poruba, Dr.

Responsible workers

- Ing. Jaromír Řehák – General Director
- Dr. Ing. Aleš Poruba, Dr. – development

5.2.50. SPOLSIN, spol. s r.o.

Moravská 1078, 560 02 Česká Třebová, I.D. 62063545

www.spolsin.cz

Brief company characteristics

Research, development and the manufacture of technical textiles (fabrics and knitting) with barrier properties focussed mainly on the protection of people and materials. The company participates in the verification of manufacturing possibilities and in looking for suitable applications for nanomodified fibres, nanofibre materials respectively.

Number of workers: 80 (2007)

Annual turnover: CZK 75 million (2006)

Activities in the area of nanotechnologies

The development of barrier textiles with high UV resistance or antimicrobial modification, etc.

Projects solved in the area of nanotechnologies

- Project of the programme EUREKA E!3778, MANGO "Managing Contamination by Fibrous Product Systems", 1/2007–1/2010, the coordinator/researcher is VTT – Technical Research Centre of Finland, 10 participants, SPOLSIN is the co-researcher.

Results of Research and development in the area of nanotechnologies

- Finished product: barrier textiles with higher UV radiation resistance

Responsible workers

- Ing. Karel Šanda – Executive Director
- Ing. Zdeňka Ledrová – Research and Development Manager

5.2.51. STARMANS electronics, s.r.o.

V Zahradách 24, 180 00 Praha 8, I.D. 49705733

www.starmans.net

Brief company characteristics

It is the company supplying engineering services involved in the development and manufacture of industrial ultrasound systems, especially the ultrasound probes, thickness metres, defectoscopes and automated measuring defectoscopic lines.

Number of workers: 40

Annual turnover: CZK 99 million (2005)

Activities in the area of nanotechnologies

Coordination of research works conducted within the projects presented below.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA4/126 "Research of semiconducting nanotubes for the implementation of cold-emission parts", 1/2007–12/2010, the researcher is Ing. Stanislav Štarman, Ph.D.
- Project of MIT, the programme "Permanent Prosperity" 2A-1TP1/092 "Research of preparation of nanoforms of layered piezoelectrics for the implementation of the high temperature ultrasonic transducers manufacture", 7/2006–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D.
- Project of MIT, the programme "Permanent Prosperity", 2A-2TP1/147 "Research of semiconductive nanotubes for the implementation of photoelectric components", 5/2007–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D.

Responsible worker

- Ing. Stanislav Štarman, Ph.D. – Statutory Representative

5.2.52. STAVEBNÍ CHEMIE SLANÝ a.s.

(Constructional Chemistry Ltd.)

U Ploché dráhy 294, 274 01 Slaný, I.D. 46357084

www.stavebni-chemie.cz

Brief company characteristics

The company was founded in January 1994. It has been involved in the manufacture of dyes and special paints for the construction industry and reconstruction of historical sites, including the hydroinsulation materials for the insulation of brickworks against wetness and hydroinsulation under facing materials.

Number of workers: 79

Annual turnover: CZK 140 million (2006)

Activities in the area of nanotechnologies

Cooperation in the project presented below.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA4/064 “Paints fulfilling the new environmental requirements of EU”, 7/2007–12/2010, the researcher is Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, the co-researcher on behalf of STAVEBNÍ CHEMIE SLANÝ is Ing. Michael Koudelka

Responsible workers

- Pavel Vácha – Director and the Chairman of the Board
- Ing. Michael Koudelka – Technical Director

5.2.53. TELURIA, spol. s r.o.

Skrchov 1, Post Code: 679 61 Letovice, I.D. 43420371

www.teluria.cz

Brief company characteristics

The manufacturer of paints, including brick and concrete paints, lacquers, glazing paints, and enamels suitable for wood or as the primers or final paints applied on metals, wood stains, and glues for floor coverings, gluing of cork, polystyrene, wallpaper, and other materials. The company makes a part of Barvy a laky, a.s. The development department of the company is involved mainly in the development of suitable connective materials, fills and additives for the preparation of brick and concrete paints and for the preparation of paint samples and testing of properties of brick and concrete paints.

Number of workers: 130

Annual turnover: CZK 173 million

Activities in the area of nanotechnologies

The development of the brick and concrete paint containing the photocatalyticly active titanium whites.

Projects solved in the area of nanotechnologies

- Project of MIT, the programme TANDEM, FT-TA4/025 "Nanomaterials of the new generation and their industrial applications", 3/2007–12/2010, the researcher is Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, the co-researcher on behalf of TELURIA, spol. s r.o., is Ing. Luboš Mrázek.
- Project of MIT, the programme "Permanent Prosperity", FT-TA4/064 "Paints fulfilling the new environmental requirements of EU", 7/2007–12/2010, the researcher is Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, the researcher on behalf of Teluria is Ing. Jaroslav Prudil.

Responsible worker

- Ing. Luboš Mrázek – Director

5.2.54. TESCAN, s.r.o.

Libušina tř. 21, 623 00 Brno, I.D. 41600240

www.tescan.com/cz

Brief company characteristics

The development and manufacture of imaging and analytical equipment based on the use of focussed beams of charged particles.

Number of workers: 85 (2007)

Annual turnover: CZK 234 million (2006)

Activities in the area of nanotechnologies

The development and manufacture of instruments used for the visualisation and analyses of nanoobjects, the nanomanufacturing by an ion beam, and nanomanipulation.

Projects solved in the area of nanotechnologies

- Project of the 6th FP EU, an integrated project, NanoHand "Micro-Nano System for Automatic Handling of Nano Objects". The project is focussed on the system integration of research and preparation of nanoobjects, 6/2006–5/2009, 10 participants. TESCAN is a partner. Additional information are available at www.nanohand.eu.
- Project MIRA – the own development and manufacture implementation of high resolution REM with the Schottky's cathode.
- Project LYRA – the own development and manufacture implementation of the equipment with the focussed electron and ion beam for the visualisation, analyses, and preparation of nanoobjects.

Results of Research and development in the area of nanotechnologies

- MIRA – the manufacture and sales of the second generation high resolution REM, the cooperation with the Charles University in Praha
- LYRA – the completion of the development of a prototype, the cooperation with the Swiss research institute EMPA
- 3D Live – the patent application related to the system for 3D imaging of nanoobjects

Responsible worker

- Ing. Jaroslav Klíma – Executive Director

5.2.55. TOP-BIO, s.r.o.

Jordana Jovkova 3262, 143 00 Praha 4, I.D. 64578895

www.top-bio.cz

Brief company characteristics

The Czech manufacturer of chemical agents for biochemistry with the stress put on the complex delivery of high quality reagens for the amplification of DNA fragments with the assistance of polymerisation chain reaction (PCR). The manufacturer for the fast isolation of RNA from cells, tissues and body liquids and reserve transcription of RNA to cDNA.

Number of workers: <5

Annual turnover: CZK 6 million (2005)

Activities in the area of nanotechnologies

Cooperation in the solution of projects presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520701 "Nano-PCR – the ultrasensitive test detecting specific proteins in body fluids", 1/2007–12/2011, the researcher is RNDr. Petr Dráber, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of TOP-BIO is Marek Dráber, MBA.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520703 "The use of ultrasound in nanomedicine", 1/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR, Praha, TOP-BIO is the co-researcher.

Responsible worker

- RNDr. Petr Dráber, DrSc. – Statutory Representative

5.2.56. TTS, s. r. o.

Novodvorská 994, 142 21 Praha 4, I.D. 48026395

www.tts-co.eu

Brief company characteristics

The development and manufacture of specialised in the vacuum applied metallic and dielectric layers of the thickness from 2 nm and applications in microelectronics, X-ray optics, sensors, etc., and the ion etching of sputtered layers.

Number of workers: 5 (2007)

Annual turnover: CZK 4 million (2006)

Activities in the area of nanotechnologies

Special depositing methods allowing the preparation of thin layers and multilayers of the sub nanometric structures and layer thickness from 2 nm.

Projects solved in the area of nanotechnologies

- Project of MIT FT-TA2/018 "High-tech energy beams technologies for deposition and treatment of films for electronics", 1/2005–12/2008, the researcher is Ing. Karel Štrobl, ELCERAM a.s., Hradec Králové, the co-researcher on behalf of TTS is RNDr. Jaroslav Merta, CSc.
- Project of MIT FT-TA3/112 "X-ray multilayer mirrors replication technology", 4/2006–12/2009, the researcher is doc. Ing. Ladislav Pína, DrSc., REFLEX, s.r.o., Praha, the co-researcher on behalf of TTS is RNDr. Jaroslav Merta, CSc.

Expert/field

- Ing. Jaromír Mirovský – vacuum sputtering of layers

5.2.57. VIDIA spol. s r.o.

Nad Safinou II č. 365, Vestec, 252 42 Jesenice u Prahy, I.D. 16556267

www.vidia.cz

Brief company characteristics

The Czech manufacturer of diagnostic sets determined for the diagnostics of herpetic viruses and antibodies or other biomarkers for research purposes, the construction of ELISA tests, their development and optimising, custom-made syntheses of peptides for the human and veterinary medicine and for research in the areas of biochemistry, pharmacology, and immunology.

Number of workers: 25

Annual turnover: CZK 25 million

Activities in the area of nanotechnologies

Cooperation in the solution of projects presented below.

Projects solved in the area of nanotechnologies

- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520701 "Nano-PCR – the ultrasensitive test detecting specific proteins in body fluids", 1/2007–12/2011, the researcher is RNDr. Petr Dráber, DrSc., Institute of Molecular Genetics of AS CR, Praha, the co-researcher on behalf of VIDIA is Ing. Michaela Poláková.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN200520702 "Nanoimmunosensors detecting cytokines", 1/2007–12/2011, the researcher is Ing. Peter Šebo, CSc., Biotechnology Institute of AS CR, Praha, the co-researcher on behalf of Vidia is RNDr. Luděk Lepša, Ph.D.
- Project of AS CR, the programme "Nanotechnology for the Society" KAN200670701 "Surface plasmon resonance biosensors and protein chips for the medical diagnostics", 1/2007–12/2011, the researcher is Ing. Jiří Homola, CSc., Institute of Photonics and Electronics of AS CR, Praha, the co-researcher on behalf of VIDIA is MUDr. Pavel Jinoch.

Responsible workers

- Ing. Michaela Poláková – Statutory Representative
- MUDR. Pavel Jinoch – Director
- RNDr. Luděk Lepša, Ph.D. – researcher

6. ANALYSIS OF THE FINANCIAL SUPPORT OF THE RESEARCH OF NANOTECHNOLOGIES IN 2008

As it has been mentioned in Chapter 3, research and development of nanotechnologies is supported in the Czech Republic in the form of research plans and in the form of programme projects. Programme projects are mostly funded in relation to their purposes and allow thus the differentiation of the research of nanotechnologies from research done in other areas of science and technology (with the exception of the research in the molecular biology, where the differentiation is very difficult), while research plans are funded institutionally and estimates of the share of the research of nanotechnologies in the solution of issues within research plans are mostly very difficult. Research plans, as it results from the Government Directive No. 462/2002 Coll., § 4, serve organisations mostly for the coverage of personal costs, costs of equipment and operational costs (materials, stock, etc.), costs of services, travel expenses, the international co-operation and overheads. In most cases, research plans are thus designed very broadly and estimates of the shares of the Research focussing on nanotechnologies are thus arguable. In the case of research plans, we have thus utilised only the main areas from the nomenclature in **Table No. II**.

6.1. RESEARCH PLANS

There have been 58 research plans identified. They completely or partly focus on nanotechnologies. The Academy of Sciences of the Czech Republic is the provider for 26 plans, while MEYS provides for 28 plans and the Ministry of Health (MH) for 4 plans. The funds allocated to each plan in 2008 have been found in the central register of research plans (CEZ). They have been adjusted in accordance with the estimated share of the research of nanotechnologies (they accompany the text of each research plan). Only five plans are fully focussed on nanotechnologies in the opinion of the authors.

The allocated funds by their providers are presented in **Table No. IV**. The allocated funds by the main fields are presented in **Table No. V**.

Table No. IV – Funds allocated to the research of nanotechnologies in the Czech Republic within research plans by providers in 2008

	Number of plans	Total, in million CZK	From the State Budget in million CZK
AS CR	26	755.580	755.800
MEYS	28	295.419	278.309
MH	4	7.919	7.919
Total	58	1058.918	1041.808

Table No. V – Funds allocated to the research of nanotechnologies in the Czech Republic within research plans by main fields in 2008

Main field	Total, in million CZK	From the State Budget in million CZK
1 - Nanomaterials	156.086	153.091
2 - Nanoelectronics, photonics, spintronics	36.595	36.595
3 - Nanobiotechnology, nanomedicine	240.733	240.586
4 - Sensors	0	0
5 - Nanotechnologies in chemistry	23.031	23.031
6 - Long-term (basic) research (6b – Nanophysics) (6d – Nanochemistry)	537.253 (409.882) (127.371)	523.285 (395.914) (127.371)
7 - Technologies and equipment, analytics (7a - Analytical equipment and methods) (7c - Layers – preparation equipment and methods)	65.220 (51.445) (13.775)	65.220 (51.445) (13.775)
Total	1058.918	1041.808

6.1.1. Partial conclusions

1) The analysis shows that there was CZK 1 058.9 million allocated in 2008 to the research of nanotechnologies within research plans, thereof CZK 1 041.8 million from the state budget – 98.4 % of the total sum.
2) In spite of the fact that AS CR and MEYS support almost an equal number of plans with institutional funds, the funds allocated by AS CR to its institutes are higher by 60 %, when compared with MEYS. This is mainly because of the sizes of the AS CR institutes and because of their specific focuses.
3) Only five research plans fully (100 %) focus on nanotechnologies in the authors' opinion. They are the following plans:
   - Institute of Physics of AS CR, AV0Z10100520 "Specific phenomena in condensed systems with reduced space dimension and disrupted symmetry", 1/2005–12/2010, the researcher is prom. fyz. Milada Glogarová, CSc.
   - Institute of Physics of AS CR, AV0Z10100521 "Physical properties and the preparation of nanostructures, surfaces and thin layers", 1/2005–12/2010, the researcher is RNDr. Antonín Šimůnek, CSc.
   - Brno Technical University, FSI, MSM0021630508 "Inorganic nanomaterials and nanostructures: preparation, analysis, and properties", 1/2005–12/2010, the researcher is prof. RNDr. Jaroslav Cihlář, CSc.
   - VSB TU Ostrava, CNT, MSM6198910016 "Synthesis, structure and properties of nanomaterials based on intercalated sheet silicates and ferromagnetics", 1/2005–12/2011, the researcher is prof. Ing. Jaromír Pištora, CSc.
   - COMTES FHT, s.r.o., Dobřany, MSM2631691901 "Metal materials with the structure in the sub micron or nanometric seales prepared by the intensive plastic deformation", 1/2004–12/2009, the researcher is prof. Ing. Jozef Zrník, CSc.

Other research plans focus on the research of nanotechnologies from 3 to 70 %.

4) The Institute of Physics of AS CR has been allocated the most funds from the public sources in 2008 for the research of nanotechnologies – CZK 281.473 million, i.e. 26.6 % of the total finance allocated in 2008 to research plans.
5) In the opinion of the authors of this publication, 50.7 % of the total sum allocated to the research of nanotechnologies has been related to the long-term basic research organised within nanophysics and nanochemistry, 22.8 % to the research of nanobiotechnology and nanomedicine, and 14.7 % to the research of nanomaterials. It means that 88.1 % of all finance allocated to research plans in 2008 was directed to these five fields.

6.2. PROGRAMME PROJECTS

There are 229 programme projects in the total focussing on the research of nanotechnologies in the Czech Republic in 2008. Their total budget is CZK 793.254 million, thereof CZK 646.491 million (81.5 %) is contributed from the state budget. The support from the state budget is provided by AS CR, GA CR, MEYS, and MIT within 16 programmes. When it comes to the topical focus of the solved projects, almost all programmes utilise the bottom-up method, which assumes that the project's focus is up to the proposing party. Only the programme of AS CR "Nanotechnology for the Society", and partly the programme of MIT "Permanent Prosperity", presented the projects' proposing parties with priorities on which they should focus.

6.2.1. Programmes of the Academy of Sciences of the Czech Republic

AS CR supports the research of nanotechnologies within the four following programmes:

- Nanotechnology for the Society (KA)
- Support of targeted research projects (1Q)
- Grants with the distinct exploratory character focussing on the area of research developed at this time mostly in AS CR (IA)
- Junior exploratory grants (KJ)

Table No. VI shows that the programme "Nanotechnology for the Society" is the dominant one. Research teams get through this programme almost a half of all funds (48.4 %) allocated by all providers to the research of nanotechnologies from the state budget of the Czech Republic. Projects solved within the other three programmes have smaller scopes and have the character of the basic research. They are usually solved by a single researcher.

Table No. VI

Program	Number of projects	Total, in million CZK	From the state budget, in million CZK	Share in %
KA	38	358.284	313.076	87.4
1Q	5	7.995	7.995	100
IA	28	22.897	22.897	100
KJ	9	3.772	3.772	100
Total	80	392.948	347.740	88.5

We will pay a special attention to the programme "Nanotechnology for the Society" because of its importance for the research of nanotechnologies.

6.2.1.1. PROGRAMME "NANOTECHNOLOGIES FOR THE SOCIETY"

As mentioned in the sub Chapter 3.1.2.1.1., the provider – Academy of Sciences of CR – has announced the four following sub programmes:

1) Sub programme "Nanoparticles, nanofibres and nanocomposite materials"
2) Sub programme "Nanobiology and nanomedicine"
3) Sub programme "Nano-macro interface"
4) Sub programme "New phenomena and materials for nanoelectronics"

These sub programmes correspond, according to the nomenclature in **Table No. II**, with the areas 1, 3, 7, and 2. The funds allocated by providers to the projects solved within the mentioned sub programmes in 2008 are presented in **Table No. VII**.

Table No. VII

Sub programme	Number of projects	Total, in million CZK	From the state budget, in million CZK	Share in %
1	8	56.784	45.790	80.6
2	14	162.482	136.426	84.0
3	6	57.686	52.102	90.3
4	10	81.332	78.758	96.8
Total	38	358.284	313.076	87.4

The **Table No. VII** shows that the most finance is contributed to the sub programme 2 (45.3 % of the total funds allocated to the programme), then to the sub programme 4 (22.7 %), while the rest is almost equally distributed between the sub programmes 1 and 3.

The share of state contributions grows in accordance with the programme conditions, from the sub programme 1 to the sub programme 4. The practically useful results are expected especially from the resolved projects in the sub programmes 1 and 2.

The average project budget in the programme "Nanotechnology for the Society" in 2008 is CZK 9.430 million (the total funds). The four following projects in the sub programme 2 deviate from this average, when it comes to their financial costs:

- KAN200200651 "Nanoparticle and supramolecular systems for the targeted transport of medication", 07/2006–12/2010, the head researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, CZK 17.905 million, 10 co-researchers.
- KAN200520703 "The use of ultrasound in nanomedicine", 01/2007–12/2011, the head researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR, Praha, CZK 16.550 million, 8 co-researchers.
- KAN200520704 "New nanoparticles for the ultrastructural diagnostics", 01/2007–12/2011, the researcher is doc. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics of AS CR, Praha, CZK 17.699 million, 4 co-researchers.

- KAN200520801 “Targeted expression and transport of bioactive molecules”, 01/2008–12/2012, the head researcher is Mgr. David Staněk, Ph.D., Institute of Molecular Genetics of AS CR, Praha, CZK 15.718 million, 3 co-researchers.

The following 2 projects in the sub programme 3 have got the biggest budget:

- KAN301370701 “Nanostructured macroscopic systems – preparation technology and characterising”, 01/2007–12/2011, the researcher is prof. RNDr. Miroslav Hrabovský, DrSc., Palacky University Olomouc, Faculty of Science, CZK 21.079 million, 2 co-researchers.
- KAN300100801 “Multifunctional metallic bulk materials with nanocrystalline and ultrafine grain structures”, 01/2008–12/2012, the head researcher is prof. Ing. Pavel Lejček, DrSc., Institute of Physics of AS CR, Praha, CZK 16.892 million, 3 co-researchers.

The following project in the sub programme 4 has got decisively the biggest budget:

- KAN400100701 “Functional hybrid semiconductor and metal nanosystems with organic substances (FUNS)”, 01/2007–12/2011, the researcher is RNDr. Bohuslav Rezek, Ph.D., Institute of Physics of AS CR, Praha, CZK 29.351 million, 4 co-researchers.

Individual projects in the programme “Nanotechnology for the Society” have been assigned numbers and letters, according to the nomenclature in **Table No. II**. The result of this analysis is presented in **Table No. VIII**. The **Table No. VIII** presents some interesting information:

- The biggest number of projects and the biggest volume of funds concentrate in the areas 1 (nanomaterials) and 3 (nanobiotechnology and nanomedicine),
- There are together with the area 2 (nanoelectronics and photonics) 31 projects, i.e. 81.6 % of all programme projects (*however, they are 3 areas of 4 ones and it is thus not too surprising*),
- The level of the state support is high in the case of all projects (88.85 %). The highest one is, surprisingly, in the area 2 – nanobiology and nanomedicine (95.5 %),
- When it comes to the specific focuses of the projects in individual programme areas, the most projects and funds concentrate on the research of nanopowders, nanofibres, etc., on the research of nanolayers, the research of the controlled transport of medication, on nanodiagnostics, and on the research of nano and mesoscopic systems,
- Projects in the programme completely ignore nanotechnologies in the area of engineering chemical technologies,
- The programme projects also ignore the health, ethical and social aspects of nanotechnologies.

However, we must stress that this analysis relates to the year 2008 and the situation in future years could be different.

Table No. VIII

Nomenclature	Number of projects	Total, in million CZK	From the state budget, in million CZK	Share in %
1a	5	32.812	27.477	
1d	4	42.773	36.855	
1e	1	16.892	15.103	
1f	1	1.503	1.403	
1g	3	8.878	6.866	
Total 1	**14**	**102.858**	**87.704**	**85.2**

2a	2	16.726	16.226	
2c	1	12.116	11.000	
2d	1	10.190	10.190	
2e	1	7.874	7.387	
Total 2	**5**	**46.906**	**44.803**	**95.5**
3b	2	33.623	28.138	
3c	1	8.054	6.808	
3d	2	30.845	26.903	
3e	3	18.624	15.728	
3g	4	43.893	37.487	
Total 3	**12**	**135.039**	**115.064**	**85.2**
4a	1	10.828	9.084	
4b	2	14.875	12.642	
Total 4	**3**	**25.703**	**21.726**	**82.8**
5	0	0	0	
Total 6c	**2**	**38.402**	**35.043**	**91.2**
7b	1	6.383	6.043	
7c	1	2.993	2.693	
Total 7	**2**	**9.376**	**8.736**	**93.2**
TOTAL	**38**	**358.284**	**313.076**	**88.8**

6.2.2. Programmes by the Grant Agency of CR

GA CR supports research of nanotechnologies with the three following programmes:

- Standard grants (GA)
- Post doctorate projects (GP)
- EUROCORES (GE)

The review of funds allocated to researchers in 2008 is presented in **Table No. IX**.

In 2008, GA CR supports in the programme "Standard Grants" 3–4-year long, exceptionally 5 years long, projects focussed on the basic research with the 100% subsidy of the average value of CZK 1 million (it provides subsidies within the range from CZK 0.169 to CZK 2.595 million in 2008).

The solved projects cover, with a varied intensity, all areas of the nomenclature.

- They are 15 projects in the area 1 (nanomaterials), thereof 5 projects in the sub area 1a and 4 projects in the sub area 1d.
- They are 4 projects in the area 2 (nanoelectronics and photonics), thereof 3 projects in the sub area 2d.
- They are 8 projects in the area 3 (nanobiotechnology), thereof 8 projects in the sub areas 3c, 3d, 3e, 3f, and 3g.
- It is 1 project in the area 4 (sensors) in the sub area 4a.
- They are 7 projects in the area 5 (nanotechnologies for chemistry), thereof 3 projects in the sub area 5b and two ones in the sub areas 5a and 5c.
- They are 16 projects in the area 6 (nanophysics and nanochemistry), thereof 2 projects in the sub area 6a, 7 projects in 6b, 1 project in 6c, 4 projects in 6d, and 2 projects in 6e.

- They are 7 projects in the area 7 (instruments, methods, and technologies), thereof 3 projects in the sub area 7b, 2 projects in 7c and 1 project in 7a and 1 project in 7d.

No projects have been focussing on the sub areas 2a, 2c, 2f, 3a, 3b, 4b, 5d, 5e, 7e, and 8. The above information shows that projects of the basic research character supported by GA CR within the programme GA, but also within the programmes GP and GE are very diverse, have limited scope, and thus also limited importance. With some exceptions, one project is solved by a sole researcher. Ambitious objectives of most projects cannot be successfully completed within the expected period with the allocated funds. The clear problem of the nanotechnological research by GA CR is the non existence of the beforehand determined priorities on which the researchers would have to concentrate.

Table No. IX

Programme	Number of projects	Total, in million CZK	From the state budget, in million CZK	Share in %
GA	58	58.949	58.949	100
GP	9	3.135	3.135	100
GE	3	3.579	3.579	100
Total	70	65.663	65.663	100

6.2.3. Programmes by the Ministry of Education, Youth and Sport of CR

MEYS supports research of nanotechnologies with the six following programmes:

- Research Centres (1M)
- Basic Research Centres (LC)
- Healthy and High Quality Life (2B)
- EUREKA (OE)
- COST (OC)
- Contact (ME)

The review of funds allocated to the researchers in 2008 is presented in **Table No. X**.

6.2.3.1. PROGRAMMES 1M AND LC

In 2005, there were activities of the so-called research centres started with the support by MEYS. They have been founded for the solution of different scientific and technological problems. Their founding is considered an important contribution to the Czech science, research and development.

Research centres 1M focus mostly on the applied research and development, while the centres of the LC kind focus on the basic research. The centres 1M were founded in two stages and their activities should terminate in 2009. The centres LC were founded in three stages and the last centres should finalise their activities in 2011.

There are currently 36 centres 1M and 51 centres LC developing research activities. We found, when the objectives of the centres were analysed, that 8 centres 1M and 8 centres LC were fully or partly focussing on the research of nanotechnologies. In the opinion of the authors of this publication, the following centres fully focus on the research of nanotechnologies:

- 1M0512 **"Research centre of powdered nanomaterials"**, 1/2005–12/2009, the head researcher is prof. RNDr. Miroslav Mašláň, CSc., Palacky University Olomouc, the total costs in 2008 equal CZK 17.500 million, thereof CZK 15.750 million from the state budget, the nomenclature 1a.

  The co-researchers:

  - Textilní zkušební ústav, s. p. (Institute of Textile Testing), Brno, RNDr. Pavel Malčík
  - Institute of Physics of Materials of AS CR, Brno, Ing. Oldřich Schneeweiss, DrSc.
- 1M0577 **"Research centre of nanosurface engineering"**, 1/2005–12/2009, the head researcher is Ing. František Peterka, Ph.D., ATG s.r.o., Praha, the total costs in 2008 equal CZK 16.210 million, thereof CZK 14.587 million from the state budget, the nomenclature 1d.

  The co-researchers:

  - Technical University in Liberec, Ing. Aleš Kolouch, Ph.D.
  - University of Chemical Technology in Praha, doc. Ing. Josef Krýsa, Dr.
  - J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, RNDr. Jaromír Jirkovský, CSc.
  - Institute of Inorganic Chemistry of AS CR, Husinec – Řež, Ing. Jan Šubrt, CSc.

Table No. X

Program	Number of projects	Total, in million CZK	From the state budget, in million CZK	Share in %
1M	8	74.138	66.309	89.4
LC	8	55.076	49.741	90.3
2B	4	17.702	15.934	88.3
OE	2	6.342	2.379	37.5
OC, ME	21	10.768	8.023	74.5
Total	43	164.026	142.386	86.6

6.2.3.2. OTHER PROGRAMMES

Three projects solved within the programme 2B started in 2006 and should finalise in 2010 or 2011. They focus on the sub areas 3d, 3g, and 6d. One project, started in 2008, relates to the utilisation of nanofibres in the preparation of systems for purification of waste waters (1g).

In 2008, there were for the first time projects started which deal with nanotechnologies within the programme EUREKA (OE). One of them focuses on the sub area 7a and another one focuses on the sub area 1a. They both follow specific practical objectives.

The programmes OC and ME support projects of the international cooperation. They are of small scope (about CZK 0.5 million on average annually) and serve rather for the maintenance of contacts between the cooperating researchers. They always relate to individuals. They cover almost the entire spectrum of the nomenclature. Project OC 103 **"Photocatalytic technologies and new nanosurface materials – problems in the application of photocatalytic nanosurface materials in the area of resolving security risks in EU"**, 3/2006–12/2009, the head researcher is Ing. František Peterka, Ph.D., UJP PRAHA a.s., Praha – Zbraslav, the total costs in 2008 equal CZK 0.4 million, thereof CZK 0.4 million from the state budget. It is the only project classified in the sub area 8a (toxicity of nanoparticles).

6.2.4. Programmes by the Ministry of Industry and Trade of CR

MIT supports research of nanotechnologies within the four following programmes:

- POKROK (1H) – (PROGRESS)
- Permanent Prosperity (2A)
- TANDEM (FT)
- IMPULS (FI)

The review of the funds allocated to researchers in 2008 is presented in **Table No. XI**.

MIT supports mostly the industrial research and development and the funding participation of the researchers is significant. While the programmes POKROK (PROGRESS), TANDEM and IMPULS use the bottom-up selection method, there were topical areas announced for the programme "Permanent Prosperity" which had to be respected by the proposing parties (see 3.1.4.2.). Project solutions should be finalised with specific applications. As descriptions of the projects' objectives of the MIT programmes indicate (see **Annex**), the researchers expect the results' utilisation in the practice. When we assess all the solved projects as a whole, the distribution of (not insignificant) funds, by the sub areas of the nomenclature, is as follows:

- 8 projects belong to the sub area 1a – nanopowders, nanofibres (the total of CZK 36.841 million, thereof CZK 20.170 million from the state budget), i.e. 22 %,
- 4 projects belong to the sub area 7d – equipment for the preparation of fibres, etc. (the total of CZK 27.761 million, thereof CZK 16.321 million from the state budget), i.e. 16.3%
- 3 projects belong to the sub area 1g – polymer nanocomposites (the total of CZK 15.822 million, thereof CZK 7.291 million from the state budget), i.e. 9.3 %,
- 1 project belongs to the sub area 2f – MEMS, NEMS (the total of CZK 12.925 million, thereof CZK 7.335 million from the state budget), i.e. 7.5 %,
- 3 projects belong to the sub area 7c – equipment and methods for the preparation of layers and coatings (the total of CZK 11.563 million, thereof CZK 6.199 million from the state budget), i.e. 6.8 %,
- The remaining 17 projects belong to the sub areas 1c, 1b, 1d, 2c, 2d, 2f, 3a, 5a, 5b, 6c, 7b, and 7e,
- With the exception of one 5.5-year long project of medium scope, which belongs to the sub area 3a – the encapsulating of medication, no other projects belong to the group 3 – nanobiotechnologies and nanomedicine,
- No project belongs to the area 4 – sensors.

Table No. XI

Programme	Number of projects	Total, in million CZK	From the state budget, in million CZK	Share in %
PROGRESS	3	7.279	3.878	53.0
Permanent Prosperity	12	72.273	37.371	52.4
TANDEM	15	68.743	39.081	56.8
IMPULS	6	23.322	10.272	44.0
Total	36	170.617	90.702	53.0

6.2.5. Review of the programme projects by the nomenclature

All programme projects got numbers and letters assigned, according to the individual main areas and sub areas of the nomenclature in **Table No. II**. For allocations of funds, we used data related to 2008 from the Central Register of Projects (see **Annex**). The results of this analysis are presented in **Table No. XII**. The Table presents the number of projects, the share of state funds in the total sum allocated to the projects and the average value of each project in 2008 in individual sub areas and areas.

The evaluation of the programme projects, according to the nomenclature, allows for the following conclusions:

- With the exception of the area 8 – Health, ecological, ethical, social, and other aspects of nanotechnologies, which is solved by only a single small project organised within the international cooperation (OC 103) in the sub area of nanoparticles' toxicity, the projects focus, with different intensity, on all sub areas of the nomenclature.
- 31.9 % of the total number of projects focuses on nanomaterials, especially on the research of nanoparticles, nanofibres, quantum dots, etc. and 13–17 % of the projects focus on the areas 2, 3, 6, and 7.
- The average project value, from all 229 projects in 2008, is CZK 3.464 million. Close to this value is also the area 1 – nanomaterials. In this case, the large projects in the programme "Nanotechnology for the Society" and the projects of MIT are compensated by a larger number of projects in GA CR and GA AS CR. The areas 2 and 5 are also close to the average project value indicated above. The significantly higher average project values occur in the area 3 – Nanobiotechnology and also, with significantly fewer projects, the area 4 – Nanotechnology in sensors. In spite of the solution of 4 large projects focussing on the area 5 – Long-term research of nanosystems, the project average is the lowest in this area. It is the result of a large number of low-cost projects by GA CR and GA AS CR focussing on the theoretical aspects of nanophysics and nanochemistry.
- The individual areas are ranked by the size of their financial volumes as follows:

  1 – Nanomaterials (73 projects)

  3 – Nanobiotechnology (38 projects)

  2 – Micro – nanoelectronics (30 projects)

  7 – Technology, equipment (31 projects)

  6 – Long-term research (34 projects)

  5 – Nanotechnology in chemistry (16 projects)

  4 – Nanotechnology in sensors (6 projects)
- The individual sub areas are ranked by the size of their financial volumes as follows:

  1a – Nanoparticles, nanofibres (25 projects)

  1d – Nanolayers, nanocoatings (15 projects)

  3b – Controlled transport of medication (4 projects)**!**

  3g – Diagnostics (9 projects)

  2a – Nanoelectronics, photonics (4 projects)

  6c – Nano and meso systems (4 projects)

  3d – Bioanalogical materials (8 projects)

  1g – Polymer nanocomposites (15 projects)

- The lowest funds – less than CZK 1 million per project, were allocated in 2008 to the following sub areas:
  8a – Toxicity of nanoparticles (1 project worth CZK 0.4 million)
  1f – Nanoceramics (7 projects of the average value of CZK 0.521 million)
  6a – Self-assembly (2 projects of the average value of CZK 0.549 million)
  6e – Ultra precise engineering (2 projects of the average value of CZK 0.600 million)
  3f – Bio-inorganic interface (1 project worth CZK 0.684 million)
  6b – Nanophysics (15 projects of the average value of CZK 0.703 million)
- The total share of the state support of solutions of the programme projects in 2008 reached 81.5%. It is relatively a high share proving the fact that many projects focus on the basic research. Individual areas are ranked as follows:
  8a – Toxicity of nanoparticles – 100 %
  6 – Long-term research – 92.7 %
  2 – Micro – nanoelectronics, photonics – 86.8 %
  3 – Nanobiotechnology – 86.5 %
  4 – Nanotechnology in sensors – 83.2 %
  1 – Nanomaterials – 76.8 %
  5 – Nanotechnology in chemistry – 75.3 %
  7 – Technology, equipment – 71.7 %
- The lowest state support has been noticed in the sub area 7c – Preparation of nanolayers (62.8 %), 5a – Filtration, membranes (64.5 %), 7d – Preparation of massive objects (65.4 %), and 1g – Polymer nanocomposites (69.1 %).

We leave other conclusions to readers.

Table No. XII

N	Area	Number of projects	Total in million CZK	SB in million CZK	Share in %	CP/P[1] in million CZK
1a	Nanoparticles, nanofibres	25	102.688	74.035	72.1	4.107
1b	Composites with nanoparticles	5	7.253	5.550	76.5	1.451
1c	Fullerens, C nanotubes	4	6.475	4.055	62.6	1.619
1d	Nanolayers, nanocoatings	15	70.073	60.516	86.4	4.672
1e	Nanostructured materials	2	22.142	18.096	81.7	11.071
1f	Nanoceramics	7	3.644	3.543	97.2	0.521
1g	Polymer nanocomposites	15	36.044	24.901	69.1	2.403
1	**Nanomaterials**	**73**	**248.319**	**190.696**	**76.8**	**3.402**
2a	Nanoelectronics	4	42.012	37.554	89.4	10.503
2b	Photonics	1	1.230	1.230	100.0	1.230
2c	Optic materials	9	20.789	17.734	85.3	2.310
2d	Magnetic materials	12	20.863	20.365	97.6	1.739
2e	Bioelectronics	3	8.849	8.362	9405	2.950
2f	MEMS, NEMS	1	12.952	7.335	100.0	12.652
2	**Micro-nanoelectronics**	**30**	**106.695**	**92.580**	**86.8**	**3.556**

3a	Encapsulating of medicine	1	2.645	1.640	100.0	2.645
3b	Controlled transport of medications	4	53.917	46.260	85.8	13.479
3c	Tissue engineering	7	26.320	22.318	84.8	3.760
3d	Bioanalogical materials	8	39.428	35.015	88.8	4.928
3e	Molecular analysis	8	24.091	21.195	88.0	3.011
3f	Bio-inorganic interface	1	0.684	0.684	100.0	0.684
3g	Diagnostics	9	52.115	45.187	86.7	5.791
3	**Nanobiotechnology**	**38**	**199.200**	**172.299**	**86.5**	**5.242**
4a	Sensors with nanomaterials	3	14.412	12.324	85.5	4.804
4b	Biomolecular sensors	3	15.740	12.762	81.1	5.247
4	**Nanotechnology in sensors**	**6**	**30.152**	**25.086**	**83.2**	**5.025**
5a	Filtration, membranes	5	16.589	10.702	64.5	3.318
5b	Nanocatalysis	8	27.394	22.734	83.0	3.424
5c	Supramolecular chemistry	3	6.891	4.871	70.7	2.297
5	**Nanotechnology in chemistry**	**16**	**50.874**	**38.307**	**75.3**	**3.180**
6a	Self-assembly	2	1.099	1.099	100.0	0.549
6b	Nanophysics (theory)	15	10.549	9.774	92.7	0.703
6c	Nano and meso systems	4	41.643	38.094	91.5	10.411
6d	Nanochemistry (theory)	11	12.712	12.155	95.6	1.156
6e	Ultra precise engineering	2	1.200	1.200	100.0	0.600
6	**Long-term research**	**34**	**67.203**	**62.322**	**92.7**	**1.977**
7a	Analytical equipment and methods	9	21.323	17.576	82.4	2.369
7b	Manufacture of nanoparticles, processing	5	15.326	11.906	77.7	3.065
7c	Preparation of layers (equipment)	7	14.205	8.921	62.8	2.029
7d	Preparation of massive objects	8	33.561	21.933	65.4	4.195
7e	Nanometrology, machining	2	5.996	4.465	74.5	2.998
7	**Technology, equipment**	**31**	**90.411**	**64.801**	**71.7**	2.916
8a	**Toxicity of nanoparticles**	**1**	**0.400**	**0.400**	**100**	**0.400**
	Total	229	793.254	646.491	81.5	3.464

Note: 1 – CP/P: The average funds per project. It has been calculated from the total funds allocated to the area or sub area.

6.2.6. Partial conclusions

1) The executed analysis shows that there was the total CZK 793.254 million allocated to the research of nanotechnologies within the programme projects in 2008, thereof CZK 646.491 million from the state budget – 81.5 % of the total sum. It is relatively a high share proving the fact that many projects focus on the basic research.

2) Individual providers' shares in the mentioned sum are as follows:

Provider	Number of projects	Total, in million CZK	From the state budget, in million CZK	Share in %
AS CR	80	392.948	347.740	88.5
GA CR	70	65.663	65.663	100.0
MEYS	43	164.026	142.386	86.6
MIT	36	170.617	90.702	53.0
Total	229	793.254	646.491	81.5

3) Almost 50″% (49.5 %) of the funds was provided for the research of nanotechnologies in 2008 by AS CR, especially to those related to the programme "Nanotechnology for the Society".
4) The average project value, from all 229 projects in 2008, is CZK 3.464 million.
5) 31.3 % of the funds allocated to the research of nanotechnologies in the form of programme projects were focussed in 2008 on nanomaterials, 25.1 % on nanobiotechnologies, and 12.5 % on nanoelectronics and photonics.
6) Projects ignore the health, ethical and social aspects of nanotechnologies.
7) Only the researchers of projects solved within MIT programmes expect the application of their results in practice.

7. EDUCATION IN NANOTECHNOLOGIES

The research of nanotechnologies currently occurs in a number of scientific disciplines like, for example, physics, chemistry, materials, mathematics, and engineering. Thanks to the efforts related to the understanding of phenomena occurring in nanosizes and to the description of properties of nanostructures, each of these disciplines has been developing rather independently so far. However, nanotechnologies present the chance of connecting different disciplines and focussing on the interdisciplinary research. Hand in hand with this, the urgency of interconnection of education in individual fields' grows and there should be professionals trained for nanotechnologies.

In addition to the training of a new generation of scientists, researchers and other professionals with multidisciplinary knowledge necessary for the fast development of nanotechnologies, it is also very important to educate, train and inform the current workers.

The education of new experts on nanotechnologies and the training and informing of the existing workers develop around the world very fast during the last decade (there is the additional information, for example, at www.nanoforum.org). The Czech Republic has reacted to this trend with some delay.

In the period 2003–2005, the Section of nanosciences and nanotechnologies of CSNMT organised a survey the objective of which was the collection of information about the university education in the field of nanotechnologies in the Czech Republic. There were 28 university faculties in the Czech Republic surveyed, but only a half of them replied. The review of gained information was made public in the publication "Nanotechnologies in the Czech Republic – 2005" in the Chapter 8 – "Education in the area of nanotechnologies at Czech universities". The review indicated the pressing needs of the intensive focus on the education in the area of nanotechnologies on a broad scientific base which related especially to chemistry, biology, physics, and the engineering fields. In addition to that, there were serious delays uncovered in the instrument infrastructure which is necessary for education and research and development of nanotechnologies.

There has been some progress noticed in the area of education about nanotechnologies after 2005:

- The first university gaining the accreditation for the three-year undergraduate and two-year graduate programme in the field of nanotechnologies was **VSB – Technical University in Ostrava**. The studies in the program **"Nanotechnologies"** started in the year 2007–2008 and they have got the strong multidisciplinary character. They are based on natural science (mainly physical and chemical) disciplines and on engineering approaches. They are based on the personnel and laboratory background of the workplaces. The basic objective of the study program "Nanotechnologies" is the informing of students about properties of nanostructures, nanoparticles and nanoinstruments and with possibilities of their application in near future within the three basic modules:
  1) Technology of the nanostructured materials, their preparation and syntheses
  2) Applications of nanostructures in optics, magnetism, chemistry, electronics and mechanics
  3) Measuring and analytical techniques for the nanostructured materials

More detailed information is available at http://nanotechnologie.vsb.cz. There is the detailed information about both programmes and the 15 minutes long information video programme, and additional information presented on this page.

- **The Department of physical electronics in the Faculty of Nuclear and Physical Engineering of the Czech Technical University in Praha** has introduced the study field in the year 2006–2007, for undergraduate and graduate studies, called **"Physics of Nanostructures"**. This study field covers the particle nanostructures, nanochemistry, nanophysics, and nanoelectronics of a semiconductor nanostructure, nanoscopy, and nanocharacterising. Additional information is available at http://kfe.fjfi.cvut.cz.
- **The Faculty of Biomedical Engineering in the Czech Technical University in Praha, the Faculty of Mechanical Engineering in the Brno University of Technology, the Faculty of Science in the Palacky University Olomouc, and the Faculty of Mechanical Engineering in the Technical University in Liberec** organised the project CZ.04.1.03/3.2.15.2/0355 called **"Preparation of the new multidisciplinary subject NANOTECHNOLOGY"** in the period 6/2006–6/2008. It was funded from the European Social Fund (ESF). Within the project, there was one semester multidisciplinary course prepared, including study materials for the students of the undergraduate studies. This course was lectured in the four above-named faculties of the Czech universities, which were the project's partners. The project's guarantor was doc. Ing. J. Kubátová, CSc., from the Technology Centre of AS CR. The course, consisting of 14 lectures by selected experts, took place in the faculties during the first half-year 2008. The topics of the individual lectures were as follows:
  1. Introduction to nanotechnologies – prof. Ing. Petr Louda, CSc., TU Liberec, FS
  2. Introduction of the quantum physics – doc. Dr. Ing. Milan Šiňor, CVUT Praha, FJFI
  3. Analytical instruments – electron microscopy with a scanning probe – doc. RNDr. Roman Kubínek, CSc., UP Olomouc, PrF
  4. Analytical instruments – electron microscopy and X-ray diffraction – prof. Ing. Jiří Švejcar, CSc., VUT Brno, FSI
  5. Nanoparticles – prof. RNDr. Miroslav Mašláň, CSc., UP Olomouc, PrF
  6. Thin layers – doc. Ing. Miroslav Jelínek, DrSc., Institute of Physics of AS CR, Praha
  7. Polymer nanocomposites – prof. RNDr. Josef Jančář, CSc., VUT Brno, FCH
  8. Nanostructures and nanoelectronics – doc. Ing. Eduard Hulicius, CSc., Institute of Physics of AS CR, Praha
  9. Carbon nanostructures – Ing. Ludvík Smrčka, DrSc., Institute of Physics of AS CR, Praha
  10. Sensors, labs-on-the-chip (molecule recognition) – Ing. Jiří Homola, CSc., Institute of Photonics and Electronics of AS CR, Praha,
  11. Nanofibres and nanotextiles – prof. RNDr. David Lukáš, CSc., TU Liberec, FT
  12. Nanomedicine – prof. RNDr. Vladimír Král, CSc., VSCHT in Praha, FCHI
  13. Risks in nanotechnologies – MUDr. Petr Lesný, Institute of Experimental Medicine of AS CR, Praha
  14. Current applications of nanotechnologies – prof. Ing. Petr Louda, CSc., TU Liberec, FS
- The **Faculty of Electrical Engineering and Communication in Brno VUT** has organised within its study programme "Electrical engineering, electronics, communication and controlling technologies" the graduate field of study "Microelectronics" in the academic year 2008–2009. There was the one semester subject **"Nanotechnology"**. Its guarantor is

prof. RNDr. Pavel Tománek, CSc. The subject focuses on basic nanostructures, interactions in the close field in nanometric distances (forces, optics, electric, magnetic, and thermal features), the applications of nanotechnologies, the chemical and material syntheses, the design and manufacture of nanostructures, the computer-assisted and theoretical nanotechnologies, nanotechnological equipment, medical and biotechnological fields, the detection and localisation of nanostructures, nanoelectronics, and the molecular electronics.

- The **Faculty of Science in the Palacky University Olomouc** (www.upol.cz) announced, in individual areas of doctor study programmes for the academic year 2007–2008, the following topics for dissertation theses:

  a) Field of study "Analytical Chemistry"

  - "Preparation and the use of nanostructured surfaces in bioanalyses", the lecturer is Ing. R. Foret, CSc., UIACH AS CR Brno.

  b) Field of study "Physical Chemistry"

  - "Syntheses of nanoparticles based on ferric oxide, Fe or Fe(VI) for water purification and treatment purposes", the lecturer is doc. RNDr. R. Zbořil, Ph.D.
  - "Study of the preparation of colloid silver particles and their application possibilities", the lecturer is doc. RNDr. T. Nevěčná, CSc.

  c) Field of study "Applied Physics"

  - "Surface modification of ferric oxide nanoparticles with the use of cool plasma", the lecturer is prof. RNDr. M. Mašláň, CSc.
  - "Microscopic study of the creation of ferric oxide nanolayers on the surfaces of salt and mineral monocrystals containing iron", the lecturer is doc. RNDr. R. Kubínek, CSc.
  - "Selected methods of the topography of nanosurfaces and layers", the lecturer is prof. RNDr. Ing. J. Pospíšil, DrSc.

The **Technical University in Liberec, the Faculty of Mechatronics and Engineering Studies**, has filed an application for the accreditation of a new study program "Nanomaterials" with MEYS in mid 2008. This should be studied within the undergraduate and graduate study programmes. All four faculties of TUL (mechanical engineering, textile, pedagogical, mechatronics and engineering studies) should participate in it.

There should be new study fields focussing on the training in the area of nanotechnologies opened at other Czech universities in next few years. It is, for example, the new study programme "Medical nanobiotechnologies" in the **Faculty of Chemistry of the Brno VUT** for the undergraduate and graduate study programmes.

8. STANDARDISING IN THE AREA OF NANOTECHNOLOGIES

There are several institutions involved in issues of the standardisation in the Czech Republic. Within the international exchange of data, these activities were assigned to the Czech Standard Institute (CNI) which is the national partner to the international institution ISO (with worldwide activities) and CEN (with activities for the European Union). There are the so-called technical commissions (TNK) established for this purpose within CNI. Their objective is the concentration of experts on individual fields and the preparation of national norms and standards (our own or expertly translated and adjusted for Czech environment).

In 2004, the European Commission (EC) initiated the establishment of a working group WG 166 within CEN into which representatives of most EU member countries were nominated with the goal to execute a fast all Europe survey of the standardisation needs for the new field – NANOTECHNOLOGIES. On the basis of this survey results, EC decided in 2006 on the founding of a new technical commission CEN/TC 352 for the field of Nanotechnologies. At the same time, the ISO organisation founded its own commission TC 229 and called on the member countries to establish the so-called national mirror commissions.

Such a national commission was founded, within CNI, in the Czech Republic in December 2007 as TNK 144 – Nanotechnology. prof. RNDr. Bruno Sopko, DrSc., from FS CVUT, was elected its Chairman and other members are (apart from the Deputy Chairman Ing. Pavel Voráček from CNI) also RNDr. Michael Solar, CSc., FS CVUT and prof. RNDr. Pavel Tománek, CSc., from Brno FEKT VUT. There was also the sub commission for Photocatalysis, chaired by Ing. František Peterka, Ph.D., founded within TNK 144. The scope of activities by TNK Nanotechnology should cover the following areas:

- Terminology,
- Metrology,
- The environment,
- Electronic and electrical engineering.

It is analogical to issues solved in the International Technical Commission ISO TC 229 Nanotechnologies, or the European Technical Commission CEN TC 352 Nanotechnologies and the International Technical Commission IEC TC 113 Nanotechnology – Standardisation for electrical and electronic products, or possibly also in the European Technical Committee CLC/SR 113 Nanotechnology standardisation for electrical and electronics products and systems.

During mutual meetings of national delegates in meetings of WG 166 and later TC 352, an idea occurred to ask EC for the approval of the project within the 6th FP / SSA the purpose of which was the mapping of standardisation needs not only in the “old”, but also in the “new” EU countries and the preparation of the roadmap for the progress of individual standardisation-related activities, specifically the new terminology, characterisation, nanometrology, nanostandardisation, and others. The project has been approved under the acronym **NANOSTRAND** and it was solved by a consortium of researchers from NPL London, DIN Berlin, LNE Paris, Optimat Glasgow, and CVUT Praha (Dr. Solar) in the period 2006–2008. During the period, there was a questionnaire survey organised among workplaces in the mentioned countries, in Slovakia, and in Hungary. The project results will be released for publication after approval by EC in the second half of 2008.

(The text was prepared by RNDr. Michael Solar, CSc.)

9. CONCLUSIONS

Nanotechnologies, nanoscience, nanomedicine, nanomaterials, nanoelectronics, etc. are all terms which have become well-known not only by experts, but also by media. Studies and applications of phenomena and of the technology for the preparation of nanosizes are supported worldwide within never seen before scope from public funds and they are in the centre of interest of private companies both small and big, especially of those focussing on electronics, chemistry or energy. It is not different in the Czech Republic. We have tried to provide the updated review in this publication presenting areas of nanosciences and nanotechnologies that are researched in the Czech Republic, together with the information who is involved in it. The last review of the development in nanotechnologies in the Czech Republic was prepared for the publication "Nanotechnology in the Czech Republic – 2005" (ISBN 80-7329-111-8) which is available on-line at www.nanotechnology.cz.

There are workers of at least 26 institutes of the Academy of Sciences of the Czech Republic, 37 university faculties, and 9 allowance research organisations involved in the basic research of different areas of nanosciences. The applied research of nanotechnologies is conducted by at least 15 research-oriented private companies and by about 69 small and big enterprises having the manufacturing character. By estimate, there are about one thousand experts involved in nanotechnologies in the Czech Republic.

Research focuses mostly on the properties of nanomaterials and on their preparation, on techniques for making nanosizes visible, but also on nanobiotechnology and nanomedicine, nanoelectronics, and nanosensors. The biggest workplace, researching different aspects of nanotechnologies, is the Institute of Physics of AS CR in Praha.

Public and private institutions get funds from research plans, grants, and research programmes. **There has been the total of CZK 793 million determined for research and development of nanotechnologies only within the programme projects in 2008, thereof CZK 646 million from the state budget.** The development in the research of nanotechnologies in the Czech Republic has been significantly assisted by the programme "Nanotechnology for the Society" which has been administered by AS CR since 2006. Its finalisation and the evaluation of the first projects are expected in the period 2010 and 2011.

The recent results of research works organised by AS CR and at universities have been largely covered in this publication. In the sector research, supported mainly by the Ministry of Industry and Trade, we can identify the first practically applicable results in the manufacture of nanofibres (Nanospider), nanocomposites polymer-clay, new formulations of paints, and in the applications of ferric oxide and titanium nanoparticles. The small company Timplant from Ostrava has presented its own application of the nanostructured titanium in dental implants. The growing number of small and medium-size enterprises, which are interested in the application of nanotechnologies in their products, gives some hope for the faster utilisation.

In 2006, there have been two nanotechnological clusters founded in the Czech Republic (Nanomedic and the Czech nanotechnological cluster) as the first signs of co-operation of the private and the public sectors. The first university gaining the accreditation of the three-year undergraduate and of the two-year graduate study programmes in the field of nanotechnologies was VSB – Technical University in Ostrava. The studies have started in the academic year 2007–2008 and they have got the significantly multidisciplinary character. They are based on disciplines of natural sciences (especially physics and chemistry) and on engineering approaches. They are also supported by the personnel and laboratory backgrounds of the workplaces. Other universities prepare the opening of similar study fields.

The Czech Republic is involved in the solution of nanotechnological standardisation issues and that is the necessary step towards the practical implementation. At the same time, there are different products made abroad and utilising nanotechnologies for the improvement of their properties entering our shops. They are products mostly in cosmetics, medication, nutritional supplements, lacquers, sport goods, household goods, etc.

The position of the state towards these issues could be described in a special chapter. While there have been national programmes for nanotechnologies established in more than 50 countries, such a programme is still missing in the Czech Republic. The programme "Nanotechnology for the Society", which was passed with difficulties, has been focussed mostly on the area of the basic research and it does not deal with other important areas like the training of new experts, standardisation, possible social and health impacts of the implementation of nanotechnologies, development strategies for this interdisciplinary field, the research infrastructure for the development of nanotechnologies, etc. Also, many important documents by the European Commission like, for example, the Communication "Nanoscience and Nanotechnology: Action Plan for Europe 2005–2009" with a number of calls on member countries, have got no response. The area of nanotechnologies has not differed so far from other expert areas – and, while the research is of the relatively good standard, the implementation of achieved results is quite poor.

ANNEX 1

REVIEW – PROGRAMME PROJECTS RESEARCHED IN 2008

This Annex presents the review of programme projects solved in 2008 by public research institutions, universities, directly managed organisations, and private subjects with the support provided from public funds.

The review is arranged in accordance with providers and programmes and it has got the same structure used in the sub chapter 3.1.2. "Target-oriented funding – research programmes".

The presented information was mostly obtained from the Central Register of Projects (CEP) which is accessible for the public on www.vyzkum.cz. It was received also from the providers and solving organisations.

It is possible that the list of projects is not exhaustive, especially in the areas of nanobiotechnologies and medicine. It is often very difficult to identify in these areas the nanotechnologically oriented projects, unless the project researchers explicitly present it in the names of projects (e.g. with the prefix "nano"), when formulating project objectives, or refer it to the authors of this publication. Many Czech scientists and research workers, who are active in biological or medical fields, do not use names with the prefix "nano" and thus, for example, they do not make molecular biology different from the nanobiotechnology.

1. PROVIDER: ACADEMY OF SCIENCES OF THE CZECH REPUBLIC (AS CR)

1.1. PROGRAMME "NANOTECHNOLOGY FOR THE SOCIETY" (Code KA)

1.1.1. List of researched projects accepted within the 1st round of the public tender

There have been the following projects accepted within the first round of the public tender for solution in the period from 1 July 2006 to December 2010:

SUB PROGRAMME 1: Nanoparticles, nanofibres and nanocomposite materials

KAN100500651 **"Preparation and studies of organic-inorganic nanocomposite material properties prepared in situ by the emulsive polymerisation"**, 07/2006–12/2009, the head researcher is Ing. Zdeňka Sedláková, CSc., Institute of Macromolecular Chemistry of AS CR, the total costs of CZK 4.193 million, thereof CZK 3.563 million from the state budget.

(Year 2008 – 1.175/0.995, 1g)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, Řež, Ing. Kamil Lang, CSc.
- Charles University in Praha, Faculty of Mathematics and Physics, RNDr. Ivan Krakovský, CSc.
- Institute of Chemical Technology Praha, Faculty of Chemical Technology, doc. Ing. František Kovanda, CSc.
- Hexion Specialty Chemicals, a.s., Sokolov, Ing. Jan Nájemník

Objective of the solution: The knowledge gained in the basic research allows for the targeted preparation of watery dispersions of polymers of unique properties. The dispersions are based on new nanocomposite polymers containing chemically bound inorganic nanomaterials. The industrial partner develops, in parallel with results of the basic research and within his own internal projects, dispersion prototypes. Thanks to the defined nanocomposite materials' architecture containing particles smaller than 100 nm, the prototypes should have unique properties suitable for the manufacture of adhesives and paints (e.g. antibacterial effects, the higher dirt resistance, the better stickiness and hardness). There are new preparation methods and characterising of new dual layer hydroxides developed within the project for the preparation of nanocomposite materials. There are also properties of the developed nanocomposite materials studied and the management of these properties is verified by adding selected additives, e.g. photosensitive substances.

KAN100500652 **"Heterogenous organic and hybrid nanocomposite materials for solar cells"**, 07/2006–12/2010, the head researcher is RNDr. Jiří Pfleger, CSc., Institute of Macromolecular Chemistry of AS CR, the total costs of CZK 27.493 million, thereof CZK 22.993 million from the state budget.

(Year 2008 – 3.953/2.871, 1g)

Co-researchers:

- J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, doc. RNDr. Svatopluk Civiš, CSc.
- Charles University in Praha, Faculty of Science, prof. RNDr. Jiří Vohlídal, CSc.
- Solartec s. r. o., Rožnov pod Radhoštěm, Dr. Ing. Aleš Poruba, Dr.

Objective of the solution: The gain of complex knowledge allowing the targeted proposal of nanostructured materials of the nanocomposite p-conjugated polymers and metal oxides' types for optoelectronic applications, especially for photoelectrochemical and solid solar cells. The molecular architecture and morphology are optimised by the combination of chemical processes and physical phenomena, e.g. by the spontaneous phase separation and crystallisation in the matrix. The relation between the chemical and super molecular structure and usable physical properties are experimentally studied and consequently theoretically modelled. Then, it is utilised for the optimising of the chemical structure. The partial project objectives are (I) the development of new photoelectrically sensitive materials, (II) the study of relations between their structure and electric and optical properties, and (III) the utilisation of gained knowledge for proposals of new kinds of organic solar cells and for the improvement of functional parameters of cells based on the traditional inorganic materials.

KAN101630651 **"Creation of nano-layers and nano-coatings on textiles with the use of surface plasma treatment under atmospheric pressure"**, 07/2006–12/2010, the head researcher is prof. RNDr. Mirko Černák, CSc., Masaryk University, Faculty of Science, Brno, the total costs of CZK 41.855 million, thereof CZK 33.810 million from the state budget.

(Year 2008 – 8.591/6.952, 1d)

Co-researchers:

- Palacky University Olomouc, Faculty of Science, prof. RNDr. Miroslav Mašláň, CSc.
- Technical University in Liberec, Faculty of Textiles, Ing. Jakub Wiener, Ph.D.
- Textile Testing Institute, s. p., Brno, RNDr. Pavel Malčík
- LIFETECH, s.r.o., Brno, doc. RNDr. Jiří Dřímal, CSc.

Objective of the solution: The research of utilisation possibilities related to the low-temperature plasma generated at the atmospheric pressure for the creation of nanolayers and nanocoatings on the surface of textile fibres. The plasma is generated during the utilisation of new unique plasma resource kinds with the potential of a successful application in the textile industry. The focus is put on the understanding of the mechanism of the plasma activation of nanolayers on fibre surfaces, on the interaction of in this way by the plasma activated surfaces with nanopowders, and on the methods creating nanolayers without the use of organic solvents and other environmentally harmful chemicals. The goal of the surface nanotreatments is the gaining of new utility properties of textile materials suitable, for example, for the protection of the environment and workplaces.

KAN108040651 **"Research of the manufacturing and the utilisation of nanoparticles based on zero-valent iron for the treatment of contaminated underground waters"**, 07/2006–12/2008, the head researcher is doc. Dr. Ing. Miroslav Černík, CSc., Technical University in Liberec, Faculty of Mechatronics and Interdisciplinary Engineering Studies, the total costs of CZK 26.350 million, thereof CZK 21.903 million from the state budget.

(Year 2008 – 10.199/8.520, 1a)

Co-researchers:

- Palacky University Olomouc, Faculty of Science, doc. RNDr. Radek Zbořil, Ph.D.
- Masaryk University, Faculty of Science, Brno, doc. RNDr. Josef Zeman, CSc.
- AQUATEST a.s., Praha, RNDr. Petr Kvapil, Ph.D.

Objective of the solution: The development and the manufacture of a new nanomaterial based on the surface modified iron nanoparticles having specific properties for the use in oxidation-reduction reactions resulting in the removal of specific underground water contaminants (chlorinated hydrocarbons, heavy metals) and creating non toxic or significantly less toxic products. The in-depth research and optimising of properties of this nanomaterial make a part of the solution. It will utilise the most advanced equipment and laboratory experiments revealing the reactions with selected contaminants and competing substances. The goal is the proposal, laboratory testing, and semi-operational testing of the manufacture of these nanoparticles. The resulting product will be experimentally verified in at least two pilot applications. The proposed precursors for the manufacture are the waste materials gained during the extraction of minerals or in the chemical production. The project should thus ensure the cheap and economically liable end product.

SUB PROGRAMME 2: Nanobiology and nanomedicine

KAN200040651 **"Electrochemical and optical analyses of biomacromolecules on microelectrodes covered with nanolayers of electroactive materials"**, 07/2006–12/2010, the head researcher is Mgr. Stanislav Hasoň, Ph.D., Institute of Biophysics of AS CR, Brno, the total costs of CZK 7.259 million, thereof CZK 6.529 million from the state budget.

(Year 2008 – 1.552/1.396, 3e)

Co-researchers:

- HVM PLASMA, spol. s r.o., Praha, Ing. Jiří Vyskočil, CSc.

Objective of the solution: The clarification of relations between the structure of biomacromolecules (nucleic acids, chemically modified oligonucleotides, or proteins) and their electrochemical behaviour on the electrically charged surfaces of new electrode materials the properties and behaviour of which are decisively determined by their surfaces and/or by their nanometric structure. The introduction of modern electroanalytical approaches in combination with diffractive and spectroscopic methods for the targeted creation of the beforehand defined nanometric layers of biomacromolecules with the use of modern nanostructures contributing to the development of simple and selective biosensors for the electrochemical detection of nucleic acids, hybridisation and DNA damage, or for the detection of their interactions with for genes toxic materials. The clarification of the adsorption behaviour and the structure of adsorbed protein layers on surfaces of advanced materials suitable for biomedicine and bioengineering, according to their surface treatment and the changed external physical-chemical parameters.

KAN200200651 **"Nanoparticle and supramolecular systems for the targeted transport of medication"**, 07/2006–12/2010, the head researcher is prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology of AS CR, Praha, the total costs of CZK 93.560 million, thereof CZK 81.560 million from the state budget.

(Year 2008 – 17.905/14.905, 3b)

Co-researchers:

- Institute of Biophysics of AS CR, Brno, prof. RNDr. Viktor Brabec, DrSc.
- Palacky University Olomouc, Faculty of Medicine, prof. RNDr. Pavel Anzenbacher, DrSc.
- Institute of Chemical Technology Praha, Faculty of Chemical Engineering, prof. RNDr. Vladimír Král, CSc.
- Charles University in Praha, Faculty of Science, doc. Ing. Josef Hájíček, CSc.
- Charles University in Praha, 1st Faculty of Medicine, prof. MUDr. Pavel Martásek, DrSc.
- Institute of Organic Chemistry and Biochemistry of AS CR, Praha, RNDr. Ladislav Kohout, DrSc.
- Institute of Molecular Genetics of AS CR, Praha, RNDr. Jarmila Králová, Ph.D.
- Institute of Macromolecular Chemistry of AS CR, Praha, prof. Ing. Karel Ulbrich, DrSc.
- Institute of Physics of AS CR, Praha, doc. Ing. Emil Pollert, DrSc.
- Zentiva, a.s., Praha, Ing. Jan Šotola, CSc.

Objective of the solution: The development of a new generation of nanopharmaceuticals, medicine, the directional systems medicine, and magnetic nanoparticles for diagnostic and nanotherapeutical purposes. Analytical techniques confirming the composition, stability and connection with the targeted biomacromolecules make parts of the project.

KAN201110651 **"Combined contrast agents for the molecular MR imaging"**, 07/2006–12/2010, the head researcher is prof. RNDr. Ivan Lukeš, CSc., Charles University in Praha, Faculty of Science, the total costs of CZK 38.371 million, thereof CZK 32.136 million from the state budget.

(Year 2008 – 6.832/5.632, 3e)

Co-researchers:

- Institute of Experimental Medicine of AS CR, Praha, prof. MUDr. Eva Syková, DrSc.
- Institute of Clinical and Experimental Medicine, Praha, Ing. Milan Hájek, DrSc.
- Interpharma Praha, a.s., Ing. Ivan Hlaváček, CSc.

Objective of the solution: The proposal and the synthesis of new ligand types, the preparation of their complexes with metallic ions, and the testing of their stability for the in vivo use. The verification of their suitability for the preparation of positive cell contrast substances mostly on the basis of gadolinium (the tune up of parameters at the molecular level). The creation of a combined contrast substance for the cell imagining based on the combination of simple gadolinium complexes and oxide nanoparticles or on their conjugates with dendrimers allowing the monitoring of both positive and negative contrasts. The verification of biological and relaxometric properties of the new synthetised compounds. The application of these contrast substances within the monitoring of stem cells. The finding out, if changes in the contrast are effective during examinations done by the whole body clinical tomographs working at 1.5 and 3 T.

KAN208240651 **"Studies of interactions of biological macromolecules and nanolayers focussed on the research of polymeric microfluid biosensors and therapeutic nanoparticles"**, 07/2006–12/2010, the head researcher is doc. Ing. Pavel Hasal, CSc., Institute of Chemical Technology Praha, the total costs of CZK 19.986 million, thereof CZK 17.458 million from the state budget.

(Year 2008 – 2.756/2.401, 4b)

Co-researchers:

- Apronex s.r.o., Jesenice u Prahy, RNDr. Vladimír Kořínek, CSc.

Objective of the solution: The research of highly integrated microfluid devices (biosensors) based on the detection of biologically specific components in a sample with the assistance of immobilised protein nanolayers and the research of organisation of macromolecular nanostructures, protein nanolayers and the retroviral capsids for diagnostic and therapeutic purposes. The partial project goals are as follows: the construction of suitable microfluid chips, the creation of biologically active nanolayers inside structural chips, the characterising of space and electric properties of the immobilised nanolayers and polymer carriers, the characterising of nanoparticles carrying a therapeutic gene at the nanolevel, the possible utilisation of the electrokinetic transport for the sample dosing, the testing of chips as the sensors in varied model and practically usable immunoanalytical systems, the testing of the parallel determination of varied analytes on biosensors, and the optimising of the used proteins' structure.

SUB PROGRAMME 3: Nano-macro interface

KAN300430651 **"Nanocrystallisation of plasma sprayed coatings based on eutectic ceramic mixtures"**, 7/2006–12/2009, the head researcher is Ing. Tomáš Chráska, Ph.D., Institute of Plasma Physics of AS CR, Praha, the total costs of CZK 8.942 million, thereof CZK 7.769 million from the state budget.

(Year 2008 – 1.503/1.403, 1f)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, Řež, doc. Ing. Jiří Hostomský, CSc.
- EUTIT s. r. o., Mariánské Lázně, Vladimír Havlíček

Objective of the solution: The utilisation of the plasma spray technology for the creation of bulk and graduated nanocrystalline elements of excellent properties. The use of the unique WSP(R) plasmotron for the application of the material based on eutectic mixtures of Al, Zr, and Si oxides for the preparation of 3D elements having the nanocrystalline structure. The final project's goal is the proposal and optimising of the technology utilising the WSP(R) plasmotron for the preparation of nanocrystalline ceramic elements or thick graduated coats with the nanocrystalline structured surface. The mechanical properties of these products should overcome the current limits in the use of convention large grain materials. The following basic questions must be answered for the successful goal achievement: – the influence of a change in the individual oxidation parts' ratio on the occurrence of an amorphous structure, after spraying; – the role of individual parts as the nucleating agents in the consequently managed crystallisation; – the grain boundaries character and their impact on the resulting material properties.

SUB PROGRAMME 4: New phenomena and materials for nanoelectronics

KAN400100652 **"Structures for spintronics and quantum phenomena in nanoelectronics created with the electron beam lithography"**, 7/2007–12/2010, the head researcher is Ing. Ludvík Smrčka, DrSc., Institute of Physics of AS CR, Praha, the total costs of CZK 54.438 million, thereof CZK 54.438 million from the state budget.

(Year 2008 – 7.042/7.042, 2a)

Co-researchers:

- Charles University in Praha, Faculty of Mathematics and Physics, prof. RNDr. Václav Holý, CSc.
- Czech Technical University in Praha, Faculty of Electrical Engineering, doc. RNDr. Jan Voves, CSc.

Objective of the solution: a) The study of the tunnel anisotropic magnetoresistance (TAMR) in diluted magnetic semiconductors of the (GaMn)As type through the creation of oriented one-size channels ("nanoconstrictions") with the resulting development of parts for spintronics; b) The research of nanodiamond structures growing in the lithographically treated substrates by the CVD method; c) The creation of homogenous fields of quantum dots on lithographically treated bases and the research of their growth by the GISAXS and GID methods. The structures used in the research are created by the newly installed electron beam lithography.

KAN400100653 **"Self-organised magnetic nanostructures",** 7/2007–12/2010, the head researcher is Ing. Ján Lančok, Ph.D., Institute of Physics of AS CR, Praha, the total costs of CZK 54.521 million, thereof CZK 54.521 million from the state budget.

(Year 2008 – 10.190/10.190, 2d)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, Řež, Ing. Adriana Lančok, Ph.D.
- Charles University in Praha, Faculty of Mathematics and Physics, prof. RNDr. Vladimír Sechovský, DrSc.
- VŠB – Technical University of Ostrava, Faculty of Mining and Geology, doc. Mgr. Kamil Postava, Dr.

Objective of the solution: The preparation of nanocomposite (NC) materials containing magnetic nanoparticles (NP), e.g. FePt, CoFe, Co, and Fe, with the methods of pulse laser deposition, magnetron sputtering, the plasma jet , or by combinations of these techniques. There is the self-assembly method used for this, together with the use of a thin crystalline nucleic interlayer. The attention is turned to the research of impacts of this interlayer's properties on the NP growth, its size, distribution, mutual distance, crystalline structure, and the crystalline orientation with the goal of their management. The structural properties of the NC layer are researched with a wide spectrum of techniques focussed on the morphology and crystalline nature. Consequently, there are magnetic and electric properties studied with the stress put on the coercivity, magnetic anisotropy, magnetoresistance, and magnetooptic properties. In final project stages, the attention will be turned to the preparation of 3D nanostructures and on the preparation of functional multistructures.

KAN400310651 **"Nanotechnology for the protein and gene diagnostics"**, 8/2007–12/2010, the head researcher is Ing. František Foret, CSc., Institute of Analytical Chemistry of AS CR, Brno, the total costs of CZK 18.013 million, thereof CZK 18.013 million from the state budget.

(Year 2008 – 3.600/3.600, 3g)

Co-researchers:

- Institute of Biophysics of AS CR, Brno, prof. RNDr. Emil Paleček, DrSc.

Objective of the solution: The basic research of nanostructured surfaces for the electronic detection of biochemical interactions. There will be the experience and know-how of both partners' laboratories utilised for the start of the new research direction based on new DNA and protein analytical methods with the use of nanotechnologies, microfluidity, and electrochemistry. The preparation and characterising of nanostructures focus on the generating of an analytical signal, strengthened by the surface, with the use of nanoporous substrates, magnetic nanoparticles, and carbon nanotubes. There are also self-assembled monolayers with the surfaces modified by Au, Hg, or amalgams for the electrochemical detection utilised. These nanostructures will be used for the immobilisation of detection probes, for the research of the surface treatment impacts on chemical interactions, and for the improved sensitivity and selectivity of the detection. The use is oriented mostly on biosensors detecting DNA damage and on the research of proteins important during the progression of neurodegenerative diseases and cancer.

KAN400400651 **"Experimental and theoretical studies of free nanoparticles: "Flying nanoreactors" for the research of processes taking place at the molecular level"**, 7/2007–12/2010, the head researcher is Mgr. Michal Fárník, Dr., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the total costs of CZK 7.527 million, thereof CZK 7.527 million from the state budget.

(Year 2008 – 1.075/1.075, 1a)

Co-researcher:

- Institute of Chemical Technology Praha, FCHT, RNDr. Petr Slavíček, Ph.D.

Objective of the solution: The preparation of free nanoparticles with the targeted management of their sizes and compositions and the experimental and theoretical studies of these nanoparticles at the molecular level. The basic idea relates to their utilisation as nanoreactors useful for the study of physical and chemical processes taking place in them. The works are topically focussed on nanoparticles and processes of the atmospheric relevance, e.g. photolysis and hydrolysis of halogen-hydrogens and other molecules on water nanoparticles which contribute to the creation of the ozone hole. The studies of interactions of the free nanoparticles with surfaces should also provide information for the creation of nanostructures on surfaces of deposited nanoparticles, in addition to the above-presented objective.

KAN400670651 **"Research of the interface of metallic nanoparticles with InP for the monitoring of undesirable substances, gases and radiation in the environment"**, 7/2006–12/2008, the head researcher is RNDr. Jiří Zavadil, CSc., Institute of Photonics and Electronics of AS CR, Praha, the total costs of CZK 6.264 million, thereof CZK 6.264 million from the state budget.

(Year 2008 – 2.430/2.430, 1a)

Co-researcher:

- Czech Technical University in Praha, Faculty of Nuclear and Physical Engineering, Ing. Anton Fojtík, CSc.

Objective of the solution: The finding of new repeatable processes preparing the interface of an organised metallic nanoparticle/InP presenting improved properties for the utilisation in gas sensors and in the roentgen radiation detecting devices. The samples with the interface of the metallic nanoparticle/InP are prepared by the electroless plating and by the electrophoresis of metallic nanoparticles from varied colloid solution forms. There are metallic Cu, Au, Ag, Pt, and Pd nanostructures studied and prepared. There will be microscopic, electric and optical methods and the SIMS analysis used for the characterising of the nanostructures and their interfaces. The study will deal with the correlation between the arrangement rate of metallic nanoparticles' structures and the electric properties of the interfaces, especially with the level of the potential barrier and the lost current. There will be the sensitivity of diode sensors with the prepared interface studied to the low concentration of hydrogen gas in the air and to nitrogen oxides. The research of structures detecting the roentgen radiation focuses on the better sensitivity and improved noise properties.

KAN401770651 **"Molecular nanosystems and nanodevices: electric transport properties"**, 7/2007–12/2010, the head researcher is Ing. Martin Weiter, Ph.D., Brno University of Technology, Faculty of Chemistry, the total costs of CZK 29.306 million, thereof CZK 27.806 million from the state budget.

(Year 2008 – 3.703/3.703, 3d)

Co-researchers:

- Institute of Physics of AS CR, Praha, Ing. Irena Kratochvílová, Ph.D.
- Institute of Macromolecular Chemistry of AS CR, Praha, prof. RNDr. Stanislav Nešpůrek, DrSc.
- GENERI BIOTECH s.r.o., Hradec Králové, Mgr. Martin Bunček, Ph.D.

Objective of the solution: The experimental and theoretical research of properties of molecular materials, DNA, and bioanalogical materials suitable for nanodevices. It is about the finding of physical characteristics of the studied substances, e.g. the generation and transport of the charge carrier, conductivity, optical absorption, photoluminescence, the transistor effect, the catching and recombination of carriers. There will be effort to define repeatable processes creating samples with the defined conductivity and to design technologies which could be utilised in nanoelectronics. The achievement of a progress in the preparation of nanoelectronic elements will be accompanied with measurements of individual molecule samples, or of molecule beams, with the stress put on derivates of DNA molecules. There is the preparation of theoretical models of the electron transport of charge carriers planned in the studied systems as well as the application of the models, when describing the transport in molecular wires.

Review of the public tender 1st round results:

	Sub programme 1	Sub programme 2	Sub programme 3	Sub programme 4	TOTAL
Number in the tender submitted proposals	9	11	4	15	39
Number of projects accepted within the programme	4	4	1	6	15
Success rate (in %)	44.4	36.4	25	40	38.5
Recognised costs of accepted projects within the research period (in thousand CZK)	99 891	158 930	8 942	169 449	437 212
Target-oriented support of accepted projects within the research period (in thousand CZK)	82 269	137 437	7 769	167 949	395 424
Average share of the target-oriented support in recognised costs (in %)	82.4	86.5	86.9	99.1	90.4

1.1.2. List of projects accepted for solution within the 2nd round of the public tender

There have been the following projects accepted within the 2nd round of the public tender for solution in the period from 1 January 2007 to December 2011:

SUB PROGRAMME 1: Nanoparticles, nanofibres and nanocomposite materials

KAN100400701 **“Hybrid nanocomposite materials”**, 01/2007–12/2011, the head researcher is prof. Ing. Jiří Čejka, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the total costs of CZK 18.75 million, thereof CZK 15.5 million from the state budget.

(Year 2008 – 3.750/3.000, 1g)

Co-researchers:

- Tomáš Baťa University in Zlín, Faculty of Technology, Ing. Dana Měřínská, Ph.D.
- Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, RNDr. Vojtěch Varga – KAUČUK, a.s., Kralupy nad Vltavou, Ing. Jiří Reiss, CSc.

Objectives of the solution: The research, development and the utilisation of new types of hybrid (organic – organic-metallic – inorganic) nanocomposite materials for special applications in the catalytic preparation of new polymers and the substantial improvement of properties of these polymer materials. Nanocomposite materials are willingly synthetised and their properties are optimised within the combination with classical, microwave and electrochemical approaches. Consequently, they will be characterised in detail with the use of a number of experimental techniques. The main attention will be paid during the research of these advanced nanocomposite materials to their utilisation in highly selective catalytic processes of the polymerisation type, exchange polymerisation type, and in the polymer composite materials. The gained experimental results will be utilised for the optimising of existing polymerisation processes and of the targeted products.

KAN100400702 **“Nanostructural materials for the catalytic, electrocatalytic and sorption applications”**, 01/2007–12/2011, the head researcher is prof. RNDr. Zdeněk Samec, DrSc.,

J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, the total costs of CZK 41.664 million, thereof CZK 40.792 million from the state budget.

(Year 2008 – 7.961/6.541, 1a)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, Řež, Ing. Ivo Jakubec, CSc.
- Charles University in Praha, Faculty of Mathematics and Physics, prof. RNDr. Vladimír Matolín, DrSc.
- Nuclear Research Institute Řež a.s., Ing. Jiří Rais, CSc., DSc.
- Euro Support Manufacturing Czechia, s.r.o., Litvínov, Ing. Milan Říčánek, CSc.

Objectives of the solution: (a) The design of preparation methods for new nanostructure and nanocomposite materials based on unique properties of metallic (alloy) nanoparticles and (mixture) metallic oxides and their interaction with inorganic carriers; (b) The gaining of system data related to the function principle of these materials in catalytic, electrocatalytic and sorption applications; (c) The extension of the spectrum of in the industry usable technologies used in the material manufacture in the Czech Republic by the transfer of knowledge. These materials will be structured in a targeted way for environmentally acceptable chemical technologies related to the areas of fuel, energy resources, and removal of pollutants; It will be, however, mainly focussed on the catalytic transformation of n-alkanes to iso-alkanes, the electrocatalytic oxidation of aliphatic alcohols in fuel cells, and sorption processes for the removal of radionuclides with the long apparent half-life (Cs, Sr, Eu, Am) from medium-term and low-active nuclear waste.

KAN101120701 **"Nanocomposite layers and nanoparticles created in the low pressure plasma for surface modifications"**, 01/2007–12/2011, the head researcher is prof. RNDr. Hynek Biederman, DrSc., Charles University in Praha, Faculty of Mathematics and Physics, the total costs of CZK 50.992 million, thereof CZK 40.792 million from the state budget.

(Year 2008 – 10.000/8.000, 1d)

Co-researchers:

- Institute of Physiology of AS CR, Praha, MUDr. Lucie Bačáková, CSc.
- Czech Technical University in Praha, Faculty of Mechanical Engineering, doc. RNDr. Vladimír Starý, CSc.
- Brno University of Technology, Faculty of Chemistry, doc. RNDr. Vladimír Čech, Ph.D.
- University of Jan Evangelista Purkyně in Ústí nad Labem, Faculty of Science, doc. RNDr. Stanislav Novák, CSc.
- HVM PLASMA, spol. s r.o., Praha, Ing. Jiří Vyskočil, CSc.
- University of South Bohemia in České Budějovice, Pedagogical faculty, prof. RNDr. Petr Špatenka, CSc.

Objective of the solution: The preparation and characterisation, with the assistance of low-pressure plasma, of nanocomposite layers, especially with the plasma polymer matrix, layered nanocomposites, and the layers consisting of nanoparticles. The research of their application possibilities, including potential applications in biology and medicine. There are researched new methods using the low-pressure plasma based on magnetron configurations, a plasma jet, including the methods of creation cluster and nanoparticles beams.

SUB PROGRAMME 2: Nanobiology and nanomedicine

KAN200520701 **“Nano-PCR – the ultrasensitive test detecting specific proteins in body fluids”**, 01/2007–12/2011, the researcher is RNDr. Petr Dráber, DrSc., Institute of Molecular Genetics of AS CR, Praha, the total costs of CZK 51.2 million, thereof CZK 43.5 million from the state budget.

(Year 2008 – 10.240/8.700, 3e)

Co-researchers:

- Charles University in Praha, 3rd Faculty of Medicine, MUDr. Aleš Bartoš
- Praha Psychiatric Center, RNDr. Daniela Řípová, CSc.
- TOP-BIO, s.r.o., Praha, Marek Dráber, MBA
- VIDIA spol. s r.o., Vestec – Jesenice u Prahy, Ing. Michaela Poláková

Objective of the solution: The development of a new diagnostic system for the ultrasensitive detection of rare proteins in body liquids with the dynamic resolution of up to 8 levels. The test is based on the bond of the studied protein with a monoclonal antibody (mAb) immobilised, together with thiolated DNA oligonucleotides, on a golden nanoparticle (NP). The consequent steps will study the complex protein-NP caught and isolated on magnetic immunoparticles. The thiolated DNA oligonucleotides become free and serve as the initiation and limiting DNA primers in the quantitative polymer chain reaction (PCR) in real time. The usability of this method will be verified in the detection of cytoskeleton proteins in body liquids of patients with neuropsychiatric diseases and in the detection of cytokinins. The testing of the use of the scale of new mAb with the nano-PCR method makes a part of the project. It is expected that the nano-PCR will be 6–8 times more sensitive, when compared with the common ELISA method, and will allow for the development of new ultrasensitive diagnostic methods of new generations.

KAN200520702 **“Nanoimmunosensors detecting cytokines”**, 01/2007–12/2011, the researcher is Ing. Peter Šebo, CSc., Biotechnology Institute of AS CR , Praha, the total costs of CZK 62.433 million, thereof CZK 53.018 million from the state budget.

(Year 2008 – 12.119/10.241, 4b)

Co-researchers:

- Institute of Microbiology of AS CR , Praha, Ing. Radim Osička, Ph.D.
- National Institute of Public Health, Praha, MUDr. Marta Havelková, CSc.
- University of Jan Evangelista Purkyně in Ústí nad Labem, Faculty of Science, Mgr. Jan Malý, Ph.D.
- VIDIA spol. s r.o., Vestec – Jesenice u Prahy, RNDr. Luděk Lepša, Ph.D.
- Proteix s.r.o., Jesenice u Prahy, Ing. Jiří Špička
- BVT Technologies, a.s., Brno, RNDr. Jan Krejčí, Ph.D.

Objective of the solution: The development of the integrated basic research of physical principles and nanotechnological processes allowing the preparation of fast reacting, sensitive, specific, and robust nanoimmunosensors in the Czech Republic for the detection of biological ligands, especially cytokines. The four academic groups have joined with three research-oriented companies for the establishment of a research consortium. It will closely co-operate in the research of relations between the structure and functions of recombinant bond proteins, the mechanisms of their immobilisation on colloid nanoparticles and on nanostructured surfaces, the principles of an effective preparation of optimised nanoelectrode surfaces, and their integration in biosensors. The dynamic characteristics and the selectivity of proposed immunochromatographic and electrochemical sensors will be verified on the model detection of the interferon gamma in defined solutions and in real blood samples of patients suspected of tuberculosis.

KAN200520703 **“The use of ultrasound in nanomedicine”**, 01/2007–12/2011, the researcher is doc. Ing. Jiří Neužil, CSc., Biotechnology Institute of AS CR, Praha, the total costs of CZK 92.823 million, thereof CZK 74.123 million from the state budget.

(Year 2008 – 16.550/12.800, 3g)

Co-researchers:

- Institute of Physiology of AS CR, Praha, doc. RNDr. František Kolář, CSc.
- Institute of Organic Chemistry and Biochemistry of AS CR, Praha, RNDr. Miroslav Ledvina, CSc.
- University of Veterinary and Pharmaceutical Sciences Brno, Faculty of Veterinary Medicine, doc. MVDr. Michal Vlašín, Ph.D.
- Veterinary Research Institute, RNDr. Jaroslav Turánek, CSc.
- Apronex s.r.o., Jesenice u Prahy, Ing. Jiří Špička
- CPN spol. s r.o., Dolní Dobrouč, RNDr. Vladimír Velebný, CSc.
- TOP-BIO, s.r.o., Praha, Marek Dráber, MBA
- KRD – obchodní společnost s.r.o., Praha, MUDr. Zdeněk Kleibl, Ph.D.

Objective of the solution: The development and application of a technology in the area of the so-called nanomedicine, with the assistance of the newest knowledge gained in the field of physical chemistry and biology, which could be used for the very efficient diagnostics and treatment of main diseases occurring in industrialised countries, including the Czech Republic – the neoplastic and cardiovascular diseases. The subject of the programme project relates to the development and application of a modern carrier based on microbubbles – the small particles the surface of which will be created mainly by lipid components, while the inner part is filled with heavy gas. These microbubbles will be modified in such a way that they connect with the targeted tissues, where they will be detected and destroyed by the ultrasound. These so-called “nanoshrapnels” will introduce biologically active substances into the targeted cells and will assist in both diagnostics and treatment. This approach is highly modern and sophisticated and it follows the newest trends in biomedicine – the molecular in vivo targeting. Results of this project will be utilised in future in diagnostics and patients’ treatment.

KAN200520704 **“New nanoparticles for the ultrastructural diagnostics”**, 01/2007–12/2011, the researcher is doc. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics of AS CR, Praha, the total costs of CZK 88.595 million, thereof CZK 73.525 million from the state budget.

(Year 2008 – 17.699/16.499, 3g)

Co-researchers:

- Institute of Macromolecular Chemistry of AS CR, Praha, RNDr. Miroslav Šlouf, Ph.D.
- Biology Centre of AS CR, Ing. Jana Nebesářová, CSc.

- SEVAPHARMA a.s., Praha, RNDr. Marek Moša, Ph.D.
- CENTRAL EUROPEAN BIOSYSTEMS s.r.o., Praha, MUDr. Zdeněk Kleibl, Ph.D.

Objective of the solution: The project should allow for the first time in history of the ultrastructural cytochemistry the sensitive marking of at least four antigens at the same time. It has got the three following main goals: 1) The development of a set of nanoparticles, of the size 5–15 nm, of varied shapes or with a component composition, suitable for the ultrastructural cytochemistry. The resulting set will have at least four different stable nanoparticles for the simultaneous detection in electron microscopes. 2) The preparation of stable detection set of nanoparticles conjugated with antibodies for the multiple ultrastructural marking in biomedicine and the in detail characterising of their properties for TEM and SEM. The resulting detection set will be transferred for the commercial completion and dissemination in the scientific community. 3) The development of a diagnostic tool and of a standardised procedure for the ultrastructural characterising of the spectrum of antigens of viral vaccines/fractions of a vaccine against mumps. The result will improve the vaccine quality and the controls of the presence of necessary immune antigens. It should be commercially utilised.

KAN200670701 **"Surface plasmon resonance biosensors and protein chips for the medical diagnostics"**, 01/2007–12/2011, the researcher is Ing. Jiří Homola, CSc., Institute of Photonics and Electronics of AS CR, Praha, the total costs of CZK 63.555 million, thereof CZK 55.688 million from the state budget.

(Year 2008 – 10.828/9.084, 4a)

Co-researchers:

- Institute of Macromolecular Chemistry of AS CR, Praha, RNDr. Eduard Brynda, CSc.
- Institute of Hematology and Blood Transfusion, Praha, prof. Ing. Jan Evangelista Dyr, DrSc.
- VIDIA spol. s r.o., Vestec – Jesenice u Prahy, MUDr. Pavel Jinoch

Objective of the solution: The achievement of a significant progress in the research of photonic nanostructures and biofunctions that should allow for the development of a new generation of optic surface plasmon resonance biosensors detecting molecular substances in nanomedicine. The research of the photonic nanostructures is focussed mostly on the metal-dielectric nanostructures with managed or localised surface plasmons which are usable in optical sensors. The research in the area of biological nanostructures focuses on sets of biological and synthetic macromolecules with the managed composition and architecture. An important part of the proposed project relates to the development of new biosensor types with potential applications in medical diagnostics, specifically the multichannel biosensors and multifunctional protein chips for new diagnostic methods for the myelodysplasia syndrome, biosensors for the diagnostics of herpes infections, and the detection of biomarkers of human health defects by polycyclic aromatic hydrocarbons and endocrine disruption agents.

SUB PROGRAMME 3: Nano-macro interface

KAN300100702 **"Creation of nanostructures by X-ray lasers"**, 01/2007–12/2011, the researcher is Ing. Bedřich Rus, Dr., Institute of Physics of AS CR, Praha, the total costs of CZK 24.345 million, thereof CZK 21.910 million from the state budget.

(Year 2008 – 3.111/2.581, 1d)

Co-researchers:

- Institute of Plasma Physics of AS CR, Praha, RNDr. Karel Koláček, CSc.
- Institute of Scientific Instruments of AS CR, Brno, Ing. Jaroslav Sobota, CSc.
- Czech Technical University in Praha, Faculty of Biomedical Engineering, Dr. Ing. Jaroslav Kuba, Ph.D.
- REFLEX s.r.o., Praha, doc. Ing. Ladislav Pína, DrSc.

Objective of the solution: The utilisation of the state of art high repetition sources of the coherent radiation in the field of the soft X-ray spectrum (10–50 nm) for the creation and monitoring of nanometric structures on surfaces of solid substances. It is qualitatively a new research direction focussing on the study of interactions of the highly intensive soft X-ray radiation with a mass which cannot be done with the conventional X-ray/XUV sources. In addition to the pilot study of fundamental physical solid phase ablation processes by the soft X-ray radiation, the project will research and optimise methods of the managed generation of nanostructures, especially in the mode of the ablation monopulse microlithography. This basic plan relates (a) to the implementation and development of highly repetitive sources of the coherent X-ray/XUV radiation on the basis of a capillare discharge and the Ti:sapphire pumping laser, (b) to the development of an advanced X-ray focus optics for the XUV/X-ray beams, and (c) to the development of the XUV/X-ray interferrometry and holography for the diagnostics of surfaces with the nanometric resolution.

KAN301370701 **“Nanostructured macroscopic systems – preparation technology and characterising”**, 01/2007–12/2011, the researcher is prof. RNDr. Miroslav Hrabovský, DrSc., Palacky University Olomouc, Faculty of Science, the total costs of CZK 79.858 million, thereof CZK 70.929 million from the state budget.

(Year 2008 – 21.071/19.322, 1d)

Co-researchers:

- Institute of Physics of AS CR, Praha, Ing. Ivan Gregora, CSc.
- PIEZOCERAM, s.r.o., Hradec Králové, Ing. Miroslav Boudyš, CSc.

Objective of the solution: The preparation of a complex approach to the technology, diagnostics, optimising, and characterising of modern structured materials for a wide spectrum of applications. The studied materials include thin-layered structures, gradient oxide systems, electroceramic and other technically important materials prepared by the original plasma-chemical methods with the special focus on the nanometric structures. Applications and the work out of modern integrated methods with the high space resolution for the nanometric mapping of surfaces and the complex characterising of samples.

KAN311610701 **“Nanometrology using methods of the scanning probe microscopy”**, 01/2007–12/2011, the researcher is Mgr. Petr Klapetek, Ph.D., Czech Metrology Institute, Brno, the total costs of CZK 21.151 million, thereof CZK 18.793 million from the state budget.

(Year 2008 – 2.993/2.693, 7e)

Co-researchers:

- Institute of Scientific Instruments of AS CR, Brno, Ing. Dr. Josef Lazar, Dr.
- Masaryk University, Faculty of Science, Brno, RNDr. Vilma Buršíková, Ph.D.

Objective of the solution: The development of methods for the scanning probe microscopy with the focus on the following areas: 1) The development of methods for the precise interferometric measuring of small lengths, 2) The direct connection of the length and shape nanostructure measuring with the state length standards, 3) The quantitative measuring of mechanical properties of nanostructures in combination with the microindentation, nanoindentation, and the scanning probe microscopy, 4) The development of theoretical models of point and surface interaction in the area of scanning probe microscopy and nanoindentation. The development of these methods will create a unique workplace dealing with the quantitative probe microscopy.

SUB PROGRAMME 4: New phenomena and materials for nanoelectronics

KAN400100701 **"Functional hybrid semiconductor and metal nanosystems with organic substances (FUNS)"**, 01/2007–12/2011, the researcher is RNDr. Bohuslav Rezek, Ph.D., Institute of Physics of AS CR, Praha, the total costs of CZK 96.021 million, thereof CZK 90.714 million from the state budget.

(Year 2008 – 29.351/28.104, 6c)

Co-researchers:

- Charles University in Praha, 1st Faculty of Medicine, Ing. Stanislav Kmoch, CSc.
- Charles University in Praha, Faculty of Mathematics and Physics, prof. RNDr. Petr Malý, DrSc.
- Brno University of Technology, Faculty of Mechanical Engineering, prof. RNDr. Tomáš Šikola, CSc.
- OPTAGLIO s.r.o., Řež, Ing. Libor Kotačka, Ph.D.

Objective of the solution: The connection of nanostructural components into functional units – nanosystems. The objective of this project is the creation of nanostructures based on thin layers of semiconductors (mainly silicon, diamond, and metal oxides), on metals and organic substances (e.g. organic dyes or DNA molecules), their connection into hybrid nanosystems with controls of growth, orientation and the placement with the assistance of physical-chemical parameters. Their functioning will be consequently characterised from the targeted applications points of view, e.g. as nanosensors, nanoelectronics, optoelectronics, or forensic devices. This experimental approach is supported by the theoretical studies and the computer assisted modelling of properties of the nanointerfaces between organic and inorganic materials. It is expected that the project results will contribute to the faster utilisation of nanotechnologies in practice and to the revelation of new phenomena at the levels of atoms and molecules.

KAN400480701 **"Nanostructures based on carbon and polymers for the use in bioelectronics and in medicine"**, 01/2007–12/2011, the researcher is Mgr. Jiří Vacík, CSc., Nuclear Physics Institute of AS CR, Řež, the total costs of CZK 47.106 million, thereof CZK 44.681 million from the state budget.

(Year 2008 – 7.874/7.387, 2e)

Co-researchers:

- Institute of Physics of AS CR, Praha, Ing. Bc. František Fendrych, Ph.D.
- Institute of Inorganic Chemistry AS CR, Řež, Ing. Zbyněk Černý, CSc.

- Institute of Chemical Technology Praha, prof. Ing. Václav Švorčík, DrSc.
- Institute of Physiology of AS CR, Department of growth and differentiation of cell populations, Praha, MUDr. Lucie Bačáková, CSc.

Objective of the solution: The preparation and characterising of perspective nanostructured materials (especially based on allotropes of carbon and on synthetic polymers) presenting important biological or other (electric, optic, etc.) properties which could be utilised in interactions with biological systems. The prepared composite materials (created on the basis of fullerenes and metals, carbon and polymers, modified nanocrystalline diamonds, multifunctional carbons, etched ion footprints, or occurring by ion implantation, or ion radiation) will be researched from the point of view of the biocompatibility, cell adhesion and growth, or other bioapplications. Another project objective is the preparation and demonstration of an active hybrid system based on the connection of a cell (or a biomolecule) with a microelectronic part through the interface created with a thin layer of a modified nanocrystalline diamond.

KAN400720701 **"Hierarchy nanosystems for microelectronics"**, 01/2007–12/2011, the researcher is Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals of AS CR, Praha, the total costs of CZK 50.0 million, thereof CZK 47.5 million from the state budget.

(Year 2008 – 9.684/9.184, 2a)

Co-researchers:

- Institute of Physics of AS CR, Praha, Mgr. Zdeněk Hubička, Dr.
- Institute of Microbiology of AS CR , Praha, RNDr. Tomáš Cajthaml, Ph.D.
- J. Heyrovsky Institute of Physical Chemistry of AS CR, Praha, Ing. Pavel Hrabánek, Dr.
- Institute of Macromolecular Chemistry of AS CR, Praha, prof. RNDr. Stanislav Nešpůrek, DrSc.
- Charles University in Praha, Faculty of Mathematics and Physics, doc. RNDr. Radomír Kužel, CSc.
- Institute of Chemical Technology Praha, Faculty of Chemical Technology, doc. Ing. Petr Klusoň, Dr.
- Výzkumný ústav organických syntéz a.s., Ústí nad Labem, Ing. Jan Rakušan, CSc.
- University of Jan Evangelista Purkyně in Ústí nad Labem, Faculty of Science, doc. RNDr. Jaroslav Pavlík, CSc.

Objective of the solution: The creation of complex structured systems with the precisely defined final function usable in microelectronics. The individual parts are made up of small arranged particles ensuring partial functions necessary for the functionality of the whole system. These complex structures should be directly suitable as parts of special sensors, photoelectrochemical energy sources, microelectrodes used in analytical instruments, etc. From the general point of view, the main project objective is the collection of a satisfactory number of high quality experimental data which could be used for the design and completion of practical nanotechnologies. The project focuses on the study of the preparation of hierarchy nanostructures, including the structural and functional characterising and prediction of their properties with the assistance of mathematical modelling.

Review of the public tender 2nd round results:

	Sub programme 1	Sub programme 2	Sub programme 3	Sub programme 4	TOTAL
Number in the tender submitted proposals	5	7	4	4	20
Number of projects accepted within the programme	3	5	3	3	14
Success rate (in %)	60	71.4	75	75	70
Recognised costs of accepted projects within the research period (in thousand CZK)	111 406	360 519	125 243	193 127	790 295
Target-oriented support of accepted projects within the research period (in thousand CZK)	88 756	299 861	111 632	182 895	683 144
Average share of the target-oriented support in recognised costs (in %)	79.7	83.2	89.1	94.7	86.4

1.1.3. List of projects accepted for solution within the 3rd round of the public tender

There have been the following projects accepted within the 3rd round of the public tender for solution in the period from 1 January 2008 to December 2012:

SUB PROGRAMME 1: Nanoparticles, nanofibres and nanocomposite materials

KAN115600801 **"New preparation and use technologies related to nanoparticles based on iron oxides for the environmental, industrial and medical applications",** 01/2008– 12/2012, the head researcher is doc. RNDr. Radek Zbořil, Ph.D., Palacky University Olomouc, Faculty of Science, the total costs of CZK 73.463 million, thereof CZK 58.757 million from the state budget.

(Year 2008 – 11.155/8.911, 1a)

Co-researchers:

- H+A Eco Cz s.r.o., Olomouc, Ing. Oleg Lysytchuk, CSc.
- MEDIHOPE s.r.o., Prostějov – Krasice, prim. MUDr. Pavel Novák

Objective of the solution: The project focuses on four key scientific fields mutually interconnected through nanoparticles of iron oxides with the following objectives: 1) The development of advanced iron oxides based catalysts with an extraordinary catalytic effectiveness in the hydrogen peroxide disintegration and other environmentally important processes of the heterogeneous catalysis; 2) The production of new functioning magnetic nanoparticles with the "core-shell" structure, including magnetozomes produced by bacteria applied during the magnetic resonance imaging for the targeted transport of medicine, and other bioapplications; 3) The managed syntheses of Fe-FeO and Fe-Fe_3O_4 nanocomposites; the semi-operational manufacture and testing in reductive water treatment technologies and in the area of magnetorheological fluid liquids; 4) The use of nanocrystalline hydrated iron oxides (ferrihydrites) as precursors for the synthesis of ferrates by the reaction in the solid phase with the goal of increasing the reaction yield and the technology implementation at large; the testing in the oxidative water treatment technologies.

SUB PROGRAMME 2: Nanobiology and nanomedicine

KAN200100801 **"Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and pharmacy"**, 01/2008–12/2012, the head researcher is prof. RNDr. Miloš Nesládek, CSc., HDR., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 121.207 million, thereof CZK 98.556 million from the state budget.

(Year 2008 – 27.142/23.200, 3d)

Co-researchers:

- Zentiva, a.s., Praha, Ing. Jan Šotola, CSc.
- GENERI BIOTECH s.r.o., Hradec Králové, RNDr. Martin Bunček, Ph.D.
- University of Pardubice, Faculty of Chemical Technology, Mgr. Jan Mistrík, Ph.D., Dr.
- University of South Bohemia in České Budějovice, Faculty of Science, Mgr. Lukáš Trantírek, Ph.D.
- Institute of Chemical Technology Praha, Faculty of Chemical Engineering, prof. RNDr. Vladimír Král, DrSc.
- Charles University in Praha, 3rd Faculty of Medicine, As. MUDr. Viktor Kočka, FESC.
- Institute of Organic Chemistry and Biochemistry of AS CR, v. v. i., RNDr. Miroslav Ledvina, CSc.
- J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., prof. RNDr. Ladislav Kavan, DrSc.
- ELMARCO s.r.o., Liberec, Ing. Lukáš Rubáček, Ph.D.

Objective of the solution: The preparation and the study of nanostructured materials with bioactive surfaces, as, for example, new medicine carriers, nanofibres and nanocarbon-based materials, i.e. carbon nanotubes, nanodiamonds, and polymers with significant biocompatibility for the use in medicine, pharmacy and diagnostics. The coating of ceramic nanoparticles and nanofibres with polymers or diamond by nucleic methods of self-assembly and the use of uniquely low temperature of diamond growth below 150 °C that should allow for the preparation of new nanocomposites with surfaces suitable for the functioning by biomolecules. The medicine carriers will be studied for the immobilisation of macrocyclic compounds, mostly porphyrins and metaloporphyrins, proteins and polysaccharides respectively. The active surfaces will be studied for the transport of DNA, peptides and cytostatic agents with the targeted therapeutic effect and the simultaneous protection against biodegradation. The chemical surface modifications will focus on applications in medicine dosing and on bioactive biocompatible surgery stents.

KAN200380801 **"Immunonanotechnology for the diagnostics of substances having the hormonal character"**, 01/2008–12/2012, the head researcher is prof. Miroslav Strnad, DrSc., Institute of Experimental Botany of AS CR, v. v. i., the total costs of CZK 35.122 million, thereof CZK 29.797 million from the state budget.

(Year 2008 – 6.044/4.588, 3g)

Co-researchers:

- Palacky University Olomouc, Faculty of Science, doc. RNDr. Radek Zbořil, Ph.D.
- Veterinary Research Institute, v. v. i., Brno, Dr. Milan Fránek, DrSc.
- OlChemIm, s.r.o., Olomouc, RNDr. Luděk Fröhlich

Objective of the solution: The development of new diagnostic "immunonanotechnologies" allowing for the highly sensitive detection (at the level of atoms and smaller) and for the quantification of hormonal substances of the plant or animal origins at the cell, tissue or plant tissue levels. The project will include the preparation of four basic components of the following nanotechnologies: 1) New kinds of antigens inducing the creation of generic poly or monoclonal antibodies;

2) The development of a new generation of immunosorbents based on functioning magnetic nanoparticles and the development and optimising of the micro and nanoimmunoextraction; 3) The development of a new generation of analytical instruments determining substances of the hormonal nature with the assistance of the combined immunoaffinative chromatography and UPLC/MS/MS at the atomic level; 4) The application of immunonanotechnologies on samples of plant tissues, tissues and cells, including the microdissection application. The project should result in more than 20 new licensed products which could be offered to cooperating companies. It is expected that most products will be exported.

KAN200520801 **"Targeted expression and transport of bioactive molecules"**, 01/2008–12/2012, the head researcher is Mgr. David Staněk, Ph.D., Institute of Molecular Genetics of AS CR, v. v. i., Praha, the total costs of CZK 72.230 million, thereof CZK 59.805 million from the state budget.

(Year 2008 – 15.718/13.233, 3b)

Co-researchers:

- Institute of Experimental Medicine of AS CR, v. v. i., Praha, RNDr. Karel Koberna, CSc.
- Institute of Organic Chemistry and Biochemistry of AS CR, v. v. i., Praha, Ing. Ivan Rosenberg, CSc.
- Institute of Applied Biotechnologies a.s., Praha, MUDr. Josef Fišer

The project has got the two basic objectives:

1. The development of nucleotide and oligonucleotide probes freely going through the membrane and the development of other approaches allowing the transport of diagnostically and therapeutically important substances of the nucleoside type, oligonucleotide or DNA constructions to cells. In addition, it will focus on the development of probes which allow visualisation at the light or electron microscope level without the need of specific antibodies' use.

2. The creation and testing of a promoter system expressing and verifying the molecular tool – bipartite proteins consisting of two different sub units which, thanks to their mutual interaction (joining) would create a functional molecule. This molecule, if it is able of, for example, fluorescence or a colour reaction, could serve as a molecular sensor. If it is able to destroy a cell, it could be used for the liquidation of ill cells.

KAN200520804 **"Biocompatible nanofibrous constructions creating new medicinal forms for the application of biologically and pharmaceutically active substances"**, 01/2008–12/2012, the head researcher is doc. RNDr. Vladimír Holáň, DrSc., Institute of Molecular Genetics of AS CR, v. v. i., Praha, the total costs of CZK 48.497 million, thereof CZK 40.124 million from the state budget.

(Year 2008 – 8.054/6.808, 3c)

Co-researchers:

- Institute of Experimental Medicine of AS CR, v. v. i., Praha, prof. MUDr. Eva Syková, DrSc.
- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, Ing. Jiří Michálek, CSc.
- ELMARCO s.r.o., Liberec, Ing. Marcela Munzarová

Objective of the solution: The research in the area of polymer nanofibre carrier use for the creation of new medicine forms serving for targeted and managed application of pharmacologically and biologically active substances, especially in the area of immunopharmacy. The research will deal with the utilisation possibilities of adsorption and absorption of biologically active substances on nanofibre carriers, but also with the utilisation of nanofibre double layers for the encapsulating of cell cultures releasing immunologically active substances. The biocompatibility and functionality of these constructions will be verified in vitro in tissue cultures and they will be tested on experimental animal models. The final objective is the design and manufacture of completely new medicine forms based on nanofibre technologies widely usable for medical purposes in different areas of medicine.

KAN208130801 **"New constructions and use of nanobiosensors and nanosensors in medicine (NANOSEMED)"**, 01/2008–12/2012, the head researcher is Ing. Jaromír Hubálek, Ph.D., Brno University of Technology, Faculty of Electrical Engineering and Communication, the total costs of CZK 32.919 million, thereof CZK 27.976 million from the state budget.

(Year 2008 – 9.051/6.939, 6c)

Co-researchers:

- Mendel University of Agriculture and Forestry in Brno, Faculty of Agronomy, doc. Ing. René Kizek, Ph.D.
- RADANAL s.r.o., Pardubice, doc. Ing. Aleš Horna, CSc.

Objective of the solution: The creation of a new and original construction of mono or heterogeneous nanosystems, as nanobiosensors and nanosensors suitable for medicine. The progress of medicinal technologies pushes into the front the on-line monitoring of not only physiological parameters of an individual, but also the treatment effect. It is based on the monitoring of the level of glucose, cytostatic agents, and other medicine, or on the simple and fast analysis of the biologically important proteins (p53, p21, metalothionein, glutathion, rb protein, etc.) and the sequences of nucleic acids (the gene for the cystic fibrosis, etc.). The nanosensors and nanobiosensors using materials with unique physical-chemical properties could initiate important progress in the area of detection of biologically and clinically important compounds. The attention will be also paid to magnetic materials suitable for the separation of these compounds. The processes will allow the simple and selective detection and separation of looked for biomolecules and compounds.

SUB PROGRAMME 3: Nano-macro interface

KAN300100801 **"Multifunctional metallic bulk materials with nanocrystalline and ultrafine grain structures"**, 01/2008–12/2012, the head researcher is prof. Ing. Pavel Lejček, DrSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 71.700 million, thereof CZK 64.529 million from the state budget.

(Year 2008 – 16.892/15.103, 1e)

Co-researchers:

- Charles University in Praha, Faculty of Mathematics and Physics,
  RNDr. Ivan Procházka, CSc.
- Institute of Chemical Technology Praha, Faculty of Chemical Technology,
  doc. Dr. Ing. Dalibor Vojtěch
- VUK-Kovohutě, s.r.o., Panenské Břežany, Ing. Miloš Choura

Metallic bulk materials with extremely small grain sizes and phases present offer fundamental improvements of their functional and structural properties and thus also significant spreading of their application potential in the transport industry, in medical implants, for the energy storage, and in the mechanical engineering. The project focuses on the preparation of ultrafine and nanocrystalline metallic bulk materials of defined structures and with perspective application properties. The top methods of material characterising should allow for the high quality feedback for the continuous improvement of their properties. The goal is to develop techniques based on severe plastic deformation and rapid cooling with subsequent consolidation and to the 3D diagnostic methodology for nanostructures with the assistance of PAS and 3D grain boundaries topology with FESEM+FIB+EBSD.

KAN300100802 **"Nanocomposite, ceramic and thin layer scintillators"**, 01/2008 – 12/2012, the head researcher is Ing. Martin Nikl, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 42.536 million, thereof CZK 37.784 million from the state budget.

(Year 2008 – 12.116/11.000, 2c)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec, Ing. Ivo Jakubec, CSc.
- Charles University in Praha, Faculty of Science, RNDr. Daniel Nižňanský, Ph.D.
- Charles University in Praha, Faculty of Mathematics and Physics, doc. RNDr. Miroslav Kučera, CSc.
- Czech Technical University in Praha, Faculty of Nuclear and Physical Engineering, prof. Ing. Viliam Múčka, DrSc.
- CRYTUR, spol. s r.o., Turnov, Dr. Jindřich Houžvička

Objective of the project: The development of technologies preparing perspective scintillation materials in the forms of nanopowders, nanocomposites, optical ceramics, and thin layers. There will be their morphologic, optical, luminescence, and scintillation properties studied. The stress will be put especially on the understanding of the role of nanograins' surfaces, and nanometric interfaces in processes of the transfer and catching energy during the scintillation conversion, the understanding of the basics of optically active defects and their relations with the used technology. The optimised technologies resulting in the maximal utility value of the developed scintillators and their tests under the conditions of practical applications should allow for the identification of suitable technological processes and perspective material systems, which should create a new generation of scintillating materials. Then, on their basis prepared scintillation detectors should allow for further development and innovation of applications in medicine and industry, of security provisions, in science and everywhere, where ionising radiation or energy particles must be monitored.

SUB PROGRAMME 4: New phenomena and materials for nanoelectronics

KAN401220801 **"Nanostructures of Controlled Size and Dimensions**", 01/2008–12/2012, the head researcher is Ing. Anton Fojtík, CSc., Czech Technical University in Praha, Faculty of Nuclear and Physical Engineering, the total costs of CZK 28.182 million, thereof CZK 26.762 million from the state budget.

(Year 2008 – 6.383/6.043, 7b)

Co-researchers:

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, Ing. Daniel Horák, CSc.
- Institute of Photonics and Electronics of AS CR, v. v. i., Praha, RNDr. Jiří Zavadil, CSc.
- REFLEX s.r.o., Praha, doc. Ing. Ladislav Pína, DrSc.

Objective of the solution: The study and implementation of repeatable nanostructure preparation processes and nanomaterials with the targeted management of sizes and arrangements. Nanoparticles of the size of several nm, up to tens of nm, of the static (solutions) and geometrical arrangements at the distance of tens to hundreds nm. There will be the molecular lithography used in combination with other methods, like ion implantation, vf or thermic coatings, electrolytic, iontophoretic, or sedimentation. There will be chemical preparation processes utilised in the restricted space for the particle size management by the use of organic layers' structures, micellar systems, growth stabilisers, and chemical ablation in dual organic systems. There will be metallic nanostructures (Pd, Ni, Ag, Au, and other suitable ones) and semiconductive nanostructures (Si, CdS, Fe oxides, Zn, and other suitable ones) studied. Accessible methods like, for example, the HRTEM, SEM, AFM, STM, and other analyses will be used for the characterising of the nanostructures. The correlation between the arrangement rate in the structures and their electric and optic properties will be studied.

Review of the public tender 3rd round results:

	Sub programme 1	Sub programme 2	Sub programme 3	Sub programme 4	TOTAL
Number in the tender submitted proposals	3	9	3	2	17
Number of projects accepted within the programme	1	5	2	1	9
Success rate (in %)	33.3	55.6	66.7	50	52.9
Recognised costs of accepted projects within the research period (in thousand CZK)	73 463	309 975	114 236	28 182	525 856
Target-oriented support of accepted projects within the research period (in thousand CZK)	58 757	256 258	102 313	26 762	444 090
Average share of the target-oriented support in recognised costs (in %)	80	82.7	89.6	95	84.5

1.2. PROGRAMME "SUPPORT OF TARGETED RESEARCH PROJECTS" (1Q)

Projects solved in the area of nanotechnologies

1QS100100553 **"New hybrid magnetic nanocomposite materials for selected applications in medicine, for the magnetic resonance imaging and the magnetic hyperthermia"**, 7/2005–12/2008, the head researcher is doc. Ing. Emil Pollert, DrSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 3.990 million, thereof CZK 3.990 million from the state budget.

(Year 2008 – 1.131/1.131, 2d)

Co-researcher:

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, Ing. Daniel Horák, Ph.D.

Objective of the solution: The research of new magnetic nanoparticles for applications in medicine. The project covers the synthesis of magnetic particles based on mixed magnetic oxides, ferromagnetic hexagonal ferrits and ferromagnetic manganites of defined properties, their stabilisation and consequent preparation of composite nanoparticles in the use of biocompatible molecules and polymers. The particle surface is suitably modified with the goal to immobilise, for example, the cancer medicine. The treatment of the resulting composites' properties focuses mostly on their consequent utilisation in the treatment of tumorous diseases by the magnetic hyperthermia or as contrast agents in the magnetic resonance imaging methods (MRI).

1QS201710508 **"Impedimetric chemical microsensors with the nanomachined surfaces of electrodes"**, 1/2005–12/2009, the head researcher is Ing. Jaromír Hubálek, Ph.D., Brno University of Technology, Faculty of Electrical Engineering and Communication, the total costs of CZK 11.387 million, thereof CZK 9.671 million from the state budget.

(Year 2008 – 2.274/1.930, 4a)

Objective of the solution: The project is considered as the targeted and applied research. It should result in new technological processes in the area of nanotechnologies which should be adjusted for the construction of new microsensors used for chemical analyses. There should be processes designed which allow for the combination of existing thick layer and thin layer technologies with the new nanotechnologies. The goal will be the finding of optimal diagnostic methods for the utilisation in the analysis of created nanostructures. The project is focussed mainly on the characterising of impedance characteristics of new microsensors and on their dependency on the technology and measured values. The project is based on the strong research and development background and focuses on industrial applications. In addition to processes, there will be also electronic sensor parts developed for the implementation in the form of microchips. The project should contribute intelligent SMART sensors to the chemical analyses requiring the high preciseness and stability.

1QS401250509 **"Ceramic materials of the hierarchy porous structure for the membrane separation technologies"**, 1/2005–2/2008, the head researcher is doc. Ing. Bohumil Bernauer, CSc., Institute of Chemical Technology Praha, Faculty of Chemical Technology, the total costs of CZK 8.063 million, thereof CZK 8.063 million from the state budget.

(Year 2008 – 2.003/2.003, 5a)

Co-researchers:

- University of Pardubice, Faculty of Chemical Technology, prof. Ing. Petr Mikulášek, CSc.
- J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, RNDr. Milan Kočiřík, CSc.
- Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, Ing. Petr Uchytil, CSc.
- Ing. Vladimír Kotek, Hradec Králové

Objective of the solution: Membrane technologies have become important alternatives to classical technologies. The all ceramic membranes are important in high temperature processes. The project has been inspired by the need of reduced costs of preparation of micro and nanofiltration membranes of the hierarchy porous structure. The reduction of the manufacturing intensity related to hierarchy membrane structures requires a lower number of transition layers in nanofiltration membranes. The nanofiltration layers will be done on the basis of zeolite silica-1, NaA, NaY, and DD3R. The main project's goals are (I) the gaining of laboratory preparation processes for standard quality ceramic carriers with a minimal number of transition layers and (II) the gaining of preparation processes for standard quality nanofiltration layers on these layers. The authors have got some ideas how to reduce the number of transitional layers and one of them relates to the use of crystalline eyes on the carrier surfaces. The main results will be materials for the consequent industrial research and development.

1QS500110564 **"New hybrid bio-artificial vascular substitutes by the tissue engineering methods"**, 7/2005–12/2009, the researcher is MUDr. Lucie Bačáková, CSc., Institute of Physiology of AS CR, Praha, the total costs of CZK 8.857 million, thereof CZK 8.857 million from the state budget.

(Year 2008 – 2.034/2.034, 3c)

Co-researcher:

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, RNDr. František Rypáček, CSc.

Objectives of the solution: The clinically used vein replacements, manufactured by the knitting technology from PET fibres in VUP a.s. in Brno, are improved by the application of new biomaterials based on copolymers, polyesters, and polyethylenoxide. These modifications limit the adsorption of proteins, the adhesion and activation of thrombocytes and immune cells, and the permeability of the replacement wall. There were biomaterials of specific functions, adhesive proteins or peptide sequences applied in the next step and they selectively supported the adhesion of endothelial cells with the aim to stimulate the creation of a continuous endothelial bed on the luminal surface of the vein replacement. In the final stage, the biomaterials with bound adhesive nanostructures, ensuring the selective interactions with cells, utilised for the preparation of complete vein replacements, new hybrid tissues made of organised cell structure of endothelial and smooth muscle cells on the carrying skeleton of the polymer biomaterial. The in vitro tissue cultivation in a dynamic reactor is developed during preparations of vein replacements of a new generation.

1QS600220501 **"Application workplace for the low-voltage electron microscopy used for biological preparations"**, 1/2005–12/2009, the researcher is Ing. Jana Nebesářová, CSc., Biology Centre of AS CR, v. v. i., Institute of Parasitology, České Budějovice, the total costs of CZK 3.194 million, thereof CZK 3.194 million from the state budget.

(Year 2008 – 0.553/0.553, 7a)

Objectives of the solution: The low-voltage electron microscope LV EM is a new microscope kind specially designed for the observation of samples consisting of elements having low atomic numbers, e.g. biological objects. It uses primary electrons speeded up by the voltage of 5 kV. These relatively slow electrons can penetrate samples of the thickness of only 20 nm, but with the very high contrast amplification, which allows for the omission of contrasting procedures during preparate preparations. This project creates an application workplace for the low-voltage electron microscopy focussed on resolving the following problems: 1) The preparates' preparations for LV EM and the interpretation of gained results, 2) The finding of suitable applications in biology and medicine, and 3) The microscope promotion among experts.

1.3. PROGRAMME "GRANTS OF A DISTINCT EXPLORATORY CHARACTER FOCUSSED ON THE RESEARCH DEVELOPED CURRENTLY MAINLY IN AS CR" (IA)

Projects solved in the area of nanotechnologies

IAA100100616 **"The electron structure and physical properties of materials for nanoelectronics"**, 1/2006–12/2009, the head researcher is RNDr. Václav Drchal, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 1.758 million, thereof CZK 1.758 million from the state budget.

(Year 2008 – 0.337/0.337, 6b)

Co-researcher:

- Institute of Physics of Materials of AS CR, v. v. i., Brno, RNDr. Ilja Turek, DrSc.

Objective of the solution: The creation of ab initio electron theory of systems with potential applications in nanoelectronics and spintronics. There will be physical properties of solid substances, clusters and nanostructures systematically studied on the basis of their electron structure. The studies of electron transport and of other dynamic phenomena, exchange interactions, energy, the phase stability, and the spontaneous creation of nanostructures are also planned. A special stress is put on the correct coverage of electron correlations.

IAA100100622 **"Conjugated silicon polymers for resistors in nanotechnologies"**, 1/2006–12/2009, the head researcher is RNDr. Josef Zemek, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 5.246 million, thereof CZK 5.246 million from the state budget.

(Year 2008 – 1.316/1.316, 1g)

Co-researchers:

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, prof. RNDr. Stanislav Nešpůrek, DrSc.
- Institute of Scientific Instruments of AS CR, v. v. i., Brno, RNDr. Petr Schauer, CSc.
- Tomáš Baťa University in Zlín, Faculty of Technology, prof. Ing. František Schauer, DrSc.

Objective of the solution: The classic optical and electron lithography remains the main technology in the semiconductor industry, when manufacturing the current line width of 100 nm. The new technology of nanoprinting into polymers works with the resolution of 10 nm. The advanced manufacturing of masks with high energy electron beams thus must go through fundamental changes. The organic silicon nanostructure polymer materials make a new group of electronically active materials. The project's goal is the research of processes resulting in the forming of metastable states in organic silicon polymers as, for example, weak bonds, their conversions to interrupted bonds, the influencing of these processes by the selection of materials, but also by active additives put into active silicon polymers. The methodologies utilised within the project will be the photoelectron spectroscopy, effusive spectroscopy, and photo and cathodoluminescence supported by the quantum-chemical calculations for the understanding of microphysical phenomena resulting in the metastability and degradation.

IAA100100632 **"Interfaces in nanogranular systems – the impact of high external pressures on magnetic and magnetic-transport properties"**, 1/2006–12/2008, the head researcher is RNDr. Zdeněk Arnold, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 0.920 million, thereof CZK 0.920 million from the state budget.

(Year 2008 – 0.311/0.311, 6b)

Objective of the solution: The granular interface takes over relatively large volume in nanogranular systems and it significantly influences macroscopic properties of these systems. The project's main goal is the contribution to the knowledge of external pressure on nanosystems' properties and to the in-depth understanding of the interface role in these systems. There will be studies of macroscopic characteristics (magnetisation, electric resistance, including GMR – the giant magnetoresistance) of iron-based systems, which contain oxide and metallic nanoparticles, organised at high hydrostatic pressures. The project will study the reversible and irreversible behaviour of ballistic conductive materials. The changes in the interface, caused by pressure, will be correlated with changes in the intrinsic magnetic properties of nanoparticles. The study will be supplemented with the Mössbauer spectroscopy in high magnetic fields utilised mostly for the study of quality of the interface and of its influence on GMR.

IAA100100718 **"Metal-dielectric nanostructures for optics"**, 1/2007–12/2009, the head researcher is Dr. Ing. Jiří Bulíř, Dr., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 3.258 million, thereof CZK 3.258 million from the state budget.

(Year 2008 – 0.932/0.932, 2c)

Co-researcher:

- Czech Technical University in Praha, Faculty of Nuclear and Physical Engineering, prof. Ing. Pavel Fiala, CSc.

Objective of the solution: The studies of optical phenomena on structures combining metals with dielectric materials (M-D). The studied materials will cover dielectrics like, for example, oxides, nitrides, and fluorides. The selection of metallic materials has been reduced to the low-loss metals, especially Ag. A special attention will be paid to phenomena on the interface of these materials, from the technological preparation point of view (e.g. the mutual interdiffusion, oxidation of metallic parts, adhesion, or the nucleation mode), but also from the optical phenomena point of view. The surface and interface qualities will be studied by the analytical methods (SEM, AFM, TEM, XPS, etc.) and indirectly simulated by the use of spectrophotometric data and the ellipsometric measurements. There will be phenomena related to the behaviour of the surface plasmon studied on the created structures, including its resonance properties and mutual optical bonds. The gained knowledge will be applied in the development of complex M-D structures using optical phenomena in connection with plasmon interactions with the electromagnetic radiation.

IAA100100719 **"The controlled preparation of semiconductor quantum dots"**, 1/2007–12/2009, the head researcher is doc. Ing. Eduard Hulicius, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 1.763 million, thereof CZK 1.763 million from the state budget.

(Year 2008 – 0.558/0.558, 7d)

Objective of the solution: The controlled preparation of the shape and sizes of polyconductors' quantum dots (QD) on the basis of InAs, later also GaSb, with the method of organic-metallic epitaxy (MOVPE). The important optic and electric properties of structures with QD are often determined by their size and shape, thanks to the comparable size of QD with the de Broglie electron and holes' wavelength, rather than by the material from which QD have been prepared. The structure kind (the QD density, the number and distance of layers with QD in the vertically arranged structures) will also play a big role in optimising of the preparations. The above-described parameters are determined by the technological preparation process. These QD parameters will be managed by the growth temperature and speed, by the ratio of growth precursors, the time course of the epitaxy, and also by other technological parameters (e.g. the orientation and the substrate preparation). The epitaxy from molecular beams (MBE) has been the dominant technology for the QD preparation so far. This project should also prove that MOVPE is comparable with MBE from the preparation point of view.

IAA100100729 **"Development of new hybrid deposition techniques for the preparation of thin nanostructural fluoride layers of distinct fluorescence properties"**, 1/2007–12/2010, the head researcher is Ing. Ján Lančok, Ph.D., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 9.768 million, thereof CZK 9.768 million from the state budget.

(Year 2008 – 2.087/2.087, 7d)

Co-researchers:

- Charles University in Praha, Faculty of Mathematics and Physics, doc. RNDr. Radomír Kužel, CSc.
- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, Ing. Jan Šubrt, CSc.

Objective of the solution: The development of a new hybrid technology for the preparation of nanostructured fluoride waveguide layers doped with rare metal elements (RE) with the utilisation of the e-beam evaporation, pulsed laser deposition, magnetron sputtering and auxiliary ion beam source. The attention will focus on the preparation of waveguide structures with extraordinary fluorescence properties. A suitable example is made by fluoride layers doped with RE ions and nanometricly controlled distribution, structures with RE metallic nanocrystals (Yb, Er, Pr), oxide nanoparticles (ZnO) in the fluoride matrix, or complex structures of doped fluoride nanocrystals (Er:LaF3, Pr:LaF3) inserted in amorphous matrices of oxy-fluoride glasses. The effect of parameters of the combined depositing techniques on the structural and, consequently, optical and fluorescence properties will be studied within a wide spectrum of methods. At the end of the project, the attention will be paid to the design, modelling, and preparation of functional fluorescence and wave guiding structures.

IAA100500501 **"Environment-responsive nanoparticles"**, 1/2005–12/2008, the head researcher is doc. RNDr. Čestmír Koňák, DrSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 1.632 million, thereof CZK 1.632 million from the state budget.

(Year 2008 – 0.424/0.424, 6d)

Objective of the solution: The development of effective ways of directional and secure transport of biological macromolecules, e.g. DNA, RNA, peptides and proteins in the organism with the goal to find suitable conditions for the supramolecular complexes (SC) preparation and evaluation of preparation impacts on their properties. The specific project's goal is the research of creation and of properties of: a) thermally managed supramolecular complexes created by hydrogen bonds between carboxyl groups of polycarboxyls and by hydrophobic interactions of thermosensitive polymers with surface agents or block copolymers,

b) complexes sensitive to pH created by electrostatic interactions between polyelectrolytes and zwitterion copolymers. The project utilises original complex preparation processes and it also tests the complexes' suitability for medical applications. For this purpose, there will be the complexes' stability in biological conditions studied. The SC is considered in future for the managed transport of medicine and genetic materials.

IAA1010404 **"Impact of external fields on small-size electron structures"**, 1/2004–12/2008, the researcher is Ing. Jozef Krištofík, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 2.067 million, thereof CZK 2.067 million from the state budget.

(Year 2008 – 0.483/0.483, 6b)

Objective of the solution: The impact of external physical fields (electric, magnetic, and acoustic fields and of the high hydrostatic pressure) on electron processes in the small size quantum structures is currently studied with the assistance of low-temperature magnetotransport and magnetocapacity methods, especially with the unique method of electric field penetration, which allows the direct study of states' density in the system, under variable outside conditions. It should be expected that the achieved experimental results would be valuable not only for the future theory development, but also for the improvement of technologies.

IAA1010413 **"Nanoscience and nanotechnology with probe microscopy: From phenomena at the atomic level to material properties"**, 1/2004–12/2008, the researcher is Ing. Vladimír Cháb, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 10.438 million, thereof CZK 10.438 million from the state budget.

(Year 2008 – 1.932/1.932, 7a)

Co-researcher:

- Brno University of Technology, Faculty of Mechanical Engineering, prof. RNDr. Tomáš Šikola, CSc.

Objective of the solution: Nanoscience applies varied nanotechnological processes in such a way that it modifies and consequently studies nanoobjects' properties. The effects of quantum phenomena are especially attractive in these sizes. The research focuses on five following areas: structural, electron, and spectroscopic properties at the atomic level, characterising of nanoclusters, the nanolithography with SPM. The macroscopic and topographic data will be combined with the local spectroscopy of electric conductivity, electroluminescence, and local density of states, diffusion, output works, and photovoltaic phenomena. These physical properties are also theoretically studies.

IAA200100701 **"Magnetic nanocomposites based on 3d-metals for the high-frequency and sensor applications prepared with the assistance of the UHV plasma jet "**, 1/2007–12/2009, the head researcher is Ing. Bc. František Fendrych, Ph.D., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 2.608 million, thereof CZK 2.608 million from the state budget.

Year 2008 – 0.882/0.882, 2d)

Co-researcher:

- Charles University in Praha, Faculty of Mathematics and Physics, doc. RNDr. Petr Řepa, CSc.

Objective of the solution: The preparation of samples of magnetically soft materials consisting of multilayers of nanocomposites based on 3d-metals, especially the layers of nitrides or oxides of the (FeCo)p-(XY)1-p kind, where X = Al, Ta, Hf, Si and Y = N, O. The direct measuring of samples verifies the assumption that these materials have extraordinary magnetic properties and allow thus for important industrial applications in, for example, GHz-inductors for mobile communication or in sensors of magnetic fields, reading memory heads with the high density of recordings, etc. It has been quite difficult so far to manufacture them in the required pure form, chemical composition, and with the expected structure. The Institute of Physics of AS CR will use the unique UHV depositing apparatus with a plasma jet for their preparation. It will be supplemented with the device necessary for the creation of multilayers, layer sputtering from non conductive targets and initiation of the managed magnetic sample anisotropy. This will develop, together with the material preparation, the preparation methodology, which would be satisfactorily effective for the practical use.

IAA200480702 **"Metallic and semiconductor nanostructures prepared by the ionic implantation"**, 1/2007–12/2009, the researcher is Mgr. Jiří Vacík, CSc., Nuclear Physics Institute of AS CR, v. v. i., Husinec – Řež, the total costs of CZK 0.930 million, thereof CZK 0.930 million from the state budget.

(Year 2008 – 0.310/0.310, 1b)

Objective of the solution: The project's goal is the study of nanostructures prepared by the implanting of selected ions in some ceramic and semiconducting substrates. The main project goal is the preparation of nanocomposites with properly defined and controlled microstructures and the finding and defining of the relation between structural and optical (or other) properties of the prepared materials.

IAA200710801 **"Conversion from micro-and nano-indentation instrumented measurements data to mechanical characteristics of visco-elastic materials"**, 1/2008–12/2010, the researcher is Ing. Jiří Minster, DrSc., Institute of Theoretical and Applied Mechanics of AS CR, v. v. i., Praha, the total costs of CZK 1.723 million, thereof CZK 1.723 million from the state budget.

(Year 2008 – 0.551/0.551, 7a)

Co-researcher:

- Czech Technical University in Praha, Faculty of Construction, Ing. Jiří Němeček, Ph.D.

Objective of the solution: The dissemination of knowledge and the gain of in-depth understanding of time dependent processes related to microindentation technique of hardness measuring with the use of the combination of component probability simulation Monte Carlo method and the instrument measuring of the microhardness and the material parameters during the entire microindentation process of loading – unloading. The comparison and evaluation of the results gained by these two approaches will be used for the determination of optimal long-term visco-elastic characteristics of materials with the quasi linear visco-elastic behaviour. The impact of non mechanical factors, the aging in laboratory and climatic conditions (i.e. the combination of temperature, humidity and radiation of lights) on the time dependent indentation processes and the visco-elasticcharacteristics of the monitored materials will be assessed at the same time.

IAA400040804 **“Applications of electrochemical methods focussed on the micro-analyses of nucleic acid bases and oligonucleotides”**, 1/2008–12/2010, the researcher is RNDr. František Jelen, CSc., Institute of Biophysics of AS CR, v. v. i., Brno, the total costs of CZK 2.496 million, thereof CZK 2.496 million from the state budget.

(Year 2008 – 0.823/0.823, 3e)

Objective of the solution: The development and application of modern electrochemical methods allowing for the microanalysis of nucleic acids and synthetic oligonucleotides’ bases. (a) There will be the highly sensitive analytical method developed, which will allow the detection of purine bases and its derivates at the presence of copper ions. The analysis will take place in solutions containing mixtures of these components on mercury film, amalgam, carbonous, composite, and metal electrodes. The proposed analytical processes will be applied for the sensitive detection of hydrolysed oligonucleotides. (b) There will be electrochemical system, working in the microdrop of the analysed sample, used for the increased sensitivity of the purine bases’ detection, or of their derivates and oligonucleotides. The microdrop will be moved by the flowing inert gas (the inversion electrochemical cell). (c) There will be an electrochemical symbol proposed for the hybridisation of oligonucleotides based on nucleotide analogues containing boron.

IAA400100701 **“Nanocomposites metal-fullerene and metal-diamond: Preparation, characterising, and modification”**, 1/2007–12/2009, the head researcher is RNDr. Vladimír Vorlíček, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 4.730 million, thereof CZK 4.730 million from the state budget.

(Year 2008 – 1.525/1.525, 1b)

Co-researcher:

- Nuclear Physics Institute of AS CR, v. v. i., Husinec – Řež, Mgr. Jiří Vacík, CSc.

Objective of the solution: The preparation, characterising and modification of binary composites based on metals and allotropes of carbon (fullerenes and nanodiamonds). The goal is the creation of new hybrid materials with properly defined structures and interesting properties, which are perspective for their further applications. The composite preparations will use suitable depositing techniques. Their characterising is possible thanks to a wide spectrum of analytical methods. The preliminary experiments demonstrated the most interesting aspect of the project – the possibility to prepare composites with a regular (sub-) micron structure created by either spontaneous self-organisation (at suitable depositing kinetics) or co-ordinated phase separation during the thermal annealing, or by the exposure to energy ion and laser beams. The project should clarify the occurrence causes, mechanisms, and kinetics of the mentioned phenomena.

IAA400400621 **“DNA condensation: the Monte-Carlo simulation, scattering of light, the correlation fluorescence spectroscopy in vitro and in vivo”**, 1/2006–12/2010, the researcher is Teresa Kral, Dr., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 6.783 million, thereof CZK 6.783 million from the state budget.

(Year 2008 – 1.645/1.645, 3e)

Co-researchers:

- Institute of Molecular Genetics of AS CR, v. v. i., Praha, MUDr. Jaroslav Blahoš, Ph.D.
- Charles University in Praha, Faculty of Science, RNDr. Miroslav Štěpánek, Ph.D.

Objectives of the project: The DNA condensation plays a key role in the transport of DNA to cells, i.e. in the gene therapy. The fluorescence correlation spectroscopy (FCS) is a sensitive method of monitoring the conformation changes during this process. This is indicated by many studies executed by the researcher's team. However, the data analysis applied so far has not provided all information about the studied problem. The Monte Carlo method simulates the free DNA molecule diffusion and the resulting FCS experiment's result. This is compared with real data and the dispersive measurements complementing FCS. The utilisation of this information and of the already gained experience from condensations allows for the study of new condensation agents, i.e. it researches the effectiveness of the impacts and abilities to protect DNA against undesirable hydrolysis in the cytosol. The last three years of the project will utilise the experience gained from experiments in vitro also for measuring in vivo, i.e. the monitoring of the form in which a cell accepts DNA present in important cell organelles.

IAA400400804 **"Supramolecular assemblies with carbon nanotubes"**, 1/2008–12/2012, the researcher is prof. RNDr. Ladislav Kavan, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 6.370 million, thereof CZK 6.370 million from the state budget.

(Year 2008 – 1.100/1.100, 1)

Objectives of the project: Synthesis of supramolecular complexes of carbon nanotubes, including chirality (n,m) identified ones, with redox active molecules, such as organometalic complexes and fullerenes. The complexes will be both endohedral and exohedral. The anchoring structures will include different interactions from weak Van der Waals bonds to covalent bonds. The prepared superstructures will be characterized by electrochemical, spectroelectrochemical and luminescence methods. Besides accumulation of fundamental knowledge about these new nanomaterials, the project is aimed at practical aspects, such as development of redox active additives for materials applicable in solar cells and Li-ion batteries.

IAA480616 **"Thermoresponsive polymer drug delivery systems for the local radiotherapy"**, 1/2006–12/2008, the researcher is Ing. Ondřej Lebeda, Ph.D., Nuclear Physics Institute of AS CR, v. v. i., Husinec – Řež, the total costs of CZK 3.965 million, thereof CZK 3.965 million from the state budget.

(Year 2008 – 1.322/1.322, 3b)

Co-researcher:

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, Mgr. Martin Hrubý

Objectives of the solution: The thermoresponsive polymers are perspective compounds for medical applications. One of them may be the radiotherapy of joint inflammation and malign lesions by the thermoresponsive polymer with the bound radionuclide. These polymers are readily soluble in water at the laboratory temperature and they might be thus marked in the radionuclide way, and applied by injections then. At the body temperature, there is a fast phase transfer and the precipitated polymer stays in the application place. The insertion of a suitable monomer unit into the polymer results in the managed polymer degradation, according to the radionuclide half-life. The goals of the suggested project are the preparation of marked polymers suitable for therapeutical purposes and the study of their properties.

IAA400500505 **“New multicomponent self-assemled nanocomposite materials”**, 1/2005–12/2009, the head researcher is Ing. Milena Špírková, CSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 1.6 million, thereof CZK 1.6 million from the state budget.

(Year 2008 – 0.325/0.325, 1g)

Objective of the solution: The complex characterising of multicomponent nanocomposite organic-inorganic materials. The organic part consists of systems based on epoxides, polyurethanes, or acrylates. The attention is focussed on the targeted in situ creation of nanodomains of inorganic nature, on the study of automatic organising of these nanostructures, and on their in-building into the organic matrix. The study of effects of the size, shape and composition of nanodomains and of the chain dynamics (from the segment level to the supramolecular level) on the properties of final materials makes an inseparable part of the project. The stress will be put especially on the study of temperature dependency of the segment dynamics, chains and domains with the objective to optimise sample preparation processes, the result of which should be products with improved final properties. There will be the most modern techniques of NMR spectroscopy of the solid state, microscopy of atomic forces, dispersion methods related to the X rays, the IR spectroscopy, and the static and dynamic mechanical analyses used.

IAA400500701 **“Nanostructural organic-inorganic polymers”**, 1/2007–12/2011, the head researcher is RNDr. Libor Matějka, CSc., Institute of Macromolecular Chemistry of AS CR, v. v. i.. Praha, the total costs of CZK 2.880 million, thereof CZK 2.880 million from the state budget.

(Year 2008 – 0.580/0.580, 1g)

Objective of the project: The explanation of processes determining the unique behaviour of polymer nanomaterials. There will be the effect of decisive factors determined, e.g. the character of nanodomains and interphase interactions on properties of polymer nanocomposites. When interpreting the properties of polymer nanocomposites, the molecular and structural supramolecular levels will be taken into consideration. For this purpose, there will be nanostructural polymers studied, especially the organic-inorganic (O-A) ones with the regulated structure in nano and in micro scales. The supramolecular structure of O-A polymers is managed with the assistance of self-assembled O-A blocked copolymers, or with the assistance of special polymer templates. There will be polymer systems of varied kinds of nanodomains, occurring in situ or introduced into polymers as properly defined nanostructural building blocks, prepared and characterised. There will be also nanocomposites researched which contain carbonous nanotubes or layered silicates.

IAA400550613 **“Dynamics of molecules and ions in the complex molecular systems”**, 1/2006–12/2008, the researcher is RNDr. Ota Bludský, CSc., Institute of Organic Chemistry and Biochemistry of AS CR, v. v. i., Praha, the total costs of CZK 1.313 million, thereof CZK 1.313 million from the state budget.

(Year 2008 – 0.442/0.442, 7a)

Co-researcher:

- Charles University in Praha, Faculty of Mathematics and Physics, Ing. Pavel Soldán, Dr.

Objective of the project: The development of theoretical methods used for the determination of spectroscopic characteristics of molecules and ions in complex molecular systems. The precise interpretation of experimental data related to studied molecules allows for the gaining of valuable information about the structure and properties of the environment with which the molecules interact. The methodology is used for the spectroscopic characterising of molecules in precious gas matrices, in fullerene-based matrices, and in zeolites.

IAA400550616 **"Molecular rotors anchored on the phase surface"**, 1/2006–12/2009, the researcher is RNDr. Ivo Starý, CSc., Institute of Organic Chemistry and Biochemistry of AS CR, v. v. i., Praha, the total costs of CZK 3.849 million, thereof CZK 3.849 million from the state budget.

(Year 2008 – 0.788/0.788, 3d)

Objective of the project: The preparation of series of molecular rotors and their anchoring on the phase surface of a non conductor and the study of their thermal movements and reaction to outside managing field.

IAA400550704 **"Fullerene containers. Design, synthesis, properties, and possible applications"**, 1/2007–12/2011, the head researcher is Ing. Petr Holý, CSc., Institute of Organic Chemistry and Biochemistry of AS CR, v. v. i., Praha, the total costs of CZK 4.934 million, thereof CZK 4.934 million from the state budget.

(Year 2008 – 0.980/0.980, 6d)

Objective of the project: The project presents a number of aromatic high volume analogues of cyclodextrines designed for the placement of fullerene in the form of inclusive complexes 1:1. The proposed architecture utilises attractive interactions between the aromatic host interior and the fullerene for the support of creation of an inclusive complex, while the periphery function is the optimising of its soluble nature in a wide spectrum of solvents, including water. There has been the utilisation in construction of molecular reactors, determined for the regioselective modification of fullerenes, suggested. Some proposed reactors are chiral and allow also the enantioselective resolution at the same time. There has been also an original chemical transformation proposed, determined specifically for the cyclotetramer anthracene inclusive complexes with a fullerene the goal of which is the creation of highly arranged covalent 1D and 2D fullerene structures usable in the molecular electronics and in constructions of chemical sensors.

IAA400550708 **"Polyacetylenes containing carbon anions in lateral chains"**, 1/2007–12/2010, the researcher is prof. Josef Michl, Institute of Organic Chemistry and Biochemistry of AS CR, v. v. i., Praha, the total costs of CZK 3.910 million, thereof CZK 3.910 million from the state budget.

(Year 2008 – 0.788/0.788, 6d)

Objective of the project: The preparation of polyacetylenes with negatively charged side chains resistant against oxidation and electrophile agents, their transformation to a highly doped state and the study of conductivity dependency on temperature. Negative charges will be localised on multiply alkylated or fluoroalkylated carbon anions of high oxidation potential and low nucleophilicity. The researchers will network polymer chains with the assistance of conjugated acetylene or phenylene bridges between carbon cages.

IAA400720619 **“New laser-initiated process producing new carbon nanomaterials and nanomaterials incorporating N, B, and Si heteroatoms”**, 1/2006–12/2010, the researcher is RNDr. Josef Pola, DrSc., Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, the total costs of CZK 5.331 million, thereof CZK 5.331 million from the state budget.

(Year 2008 – 1.063/1.063, 6d)

Co-researchers:

- J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, RNDr. Zdeněk Bastl, CSc.
- Institute of Inorganic Chemistry AS CR, v. v. i., RNDr. Snejana Bakardieva, Ph.D.
- Institute of Physics of AS CR, v. v. i., Praha, Ing. Miroslav Maryška, CSc.

Objective of the project: The research of photolysis of gaseous unsaturated hydrocarbons (ethylene, butadiene, benzene, toluene) and dichlorethylenes by the effect of highly intensive radiation (MW and GW) of excimer lasers. The research extends the preliminary results suggesting that the above-presented process might result in a completely non conventional creation of new kinds of carbon nanostructures without the intermediate creation of polyaromatic hydrocarbons. The research of laser co-photolysis of gaseous mixtures of hydrocarbon and chlorethylenes with heteroatoms (B, N, Si)-containing compounds by the effects of MW and GW radiation of excimer lasers is conducted with the objective to prepare new carbon nanostructures with incorporated heteroatoms. The new materials are research with spectral methods (IC, Raman, XP, NMR, UV, and the EPR spectroscopy) and electron microscopy, their magnetic properties will be also studied. The research objective is the preparation of new carbon nanostructures with unique properties and applications in nanoscience and nanotechnologies.

IAA401250701 **“Modified aluminosilicates – the effective nanosorbents of arsenic, antimony and selen oxoanions: mechanics and kinetics of reactions on solid phase surface”**, 1/2007–12/2009, the head researcher is Ing. Barbora Doušová, CSc., Institute of Chemical Technology Praha, Faculty of Chemical Technology, the total costs of CZK 0.883 million, thereof CZK 0.883 million from the state budget.

(Year 2008 – 0.305/0.305, 6d)

Objective of the project: Hydrated surfaces of aluminosilicates belong among effective sorbents in natural and technological processes. However, thanks to low values of the isoelectric point, they are not selective sorbents of anions. Many studies, thanks to good properties and the price of these materials, deal with the treatment of aluminosilicates’ surfaces in order to increase their sorption capacity related to toxic oxoanions. The project deals with the treatment of aluminosilicates by Fe, Al, and Mn ions and the consequent adsorption of As, Sb, and Se oxoanions on their surfaces. The objective of the research is the study of the mechanism and the phenomena’s kinetics taking place on the surface of the solid phase. The use of the already gained experience, new experimental data and other identification methods (ESCA, molecular simulation) will allow for the determination of adsorption properties of the treated sorbents, according to the physical-chemical conditions in the system. The identical experimental conditions will allow, for the first time, the mutual comparison of oxoanions with the sorbent – their affinity, sorption kinetics, competition related to the active place, etc.

IAA401250703 **"Porous ceramics, ceramic composites and nanoceramics"**, 1/2007–12/2009, the head researcher is doc. Dr. Dipl.-Min. Willi Past, Germany, Institute of Chemical Technology Praha, Faculty of Chemical Technology, the total costs of CZK 0.613 million, thereof CZK 0.613 million from the state budget.

(Year 2008 – 0.172/0.172, 1f)

Objective of the project: Porous ceramics and ceramic composites are heterogenous materials offering effective properties determined by the properties of individual phases and by the microstructure of these materials. Relations between the microstructure and properties could be described in the best way within micromechanics (the theory of composites). The first objective of this project is the presentation of an exhaustive review of porous ceramics from the micromechanics point of view, including the description of the microstructure and properties resulting from it. Ceramic composites will be dealt with within the same micromechanical framework. The ceramic material classes in this project cover oxide and non oxide ceramics and their composites, but also the traditional ceramics. The final project's part uses the micromechanical approach for the analysis of publicised experimental data related to nanocrystalline ceramics, especially with the assistance of the so-called model of phase mixtures. The project's results will make up the basis for the planned monograph (the publishing of which does not make a part of this project).

IAA401770601 **"Electron processes at the molecular level in substances suitable for the photosensitive organic parts"**, 1/2006–12/2009, the researcher is Ing. Martin Weiter, Ph.D., Brno University of Technology, Faculty of Chemistry, the total costs of CZK 1.973 million, thereof CZK 1.973 million from the state budget.

(Year 2008 – 0.452/0.452, 6d)

Co-researcher:

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, RNDr. Petr Toman, Ph.D.

Objective of the project: The studies of electron processes influencing charge carriers' generation and of the consequent transport in materials suitable for the construction of organic photosensitive parts (e.g. solar cells) with the goal to increase their efficiency. The research activities of this project cover the theoretical and experimental studies of photodisociation of charge carriers' processes and their transport at the molecular level. The study of these processes will pay attention mostly to the distribution of the density of electron localised states in the studied materials. The theoretical part of the project focuses on quantum mechanical modelling of intramolecular transport of charge carriers. The necessary molecular parameters, like ionisation potentials and transfer integrals, will be gained with the assistance of quantic chemical calculations. The experimental part of the project includes the study of electron processes by the methods of spectroscopy of electron states based on the transient photoconductivity and on currents limited by the space charge.

IAA500390702 **"The tissue carrier of nanofibre materials with the inbuilt liposomes"**, 1/2007–12/2011, the head researcher is doc. RNDr. Evžen Amler, CSc., Institute of

Experimental Medicine of AS CR, v. v. i., Praha, the total costs of CZK 4.391 million, thereof CZK 4.391 million from the state budget.

(Year 2008 – 0.950/0.950, 3c)

Co-researchers:

- Technical University in Liberec, Faculty of Textiles, prof. RNDr. David Lukáš, CSc.

Objective of the project: Damage of cartilages finally results in very painful situations and invalidity. A new treatment approach has recently occurred: the implanting of autologous chondrocytes and the construction of artificial cartilages. This approach uses biodegradable carriers and their consequent settlement by autologous chondrocytes. Preliminary results by the project's researchers suggest that they can create a biodegradable carrier based on the non woven nanofibres in combination with liposomes. The main objective of this project is the creation of a nanofibre carrier with varied kinds of liposomes and the creation of methodology of their progressive opening by the use of ultrasound waves. The project thus focuses on: 1. Development of liposome nanofibres and the methodology of the liposome opening both in vitro and in vivo; 2. The preparation of biodegradable carrier for liposome nanofibres for the use in the tissue engineering; 3. The preparation of artificial cartilages from autologous chondrocytes on the basis of the newly developed carriers.

IAA500500701 **"Internal organisation of macromolecular systems, crystallisation and the determining of the macromolecular system structures containing proteins"**, 1/2007–12/2011, the researcher RNDr. Jindřich Hašek, DrSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 2.786 million, thereof CZK 2.786 million from the state budget.

(Year 2008 – 0.565/0.565, 6d)

Objective of the project: The low success rate in the preparation of diffraction quality crystals is considered a problem, when determining the protein structures. Polymer precipitates, using about 30 protein complexes for the design of structures, remain often partly adsorbed on the protein surface, while most of them remain diluted in the buffer filling 40–80 % of the crystal space. The preliminary analysis suggests that the success rate of these precipitates is high and dependent on varied levels of blocking of specific sorption places on the surface of the target macromolecule. Proteins have got a large number of potential sorption places on their surface, but a crystal of the diffraction quality occurs only when only one adhesion possibility is preferred. This project focuses on the experimental and the theoretical analyses of this phenomenon, i.e. how do adhesion places on the protein surface, accessible for the blocking ligands, look like and which ligands should be used, and under which conditions they are successful. The role of all parts of the crystalline solution must be analysed.

1.4. PROGRAMME "JUNIOR EXPLORERS' GRANTS" (KJ)

Projects solved in the area of nanotechnologies

KJB100100623 **"The nanocrystalline diamond growth at low temperature and the biofunctionalization of its surface"**, 1/2006–12/2008, the head researcher is Mgr. Zdeněk Remeš, Ph.D., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 0.498 million, thereof CZK 0.498 million from the state budget.

(Year 2008 – 0.166/0.166, 1f)

Objective of the solution: The management of nanodiamond layers' growth at lower temperature. This should allow for depositing on easily accessible glass bases. The layers are grown in the plasma generated by the microwave electromagnetic field. The impact of the base surface, the total pressure, and the concentrations of hydrogen, methane, oxygen, nitrogen and of their free radicals on the growth of nanodiamond layers at varied temperatures is studied. Another objective is the bio-activation of the nanodiamond's surface and its preparation for chemisorption (immobilisation) of proteins. This is important for future bioapplications. There is the radio-frequency discharge in vapours of ammoniac, organiaminosilane, and allylamin used for the achievement of the high coverage density on the diamond surface by the primary amino group (NH_2). Optical and electrical properties of these modified surfaces are studied by the methods accessible in the Institute of Physics, especially the luminescence spectroscopy, the Fourier infrared reflex spectroscopy, and the Fourier photo-current spectroscopy.

KJB100100701 **"New magnetic composite nanoparticles for medical purposes derived from hexagonal ferrite"**, 1/2007–12/2009, the head researcher is Ing Pavel Veverka, Ph.D., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 0.963 million, thereof CZK 0.963 million from the state budget.

(Year 2008 – 0.321/0.321, 2d)

Co-researcher:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, Ing. Adriana Lančok-Kláriková, Ph.D.

Objective of the solution: The synthesis of new magnetic nanoparticles of the composite character derived from the group of hexagonal ferrites using the structural relationship of spinel and hexagonal ferrites. Considering the main objective, the finding of a material for magnetic cores suitable for potential medical applications, especially in magnetic hyperthermia, the magnetic properties, the saturated magnetisation, coercivity, remanence, and the thermal coefficient of magnetisation will be set by the utilisation of changes in the chemical and phase composition and by the nanoparticle sizes. The impact of the phase composition and nanoparticle phases on the transfer between the arranged ferrimagnetic state and the superparamagnetic behaviour will be studied in detail. The use of Mössbauer spectroscopy for the study of this transfer is characteristic by its unique chance to differentiate behaviours of particles in the given phase.

KJB100100704 **"Size effects in ferroelectrics"**, 1/2007–12/2009, the head researcher is Ing. Dmitry Nuzhnyy, PhD, Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 0.792 million, thereof CZK 0.792 million from the state budget.

(Year 2008 – 0.264/0.264, 6b)

Objective of the solution: The impact of the size effect on the dielectric and ferroelectric properties will be studied in normal ferroelectrics (e.g. the $BaTiO_3$ nanoparticles covered with a thin layer of alumina) and in incipient ferroelectrics (the $KTaO_3$ nanoceramics and $SrTiO_3$ ultra thin layers on $DyScO_3$ bases), but also in relaxor based ferroelectrics (the $PbMg_{1/3}Nb_2/3O_3$ – $PbTiO_3$ nanoceramics). The broadband dielectric spectroscopy, in time differentiated terra hertz spectroscopy, and the Raman spectroscopy will be used at the temperatures 10–950 K for the study of dynamics of phase interfaces, especially the behaviour of the soft and central modes in samples with nanograins, or in ultra thin layers. The $BaTiO_3$ nanograins coated with an alumina thin layer will be used as a model example of nanoceramics with well-defined parameters of grains and grain boundaries (the so-called dead layers).

KJB100100707 **“Low-temperature plasma deposition of polycrystalline and nanocrystalline thin oxide layers with the assistance of the hollow cathode system”**, 1/2007–12/2009, the head researcher is Mgr. Jiří Olejníček, Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 1.618 million, thereof CZK 1.618 million from the state budget.

(Year 2008 – 0.479/0.479, 7c)

Objective of the solution: The low-temperature deposition of selected thin oxide layers with the assistance of a multi plasma jet system. There are advanced diagnostic methods used for the measuring of plasma parameters in the course of depositing. The main objective is the deposition of thin ferroelectric Ba1-xSrxTiO_3 and PbZr1-xTixO_3 layers at low temperatures with high quality dielectric and ferroelectric properties. These parameters are measured within a wide span of frequencies and temperatures. The stress is put on the controlled depositing from the points of view of the grain sizes, the preciseness of the required chemical composition the defect density, oxygen vacancies, and dielectric properties, according to the measured plasma parameters. The resolution of the previous tasks should allow for depositing of gradient perovskite layers. Another task will be the depositing of high quality nanocrystalline layers of anatase with a small vacancy density and the precise stoichiometry. The objective is the achievement of a high depositing speed and of very good photocatalytic properties.

KJB100480601 **“The use of ionic beams in studies of crystalline structures”**, 1/2006–12/2008, the researcher is RNDr. Anna Macková, Ph.D., Nuclear Physics Institute of AS CR, v. v. i., Husinec – Řež, the total costs of CZK 0.793 million, thereof CZK 0.793 million from the state budget.

(Year 2008 – 0.262/0.262, 6b)

Objective of the solution: The characterising of $LiTaO_3$ based crystalline structures, simple monocrystals of $SrTiO_3$ and $BaTiO_3$ perovskites and Pb, Mg doped $KTaO_3$ with the utilisation of ion beams. The crystalline materials and structures researched within this project are perspective in preparations of optical planar lasers. It is also about ferroelectrics and antiferroelectrics. The deep profiles of dopants and the component composition of crystalline structures are measured by the RBS, ERDA, and PIXE methods. Positions of interstitial dopants in the volume subsidised crystals and the level of modification of crystalline structures could be determined by the innovative method of RBS channelling and crystalline structure changes are comparatively researched by XRD in co-operation with Forschungszentrum Rossendorf in Germany and by the Raman spectroscopy in co-operation with the Institute of Physics of AS CR. A part of the project relates also to the studies of super matrices and of the interface quality in these structures by the RBS channelling method. The results of these analyses will be confronted with other properties of the prepared structures.

KJB200410801 **“Study of nano-structured materials consolidated from powder compacts by the ECAP technique”**, 1/2008–12/2010, the researcher is Ing. Jiří Dvořák, Ph.D., Institute of Physics of Materials of AS CR, v. v. i., Praha, the total costs of CZK 1.237 million, thereof CZK 1.237 million from the state budget.

(Year 2008 – 0.427/0.427, 1e)

Objective of the solution: The powder metallurgy serves for the manufacture of bulk materials of metallic composite or ceramic powders. However, the high working temperatures during consolidations, which result in changes in the microstructure, but also the porousness of manufactured materials, are considered the critical problems of this technology. There have been results of successful experiments recently presented which related to the utilisation of severe plastic deformation (SPD) techniques during the consolidation of metal and nanocomposite powder compacts. Materials prepared in this way do not contain pores and the non homogeneity and they are not contaminated by undesirable impurities during their preparation. There have been only few studies executed in the world which researched the mechanical properties of materials prepared in this way. The issue has not been researched in the Czech Republic at all. The main objective of the project is the preparation of bulk materials from powder metals and nanocomposites with the assistance of ECAP, and the consequent detailed research of these materials from the stability of the microstructure point of view, their mechanical properties at room or increased temperatures.

KJB201240701 **"Nanocomposite coatings with higher wear resistance at higher temperatures"**, 1/2007–12/2009, the head researcher is Ing. Tomáš Vítů, Czech Technical University in Praha, Faculty of Mechanical Engineering, the total costs of CZK 2.153 million, thereof CZK 2.153 million from the state budget.

(Year 2008 – 0.685/0.685, 1d)

Co-researchers:

- Czech Technical University in Praha, Faculty of Electrical Engineering, Ing. Tomáš Polcar, Ph.D.
- Institute of Physics of AS CR, v. v. i., Praha, Mgr. Martin Stranyánek

Objective of the solution: The development of new nanocomposite coatings of improved wear resistance at high temperatures. The Cr-Al-Si-N coatings will be prepared with the use of the magnetron sputtering method. There will be new materials prepared in the course of the project, while the depositing process should be optimised. The coatings are characterised in detail, including the tribological tests, at high temperatures. The attention will be paid to the study of oxidation mechanisms, structural changes at temperatures, and to changes in mechanical parameters. The main wear mechanisms will be described on the basis of the analysis of wear marks and particles with the use of the advanced image processing. The set up of a model of layers' wear, which should help in the prediction of wear of new materials, makes a part of the project.

KJB400400601 **"Electrochemical and spectroelectrochemical studies of carbon nanostructures"**, 1/2006–12/2008, the head researcher is RNDr. Martin Kalbáč, Ph.D., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 0.988 million, thereof CZK 0.988 million from the state budget.

(Year 2008 – 0.336/0.336, 1c)

Objective of the solution: The study of electrochemical properties of SWCNT (a single wall carbon nanotubes), DWCNT (the double wall carbon nanotubes), the fullerene peapods (C60@SWCNT, C70@SWCNT, La@C82@SWCNT and Dy3N@C80@SWCNT). The properties are compared with the properties of highly organised fullerene layers. The research is based on both ex-situ and in-situ electrochemical measuring. The in-situ studies combine the electrochemistry with the Raman or VIS-NIR spectroscopy. The transfer of a charge is studied in varied electrolytes, including the so-called ion liquids. In the case of peapods and DWCNT, there are fullerene interactions studied, or the inner tubes with the wall of the outer tube. The electric shielding and the creation of new situations in the electronic fullerene and inner tubes structures are studied in detail. The organised films of fullerenes are studied with the assistance of STM.

KJB401630701 **"Protein resistant surfaces and highly adherent surfaces – the new nanotechnological and bioanalytical methods testing their quality"**, 1/2007–12/2009, the head researcher is Mgr. Jan Přibyl, Ph.D., Masaryk University in Brno, Faculty of Science, the total costs of CZK 2.496 million, thereof CZK 2.496 million from the state budget.

(Year 2008 – 0.832/0.832, 3d)

Objective of the solution: The research of specifically modified surfaces, which can be protein resistant in solutions, and complementary surfaces of the opposite properties – i.e., with the highly adhesive properties. The substances of these surfaces are synthetic polymers, but also proteins or polysaccharides. Surfaces modified in this way are irreplaceable in constructions of biosensors able to work in the environment with a high presence of proteins (e.g. the bloodstream); also in the construction of sterile packing of a minimal adherence of biomolecules or in the area of development of implanting materials. There are methods developed for testing of these layers' quality based on biosensors (they allow the monitoring of the created layer's quality and they continuously monitor the adherence of proteins to the prepared surfaces) and in nanotechnologies (AFM, the microscopy of atomic forces), which allow for the monitoring of the molecular composition of prepared structures and of the localisation of the adherence in the nanometric scale. There are also developed affinity and enzyme biosensors using the developed layers.

2. PROVIDER: GRANT AGENCY OF THE CZECH REPUBLIC (GA CR)

2.1. PROGRAMME "STANDARD GRANTS" (GA)

Projects solved in the area of nanotechnologies

GA101/06/0490 **"Scanning and analyses of surface textures of advanced materials for the highly precise managed technological methods"**, 1/2006–12/2008, the researcher is doc. Ing. Leoš Bumbálek, Ph.D., Brno University of Technology, FSI, the total costs of CZK 1.670 million, thereof CZK 1.670 million from the state budget.

(Year 2008 – 0.560/0.560, 6e)

Objective of the solution: The scanning and analysis of surface textures of parts manufactured by highly precise technological processes, when their measurements are in micrometre or nanometre. The analysed surfaces include their geometrical and physical properties resulting from different manufacturing systems utilising the existing finalisation methods in the area of micro manufacturing. The project's solution is based on the analysis of functional surfaces which shows that the surface properties have the decisive importance in quality improvements for managed highly precise technological methods. An important part of the project is the focus on custom-made surfaces with regard to varied functional applications. The project should also contribute to better understanding of the creation mechanism of a new surface, together with its physical and chemical properties. The objectives of this research are the preparation of a methodology of scanning and assessing of surface textures by 2D and 3D methods and the preparation of a set of frequency surface textures' parameters.

GA101/07/0789 **"Nanodiagnostics of defects within the 3D molecular dynamics"**, 1/2007–12/2009, the researcher is doc. Ing. Petr Hora, CSc., Institute of Thermomechanics of AS CR, v. v. i., Praha, the total costs of CZK 1.515 million, thereof CZK 1.515 million from the state budget.

(Year 2008 – 0.505/0.505, 6b)

Objective of the solution: The project utilises the atom simulation by the method of molecular dynamics (MD) for the gaining of information about possibilities of detecting pre-existing cavities and precipitates of nanoscopic sizes with the assistance of the comparison of scattered stress waves in perfect crystals and in crystals with the mentioned defects. This information can be beneficial for the acoustic non destructive detection of defects in nanostructured materials. There are also MD studies of the impact of Cu nanoparticles on the stability of cracks and nanocavities in the 3D alpha-iron crystals planned. These results could be useful for the better understanding of the so-called copper embrittlement of structural ferritic steels, including older reactor steels.

GA101/08/0299 **"Research of intelligent composite parts, made of ultra-high-module fibres, in manufacturing machines and the matrices modified by nanoparticles"**, 1/2008–12/2011, the researcher doc. Ing. Václava Lašová, Ph.D., University of West Bohemia in Plzeň, Faculty of Mechanical Engineering, the total costs of CZK 7.262 million, thereof CZK 7.262 million from the state budget.

(Year 2008 – 1.836/1.836, 1b)

Co-researchers:

- Compo Tech PLUS, spol. s r.o., Ing. Ondřej Uher, Ph.D.
- Czech Technical University in Praha, Faculty of Mechanical Engineering, prof. Ing. Milan Růžička, CSc.

Objective of the solution: The current trend of going to more progressive utilisation of composite materials in machinery designs is not completely effective because of the unsatisfactory research in the area of the use of ultrahigh modulated carbon fibres in combination with nanoparticles in the matrix. The recent research results related to technological possibilities in manufacturing show the need of the research of new constructions of completely non conventional shapes and kinds with integrated parts (smart structures). The main objective of the grant is the design of new constructional machinery parts of ultrahigh strength and with very progressive dynamic properties. The use of modern numerical methods will allow the development of calculation models and new designs, optimal processes and limit criteria for composite parts of non conventional constructional designs using advantages of these material kinds. The material and structural characteristics will be determined experimentally on model samples of new hub kinds.

GA101/08/1110 **"Development of a new technology utilising the high level of deformation for the manufacturing of ultrafine grained materials"**, the researcher is prof. Ing. Stanislav Rusz, CSc., VŠB – Technical University of Ostrava, Faculty of Mechanical Engineering, the total costs of CZK 3.520 million, thereof CZK 3.520 million from the state budget.

(Year 2008 – 1.139/1.139, 7d)

Objective of the solution: The development of new materials with ultrafine structures and of nanostructural materials is currently in the forefront of material research and manufacturing technologies worldwide. This issue is one of the main topics in the 7th Framework Programme by EU. The process substance relates to the achievement of a grain size of tested materials below 1 um. Sub microcrystalline materials with the average grain size in the range from 50 to 200 nm are characterised by their high formability, while their very good strength properties are maintained. An important part of studies of the existing research centres pays their attention to the issue of strengthening during the process of plastic deformation. The practical aspect of the given process depends on the possibility to increase of loading transferred by the constructional parts, manufactured of nanostructural materials, and on the increased security, when loaded by strengths higher than the strengths proposed in their constructional designs. The main objectives of the works in the project related to the verification of a new technology used in the manufacture of nanostructural materials, the so-called EHAD – the extrusion with high amounts of deformation. The solution of the following areas is planned:

1. The supplementing of the existing workplace for the development of technologies for the manufacture of ultrafine grained materials with a matrix heating facility, an oven with the continuous temperature regulation, and laboratory digital microscope.
2. The design of a new technology achieving a high level of deformation by the change in the deformation way EHAD (the high deformation level extrusion).
3. The constructional design and manufacturing of forming tools for the EHAD technology.

4. The verification of the given technology with selected alloys of nonferrous metals, on the basis of Al, Cu, Mg, and Si.
5. Mathematical simulations of the given process.
6. The creation of a database of technological and forming parameters from the achievement of advantageous mechanical properties and plasticity of selected materials' point of view.

GA102/06/0381 **"Spintronic applications of ferromagnetic semiconductor nanostructures"**, 1/2006–12/2008, the head researcher is doc. RNDr. Jan Voves, CSc., Czech Technical University in Praha, Faculty of Electrical Engineering, the total costs of CZK 2.782 million, thereof CZK 2.782 million from the state budget.

(Year 2008 – 0.933/0.933, 2d)

Co-researcher:

- Institute of Physics of AS CR, v. v. i., Praha, RNDr. Miroslav Cukr, CSc.

Objective of the solution: The project proposes, prepares and characterises structures with the layers of magnetic semiconductors of the A3B5 kind supplemented with Mn. The main objectives of the proposed project are the study and optimising of these structures from the point of view of phenomena important for the function of spintronic parts. It is about the effective injection of spin polarised carriers, their transport and detection with the assistance of phenomena of dependent tunnelling, by the magnetic field managed resonance tunnelling by the double barrier, huge magnetoresistance, and the interaction of these carriers with radiation. The project has been based on the close co-operation of the part and application-oriented workplace of the Czech Technical University, Faculty of Electrical Engineering, with the technological and theoretical groups in the Institute of Physics of AS CR. The solution will utilise experience from designing and simulation of semiconductor structures in the Faculty of Electrical Engineering, the great theoretical knowledge from the area of ferromagnetic semiconductors, and the experience with the epitaxy layer growth in the Institute of Physics.

GA102/06/1106 **"Metamaterials, nanostructures, and their applications"**, 1/2006–12/2008, the head researcher is prof. Ing. Ján Zehentner, DrSc., Czech Technical University in Praha, Faculty of Electrical Engineering, the total costs of CZK 2.574 million, thereof CZK 2.574 million from the state budget.

(Year 2008 – 0.915/0.915, 6b)

Co-researchers:

- Institute of Chemical Technology Praha, Faculty of Chemical Technology, prof. Ing. Václav Švorčík, DrSc.
- Nuclear Physics Institute of AS CR, v. v. i., Husinec – Řež, doc. Ing. Vladimír Hnatowicz, DrSc.

Objective of the solution: The research of new "particles" that should allow the simple manufacturing of bulk metamaterials of negative effective permittivity and/or negative effective permeability. The new medium will be useful in the microwave technology, in qualitatively new applications, and in the volume saving designs of passive circuits and antennas. The material will be developed by the cascade arrangement of layers with periodically assembled "particles". The parallel research of sub micron metal polarisation matrices in polymer substrates should be finalised by the design and manufacture of a waveguide attenuator with the continuously adjustable attenuation. The research of metal nanolayers' depositing on polymer films, of the optimal metal and polymer thickness, and of the metal diffusion into the polymer should result in the MIM structure than would be technologically useful in switches and in parts with the negative differential resistance. The project stages have both exploratory and application characters. The project creates good conditions for the scientific education of students and post graduates.

GA102/06/1624 **“Micro and nano sensor structures and systems with the inbuilt intelligence (MINASES)”**, 1/2006–12/2008, the head researcher is prof. Ing. Miroslav Husák, CSc., Czech Technical University in Praha, Faculty of Electrical Engineering, the total costs of CZK 3.916 million, thereof CZK 3.916 million from the state budget.

(Year 2008 – 1.310/1.310, 4a)

Co-researcher:

- Brno University of Technology, Faculty of Electrical Engineering and Communication, prof. Ing. Radimír Vrba, CSc.

Objective of the solution: The development of new kinds of intelligent integrated micro and nanostructure sensors and actuators, including the electronic circuits for the processing and transmission of data signals. There will be means of microtechnologies used together with nanotechnologies and nanotechniques, especially in the area of materials and structures for chemical sensors and biosensors. The project includes the modelling, property simulation, and the development of a RF MEMS switch, the MEMS structures for an absorption sensor of the vf radiation, the development of active integrated tensiometers and wireless Bluetooth, the ZigBee transfer of data signals, the development of sensors utilising polymer electronics, the development of new optochemical sensors for the measuring of pollutant concentrations in the environment, the development of micro and nanosensors for chemical and biochemical applications, the insertion of intelligence into integrated sensors and systems, and the mutual impacts of electromagnetic energy radiation on integrated circuits and biosystems.

GA102/08/1474 **“Local optical and electrical characterising of optoelectronic structures having the nanometric resolution”**, 1/2008–12/2010, the researcher is prof. RNDr. Pavel Tománek, CSc., Brno University of Technology, Faculty of Electrical Engineering and Communication, the total costs of CZK 1.331 million, thereof CZK 1.331 million from the state budget.

(Year 2008 – 0.607/0.607, 6b)

Objective of the solution: The project focuses on local characterising of optical and electronic properties of optoelectronic structures, including the electroluminescence structures. As there is not much information about nanoscopic properties of these structures, there will be the relatively new method of scanning microscopy, so called near-field scanning optical microscopy (SNOM), in this workplace. The main objective of this project is the understanding and the better quality and longer life span of these structures. They get worse by absorption, inner reflection and by other losing mechanisms. The shape of the electromagnetic field nearby parts and the main mechanisms of the local electroluminescence will be studied with the focus on the aging caused by strengthened diffusion of ion additives and by the vacancy of a carrier. In order to find the quality and the life span of parts, there will be the basic local optic and electric characteristics researched, with the assistance of the noise spectroscopy method, the local photo and electroluminescence, and the nearby optic field.

GA102/08/1546 **“Miniaturised intelligent systems and nanostructured electrodes for chemical, biological and pharmaceutical applications (NANIMEL)”**, 1/2008–12/2012, the researcher is Ing. Jaromír Hubálek, Ph.D., Brno University of Technology, Faculty of Electrical Engineering and Communication, the total costs of CZK 9.990 million, thereof CZK 9.990 million from the state budget.

(Year 2008 – 2.169/2.169, 6c)

Co-researcher:

- Mendel University of Agriculture and Forestry in Brno, Faculty of Agronomy, doc. Ing. René Kizek, Ph.D.

Objective of the solution: This project’s objective is the research of different material’s nanostructures creation (e.g. Bi, Ga, and Galinstan) on planar microelectrodes as sensitive parts of electrochemical sensors with the goal to achieve the high sensitivity in electrochemical analyses like, for example, the detection of heavy metals, the research of bioactive substances for the modification of microelectrodes as the affinity layer in biomolecules’ analyses. There will be a miniature mobile system for in field and laboratory measuring designed, together with the microchip developed for microelectrodes and targeted applications. Microelectrodes with nanostructures will be integrated in the sensor field together with the developed integrated electronic intelligent system. This unique mobile facility will allow for the execution of a large number of varied analyses within a short time, by different methods, including with electrodes, like, for example, the protein analyses, DNA, etc. This should make research works, related to electrochemical analyses, much more efficient.

GA103/06/1856 **“Determining the physical properties of the cement with nanoindentation”**, 1/2006–12/2008, the researcher is prof. Ing. Zdeněk Bittner, DrSc., Czech Technical University in Praha, Faculty of Civil Engineering, the total costs of CZK 3.078 million, thereof CZK 3.078 million from the state budget.

(Year 2008 – 1.026/1.026, 7a)

Objective of the solution: The development of an experimental methodology necessary for the description of microscopic non elastic deformations in materials and their applications on cement composites. The proposed process is based on the combination of several measuring techniques, e.g.: the environmental scanning electron microscopy (ESEM), the atomic forces microscope (AFM), and nanoindentation. The works’ objective will be the determination of quality of the preparation of sample surfaces on the AFM basis. The measuring with the assistance of nanoindentation will be used for the determination of micromechanical properties of selected cement pastes with additives. There will be also the 3D topological model of the permanently deformed sample surface developed with the assistance of AFM.

GA103/08/1639 **“Microstructures of inorganic alumosilicate polymers”**, 1/2008–12/2010, the researcher is prof. Ing. Zdeněk Bittner, DrSc., Czech Technical University in Praha, Faculty of Civil Engineering, the total costs of CZK 6.086 million, thereof CZK 6.086 million from the state budget.

(Year 2008 – 1.021/1.021, 1e, the nanotechnology research share – 50 % of the allocated sum)

Co-researcher:

- Institute of Chemical Technology Praha, Faculty of Chemical Technology, doc. RNDr. František Škvára, DrSc.

Objective of the solution: Inorganic aluminosilicate polymers make a new perspective material group of extraordinary properties, when it comes to the resistance against acidity, durability, fire resistance, frost resistance by the fixation of heavy metals, and mechanical properties. The raw materials are natural aluminosilicate substances like clays and related minerals, but also wastes from inorganic and energy related manufacturing processes – fly ash from power stations, slugs from the metallurgy of ferrous and some nonferrous metals. The synthesis and studies of these polymers at the nano, micro and macro levels require an interdisciplinary approach in chemistry, physics, mechanics, and construction material areas. The role of water and alkaline cations at the nanolevel, the creation mechanism and factors influencing the preparation of aluminosilicate polymers have not been satisfactorily explained so far. The project should determine properties of polymers resulting from their structures at the nano, micro, and macro levels.

GA104/06/0437 **"Development of plasma-chemical processes for the development of intelligent polymer nanostructures"**, 1/2006–12/2008, the head researcher is doc. RNDr. Vladimír Čech, Ph.D., Brno University of Technology, Faculty of Chemistry, the total costs of CZK 2.370 million, thereof CZK 2.370 million from the state budget.

(Year 2008 – 0.790/0.790, 7c)

Objective of the solution: The technological utilisation of functional polymers often requires their preparation in the form of thin layers. A number of techniques for the thin homogeneous layers' preparation have been already developed and some of them are suitable for the preparation of high quality polymer layers which could be frequently reproduced. This technology level allows for the management of a more complicated polymer structure. This project should utilise and extend experience from the joint Czech-Japanese research done in the area of complicated plasma-chemical processes and the experience with the nanoindentation technique gained within the joint Czech-British project. The main project's objective is the managed construction of polymer nanostructures (layered or gradient), when utilising the polymerisation technology in plasma. This conception presents a new technological progress in the creative designing and utilisation of complex layered systems for intelligent polymer nanostructures.

GA104/06/0642 **"Thin Films of Magnetically Doped A(iii)N Semiconductors for Spin Electronics Applications"**, 1/2006-12/2008, the researcher is prof. Ing. David Sedmidubský, Dr., Institute of Chemical Technology in Praha, Faculty of Chemical Technology, the total cost of CZK 3,039 million, thereof CZK 3,039 milion from the state budget.

(Year 2008 – 0,974/0,974, 2d)

Co-researcher:

- Institute of Physics of AS CR, v.v.i., Praha, Ing. Dr. Jiří Hejtmánek, CSc.

Objectives of the solution: The transition metal (TM) doped A3B5 semiconductors belong to a new class of advanced materials, dilute magnetic semiconductors, which have recently received much experimental and theoretical attention as a suitable spin source for spintronic devices, such as spin transitors, LEDs, magnetic RAMs and sensors. Some of the highly doped wide band gap materials like (Ga,Mn)N reveal a ferromagnetic like behavior near and above room temperature, which is considered as a major criterium for spintronic applications. The project focuses on material and technological aspects of the TM doped AIIIN thin films fabricated by metalorganic vapor phase epitaxy (MOVPE) technique. Three different methods are employed to incorporate TM (Mn, Cr, Fe, Co) into GaN (AlN) thin layers: (a) ion implantation followed by annealing, (b) diffusion at elevated temperatures from vapor deposited metallic layers into intrinsic GaN, and, (c) in-situ MOVPE using metalorganic precursors $(C_5H_2)_2TM$ as TM sources.

GA104/06/1087 **"Development of catalytic processes for the preparation of conjugated polymers with heteroatoms and their functional nanocomposites"**, 1/2006 – 12/2008, the researcher is prof. RNDr. Jiří Vohlídal, CSc., Charles University in Praha, Faculty of Science, the total costs of CZK 2.873 million, thereof CZK 2.873 million from the state budget.

(Year 2008 – 0.988/0.988, 5b)

Objective of the solution: The development of new methods of catalytic polymerisation of monomers of the aniline, pyrrol, and thiophen kinds to the relevant conductive conjugated polymers having the high purity and the utilisation of these catalytic processes for the direct preparation of these polymers' nanocomposites with the inorganic phase like, for example, TiO_2, Li_2TiO_3, and ZnO, which are studied from the point of view of their utilisation in constructions of photovoltaic cells. The first part of the project relates to the tune up of the redox potential of the catalytic Fe_{2+}-H_2O_2 system by a suitable selection of ligands and by optimising systems of these kinds for the polymerisation of individual monomers. The second part of the project relates to the implementation of new redox catalytic systems based on molybdates which could be re-oxidated by oxygen. The new method should provide polymers the contamination of which by inorganic compounds should be hundreds, or up to a thousand times lower, when compared with polymers prepared by stoichiometrical polymerisations.

GA104/07/1093 **"Preparation of composite nanoparticles by the aerosol process"**, 1/2007–12/2010, the head researcher is Ing. Pavel Moravec, CSc., Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, the total costs of CZK 3.638 million, thereof CZK 3.638 million from the state budget.

(Year 2008 – 0.914/0.914, 7b)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec, RNDr. Snejana Bakardjieva, Ph.D.
- Tampere University of Technology, Finland, doc. Jyrki Mikael Mäkelä, PhD

Objective of the solution: The preparation of nanoparticles by the method of chemical depositing of vapours in a tube reactor with the heated wall. The first step will synthetise: (I) A single component metallic and ceramic nanoparticles (Co, Ni, Pd, MnO) of a large potential in applications by the thermal disintegration of the relevant organo-metallic precursors. The next step will be the preparation of a two-component particle by the simultaneous disintegration of two precursors; (II) The mixed particle ceramics-metal or the ceramic particles coated by metallic material (TiO_2-Co, Al_2O_3-Ni and Al_2O_3-Pd) with the potential utilisation in catalysis and composite two-component particles metal-ceramics (Co-SiO_2) and ceramics-ceramics (MnO-SiO_2) with the potential utilisation as sensors or in electronics. The morphology, the crystalline structure and the chemical composition of particles will be researched with SEM, TEM, SAED, XRD, EDS, and others. Results of the experiments in the tube reactor will be compared with results of the experiments done by the liquid flame spray reactor at Tampere University of technology.

GA104/07/1127 **“Mathematic modelling and the experimental study of the mesoscopic structure creation in polymer materials”**, 1/2007–12/2009, the researcher is Ing. Juraj Kosek, Dr., Institute of Chemical Technology Praha, Faculty of Chemical Technology, the total costs of CZK 2.280 million, thereof CZK 2.280 million from the state budget.

(Year 2008 – 0.760/0.760, 6d)

Objective of the solution: The project deals with the morphogenesis and the relation between the mesoscopic structure and properties of the following polymer materials: (I) porous semi-crystalline particles of polyalkenes and (II) polymer foam. The first project’s objective is the experimental study and mathematical modelling of creation of the morphology of polyalkene particles occurring by the catalytic polymerisation. The evolution of polymer foams, in amorphous, semi-crystalline and branched polymers, is experimentally studied and modelled at the same time. The second objective is the experimental research and the mathematical modelling of relations between the structure and properties of polymer materials (the mechanical, deformation, thermally insulating and transport properties). The instruments for the achievement of these objectives are the prepared experimental facilities for gravimetric measuring at higher temperatures and pressures, for the microscopy observation of the morphogenesis in a pressure vessel, and for the inversion gaseous chromatography taking place at higher pressures, but also the advanced methods of the mesoscopic 3D modelling.

GA104/07/1400 **“Depositing of oxide catalysts for the VOC oxidation on shaped carriers and their modification by nanoparticles of precious metals”**, 1/2007–12/2009, the head researcher is Ing. Květa Jirátová, CSc., Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, the total costs of CZK 3.075 million, thereof CZK 3.075 million from the state budget.

(Year 2008 – 1.025/1.025, 5b)

Co-researchers:

- Institute of Chemical Technology Praha, Faculty of Chemical Technology, doc. Ing. František Kovanda, CSc.
- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec, RNDr. Tomáš Grygar, CSc.

Objective of the solution: The systematic studies of possible ways of depositing of precursors of the hydrotalcite kind on a selected shaped carrier for the purpose of increased mechanical strength of the resulting catalyst, the reduction of the amount of active components per weight unit of the catalyst, and the improvement of its thermal resistance. The study of impacts of the modification of these catalysts by a small amount (10–1 % of the weight) of precious metals from the group of Pt, Pd, Ag, Au, Rh on the physical-chemical properties of the catalysts and on the total oxidation course of the selected model chemical compounds (ethanol, toluene, hexane). The research will focus on the most active oxidation systems found during the solution of the grant by GA CR 104/04/2116. The solution of the project should result in the finding of an optimal precursor depositing process on a shaped carrier, especially the clarification of the relation between the carrier’s properties and the creation of the active surface layer of the oxide on the carrier. There should be an optimal promoter of the catalytic activity and oxidation catalysts' selectivity found for the total oxidation of volatile substances.

GA104/08/0229 **"Thin layers deposited by pulse lasers"**, 1/2008–12/2010, the researcher is doc. Ing. Petr Němec, Ph.D., University of Pardubice, FCHT, the total costs of CZK 3.129 million, thereof CZK 3.129 million from the state budget.

(Year 2008 – 1.053/1.053, 7c)

Objective of the solution: There will be the advanced depositing method – the pulse laser depositing (PLD), used within the project for the preparation of thin layers (nanolayers) of amorphous chalcogenides and polymer materials. The project's objective is the optimising of the PLD process for the purpose of preparation of applicable high quality thin layered structures and their physical-chemical characterising. The project's results should contribute to the basic knowledge about the PLD process and about the phenomenon of photo and thermally induced changes in properties of solid amorphous substances. It is assumed that the gained results would prove the suitability of the PLD technique for the preparation of new thin layers of parameters which address the requirements on their applications as modern materials in optics, optoelectronics, electronics, etc.

GA104/08/0435 **"Smart structured mesoporous TiO_2 layers with the antibacterial and controlled variable wetting properties"**, 1/2008–12/2010, the researcher is Ing. Jiří Rathouský, CSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 3.738 million, thereof CZK 3.738 million from the state budget.

(Year 2008 – 1.382/1.382, 1d)

Co-researcher:

- Institute of Chemical Technology Praha, Faculty of Chemical Technology, doc. Dr. Ing. Josef Krýsa

Objective of the solution: The arranged mesoporous TiO_2 films with the precisely controlled morphology properties and crystallisation will be prepared by the optimised EISA method. Thanks to their extraordinary properties, they will show the significantly higher photocatalytic activity in disintegration of deposits of liquid and solid organic substances, when compared with the non porous films. The reason is the removal of the restrictive impact of the O_2 and H_2O molecules' transport to the photocatalyticly active surface. These mesoporous layers will show also the easily achievable and very stable superhydrophilicity induced by the UV radiation. The synergy of these properties will allow the construction of self-cleaning films of much higher effectiveness, when compared with the existing materials. A special attention will be paid to the in-depth understanding of physical and chemical principles governing the wetting properties of textured surfaces. There will be new concepts prepared for the management of liquid interaction with the surface.

GA104/08/1501 **"Preparation, characterising and chemical properties of supported gold-based bimetallic nanoparticles"**, 1/2008–12/2010, the researcher is Ing. Jan Plšek, Ph.D., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 3.637 million, thereof CZK 3.637 million from the state budget.

(Year 2008 – 1.213/1.213, 7b)

Objective of the solution: The objective of the proposed research is the finding and optimising of preparation conditions for supported bimetallic nanoparticles Au-Pd and Au-Pd of the required composition and with the atomically pure surface. The nanoparticles will be prepared by the controlled sequential vapour deposition , or by the laser ablation. The base, on which the nanoparticles would be deposited, will be oxides important for the heterogeneous catalysis (Al_2O_3, ZrO_2, WO_x, and VO_x) and graphite. The created systems will be characterised by the surface sensitive techniques: XPS, SRPES, ISS, FEM, and AFM. The adsorption properties of CO, NO (O_2, C_2H_4) on bimetallic nanoparticles will be studied with the assistance of photoelectron spectroscopy and TPD. The electrochemical properties on the graphite will be researched with the assistance of the cyclic voltametry. The bimetallic alloy nanoparticles containing gold make up a group of materials which is important, among other applications, also for the heterogeneous catalysis and for the development of fuel cells.

GA106/06/0044 **"Polymer nanocomposite with multiphase polymer matrix; action of nanofiller as reinforcement and compatibilizer"**, 1/2006–12/2008, the head researcher is Ing. Ivan Kelnar, CSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 1.771 million, thereof CZK 1.771 million from the state budget.

(Year 2008 – 0.577/0.577, 1g)

Objective of the solution: There has been the important ability of particles of the layered silicate – compacting of non mixing polymer mixtures, recently found. However, the mechanic behaviour of these systems has not been studied yet. The objective of this project is the in detail study of nanocomposites with a multi component polymer matrix, i.e. the systems in which the high solidifying and compacting effects of nanofills are combined. One of the results should be the clarification of the dependency of the mechanical behaviour, including the fracture mechanics, on the morphology, i.e. the structure of the polymer matrix, the locality, and the level of nanofill dispersion. There will be the possibilities of the structure influencing by the modifications of polymers and nanofills verified (with the objective to find the chemical relations between the fill and the polymer part) as well as the cointercalation by reactive compounds, preparation conditions, and the order of parts' mixing. The objective is the understanding of the main factors influencing structures of these systems and of the scope of compacting abilities of the nanofills.

GA106/06/0270 **"Nanoceramic materials based on zircon oxide – the study of the microstructure by the positron annihilation spectroscopic method"**, 1/2006–12/2008, the head researcher is RNDr. Ivan Procházka, CSc., Charles University in Praha, Faculty of Mathematics and Physics, the total costs of CZK 0.994 million, thereof CZK 0.994 million from the state budget.

(Year 2008 – 0.315/0.315, 1f)

Objective of the solution: The complex research of nanopowder and nanoceramic materials based on the zircon oxide. The basic experimental method is the positron annihilation spectroscopy. There will be the microstructure studied in detail with the stress put on the influence of defects and of alloying components on these materials' properties.

GA106/06/0327 **"Crystallisation of amorphous and thin nanocrystalline layers"**, 1/2006–12/2008, the head researcher is doc. RNDr. Radomír Kužel, CSc., Charles University in Praha, Faculty of Mathematics and Physics, the total costs of CZK 2.884 million, thereof CZK 2.884 million from the state budget.

(Year 2008 – 0.938/0.938, 1d)

Co-researcher:

- University of West Bohemia in Plzeň, Faculty of Applied Science, prof. Ing. Jindřich Musil, DrSc.

Objective of the solution: The properties of thin layers depend very much on their real structures, or crystallinity. The crystallisation of amorphous and nanocrystalline layers is monitored in two cases – the TiO_2 layers, which have been recently applied in varied industries, especially thanks to the photocatalytic activity and self-cleaning ability, and the hard amorphous or nanocrystalline layers, especially in the Zr-Si-N system. In the first case, the goal is to reduce the crystallisation temperature, while the second one tries to increase it. In addition, the TiO_2 layers are doped with suitable elements for the purpose of a shift of the banned zone into the visible area. The real layers' structure and its development, dependent on the temperature, are studied with the assistance of the complex characterising of X-frays diffraction and reflection, i.e. the phase composition, microdeformation, the reminder tension, the layers' thickness, the roughness of the surface, the analysis of crystallite sizes and shapes and their preferential orientation in the case of both annealed layers and in situ by measuring.

GA106/06/1486 **"Impacts of nanoparticles on the damage and life-span of thermoplastic composites"**, 1/2006–12/2008, the head researcher is Ing. Robert Válek, Ph.D., SVÚM a.s. Praha, the total costs of CZK 2.725 million, thereof CZK 2.725 million from the state budget.

(Year 2008 – 0.925/0.925, 1g)

Co-researcher:

- Czech Technical University in Praha, Faculty of Mechanical Engineering, Ing. Jan Rybníček, Ph.D.

Objective of the solution: There are conditions of the composite disruption in the relation to its microstructure studied on the basis of the behaviour of thermoplastic PP, PA/organic clay-based nanocomposites, when under stress for a long time by pulling or impact loading at high deformation speeds. The nanocomposite properties are primarily governed by the properties of the interphase which, thanks to the size of reinforcing nanoparticles, has a much bigger surface, when compared with composites filled with conventional particles. The creep of the nanocomposite and of a not reinforced matrix is studied in axial pulling stresses on standard and notched testing pieces (the modelling of corrosion effects during the stress in tensides. The measured data and the find microstructural changes will be utilised for the clarification of the creep deformation mechanism and the creep disruption. The effect of the matrix reinforcing on the toughness of the nanocomposite will be studied at the same time on the basis of parameters gained by the methods of instrument measuring of the notched toughness, disruption by penetration during multi axial tension, and by the measuring of the fracture toughness.

GA106/06/1576 **"Porous composite materials with the polyamide lining and the siloxane matrix with nano-hydroxyapatite as biomaterials"**, 1/2006–12/2008, the researcher is

Ing. Karel Balík, CSc., Institute of Rock Structure and Mechanics of AS CR, v. v. i., Praha, the total costs of CZK 3.716 million, thereof CZK 3.716 million from the state budget.

(Year 2008 – 1.338/1.338, 3d)

Co-researchers:

- Institute of Physiology of AS CR, v. v. i., Praha, MUDr. Lucie Bačáková, CSc.
- Czech Technical University in Praha, Faculty of Mechanical Engineering, doc. Ing. Miroslav Svoboda, CSc.

Objective of the solution: The design and development of composite materials of optimal sizes of open pores and with suitable mechanical properties used as bone tissue replacements. The composite consists of a polyamide textile placed in the siloxane matrix, where there are micro or nano crystals of hydroxyapatite regularly dispersed. There will be tests executed on the prepared composites and implants in vitro, in vivo, and the histologic tests. The composite applications will be done on selected bone replacements.

GA106/07/0805 **"Complex structural analysis of the property gradients of surface layers of important technological materials after their mechanical treatment"**, 1/2007–12/2009, the researcher is Ing. Martin Čerňanský, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 1.920 million, thereof CZK 1.920 million from the state budget.

(Year 2008 – 0.640/0.640, 6e)

Co-researcher:

- Czech Technical University in Praha, FJFI, doc. Ing. Nikolaj Ganev, CSc.

Objectives of the solution: The complex research of steel surface layers after certain ways of the mechanical surface machining. In contrast to the existing works, this project is based on the fact that the surface layer has got certain other than zero thickness and that the structure, tension, and material properties change along this thickness. There will be identical sets of samples of selected steel kinds researched with the methods of the X-ray diffraction (the phase analysis, the X-ray tensometry, the analysis of diffraction lines' analysis), nanoindentation, and with the method of the surface acoustic waves for the purpose of determining the structure gradients (the phase composition, crystallite sizes, and microdeformations), gradients of the reminding macroscopic tensions and mechanical properties (the hardness and elastic modules). There will be the summary interpretation of the mentioned structure parameters, of the macro and micro tension states, and of the measured characteristics of the mechanical properties prepared.

GA106/07/0949 **"New ways of magnetic nanocomposites (spinel ferrites) preparation and the study of their physical properties"**, 1/2007–12/2009, the head researcher is RNDr. Daniel Nižňanský, Ph.D., Charles University in Praha, Faculty of Science, the total costs of CZK 8.312 million, thereof CZK 8.312 million from the state budget.

(Year 2008 – 2.595/2.492, 2d)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, RNDr. Jiří Plocek, Ph.D.
- Institute of Physics of AS CR, v. v. i., Praha, Ing. Ján Lančok, Ph.D.

Objective of the solution: The preparation of ferrites of the spinel structure in diamagnetic matrices and their physical characterising. These nanocomposites are prepared by either chemical (sol-gel) or physical (laser ablation and magnetron sputtering) preparation methods. There are both classic and the new preparation processes for sol-gel used. The new process is based on the preparation of the compound the molecule of which contains both precursor of the matrix and active substances. There is the combination of laser and magnetron sputtering used for the preparation of nanocomposites in the form of thin layers. The resulting samples will be characterised by the X-ray diffraction, electron microscopy, IC spectroscopy, optic and magnetic measurings, and the Mössbauer spectroscopy. Different physical and chemical preparation methods will result in different surface structures, which will influence the physical properties. The attention will be paid to the finding of composites providing extraordinary physical properties suitable for the construction of functional parts.

GA106/07/1149 **"Bioactive and photocatalytic sol-gel nanolayers"**, 1/2007–12/2009, the head researcher is prof. Ing. Josef Matoušek, DrSc., Institute of Chemical Technology Praha, Faculty of Chemical Technology, the total costs of CZK 2.265 million, thereof CZK 2.265 million from the state budget.

(Year 2008 – 0.750/0.750, 3d)

Objective of the solution: There will be bioactive layers based on TiO_2 and SiO_2 and calcium-phosphate prepared with the sol-gel method and there will be their bioactivity in vitro determined and their modification possibility by Ca^{2+} and Na^{+} verified. There will be also active TiO_2 nanolayers prepared on substrates of different material kinds. Beside TiO_2 layers, there will be also layers combined with other oxides prepared as well as the layers with dispersed silver nanoparticles, or layers doped with other additives, and hybrid layers, where the polydimethylsiloxane (PDMS) will make the polymer part. There will be standard mechanical and chemical properties of these layers, determining their practical use, established and their photocatalytic activity will be verified. Their antibacterial properties will be experimentally researched. Apart of outcomes useful in the practice, there will be information about these layers' microstructures, composition and textures gained and the knowledge of their creation mechanism and their growth mathematical model will be made more precise.

GA106/08/1440 **"Iron and iron oxides based nanoparticles for magnetic separation processes"**, 1/2008–12/2011, the researcher is Ing. Oldřich Schneeweiss, DrSc., Institute of Physics of Materials of AS CR, v.v.i, Brno, the total costs of CZK 10.259 million, thereof CZK 10.259 million from the state budget.

(Year 2008 – 2.136/2.136, 1a)

Co-researcher:

- Palacky University Olomouc, Faculty of Science, prof. RNDr. Miloslav Mašláň, CSc.

Objective of the solution: The coordinated complex experimental research of nanocrystalline particles of iron and iron oxides, which provide for interesting magnetic properties suitable in applications within magnetic separation processes. The nanocrystalline particles alpha-Fe, of magnetite and maghemite with graphite shell will be gained with the assistance of processes based on reactions in the solid phase in reduction atmospheres from precursors created by oxides, hydro oxides and Fe compounds. There will be the structure and phase compositions analysed in the synthetised materials (XRD, Mössbauer spectroscopy, Raman spectroscopy, IR, and TG/DTA) as well as the sizes and morphology (TEM, AFM, DLS, and BET) and magnetic behaviour (Mössbauer spectroscopy, VSM, and SQUID). The nanocrystalline powders will be tested from the point of view of their applications in biomagnetic detoxication processes, magnetism separations used in the mineralogy and in ecological applications (the purification of water and air).

GA/202/06/0531 **"Reflexion and wave guiding phenomena in magnetic nanostructures"**, 1/2006–12/2008, the researcher is prof. Ing. Štefan Višňovský, DrSc., Charles University in Praha, Faculty of Mathematics and Physics, the total costs of CZK 5.017 million, thereof CZK 5.017 million from the state budget.

(Year 2008 – 1.672/1.672, 6b)

Co-researcher:

- VŠB – Technical University of Ostrava, Faculty of Mining and Geology, prof. Ing. Jaromír Pištora, CSc.

Objective of the solution: The basic research of multilayers and nanostructures based on magnetic oxides and metals. The research is motivated with the use for the magnetic information recording, magnetic and magnetooptic (MO) sensors, spin electronics, and integrated optoelectronics. The project takes advantage of the original experimental equipment for the magnetooptic (MO) spectroscopic ellipsometry, MO vector magnetometry, the analysis of surfaces with the assistance of evanescent waves and experience from the modelling of optic feedback in multilayers, side-periodical structures, and the non reciprocal MO waveguides. It utilises the combination of the classic and spectroscopic MO ellipsometry and of the computer-assisted simulations for the metrology of magnetic periodical structures with the resolution below the classic limit. The research takes place in cooperation with university laboratories in France, Japan, USA, and Germany.

GA202/06/0718 **"Quantum dots' engineering"**, 1/2006–12/2008, the researcher is Ing. Jiří Oswald, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 3.270 million, thereof CZK 3.270 million from the state budget.

(Year 2008 – 1.046/1.046, 1a)

Co-researchers:

- Czech Technical University in Praha, Faculty of Electrical Engineering, doc. Ing. Pavel Hrazdíra, CSc.
- Masaryk University in Brno, Faculty of Science, doc. Mgr. Dominik Munzar, Dr.

Objective of the solution: The preparation of vertically correlated multilayer structures of quantum dots (QD) InAs with the high intensity of luminescence. There are structures prepared with defined properties like, for example, the emission wave length, energy difference between the lowest and the second lowest radiation interface in QD and the area QD density important for the use in optoelectronics. The layered structures of correlated QD are prepared with the method of gaseous epitaxy from organic-metallic compounds (MOVPE) in the growth Stransky-Krastanov mode. Their properties are tuned up by changes in the number of layers, variable thickness of separating GaAs layers between the InAs quantum dots' layers, and by changes in the chemical composition and the thickness of the buffer layer. The samples are characterised with the structural and optical methods, especially with the assistance of dispersed X-ray radiation, TEM, AFM, luminescence, absorption, reflection, and photoconductivity. In parallel, there are theoretical studies of impacts of the buffer layer and of the vertical correlation on the electron structure of quantum dots organised.

GA202/07/0456 **"New materials for spintronics: Computer assisted designs of magnetically doped semiconductors"**, 1/2007–12/2009, the researcher is RNDr. František Máca, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 1.763 million, thereof CZK 1.763 million from the state budget.

(Year 2008 – 0.573/0.573, 2d)

Objective of the solution: The understanding and the design of new material and new phenomena in the area of spin electronics. The process basis is made by calculations of electron and magnetic properties based on the formality of the density functional that is especially suitable for the realistic description of their basic properties. The project deals with classic materials, but also with mixed crystals which are optimised for much more suitable property. The studied materials are quaternary alloys like, for example, Li(Ga, Mn)As and (Ga, Mn)(As, P). The calculations of magnetic properties should allow the determination of decisive exchange mechanisms, the impact of other additives, and the finding of relations between the creation of the magnetic moment and the electron structure of the host material. There are both own and taken over calculation programmes, based on the first principles, utilised for the gaining of results. The critical temperatures of magnetic arrangements, which are very important for technological applications, will be gained from the calculated parameters of exchange interactions.

GA202/07/0601 **"GaAs and $Ga_{1-x}Mn_xAs$ nanolayer surfaces prepared by the low-temperature molecular beam epitaxy"**, 1/2007–12/2010, the researcher is doc. RNDr. Igor Bystroň, DrSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 2.437 million, thereof CZK 2.437 million from the state budget.

(Year 2008 – 0.523/0.523, 1d)

Objective of the solution: Crystalline GaAs nanolayers are prepared by the low-temperature molecular beam epitaxy (LT MBE) and controlled in situ with the assistance of RHEED. The mentioned epitaxy allows for insertion of magnetic impurities into a semiconductor and it thus result in the perspective creation of a material that combines magnetic properties with the advanced semiconductor technology. The low-temperature growth provides nanolayers of physical properties dependent on growth conditions and on the consequent tempering. The samples are transported in the ultrahigh vacuum to the angular electron spectrometer. There are measured intensities of the electron beams diffracted from the surface, energy and angle differentiated photoelectron spectra emitted from a valence band and from inner atom levels. The experimental data will be interpreted theoretically with the assistance of the dynamic LEED theory, one-level photoemission model, and the photoelectron diffraction from the final set of atoms.

GA202/07/0643 **"Electron transport in organic-inorganic nanoparts"**, 1/2007–12/2009, the researcher is Mgr. Miroslav Menšík, Dr., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 1.635 million, thereof CZK 1.635 million from the state budget.

(Year 2008 – 0.545/0.545, 6b)

Co-researcher:

- Institute of Physics of AS CR, v. v. i., Praha, RNDr. Karel Král, CSc.

Objective of the solution: The theoretical modelling of semiconductor nano-devices with the stress put on organic and inorganic material components for the purpose of understanding these elements and assisting their practical use. The typical studied devices are the emission diodes (LED) and molecular transistors using organic material components. There is the kinetic luminescence of emission diodes (LED) with nanoparticles in polymer organic matrices analysed. The electronic properties of molecular transistors are studied in their dependency on the selection of material components. There will be the impact of matrix vibrations on the properties of studied elements calculated, but also the quantum tunnelling. In order to gain data characterising real devices, some model systems will be prepared technologically and measured.

GA/202/07/0818 **"Silicon nanophotonics – from individual nanocrystals to photonic structures"**, 1/2007–12/2009, the researcher is doc. RNDr. Jan Valenta, Ph.D., Charles University in Praha, Faculty of Mathematics and Physics, the total costs of CZK 4.999 million, thereof CZK 4.999 million from the state budget.

(Year 2008 – 1.230/1.230, 2b)

Co-researchers:

- Institute of Physics of AS CR, v. v. i., Praha, RNDr. Kateřina Herynková, Ph.D.
- Czech Technical University in Praha, Faculty of Nuclear and Physical Engineering, Dr. Ing. Anton Fojtík, CSc.
- University of South Bohemia in České Budějovice, Physical Biology Institute, doc. RNDr. František Vácha, Ph.D.

Objective of the solution: The project develops in parallel the two perspective areas: (1) Experimental techniques characterising nanostructures: the optical microspectroscopy (able to provide information about individual nanocrystals and about larger photonic structures) and non linear optical methods (providing information about the excitation mechanism and deexcitation and kinetics of photoinduced processes). (2) Nanotechnology of silicon materials with the goal of optimising their properties for the use in optoelectronics, or sensors and biocompatible substances. The joining of these two areas should allow for the achievement of progress in the understanding of mechanisms of luminescence and optical gain in silicon nanostructures, of the impact of surface states and defects, and of the emission changes caused by the insertion of nanocrystals into photonic structures (the microresonators and waveguides).

GA202/07/1669 **"Depositing of stable thermomechanical nanostructured diamond like thin layers in dual-frequency capacitive discharges"**, 1/2007–12/2011, the researcher is RNDr. Vilma Buršíková, Ph.D., Masaryk University in Brno, Faculty of Science, the total costs of CZK 6.579 million, thereof CZK 6.579 million from the state budget.

(Year 2008 – 1.309/1.309, 1d)

Co-researchers:

- Czech Metrology Institute, Brno, Mgr. Petr Klapetek, Ph.D.
- Nuclear Physics Institute of AS CR, v. v. i., Husinec, RNDr. Vratislav Peřina, CSc.
- Institute of Scientific Instruments of AS CR, v. v. i., Brno, Ing. Jaroslav Svoboda, CSc.

Objective of the solution: The development of a depositing system for the preparation of the thermal stable nanostructured diamond-like carbon layers with the use of dual-frequency capacitive plasma (DFCCP). The controlled growth of layers should be achieved by the combination of the high frequency actuation, which ensures the stability and the high plasma density, and the low-frequency actuation, which controls independently the ions' energy. The subject of the study is the finding of an optimal combination of the high and low frequency actuation (the continual or pulse actuation) allowing the balanced coating of not flat cascading substrates' surfaces and the substantial decrease of the inner tensions in the layers. Complex DFCCP diagnostics and the computer-assisted simulation, for the description and understanding of processes taking place in the course of depositing, make parts of the project. The prepared layers will be in detail characterised from the point of view of their structures (RBS, ERDA, TOF ERDA, HRTEM, SEM, etc.), but also from the point of view of their properties (e.g. ellipsometry, spectrophotometry, and the micro and nanoindentation).

GA202/08/0178 **"Synthesis of magnetic Fe-based nanoparticles in low-temperature microwave plasma"**, 1/2008–12/2010, the researcher is Mgr. Vít Kudrle, Ph.D., Masaryk University in Brno, Faculty of Science, the total costs of CZK 3.691 million, thereof CZK 3.691 million from the state budget.

(Year 2008 – 1.575/1.575, 1a)

Co-researchers:

- Institute of Physics of Materials of AS CR, v. v. i., Brno, Ing. Bohumil David
- Institute of Scientific Instruments of AS CR, v. v. i., Brno, Mgr. Jiřina Matějková

Objective of the project: The project's objective is the synthesis of iron-based nanoparticles with the assistance of microwave plasma, their characterising and optimising of their properties, while considering their use in new magnetic materials and for the synthesis catalysis of carbon nanotubes, etc. There will be the microwave charge with the two basic arrangements utilised for the nanoparticle synthesis. The arrangements fundamentally differentiate the inner plasma parameters – (a) the charge with the surface wave at low pressure ~1 kPa, (b) the torch charge at the atmospheric pressure. Vapours of organic iron compounds will make the iron source. There will be the ferro-pentacarbonyl tested. As the iron particles tend to oxide in the atmospheric pressure, these particles will be made passive. The nanoparticles will be studied with the methods of structural and morphology analyses. There will be also their functional properties researched, especially their catalytic abilities and magnetic properties at both low and high temperatures.

GA202/08/0722 **"Physical properties of high-temperature superconductors having nanoscopic defects"**, 1/2008–12/2009, the researcher is RNDr. Miloš Jirsa, DSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 0.800 million, thereof CZK 0.800 million from the state budget.

(Year 2008 – 0.394/0.394, 6b)

Objective of the project: The superconductors of the $(RE)Ba_2Cu_3O_7$ type provide for huge application potential as materials for the massive superconducting magnets with the magnetic field of up to 20 Tesla. They are thus suitable for a number of compact applications, e.g. in mobile diagnostic instruments. Defects in the crystal matrix, especially the nanoscopic ones that are comparable with the core sizes of superconductive whirls, have important roles in increases of superconductive currents and in their time stabilisation. The relevant interactions have not been yet satisfactorily described and theoretically understood. The role of the defects' homogenous assembly has been thus also unknown. The project is based on the existing close co-operation with leading technological centres. Experimental and theoretical studies of the magnetising, transport and structural properties of new composites make parts of the project. The project also focuses on the realistic theoretical description of these interactions with special attention paid to conditions of the high defects' concentration in textured materials and in big crystals, and of their behaviour in extreme situations.

GA202/08/1688 **"The use of physical study methods related to the adsorption of nucleic acids and proteins at interfaces in medical diagnostics and in studies of biocompatibility"**, 1/2008–12/2010, the researchers is prof. RNDr. Vladimír Vetterl, DrSc., Institute of Biophysics of AS CR, v. v. i., Brno, the total costs of CZK 2.052 million, thereof CZK 2.052 million from the state budget.

(Year 2008 – 0.684/0.684, 3f)

Objective of the solution: The development of electrochemical and optical methods for the cheap and sensitive determination of nucleotide sequences in oligonucleotides and their utilisation in medical diagnostics. Other project's objectives are the finding of optimal conditions on the ODN immobilisation in DNA biosensors, optimal methods of a sensitive detection of hybridisation and the microdetection of ODN samples in small volumes. A similar methodological approach will be used for the determination of conditions on the achievement of the optimal biocompatibility of titanium implants.

GA203/06/0285 **"Photoactive molecular electronic parts: the theoretical study and experimental modelling"**, 1/2006–12/2008, the researcher is RNDr. Petr Toman, Ph.D., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 2.274 million, thereof CZK 2.274 million from the state budget.

(Year 2008 – 0.728/0.728, 2e)

Co-researcher:

- Brno University of Technology, Faculty of Chemistry, doc. Ing. Martin Weiter, Ph.D.

Objective of the project: The design of new molecular electronic elements based on the interaction between conjugated macromolecular substances and the photochromic substances. The research project's activities are focussed on the theoretical and experimental studies of model molecular systems suitable for the construction of new electronic elements transforming an optical signal to the electrical one. The quantum chemical calculations will provide molecular parameters necessary for the modelling of intramolecular transport of charge carriers like ionising potentials, electrostatic potential barriers, and transmission integrals. The modelling of the intramolecular transport of charge carriers is based on the solution of the time dependent Schrödinger formula within the approximation of the tight coupling. The experimental project's part covers the study of the optical and electrical switching and its dynamics and the transport of charge carriers considering the density of electron localised states induced by photochromic substances.

GA203/06/0786 **"Modification of nanocrystalline silicon surfaces with diagnostic organic parts for the optical detection of chemical substances"**, 1/2006–12/2008, the researcher is doc. RNDr. Juraj Dian, CSc., Charles University in Praha, Faculty of Mathematics and Physics, the total costs of CZK 2.553 million, thereof CZK 2.553 million from the state budget.

(Year 2008 – 0.851/0.851, 6d)

Co-researcher:

- Institute of Chemical Technology Praha, Faculty of Chemical Engineering, prof. RNDr. Vladimír Král, CSc.

Objective of the solution: The chemical modification of the porous silicon surface by organic recognition elements for sensor applications. The main works focus on the research of chemical reactions in the course of which suitable organic substances get tied to the porous silicon surface. The main tasks are as follows: (I) The synthesis of suitable recognising elements and (II) the optimising of their relation from the points of view of the morphology of porous silicon and the size of tied molecules. The purpose of the chemical modification is as follows: (I) The gaining of basic knowledge about the surface chemistry of the nanostructural silicon, (II) the increase in the long-term stability of porous silicon physical properties, (III) the utilisation of the modified material for the detection of chemicals in liquid and gaseous states, and (IV) the determination of the interaction kinds between the recognition elements on the surface of porous silicon and the selected analytes, the quantitative studies of the sensor reactions to the amount of analytes.

GA203/06/1368 **“Preparation and studies of amorphous chalcogenide layers and their potential application in optical recordings and memory”**, 1/2006–12/2008, the researcher is prof. Ing. Tomáš Wágner, CSc., University of Pardubice, FCHT, the total costs of CZK 3.274 million, thereof CZK 3.274 million from the state budget.

(Year 2008 – 1.068/1.068, 1d)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, RNDr. Tomáš Grygar, CSc.
- Nuclear Physics Institute of AS CR, v. v. i., Husinec – Řež, RNDr. Vratislav Peřina, CSc.

Objective of the solution: The project studies the preparation of amorphous chalcogenide layers prepared with the spin coating method, laser pulse depositing, and the magnetron sputtering in combination with the optically induced diffusion and silver solution (OIDR) in glassy systems As-S, As-S-Se, Ge-Se, and in systems containing silver, e.g. Ag-As-Sb-S or Ag-Ge-Se. The OIDR kinetics is measured from the change in reflection of double layers Ag/chalcogenide and by the spectral ellipsometry that determines the optical parameters of the layers. There is the method of Rutherford back-scattering of ions (RBS) used for non destructive analyses of product compositions after and in the course of OIDR. The structure of prepared layers and of OIDR prepared layers, before and after exposing to the laser, is determined by the (micro) Raman, UV-vis-Infrared spectroscopy and the roentgen (micro) diffraction. There are also thermal properties of the prepared thin layers and of volume samples studied with the differentiation scanning calorimetry and photocalorimetry.

GA203/06/1488 **“Inorganic molecules and ions in thin water films on the surface of mixed hydrophilic/hydrophobic self-assembled monolayers”**, 1/2006–12/2008, the researcher is RNDr. Martina Roeselová, Ph.D., Institute of Organic Chemistry and Biochemistry of AS CR, v. v. i., Praha, the total costs of CZK 0.555 million, thereof CZK 0.555 million from the state budget.

(Year 2008 – 0.169/0.169, 6a)

Objective of the solution: Chemical processes taking place on organic surfaces play an important role in many areas, from biology and atmospheric chemistry to nanotechnologies. A thin layer of water adsorbed at the surface, which creates a very specific reaction environment, is an important factor in a number of heterogenous chemical reactions. For the understanding, management and possible utilisation of heterogenous processes, we must gain detailed microscopy information about the structure and properties of these thin water films and about the solvation of inorganic molecules and ions in them. For this purpose, there has been the systematic research of a single and multi component self-assembled monolayers proposed and their interaction with water and inorganic molecules and ions should be researched with the assistance of molecule dynamic simulations and the ab initio calculations. The project takes place in close coordination with experimental laboratories at the California University in Irvine.

GA203/07/0267 **"Ternary skutterudites for the thermoelectric applications: from bulk samples to thin films"**, 1/2007–12/2009, the researcher is Ing. Jiří Navrátil, CSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 3.075 million, thereof CZK 3.075 million from the state budget.

(Year 2008 – 1.050/1.050, 5c)

Co-researchers:

- Institute of Photonics and Electronics of AS CR, v. v. i., Praha, Ing. Jarmila Walachová, CSc.
- Institute of Physics of AS CR, v. v. i., Praha, doc. Ing. Miroslav Jelínek, DrSc.

Objective of the solution: The preparation of semiconductor compounds of the skutterudite structure ($CoAs_3$), which have recently become one of the most promising material groups usable for new and more output performing thermoelectric applications, i.e. for the direct transformation of the thermal energy to the electric energy (the thermoelectric generators) or the reverse transformation (the thermoelectric cooling elements). Their unique complex structure allows the lowering of the matrix thermal conductivity without big worsening of their electronic properties. It thus allows for the fulfilment of one of the basic requirements on new thermoelectric materials. There were two strategies for the reduction of the matrix thermal conductivity utilised – the preparation of ternary skutterudites and the "filling" of empty cavities in their structures with suitable atoms. The prepared skutterudite compounds are characterised by the measuring of their thermoelectric properties and further studied for the chance to reduce their matrix thermal conductivity – the preparation of their very thin films by the laser pulse depositing.

GA203/07/0546 **"Laser disintegration of cobalt and nickel carbonyls at the presence of acetylene for the preparation of carbon encapsulated metallic nanoparticles"**, 1/2007–12/2009, the researcher is RNDr. Radek Fajgar, CSc., Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, the total costs of CZK 2.604 million, thereof CZK 2.604 million from the state budget.

(Year 2008 – 0.866/0.866, 7b)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, Ing. Jan Šubrt, CSc.
- J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, RNDr. Zdeněk Bastl, CSc.
- Institute of Physics of AS CR, v. v. i., Praha, Ing. Miroslav Maryška, CSc.

Objective of the solution: The preparation of amorphous cobalt and nickel nanoparticles coated by a stabilising layer of amorphous carbon by the method of chemical depositing from the gaseous phase. The preparation is executed with the use of ArF excimer laser with the use of three volatile carbonyl metal precursors and acetylene as the carbon source. The reaction course is monitored and the gained results and knowledge of the final products serves for the design of a reaction mechanism. There will be different depositing conditions studied (partial pressures, the radiation density) and their impacts on the composition and the size of deposited particles. This should allow for the process optimising. There will be the sample tempering at the temperatures up to 1100 °C executed and that should allow the crystallisation of the metal core and of the carbonous coating. The impact of the metal on the diamond crystallisation will be studied at different conditions (temperature and the crystallisation times). The properties of amorphous and nanocrystalline deposits will by studied by a number of spectroscopic and microscopic techniques. Diffraction and the measuring of magnetism will be used for the in-depth characterising.

GA203/07/0717 **"Chemical processes supported by laser radiation affects in systems with plasmatic metallic nanoparticles"**, 1/2007–12/2009, the researcher is doc. RNDr. Blanka Vlčková, CSc., Charles University, Faculty of Science, the total costs of CZK 4.166 million, thereof CZK 4.166 million from the state budget.

(Year 2008 – 1.306/1.306, 6d)

Co-researcher:

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, RNDr. Jiří Pfleger, CSc.

Objective of the solution: The research and the utilisation of the current laser radiation effects (both pulse and continual) of the defined parameters and specific chemical interactions in the systems with plasmonic metal nanoparticles. The research strategy focuses on the clarification of mechanisms of selected by the laser-assisted chemical processes, especially the adsorption-desorption, the creation and removal of specific ties metal-adsorbate and the complexity of metallic ions in which selected molecule types participate (both stable ones and the ones presenting specific photoreactions) in systems with the Ag or Au nanoparticles. The results will be used for the preparation of chemically modified nanoparticles of an optimal size for the use in plasmonics and for the development of functional nanoparticle sets the primary function of which is the provision of SERS signals of structural molecule kinds as analytes. Scientific education of students and the international co-operation make also parts of the project.

GA203/07/1424 **"Self-assembled porphyritic nanotextures"**, 1/2007–12/2009, the researcher is RNDr. Pavel Kubát, CSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 2.792 million, thereof CZK 2.792 million from the state budget.

(Year 2008 – 0.930/0.930, 6a)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, Ing. Kamil Lang
- Charles University in Praha, Faculty of Science, RNDr. Jiří Mosinger, Ph.D.

Objective of the solution: The preparation of new self-organised porphyrins' nanostructures the size and shape of which could be managed by changes in preparation conditions and which provide unique physical and chemical properties and attractive functional properties. Derivates of meso-tetraphenylporphyrin, metalporphyrins, chlorines, sapphyrines and texaphyrines of lanthanides will be used as the building blocks. The research includes especially: (1) The design of building blocks for the porphyrins' nanostructures by changes in periphery substituents, in their location, by insertion of metals, and changes in the macro cycle structure; (2) The self-aggregation of porphyrins in solutions by the managed solvent, pH, temperature, salt concentration, incubation time, the template presence, and by other factors; (3) The depositing of self-assembled structures from solutions on varied kinds of substrates; (4) The visualisation of these nanostructures with the assistance of AFM and TEM high resolution and by the measuring of physical, chemical and photophysical properties mostly with the spectroscopic methods.

GA203/07/1443 **"Oriented zeolitic layers for membrane separators and reactors"**, 1/2007–12/2009, the researcher is Ing. Pavel Hrabánek, Ph.D., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 2.600 million, thereof CZK 2.600 million from the state budget.

(Year 2008 – 0.650/0.650, 5a)

Objective of the solution: The development of zeolitic and substituted zeolitic composite membranes. Te development of composite membranes focuses on membrane systems combining separation and catalytic properties. The key issues are as follows: (I) The role and character of the crystalline orientation and crystalline grain borders in a membrane; (II) The impact of a carrier on the crystalline growth, and (III) The impact of an incorporation of metallic ions in the zeolite matrix on the crystalline orientation. Most zeolitic membranes described in literature are either randomly or partly oriented. Empirical dependencies are the main shortcomings in the preparation of zeolitic membranes. The main idea behind this project is thus the effort to contribute to the creation of physical and chemical understanding of relations in nucleation and in the growth of oriented zeolite (MFI, MEL) and substituted (Ti, V) zeolitic layers. Another goal in the project is the finding of the separation effectiveness of oriented zeolitic layers from the practical application point of view.

GA203/08/0094 **"Computer assisted modelling of structural, dynamic and transport properties of nano-size liquids"**, 1/2008–12/2011, the researcher is Mgr. Milan Předota, Ph.D., University of South Bohemia in České Budějovice, Faculty of Science, the total costs of CZK 2.044 million, thereof CZK 2.044 million from the state budget.

(Year 2008 – 0.571/0.571, 6b)

Co-researcher:

- Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, doc. Ing. Martin Lísal, DrSc.

Objective of the solution: Properties of liquids of nanosizes, the interfaces solid matter-liquid and carbonous nanoporous materials (the active carbon and carbon nanotubes) will be studied with balanced and not balanced computer simulations with the goal of gaining structural, dynamic and transport properties of liquids in the nanospace. The simulation results related to the water molecules' dynamics in the interface solid matter-liquid will be confronted with the quasi-elastic neutron diffraction. The in space changeable viscosity and dielectric properties will be related to electrophoretic data. There will be also a method developed for the determination of the local in space changeable permittivity in non homogenous systems. In the case of carbonous non porous materials, the method of calculating the in space changeable viscosity will be applied at first on single component liquids in plane and cylindrical nanopores and, then, the method will be made general and applied on liquid mixtures. There will be also structural, dynamic and transport properties of in the industry important liquid mixtures simulated in varied models of carbonous structures.

GA203/08/0604 **“Advanced molecular sieves for capture and storage of CO_2 and H_2”**, 1/2008–12/2012, the researcher is prof. Ing. Jiří Čejka, DrSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 6.296 million, thereof CZK 6.296 million from the state budget.

(Year 2008 – 1.553/1.553, 5a)

Objective of the solution: The separation, adsorption and the storage of greenhouse gases, e.g. CO_2 and the storage of H_2 are very important for the further development in the society. This project focuses on the synthesis, characterising and, especially, on the utilisation of new advanced adsorbents based on molecule networks for the adsorption and storage of CO_2 and H_2. Within the project, there will be 3 basic kinds of adsorbents, ion-changed zeolites (zeolite X, MCM-22), micro/mesoporous composites prepared which allow the fast kinetics of the adsorption process. The organic metal analogues of zeolites (MOFs) present big affinity during the H_2 adsorption. The mesoporous molecule screens, MCM-41, -48, SBA-15, -16, will be modified by the aluminium oxide and surface alkylammonion groups with the goal of increasing the adsorption capacity for CO_2. The expected project results could be summarised as follows: I) The synthesis of new advanced adsorbents with high adsorption capacity for CO_2 and H_2; II) The understanding of the thermal dependency of the CO_2 adsorption; III) The synthesis of new organic metallic analogues of zeolites for the storage of H_2.

GA203/08/1157 **“The use of the lock and key motifs in new low-dimensional structures at the electrode interface”**, 1/2008–12/2011, the researcher is Mgr. Magdaléna Hromadová, Ph.D., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 2.226 million, thereof CZK 2.226 million from the state budget.

(Year 2008 – 0.625/0.625, 5b)

Objective of the solution: Within the project, there will be the forming of low-dimension structures studied on the electrode interfaces which include a set of recognition places based on the principle of a lock and key. These structures will be utilised as carrying media for the creation of new immunoassay systems and for the anchoring of individual electrochemically addressed molecules. This is important especially for the successful construction of facilities for the molecular electronics. The transfer of the electron will be studied in electrode sets consisting of substances containing sub nanometre and nanometre size cavities (modified cyclodextrines). The principle of the lock and key will ensure the presence of only a single electroactive molecule in a single active place on the electrode. The study of the creation of complexes of non flexible CD dimers could result in the inclusion of longer electroactive molecules (the molecular wires). There will be modern electrochemical methods used in the project as well as the methods characterising surfaces, including methods accessible thanks to the international cooperation.

GA203/08/1445 **"Functional molecular tweezers on the principle of bis Tröger bases"**, 1/2008–12/2012, the researcher is Ing. Bohumil Dolanský, Ph.D., Institute of Chemical Technology Praha, Faculty of Chemical Engineering, the total costs of CZK 4.224 million, thereof CZK 4.224 million from the state budget.

(Year 2008 – 0.790/0.790, 5c)

Objective of the project: The project will deal with molecular tweezers based on the recently invented bis Troeger bases (bisTB). BisTB is a new and unique kind of molecular tweezers the valence function of which could be managed by changes of the pH value in the environment. This property makes the bisTB tweezers very unique and allows the use of these substances in a number of applications, e.g. in sensors or for the targeted transport of medicine. The project will deal with the synthetic processes resulting in the preparation of a number of bisTB from commercially accessible aromatic amines. The project will also deal with the study of their bond abilities with the goal of finding an interesting pair host-guest for applications. The project will study also the behaviour of bisTB (and of their complexes) in varied pH environments. All studies will be governed by the vision of a potential application in sensors or for the targeted transport of medicine.

GA203/08/1680 **"Nanotechnology in the functional diagnostics of apoptotic and tumorous cells"**, 1/2008–12/2011, the researcher is Ing. Karel Klepárník, CSc., Institute of Analytical Chemistry of AS CR, v. v. i., Brno, the total costs of CZK 6.291 million, thereof CZK 6.291 million from the state budget.

(Year 2008 – 2.081/2.081, 3g)

Co-researchers:

- Masaryk Memorial Cancer Institute in Brno, MUDr. Dalibor Valík, Ph.D.
- Institute of Animal Physiology and Genetics of AS CR, v. v. i., Liběchov, prof. MVDr. Ivan Míšek, CSc.

Objective of the solution: Clinical tests based on the interaction of samples with nanomaterials offer more sensitive and more selective analyses, when compared with usual diagnostic systems. However, to ensure a wider utilisation of nanotechnologies in the clinical practice, further research is necessary. This project will focus on the design of new nanoparticle preparation processes and their chemical modifications for the interactions of the antigen – antidote and receptor – ligand kinds. There will be an original microfluid system constructed which would integrate the target for catching the cells catapulted by the laser microdissector, the sample treatment by nanoparticles, the consequent chemical analysis of the cell contents with the assistance of cell components separation, and their identification. The researchers will use the laser induced fluorescence, the resonance of the surface plasmon, by the surface strengthened Raman dispersion, and weight spectrometry as the detection principles. The newly proposed methodology and instruments will be verified during the research of signal routes in cells of the high growth potential, during the research of embryo genesis and carcinogenesis.

GA203/08/0686 **"Spectroscopic studies of the polyaniline nanostructures' development"**, 1/2008–12/2011, the researcher is doc. RNDr. Miroslava Trchová, CSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 2.347 million, thereof CZK 2.347 million from the state budget.

(Year 2008 – 0.557/0.557, 6d)

Objective of the solution: The development of molecular and supramolecular structures of products of the chemical oxidation polymerisation of aniline at different conditions, which result in the creation of varied morphologies (granular or nanotubular), will be studied with the assistance of FTIR and Raman spectroscopy in combination with theoretical calculations. The first group of experiments is based on the isolation of reaction intermediate products and their ex situ characterising. The second group of experiments considers the in situ monitoring of aniline polymerisation with the assistance of ATR FTIR spectroscopy. It is expected that the non conductive non soluble aniline oligomers, created in the first polymerisation stage, will determine the consequent growth of conductive polyaniline nanotubes and nanorods during the second reaction stage. The analysis of the first stages of the aniline oxidation polymerisation is thus the key for the understanding of the development of molecular and supramolecular polyaniline structures. The new properties of nanotubes, nanofibres, or nanoballs of conductive polymers provide for the application potential in the nanoengineering.

GA204/06/0225 **"Adhesion, growth and differentiation of bone and vascular cells on carbon allotropes"**, 1/2006–12/2008, the researcher is MUDr. Lucie Bačáková, CSc., Institute of Physiology of AS CR, v. v. i., Praha, the total costs of CZK 3.059 million, thereof CZK 3.059 million from the state budget.

(Year 2008 – 1.008/1.008, 3c)

Co-researchers:

- Nuclear Physics Institute of AS CR, v. v. i., Husinec – Řež, Jiří Vacík, CSc.
- Institute of Chemical Technology Praha, FCHT, prof. Ing. Václav Švorčík, DrSc.

Objective of the solution: The preparation of bioactive carbon layers perspective for the surface modifications of biomaterials used in the tissue engineering, especially in bone implants. These layers are created by dusting or steaming from a carbon target, but also by the coating of carbon allotropes like fullerenes, nanotubes, or nanodiamonds. They are set with osteoblasts and smooth vein muscle cells in the in vitro conditions. It could be expected that the layers' nanostructure will support the adsorption of vitronectine, i.e. the extracellular matrix protein mediating the preferential osteoblasts' adhesion which would be further strengthened by the functioning layers of oxygen groups or by amino groups. The layers composed of fullerenes and nanotubes will be embedded on ligands for the adhesion cell receptors (e.g. oligopeptides with the amino acid RGD sequence or the KRSR oligopeptide, specific for the osteoblasts). The cell adhesion, growth and differentiation will be regulated also with the assistance of hierarchy organised micro and nano surface structures.

GA205/07/0772 **"Behaviour of fullerenes in geological materials and environments"**, 1/2007–12/2009, the researcher is doc. RNDr. Jan Jehlička, DrSc., Charles University in Praha, Faculty of Science, the total costs of CZK 4.169 million, thereof CZK 4.169 million from the state budget.

(Year 2008 – 1.387/1.387, 1c)

Co-researchers:

- Institute of Rock Structure and Mechanics of AS CR, v. v. i., Praha, Ing. Zuzana Weishauptová, DrSc.
- Institute of Physics of AS CR, v. v. i., Praha, Ing. Věra Hamplová, CSc.

Objective of the solution: The processes used so far for the proving of fullerene presence in geological materials have been found problematic in several recent studies. The main objective of this project is the deepening of our knowledge about the fullerene interaction with synthetic referential (silica gel, the HOPG graphite, porous carbon, and zeolite) and geological (kerogene, humine, illite, kaolinite) matrices. The key problem is the specific interaction of fullerenes with a certain matrix part ability to influence the derivation and disintegration of fullerenes. Results of this project's part could resolve the problem of fullerene presence and of the insertion way in geological materials. The laboratory experiments will test the impact of higher temperature and pressure, and of different reactive species, on fullerenes in the mentioned matrices. The use of the in situ analytical methods in the fullerenes in matrices (including the thermally, pressure and chemically loaded systems) should increase our knowledge about the interaction fullerene-matrix.

GA206/06/0364 **"Structural and functional dynamics of photosynthetic membranes"**, 1/2006–12/2008, the researcher is Mgr. David Kaftan, Ph.D., Institute of Systems Biology and Ecology of AS CR, v. v. i., České Budějovice, the total costs of CZK 2.877 million, thereof CZK 2.877 million from the state budget.

(Year 2008 – 1.003/1.003, 3g)

Co-researcher:

- University of South Bohemia in České Budějovice, Physical Biology Institute, doc. RNDr. František Vácha, Ph.D.

Objective of the solution: The project creates a methodological base for the high resolution imagining and detection in living cells, organelle and biological membranes at the molecular level. There will be new and adjusted existing non invasive protocols developed for the immobilisation and imagining of the photosynthetic membrane proteins, native thylakoid membranes, and chloroplasts on activated surfaces for the microscopy by a scanning probe (SFM). The photosynthetic membranes present a unique model of complex membrane systems which dynamically react to changes in external conditions. In contrast to purpure bacteria (Scheuring et al. 2004, PNAS 101(31): 11293–11297), the high resolution topographies of the oxygen developing photosynthetic membranes have not been obtained so far.

GA305/07/1073 **"Molecular interaction of polymers for biological and medical applications"**, 1/2007–12/2011, the researcher is RNDr. Jindřich Hašek, DrSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 3.142 million, thereof CZK 3.142 million from the state budget.

(Year 2008 – 0.619/0.619, 3e)

Objective of the solution: The utilisation of polymer conjugates is widespread in the designs and optimising of modern medicine. In spite of the fact that this issue has been intensively researched by many different modern methods, it has not been yet researched with the assistance of the protein crystallography methods probably because of the wide spread opinion that the study of polymers by diffraction method is very difficult. However, a researcher has recently proved that this has not been so in the case of the current protein crystallography. The newly developed methods for the preparation of samples and the processes of the mathematical processing allow the direct observation of interactions taking place between proteins and polymers. The preciseness allows for the evaluation of quality of weak intermolecular interactions. The experimental study of the structure of selected polymer conjugates will be supplemented with the analysis of experimental structural databases and calculations of energies active in these systems. The main attention is paid to conjugates of selected polymers based on polyethylene glycol because this material has been often practically utilised.

GA309/06/1594 **"Cellular contrast agents for MR imaging"**, 1/2006–12/2008, the researcher is Mgr. Vít Herynek, Ph.D., IKEM Praha, the total costs of CZK 4.013 million, thereof CZK 4.013 million from the state budget.

(Year 2008 – 1.326/1.329, 3c)

Co-researcher:

- Institute of Experimental Medicine of AS CR, v. v. i., Praha, RNDr. Pavla Jendelová, Ph.D.

Objective of the solution: Cell transplantations are considered a potentially useful therapeutic instrument. Transplanted multipotent cells could replace or speed up the regeneration of tissues of the low self-renewal ability. Magnetic resonance offers processes of the cell monitoring after the in vivo transplantations. Despite the space MRI resolution is substantially lower than the size of individual cells, the cells could be visualised with the assistance of contrast substances causing signal changes in the image which are much larger in scope. The project's objective is the development and utilisation of new contrast substances for the MR imaging on the basis of nanoparticles of iron, manganese, or other metals of strong (super) paramagnetic properties and their consequent utilisation for the MR imaging of cells determined for transplantations.

2.2. PROGRAMME "POST DOCTORATE PROJECTS" (GP)

Projects solved in the area of nanotechnologies

GP102/07/P507 **"Optic fibres having the nanostructured core for optical amplification"**, 1/2007–12/2009, the head researcher is Ing. Ondřej Podrazký, Ph.D., Institute of Photonics and Electronics of AS CR, v. v. i. Praha, the total costs of CZK 1.492 million, thereof CZK 1.492 million from the state budget.

(Year 2008 – 0.499/0.499, 2c)

Objective of the project: The research of methodological preparation bases for optical silicon fibres with cores containing nanocrystals of aluminium oxide with rare-earth elements which could strengthen the fluorescence. There will be two routes taken for the achievement of the proposed basic objective – the doping of fibre cores with aluminium oxide nanoparticles with rare-earth elements and the preparation of fibres doped with these elements and a nanocrystalline core, thanks to the thermal processing. The results should be, in addition to the methodological preparation bases for nanostructured silicon fibres, also samples of fibres doped with erbium and thulium, where the strengthened ASE could be expected. This could consequently result in the higher efficiency of fibre amplifiers and lasers working in C-, L-, and S- telecommunication bands.

GP104/06/P301 **"Multilevel modelling of reactions and transport in structured porous catalytic agents"**, 1/2006–12/2008, the researcher is Ing. Petr Kočí, Ph.D., Institute of Chemical Technology Praha, FCHT, the total costs of CZK 0.975 million, thereof CZK 0.975 million from the state budget.

(Year 2008 – 0.325/0.325, 5b)

Objective of the project: The development and utilisation of methods for modelling of reactions and transfers of matter in porous structures of heterogenous catalysts. The attention will be paid especially to catalysts for the conversion of exhaust gases, while the general use of the developed processes would be maintained. The project's objective is the development of a methodology that should allow the description, forecasting and optimising of the general effectiveness of catalysers dependent on properties of the porous structure at the level of micro and nano metres. The base for the proposed approach will be as follows: 1) The computer-assisted reconstruction of the catalyser's porous structure; 2) The modelling of diffusion and reaction in a reconstructed porous catalyser, the microkinetics taking into the account the impact of the catalytic centre kind and the particle carriage; 3) The execution of simulations for different scales, the results' combinations, the comparison with experimental results and the more simple model of the catalyser unit.

GP106/06/P189 **"Adaptation of properties of carbonous nanotube based polymer nanocomposites from the temperature stability point of view"**, 1/2006/–12/2008, the head researcher is Ing. Petr Slobodian, Ph.D., Tomáš Baťa University in Zlín, Faculty of Technology, the total costs of CZK 0.681 million, thereof CZK 0.691 million from the state budget.

(Year 2008 – 0.227/0.227, 1g)

Objective of the project: In solid amorphous substances, existing below the temperature of the glassy transformation, we see the phenomenon of consolidation of their structural arrangement which is usually called the structural relaxation. Individual relaxing units tend to get closer to the thermodynamically equilibrium state during this process. This results in a time change of many macroscopic material properties. The preparation of composite materials based on an amorphous polymer/filler creates a heterogenous system of different properties of the polymer matrix at the phase interface. There is an immobilised polymer layer of modified physical properties and different kinetics of the structural relaxation created. When there are nanoparticles used, the filler surface dramatically grows and the same happens to the volume of this immobilised layer. A good example is the amorphous polymer-based nanocomposite and carbon nanotubes. In this system, the changed relaxation ability of the polymer material directly relates to the structure of the prepared nanocomposite.

GP106/07/P044 **"Transport and absorption of sound in nanofibres assemblies"**, 1/2007–12/2009, the head researcher is Ing. Klára Kalinová, Ph.D., Technical University in Liberec, Faculty of Textiles, the total costs of CZK 0.332 million, thereof CZK 0.332 million from the state budget.

(Year 2008 – 0.113/0.113, 1a)

Objective of the project: The research of mechanisms spreading and absorbing acoustic waves in nanofibre layers and nanofibre composites of the diameters 10–100 nanometres. The nanofibre structures are characterised by extremely large measurable surface thanks to which the researched properties reach extreme values. They cannot be derived by extrapolation using the size of the structural units. The researcher's workplace developed the laboratory equipment preparing nanofibres and allowing the research of their creation mechanism. The project supplements the research of transport phenomena in nanofibre layers done at the workplace of the proposing party. It could be expected that nanofibres will present a completely new phenomenon in the material engineering.

GP202/07/P486 **"In-depth profiling of 2D nanostructures by the SIMS, TOF-LEIS and XPS methods with the assistance of low-energy ion separation"**, 1/2007–12/2009, the researcher is Ing. Petr Bábor, Ph.D., the total costs of CZK 1.133 million, thereof CZK 1.133 million from the state budget.

(Year 2008 – 0.378/0.378, 6b)

Objective of the project: The project focuses on the study of (ultra) thin layers/multilayers (2D nanostructures) prepared by the ion and molecular bundle technologies and on the application and improvement of methods for the in situ deep analysis of these structures by the SIMS, TOF-LEIS, and XPS methods. The in-depth analysis done by these methods will use the low energy (200–1500 eV) ion dusting off. There are especially magnetic (ultra) thin layers and multilayers (Co/CoN, Ni/NiN, Co/Al_2O_3, ...), ultra thin Ga and GaN and the "high-k" dielectric ultra thin layers (ZrO_2, HfO_2, ...) studied. These layers are prepared within the research plan of the workplace of the proposing party. The information gained by the in-depth profiling should extend the feedback during optimising of the depositing process and that should result in better required properties of the created 2D nanostructures. The study motivation is the detailed learning and understanding of GMR phenomena, TMR and the "high-k" properties of the dielectric ultra thin layers.

GP202/07/P523 **"Plasma enhanced chemical vapour deposition (PECVD) of carbon nanotubes"**, 1/2007–12/2009, the head researcher is Mgr. Marek Eliáš, Ph.D., Masaryk University in Brno, Faculty of Science, the total costs of CZK 1.081 million, thereof CZK 1.081 million from the state budget.

(Year 2008 – 0.352/0.352, 1c)

Objective of the project: Within the project, there are carbon nanotubes (CNT) prepared as well as nanofibres (CNF) with the PECVD method. The synthesis is executed in the capacity or inductive high frequency glow discharge. The unique preparation method in the atmospheric microwave plasma heater is studied at the same time. The depositing process is studied with the assistance of optical emission and mass spectroscopy. Discharges are characterised by the electrical measuring. The research focuses also on the study of the growth phase CNT and CNF, including the preparation of catalytic metal layers. These layers are deposited with the assistance of the magnetron sputtering and vacuum evaporation. The prepared samples are characterised with the assistance of TEM and SEM, AFM and STM, the Raman spectroscopy, XPS, XRD, and the non traditional MALDI method. The project will also focus on the study of possible CNT and CNF applications, especially on the creation of the nanacomposite materials, which are interested because of their mechanical properties and the electromagnetic shielding. There will be the emission properties, the preparation of sensors, and the fitting of CNT on AFM tips studied.

GP202/08/P038 **"Study of behaviour of the hybrid depositing process and of its utilisation in the preparation of thin layers"**, 1/2008–12/2010, the researcher is Mgr. Petr Vašina, Ph.D., Masaryk University in Brno, Faculty of Science, the total costs of CZK 1.125 million, thereof CZK 1.125 million from the state budget.

(Year 2008 – 0.400/0.400, 7c)

Objective of the project: The study of the behaviour of the hybrid PVD-PECVD process, which will be utilised for the preparation of nanocomposite n-Ti:C/a-C:H and a-BCN:H materials.

Some of the gaseous hydrocarbons, delivered directly to the depositing reactor, which would completely replace the traditional sputtering of the carbon target, will be used as the carbon source for the preparation of thin layers. The hysteretic behaviour of this depositing process and properties of prepared layers will be compared with the PVD process. There will be a comparative study for different hydrocarbon kinds prepared. The existing model of the reactive magnetron dusting should be improved by the executed experiments. This model will work with an unbalanced density shape of the discharge current and it will be extended with the interaction of the gaseous hydrocarbon with the surface of a magnetron cathode and depositing reaction walls.

GP203/06/P226 **"Strengthening of the photoelectric conversion in polymer composites with metallic and semiconducting nanoparticles"**, 1/2006–12/2008, the researcher is Mgr. Klára Podhájecká, Ph.D., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 1.130 million, thereof CZK 1.130 million from the state budget.

(Year 200 – 0.373/0.373, 1g)

Objective of the project: Mostly the experimental studies which should verify the possibility of strengthening the effectiveness of polymer and nanocomposite solar cells by the effects of resonance impacts of the impinging light with the surface plasmon on metallic nanoparticles mixed into the photoelectrically active layers and the attempt to explain the mechanism of these phenomena. The following possibilities of the strengthening effects will be studied: (I) The increased optical absorption of the photoelectric active part within the wide spectral area caused by the resonance of the impinging light with the surface plasmon of the metallic nanoparticle; (II) The reduction of the probability of radiation interfaces caused by the interaction of the surface plasmon with the excited states of chromophore which could result in the strengthening of the complementary process of generation of free charges; (III) The increased probability of the charge transfer between the donor and the acceptor in two-component organic polymer mixtures, or composites containing a low-molecular organic or inorganic component.

GP203/08/P598 **"Electrochemical tools for the detection of mutations and polymorphisms in DNA"**, 1/2008–12/2010, the researcher is Mgr. Pavel Kostečka, Ph.D., Institute of Biophysics of AS CR, v. v. i., Brno, the total costs of CZK 1.404 million, thereof CZK 1.404 million from the state budget.

(Year 2008 – 0.468/0.468, 3e)

Objective of the project: The project will extend the previous research of the electrochemical tools detecting the DNA hybridisation. There will be oligonucleotides modified by varied electrochemically active markers (especially based on metal nanocomplexes), their electrochemical behaviour will be analysed and utilised as signal probes during the DNA hybridisation. Works will also focus on the utilisation of Os, L complexes as chemical probes for wrongly paired and non paired bases in the DNA hetero duplexes. There will be the detection method for mutations in DNA designed on this principle. There will be also conditions optimised for the handling of duplexes, containing wrong pairs and abasic places, and conditions on the electrochemical or immunochemical detection of modified bases. During the detection, there will be the so-called two-surface strategy utilised, when the DNA hybridisation process takes place on an independent surface – on paramagnetic beads. This arrangement allows for the precise "tuning up" of conditions for the hybridisation and for the detection.

2.3. PROGRAMME "EUROCORES" (GE)

Projects solved in the area of nanotechnologies

GEFON/06/E001 **"Spin-dependent transport and electron correlations in nanostructures"**, 1/2006–12/2009, the head researcher is Ing. Vít Novák, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 4.399 million, thereof CZK 4.399 million from the state budget.

(Year 2008 – 1.566/1.566, 2d)

Co-researchers:

- Charles University in Praha, Faculty of Mathematics and Physics, prof. RNDr. Václav Holý, CSc.
- Brno University of Technology, Faculty of Mechanical Engineering, prof. RNDr. Tomáš Šikola, CSc.

Objective of the solution: 1. The design and preparation of spin filters and of a spin detector in paramagnetic and ferromagnetic semiconductors, hybrid structures of the ferromagnet/semiconductor type, nanostructures of the supraconductor/semiconductor type, and parts of the ferromagnet/molecule/ferromagnet type. 2. The theoretical and experimental studies of excitations of turning-over of the magnetic orientation caused by the spin-polarised current in nanostructures. 3. The study of the role of electron correlations, multiparticle phenomena and quantum interference in the electron transport in nanostructures. 4. The experimental study of entangled electron pairs occurring by injection of Cooper pairs in nanointerface supraconductor/semiconductor.

GEFON/06/E002 **"Spin coherent transport in quantum nanostructures"**, 1/2006–12/2009, the head researcher is Dr. Tomáš Jungwirth, Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 1.068 million, thereof CZK 1.068 million from the state budget.

(Year 2008 – 0.356/0.356, 2d)

Objective of the solution: 1. The influence of the spin-orbital interaction on the transport in quantum wires, dots, and rings. 2. The Landé g-factor managed by the field in quantum dots. 3. Tunnelling phenomena in quantum dots and ferromagnetic semiconductors influenced by the strong spin-orbital interaction. 4. The impact of the spin-orbital interaction, impurities and electron-electron interactions on the abnormal and spin Hall phenomenon. 5. The detection of spin currents based on the research of fluctuation charge current and of the Kondo phenomenon.

GESON/06/E005 **"Biofunctional self-assembled nanostructures of amphiphilic copolymers, biopolymers, biomacromolecules, and nanoparticles: from bioinspired to biointegrated systems"**, 1/2006–12/2009, the head researcher is RNDr. Petr Štěpánek, CSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 4.971 million, thereof CZK 4.971 million from the state budget.

(Year 2008 – 1.657/1.657, 6a)

Objective of the solution: The contribution to the creation of a new technological research direction and education in the modern and interdisciplinary polymer science. This field combines advanced research of biotechnology, polymer chemistry and physics. The current possibilities of chemistry and physics provide effective methods for syntheses, characterising, theoretical research, and manufacturing of varied materials. Biology provides knowledge about the most complicated existing functional nanostructures. Biology will be integrated into the project at different levels. Biological molecules will be integrated into assemled systems and substrates of created conventional polymers. Biological molecules will be combined with amphiphilic block and engrafted polymers, the layered nanoparticles, and Janus micelles with the goal to combine the assembly abilities of classical polymers with the specific functionality of biological polymers (specific bonds, sensor abilities, and nonlinear reactions).

3. PROVIDER: MINISTRY OF EDUCATION, YOUTH AND SPORT (MEYS, or MŠMT)

3.1. PROGRAMME "RESEARCH CENTRES" (1M)

There are 8 out of the total 36 centres of the 1M type focussing on nanotechnologies partly or fully.

Projects solved in the area of nanotechnologies

1M0505 **"Centre of targeted therapeutic drugs"**, 1/2005–12/2009, the researcher is doc. MUDr. Vladimír Viklický, CSc., Nuclear Research Institute Řež, a.s., the total costs of CZK 157.173 million, thereof CZK 139.073 million from the state budget.

(Year 2008 – 18.972/16.800, 3b, the nanotechnology research share makes up 60 % of the allocated sum.)

Co-researchers:

- EXBIO, a.s., Vestec, Ing. František Škrob
- Institute of Microbiology of AS CR , v. v. i., Praha, prof. RNDr. Blanka Říhová, DrSc.
- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, doc. Ing. Karel Ulbrich, DrSc.
- Institute of Experimental Botany of AS CR, v. v. i., RNDr. Karel J. Angelis, CSc.
- Institute of Molecular Genetics of AS CR, v. v. i., Praha, RNDr. Milan Fábry, CSc.
- Charles University in Praha, Faculty of Science, doc. RNDr. Karel Bezouška, CSc.

Objective of the project: The works by the Centre are focussed on molecular biology and bionanotechnologies. There are the following activities conducted: the construction of new hybridoma lines against antigens potentially useful as targets for the tumour treatment; there are preparation technologies worked on which related to recombinant fragments of monoclonal antibodies – bond and multiple bonds; the required proteins for the centre's needs should be produced in the 3rd year of the project. It is also about: the design of effective purification methods for the produced recombined antibodies; the design of a structure, synthesis and utilisation of three polymer carriage systems for the construction of directed medicine; the design of a structure, preparation and testing of biological effects of ligand dendrimers (saccharide and peptide ones) and their application as immunodiagnostic and immunotherapeutic instruments. The practical outcome should be a multifunctional bioconjugate containing dendrimers. There is the research of biotransformation routes of tumour effective medicine and their effects conducted as well as the development and synthesis of new anti cancer medicine well tolerated by our organism (bioconjugates and directed medicine).

1M0506 **"Centre of molecular and cellular immunology"**, 1/2005–12/2009, the researcher is prof. RNDr. Václav Hořejší, CSc., Institute of Molecular Genetics of AS CR, v. v. i., Praha, the total costs of CZK 169.218 million, thereof CZK 149.718 million from the state budget.

(Year 2008 – 3.390/3.000, 3g, the nanotechnology research share makes up 10% of the allocated sum.)

Co-researchers:

- EXBIO, a.s., Vestec, Ing. Miloslav Suchánek, Ph.D.
- Apronex s.r.o., Jesenice, RNDr. Ladislav Anděra, CSc.
- Institute of Microbiology of AS CR, v. v. i., Praha, Ing. Peter Šebo, CSc.
- Charles University in Praha, Faculty of Science, Mgr. Jan Černý, Dr.

Objective of the project: The works by the Centre are focussed on molecular biology and bionanotechnologies. The objective is to clarify immunity functions of some signalling immunocyte molecules (adapter proteins PAG, NTAL, LIME, and non receptor phosphatases) and of their functions in some diseases; the identification, cloning and functional characterising of potentially new signalling proteins which participate in activities ensuring the correct starts and regulation of immunity reactions; the implementation of the production of recombinant factors Wnt1 and Wnt3a and their use for the clarification of the role of the Wnt-signalling route, when suppressing apoptis; the characterising of the roles of signalling and immunoregulation molecules (cytokinins, bacterial toxins and other natural and synthetic immunomodulators) in the activation of macrophages and dendritic cells, e.g. in xenotransplantation reactions (transplants of corneas); the construction of series of potentially commercially important: (a) hybridome lines producing monoclonal antibodies against important and known, but also newly found signalling immunocyte proteins; (b) relevant recombinant proteins; (c) proteins marked with fluorophores.

1M0512 **“Research centre of powdered nanomaterials”**, 1/2005–12/2009, the head researcher is prof. RNDr. Miroslav Mašláň, CSc., Palacky University Olomouc, the total costs of CZK 87.318 million, thereof CZK 78.528 million from the state budget.

(Year 2008 – 16.210/14.587, 1a)

Co-researchers:

- Textile Testing Institute, s. p., Brno, RNDr. Pavel Malčík
- Institute of Physics of Materials of AS CR, v. v. i., Brno, Ing. Oldřich Schneeweiss, DrSc.

Objective of the project: The Research Centre focuses on the synthesis of metallic nanoparticles and metal oxides with properties suitable for their practical use as nanopigments, catalysts, and sorption and purification materials. The research activity consists of the three basic steps: the synthesis of powder nanomaterials, their complex physical and chemical characterising, and the practical testing in selected areas of application. The research education of students in graduation and post graduation programmes focuses on the issues of nanoparticles, nanomaterials, and, most of all, on their practical utilisation. Needs of potential users are considered, when topics of dissertation and graduation studies are selected.

1M0538 **“Centre of the cell therapy and tissue repair”**, 1/2005–12/2009, the researcher is prof. MUDr. Eva Syková, DrSc., Charles University in Praha, 2nd Faculty of Medicine, the total costs of CZK 167.459 million, thereof CZK 150.300 million from the state budget.

(Year 2008 – 10.090/9.044, 3c, the nanotechnology research share makes up 30 % of the allocated sum.)

Co-researchers:

- Institute of Clinical and Experimental Medicine, Praha, Ing. Milan Hájek, DrSc.
- Institute of Hematology and Blood Transfusion, Praha, MUDr. Petr Kobylka, CSc.

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, RNDr. František Rypáček, CSc.
- Institute of Animal Physiology and Genetics of AS CR, v. v. i., prof. RVDr. Jan Motlík, DrSc.
- Institute of Experimental Medicine of AS CR, v. v. i., Praha, doc. Alexandr Chvátal, DrSc.

Objective of the project: The cell therapy is an alternative in treatments of degenerative and civilisation diseases, including the nervous diseases. The goal of the cell therapy is the replacement, repair, or improvement of damaged tissue functions, especially with the assistance of stem cells. This is achieved by implanting isolated and well-characterised cells into the target organ, at the satisfactory number and quality, which should start the function renewal. The research of biocompatible bio gels and their abilities to support the renewal and replacement of damaged tissues, and increasing the chances of regeneration, make parts of this project. The project's objective is the conducting of clinical tests and the use of verified processes in the clinical practice. One of the project's activities is the development of nanoparticles suitable for the marking of different kinds of stem cells. Other activities relate to the preparation of polymer nanofibres and their use in preparations of scaffolds.

1M0554 **"Advanced remedial technologies and processes"**, 1/2005–12/2009, the researcher is doc. Ing. Dr. Jiří Maryška, CSc., Technical University in Liberec, Faculty of Mechatronics, the total costs of CZK 169.789 million, thereof CZK 151.807 million from the state budget.

(Year 2008 – 3.422/3.072, 1a, the nanotechnology research share makes up 10 % of the allocated sum.

Co-researchers:

- Czech Geological Survey, RNDr. Martin Novák, Ph.D.
- University of Jan Evangelista Purkyně in Ústí nad Labem, doc. Ing. Pavel Janoš, CSc.
- AQUATEST a.s., Praha, doc. Ing. Miroslav Černík, CSc.
- Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, Ing. Josef Kozler, CSc.
- Institute of Information of AS CR, v. v. i., Praha, Ing. Julius Štuller

Objective of the project: The concentrated research conducted in the area of new progressive processes and technologies reacting to the more strict trends occurring in the area of requirements on the quality of underground waters and the mineral environment. The applied research focuses on technological processes and methods of immobilising and in situ removal of contamination also in combination with classical technologies. In parallel with technological and process solutions, the research focuses on the study and development of modern methods of mathematical modelling of geochemical and biochemical processes and systems with the goal of improving predictions of their development in time. An inseparable part of the research plan of the centre is the research of methods evaluating risks for the population in contaminated areas or areas affected by accidents, the issue of reliability and risk analyses related to hazardous operations, and the assessment activities. The utilisation of the zero-valent nanoiron is tested for maintenance works.

1M0577 **"Research centre of nanosurface engineering"**, 1/2005–12/2009, the head researcher is Ing. František Peterka, Ph.D., ATG s.r.o., Praha, the total costs of CZK 83.638 million, thereof CZK 78.191 million from the state budget.

(Year 2008 – 16.210/14.587, 1d)

Co-researchers:

- Technical University in Liberec, Ing. Aleš Kolouch, Ph.D.
- Institute of Chemical Technology Praha, doc. Ing. Josef Krýsa, Dr.
- J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, RNDr. Jaromír Jirkovský, CSc.
- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, Ing. Jan Šubrt, CSc.

Objective of the project: The complex study of unique photocatalytic properties of nanocrystalline titanium oxide focussed on potential consequent industrial applications in the areas of self-cleaning and hygienic surface treatments, the photocatalytic cleaning and disinfection of the air, water and contaminated soils, organic syntheses and the utilisation of solar energy.

The partial research topics are as follows: (I) The synthesis of highly photo active titanium oxide nanoparticles, including doped or mix materials with the spectral sensitivity extended into the visible area; (II) The preparation of layers based on nanocrystalline titanium oxide from the gaseous phase by the technique of plasma depositing, but also from the solution with the assistance of varied chemical processes, including the advanced methods utilising micelles as templates for the creation of a defined porous structure; (III) The characterising of nanoparticles and nanocrystalline layers of titanium oxide focussed on the finding of direct relations between material properties and the photo activity; (IV) The development of standard methods testing the self-cleaning abilities and disinfection effects of the photocatalytic surfaces; (V) The construction of different kinds of laboratory photoreactors for the photocatalytic cleaning and disinfection of the gaseous, liquid or solid phases and their testing for the purpose of optimising working conditions; (VI) The study of kinetics and the mechanism of photocatalytic processes deactivating microorganisms and the oxidative mineralisation of organically harmful agents from the point of view of possible creation of dangerous degradation side products; (VII) The use of the photocatalysis for purposes of the organic synthesis.

1M06002 **“Optical structures, detection systems and the related technologies for the low-photo number applications”**, 3/2006–12/2009, the researcher is prof. RNDr. Miroslav Hrabovský, DrSc., Palacky University Olomouc, Faculty of Science, the total costs of CZK 71.396 million, thereof CZK 62.319 million from the state budget.

(Year 2008 – 2.538/2.228, 2c, the nanotechnology research share makes up 20 % of the allocated sum.)

Co-researchers:

- Meopta – optika, a.s., Přerov, RNDr. Zdeněk Lošťák
- Institute of Physics of AS CR, v. v. i., Praha, RNDr. Ondřej Haderka, Ph.D.

Objective of the project: The research of optic structures, detection methods and constructions of detection structures and systems of the weak and ultra weak optic radiation in the visible, UV close and infrared spectral areas, also similar optic structures, and related optic technologies. It is about the detection of extremely weak optic radiation, up to the level of a single photon of varied terrestrial or cosmic origin. The detection principles have been selected in such a way to make their implementation into practice accessible thanks to the current world standard of technical components and manufacturing technologies for these detection systems. The project’s goal is the design, verification and completion of optical structures and systems (e.g. photonic nanostructures) suitable for the detection of weak and ultra weak optic radiation, including the manufacturing technology and controls. The utilisation could be expected in the implementation of detection systems researching cosmic radiation for optic communication systems based on quantum optics, in the optical manufacturing of the modern type generally, etc. Results of the technological project part will be partly used in the construction of functional detection systems researching cosmic rays, optical communication systems built on the principle of quantum optics, etc.

1M06032 **"Research centre of forming technologies – FORTECH"**, 3/2006–12/2009, the researcher is prof. Dr. Ing. Bohuslav Mašek, University of West Bohemia in Plzeň, FS, the total costs of CZK 66.857 million, thereof CZK 60.728 million from the state budget.

(Year 2008 – 2.016/1.828, 7d, the nanotechnology research share makes up 15 % of the allocated sum.)

Co-researchers:

- SVÚM a.s., Praha, Ing. Ivo Černý, Ph.D.
- COMTES FHT s.r.o., Dobřany, Dr. Ing. Zbyšek Nový
- ŠKODA VÝZKUM s.r.o., Plzeň, Ing. Aleš Sborný

Objective of the project: The Research Centre focuses on the progressive work out, knowledge and handling of processes which should allow in future for implementation of new ideas in the area of forming and material technologies, especially of their innovative combinations. The main innovative parts and topics, which make up the central common axis of the project, are as follows: ultrafine grained structures and nanostructures, multi phase and polycomponent materials, difficult forming materials, new strategies for combining deformation and thermomechanical processes, the "materials friendly forming", non conventional forming in the area of decreased and increased temperatures, the thixotropic forming, the managed structure development, the rapid prototyping in the area of forming, non conventional recycling of material wastes, the modelling and FEM simulations, and the non conventional material joining.

3.2. PROGRAMME "BASIC RESEARCH CENTRES" (LC)

Projects solved in the area of nanotechnologies

LC06007 **"Centre of modern optics"**, 3/2006–12/2010, the head researcher is Mgr. Jaromír Fiurášek, Ph.D., Palacky University Olomouc, Faculty of Science, the total costs of CZK 52.481 million, thereof CZK 48.278 million from the state budget.

(Year 2008 – 0.876/0.802, 2c, the nanotechnology research share makes up 10 % of the allocated sum.)

Co-researcher:

- Institute of Scientific Instruments of AS CR, v. v. i., Brno, doc. RNDr. Pavel Zemánek, Ph.D.

Objective of the project: The Centre of Modern Optics (CMO) associates the two important Czech optical workplaces – the Department of optics of the Palacky University Olomouc and the Institute of Scientific Instruments of AS CR in Brno. The Centre focuses on the objective to get these two research teams closer together and to support their complementary experimental and theoretical research activities in priority areas of modern optics like, for example, the utilisation of quantum and classical principles in the design of new methods for optical processing and transfer of information, optical micro handling, and nanometrology.

The Centre also allows for extending research activities of the workplaces, when it comes to materials and personnel and gets them closer to the leading European workplaces. It also supports education of new post graduates and young researchers and co-operation with top foreign research teams, and from it resulting better participation in the network of elite European research workplaces.

LC06010 **"Centre of biocatalysis and biotransformation"**, 3/2006–12/2010, the researcher is doc. Ing. Vladimír Křen, DrSc., Institute of Microbiology of AS CR , v. v. i., Praha, the total costs of CZK 61.480 million, thereof CZK 61.373 million from the state budget.

(Year 2008 – 11.263/11.263, 5b)

Co-researchers:

- Institute of Systems Biology and Ecology of AS CR, v. v. i., RNDr. Rüdiger Ettrich, Ph.D.
- University of South Bohemia in České Budějovice, Faculty of Science, Mgr. Ivana Kutá Smetanová, Ph.D.
- Masaryk University in Brno, Faculty of Science, doc. Mgr. Jiří Damborský, Ph.D.

Objective of the project: The development and optimising of new biocatalysts (dehalogenase, esterase, nitrilase, amidase, glucosidase, and other selected enzymes), the study of mechanisms of biocatalysis and molecular structures of these enzymes, the development and implementation of methods for the study of structures and functions of enzymes, and for their targeted optimising. The works relate to the area of bionanotechnologies and nanocatalysis. The main utilised methodologies are as follows: the screening of new microbial enzymes and the creation of libraries, the methods for the managed evolution, cloning and gene expression, the crystallisation of proteins and the consequent analysis, the molecular modelling, modification and development of new software, the chemoenzymatic synthesis, and the biotransformation verifying practical enzyme applications. The education of undergraduates and post graduates, the organisation of methodology seminaries, workshops, scientific congresses, and the development of international relations, especially the participation in international projects, make also parts of the project.

LC06035 **"Centre of biophysical chemistry, bioelectrochemistry and bioanalysis. New tools for genomics, proteomics, and biomedicine"**, 3/2006–12/2010, the head researcher is doc. RNDr. Miroslav Fojta, CSc., Institute of Biophysics of AS CR, v. v. i., Brno, the total costs of CZK 48.494 million, thereof CZK 48.494 million from the state budget.

(Year 2008 – 1.903/1.903, 3e, the nanotechnology research share makes up 20 % of the allocated sum.)

Co-researchers:

- Charles University in Praha, prof. RNDr. Jiří Barek, CSc.
- Masaryk University in Brno, Faculty of Science, doc. RNDr. Jiří Pazourek, Ph.D.
- University of Pardubice, FCHT, prof. Ing. Karel Vytřas, DrSc.
- Masaryk Memorial Cancer Institute in Brno, RNDr. Bořivoj Vojtěšek

Objective of the project: It is necessary to prepare simple and cheap methods allowing the analysis of genome details of individuals after the finalising the human genome project. The world science is currently focussing on the electrochemical detection of DNA during this analysis. The DNA electro activity was found by the Institute of Biophysics of AS CR in Brno. This workplace has more than 40-year-long traditions and belongs among leaders in this area. Partner laboratories have recently achieved an important progress in the research of electrochemical DNA sensors and in the analysis of proteins and other substances. The project is based on the achieved results and focuses on the advanced research of properties of biomacromolecules and their interactions with surfaces, especially electrodes, and on the research of intermolecular DNA interactions and proteins important in relation to serious diseases (cancer, Parkinson and Alzheimer diseases). There will be new approaches and methods designed on the basis of electrochemistry, miniaturising, and nanotechnologies for the modern biology and biomedicine of the 21st century.

LC06040 **"Structures for nanophotonics and nanoelectronics"**, 3/2006–12/2010, the head researcher is prof. RNDr. Tomáš Šikola, CSc., Brno University of Technology, Faculty of Mechanical Engineering, the total costs of CZK 37.151 million, thereof CZK 37.151 million from the state budget.

(Year 2008 – 6.813/6.813, 2a)

Co-researcher:

- Institute of Physics of AS CR, v. v. i., Praha, RNDr. Antonín Fejfar, CSc.

Objective of the project: The finding or creation of a nanostructure with its possible utilisation in photonic or electronic parts. The research of photonic, electronic and transport properties of nanostructures utilises the combination of top technological methods and processes, e.g. the local anodic oxidation done by the scanning probe microscopes (SPM), the selective growth utilising the managed self-assembly with the prepared methods like the fluorescence optical microscopy, spectroscopy, local conductivity measuring, and the SPM potential. The project utilises complementary knowledge and top technological measuring facilities of both workplaces, which participate in the project solution, but also the direct co-operation with X-ray multilayer mirrors replication technologyX-ray multilayer mirrors replication technologyforeign workplaces. There are at least 10 post graduates from the Technical University and the Institute of Physics participating in the Centre activities.

LC06041 **"Preparation, modification and characterising of materials by energy radiation"**, 3/2006–12/2010, the researcher is doc. Ing. Vladimír Hnatowicz, DrSc., Nuclear Physics Institute of AS CR, v. v. i.. Husinec – Řež, the total costs of CZK 60.415 million, thereof CZK 52.764 million from the state budget.

(Year 2008 – 2.982/2.357, 6b, the nanotechnology research share makes up 40% of the allocated sum.)

Co-researchers:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, Ing. Jan Šubrt, CSc.
- University of Jan Evangelista Purkyně in Ústí nad Labem, Faculty of Science, doc. RNDr. Jaroslav Pavlík, CSc.
- Czech Technical University in Praha, Institute of Technical and Experimental Physics, Ing. Jan Jakůbek, Ph.D.
- Institute of Chemical Technology Praha, FCHT, prof. Ing. Václav Švorčík, DrSc.
- Czech Technical University in Praha, Faculty of Electrical Engineering, prof. Ing. Jan Vobecký, DrSc.

Objective of the project: The project concentrates the instrument and personnel capacities of the participants for the achievement of higher internationally comparable level of the experimental and theoretical studies: – effects of the energy radiation on the structure and properties of substances and the possibilities of their utilisation for the preparation of new materials and structures having important electric, optic, and biological properties; – the development of preparation methods for nano and micro structured materials potentially applicable in electronics, optoelectronics and medicine; – the development of new methods for the complex material diagnostics, especially the ones which are still not at the disposal in the Czech Republic, including the development of detectors providing the high energy and space resolution.

LC06063 **"Fluorescence microscopy in the biological and medical research"**, 3/2006–12/2010, the researcher is doc. Martin Hof, Dr. rer. nat., J. Heyrovsky Institute of Physical Chemistry, Praha, the total costs of CZK 83.684 million, thereof CZK 83.085 million from the state budget.

(Year 2008 – 10.873/10.873, 7a, the nanotechnology research share makes up 70 % of the allocated sum.)

Co-researchers:

- Institute of Physiology of AS CR, v. v. i., Praha, RNDr. Lucie Kubínová, CSc.
- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, doc. RNDr. Pavel Hozák, DrSc.
- Charles University in Praha, Faculty of Science, doc. RNDr. Zdena Palková, CSc.

Objective of the project: The development of new fluorescence microscopy processes for the studies of dynamic processes in living cells and in model systems, which should allow for the gaining of new knowledge from the areas of non viral gene therapy, signal transduction and the regulation of gene expression. The project includes the development of fluorescence techniques having the sensitivity of a single molecule and of methodologies for the data processing, the development of new DNA condensers, the establishment of the role of G proteins in hormonal actions, the development of new ways of the fluorophor marking of protein molecules, the clarification of interactions of proteins participating in the organisation of the cell core, and of the role of transport proteins in plasmatic membrane.

LC510 **"Centre of nanotechnologies and materials for nanoelectronics"**, 2/2005–12/2009, the head researcher is RNDr. Jan Kočka, DrSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 89.376 million, thereof CZK 69.469 million from the state budget.

(Year 2008 – 18.473/14.515, 2a)

Co-researchers:

- Charles University in Praha, Faculty of Mathematics and Physics, doc. RNDr. Jan Valenta, Ph.D.
- J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, prof. RNDr. Ladislav Kavan, CSc.

Objective of the project: The Centre focuses on the nanoelectronics area which should allow for the utilisation of unique quantum phenomena, but which require problem solutions in 3 branches of the basic research: I) The finding of new sources of photons which allow the photon transfer; II) The use of the charge carriers' spin in semiconductor nanostructures for the maintenance and transmission of information; III) The use of new materials instead of the currently dominating crystalline silicon – e.g. diamond or the nanostructures of unique properties (carbon nanotubes). The main objective will be the preparation and selection of the most perspective spintronic materials from the point of view of working temperature and the spin coherence time, which directly determines the surface electronic properties and the surface bioactivation. Then, there will be new biosensors or by the field governed nanotransistors designed, carbon nanotubes and fulleren enclosures will be prepared and their structure, electronic and photochemical properties will be studies. An important objective of the Centre is the creation of the interdisciplinary platform, which is missing in the Czech Republic, interconnecting physics, chemistry, electronics, and biology. The candidates will verify possibilities of the research interconnection in the areas of Si and carbon nanostructures and the integration of optoelectronic and spintronic structures.

LC523 **"Perspective inorganic materials"**, 2/2005–12/2009, the head researcher is prof. Ing. Miloslav Frumar, DrSc., University of Pardubice, the total costs of CZK 92.254 million, thereof CZK 58.855 million from the state budget.

(Year 2008 – 1.913/1.215, 1a, the nanotechnology research share makes up 10 % of the allocated sum.)

Co-researcher:

- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, Ing. Jan Šubrt, CSc.

Objective of the project: The basic research of new inorganic materials, organic metalloid and organometallic compounds with the perspective utilisation in electronics, optics, optoelectronics, in the glass industry, in the industry of ceramics, in nanotechnologies, and also as pigments. The attention will be paid to the determination of the structure, chemical composition and physical and chemical properties, especially the chalcogenides which could be practically used in the high-tech technologies. The attention will be also paid to the studies of optically and thermally induced phenomena in new materials. The project's objective relates also to the increased competitiveness of the basic research, the improved education of post graduates, graduates, and to the better standard of both national and international co-operation by both co-operating organisations.

3.3. TOPICAL PROGRAMME "HEALTHY AND HIGH QUALITY LIFE" (2B)

Projects solved in the area of nanotechnologies

2B06056 **"Diagnostics of by polyaromatic compounds damaged DNA with the use of nanotechnological and bioanalytical methods for the early detection of cancers"**, 7/2006–6/2010, the head researcher is Mgr. Jan Přibyl, Ph.D., Masaryk University in Brno, Faculty of Science, the total costs of CZK 9.998 million, thereof CZK 8.998 million from the state budget.

(Year 2008 – 1.348/1.216, 3g, the nanotechnology research share makes up 60 % of the allocated sum.)

Co-researcher:

- EXBIO Praha, a.s., Ing. Miloslav Suchánek, Ph.D.

Objective of the project: The indirect carcinogens like, for example, benzo pyrene, cause malignancy by the chemical modification of nucleic acids and related substances and by preventing the natural functioning of human cells. The project wishes to contribute to the area of revealing this process mechanism by the precise localisation of damages with the assistance of nanotechnological imagining techniques. For this purpose, there will be antibodies prepared which would be specific, according to the damaged place, the bound molecule respectively. These antibodies will be then utilised for the development of methods allowing a simple, fast, but precise identification of the mentioned damages. Methods of the heterogenous immunoanalysis (ELISA) or biosensors with a transducer based on a surface plasmon look like the most perspective in this area. The localisation of damages on DNA is further studied with the assistance of the AFM technique utilising the nanoparticle marked antibodies as tools making the damaged areas visible.

2B06104 **"Photosensibilisers in dental medicine"**, 7/2006–12/2010, the researcher is Ing. Marie Karásková, Výzkumný ústav organických syntéz a.s., Pardubice, the total costs of CZK 30.500 million, thereof CZK 27.454 million from the state budget.

(Year 2008 – 5.649/5.084, 6d)

Co-researcher:

- Charles University in Praha, doc. MUDr. Radovan Slezák, CSc.

Objective of the project: The development of phthalocyanine derivates, which present, thanks to their arrangements, properties of effective photosensibilisers and which are also suitable for the fixation of nanoparticles on selected carriers. The prepared compounds and nanocomposites will be tested from the point of view of creation of the single oxygen after light exposure, but also on their antimicrobial effectiveness. Their retention on targeted tissues and the biocompatibility with human cells will be also studied. There will be an optimal combination of a photosensibiliser and the relevant nanocarrier selected, according to results of the in vitro conducted pre clinical tests, and it will be recommended for consequent clinical tests.

2B06130 **"The utilisation of the newly synthetised biomaterials in combination with stem cells in the treatment of diseases affecting human tissues derived from mesoderm: the cartilage, bone, ligaments, and meniscus"**, 7/2006–6/2011, the head researcher is prof. MVDr. Alois Nečas, Ph.D., University of Veterinary and Pharmaceutical Sciences Brno, the total costs of CZK 80.499 million, thereof CZK 72.450 million from the state budget.

(Year 2008 – 4.705/4.234, 3d, the nanotechnology research share makes up 30 % of the allocated sum.

Co-researchers:

- Masaryk University in Brno, Faculty of Medicine, prof. MUDr. Petr Gál, Ph.D.
- Brno University of Technology, Faculty of Chemistry, prof. RNDr. Josef Jančář, CSc.
- Institute of Animal Physiology and Genetics of AS CR, v. v. i., Liběchov, prof. MVDr. Jan Motlík, DrSc.
- Institute of Experimental Medicine of AS CR, v. v. i., Praha, prof. MUDr. Eva Syková, DrSc.

Objective of the project: The gaining of fundamental information about biological properties of stem cells in combination with newly synthetised polymer biomaterials and nanofibres, both in tissues and in vitro. The main attention will be paid to the preparation of effective methodologies managing the differentiation of stem cells to chondrocytes, osteocytes, and fibrocytes. There will be also testing of their compatibility with the mentioned biomaterials and the populations will be characterised in a complex way. The project will be directed in such a way that the experimental development would result in technologies which should guarantee the secure use of biomaterials into which there would be cells determined for transplantation to bones, joints, tendons, and ligaments of small pigs and rabbits inserted. The biomaterial composites with cells induced for differentiation will be transplanted to the relevant places in the muscle-skeletal system of the optimal animal models (the miniature pig and rabbit) for the purpose of verification of their effectiveness in the treatment of serious diseases of joints and bones. This experimental work is important for the development of secure and effective technologies before the start of clinical studies and before the clinical use of these biomaterials as replacements of the irreversibly damaged cells and human tissues.

2B08062 **"Genetic and physiological handling of bacterial degradation agents in aromatic pollutants and their utilisation (AROMAGEN)"**, 1/2008–12/2011, the researcher is Ing. Miroslav Pátek, CSc., Institute of Microbiology of AS CR , v. v. i., Praha, the total costs of CZK 29.900 million, thereof CZK 26.900 million from the state budget.

(Year 2008 – 6.375/5.773, 1g)

Co-researchers:

- DEKONTA, a.s., Ing. Petra Žáčková
- MikroChem LKT spol. s r.o., Mgr. Marius Byss
- Technical University in Liberec, Faculty of Mechatronics, doc. Dr. Ing. Miroslav Černík, CSc.
- Institute of Chemical Technology Praha, prof. RNDr. Vladimír Jirků, DrSc.

Objective of the project: The creation of a system of preparation and the utilisation of bacterial degraders of aromatic pollutants with the use of genetic manipulation, nanofibres as the carriers of microbial biofilm and of humic additives and the testing of their biodegradation function in real situations. The first step in the application of biofilms will be the use of nanofibres as a new carrier variant which could positively influence the development and the structural stability of biofilms and thus also the required remedy function. We expect, on the basis of the executed experiments, that these carriers will be suitable especially for applications of biofilms of rhodococci for the remedy of specifically contaminated waste water and for the intensification of classical treatment technologies.

3.4. INTERNATIONAL RESEARCH AND DEVELOPMENT PROJECTS BY MEYS (MŠMT) – THE PROGRAMME COST (OC)

Projects solved in the area of nanotechnologies

OC 101 **"Nanoscopic ferroelectrics and their spectroscopic characterising"**, 3/2006–12/2009, the head researcher is RNDr. Přemysl Vaněk, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 2.360 million, thereof CZK 1.4 million from the state budget.

(Year 2008 – 0.688/0.400, 1f)

Objective of the solution: The studies of nanoscopic ferroelectric ceramics and thick films with the infrared and Raman spectroscopy.

OC 102 – Action COST 539 **"Preparation of electroceramics of nanopowders"**, 3/2006–12/2009, the researcher is doc. RNDr. Karel Maca, Dr., the total costs of CZK 2.360 million, thereof CZK 1.4 million from the state budget.

(Year 2008 – 0.400/0.400, 1f)

Objective of the solution: The preparation of volume ceramic materials with the required structure, chemical and phase composition.

OC 103 **"Photocatalytic technologies and new nanosurface materials – problems in the application of photocatalytic nanosurface materials in the area of resolving security risks in EU"**, 3/2006–12/2009, the head researcher is Ing. František Peterka, Ph.D., UJP PRAHA a.s., Praha – Zbraslav, the total costs of CZK 1.6 million, thereof CZK 1.6 million from the state budget.

(Year 2008 – 0.400/0.400, 8a)

Objective of the solution: The deepening of the basic knowledge about nanocrystalline photo active materials and the development of new materials.

OC 104 **"Physical-chemical characterising of photoactive materials and surface treatments on the basis of nanocrystalline titanium oxide – the development of standard testing methods"**, 3/2006–12/2009, the head researcher is RNDr. Jaromír Jirkovský, CSc., J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 1.6 million, thereof CZK 1.6 million from the state budget.

(Year 2008 – 0.400/0.400, 7a)

Objective of the solution: The extension of basic knowledge about nanocrystalline photo active materials having the self-cleaning ability and the antibacterial effects.

OC 105 **"Photocatalytic ceramic nanomaterials and layers for the photochemical disintegration of water and polar substances"**, 3/2006–12/2009, the head researcher is prof. Ing. Jaroslav Cihlář, CSc., Brno University of Technology, Faculty of Mechanical Engineering, the total costs of CZK 1.6 million, thereof CZK 1.6 million from the state budget.

(Year 2008 – 0.400/0.400, 1f)

Objective of the solution: The studies of the preparation and properties of the photocatalytic oxide materials, the photolytic water splitting to hydrogen and oxygen.

OC 108 **"Magnetic techniques for the detection and establishment of xenobiotics in waters"**, 3/2006–3/2009, (COST 636: Xenobiotics in the Urban Water Cycle, 2006–2008), the researcher is doc. Ing. Ivo Šafařík, DrSc., Institute of Systems Biology and Ecology of AS CR, v. v. i., České Budějovice, the total costs of CZK 1.5 million, thereof CZK 1.5 million from the state budget.

(Year 2008 – 0.400/0.400, 3g)

Objective of the solution: The development of new techniques for the pre concentration, detection and establishment of selected xenobiotics from water samples. The solution will utilise magnetic nanoparticles.

OC 137 **“Transport of charge carriers in solid molecular substances and nanoparts”**, 3/2006–12/2010, the head researcher is Ing. Irena Kratochvílová, Ph.D., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 1.841 million, thereof CZK 1.351 million from the state budget.

(Year 2008 – 0.410/0.300, 6b)

Objective of the solution: The experimental and theoretical studies of materials suitable for the use in microelectronics.

OC 138 **“Molecular photoconductive and photorefractive systems: From macroscopic elements to nanostructures”**, 3/2006–2/2010, the head researcher is prof. RNDr. Stanislav Nešpůrek, DrSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 3.676 million, thereof CZK 1.610 million from the state budget.

(Year 2008 – 0.877/0.380, 2c)

Objective of the solution: The experimental and theoretical studies of the relations between photochemical activities and electron properties of molecular materials, clusters and polymers.

OC 147 **“Multilevel model structures and properties of nanowires”**, 3/2006–12/2009, the head researcher is prof. RNDr. Mojmír Šob, DrSc., Institute of Physics of Materials of AS CR, v. v. i., Brno, the total costs of CZK 1.3 million, thereof CZK 1.3 million from the state budget.

(Year 2008 – 0.400/0.400, 1a)

Objective of the solution: The gaining of new fundamental knowledge about the strength and magnetic properties of selected metal nanowires.

OC 148 **“Two-level analysis of the voltage distribution under the nano-indentor’ tip”**, 3/2006–12/2009, the head researcher is Mgr. Miroslav Černý, Ph.D., Brno University of Technology, Faculty of Mechanical Engineering, the total costs of CZK 1.2 million, thereof CZK 1.2 million from the state budget.

(Year 2008 – 0.400/0.400, 7a)

Objective of the solution: The achievement of better understanding of relations between the microstructural and the mechanical material properties.

OC157 **“Magnetic modification of renewable polymer materials and microbial cells”**, 3/2007–9/2010, (COST 868, Biotechnical Functionalisation of Renewable Polymeric Materials, 2007– 2010), the researcher is doc. Ing. Ivo Šafařík, DrSc., Institute of Systems Biology and Ecology of AS CR, v. v. i., České Budějovice, the total costs of CZK 1.742 million, thereof CZK 1.742 million from the state budget.

(Year 2008 – 0.500/0.500, 2d)

Objective of the solution: The development of new processes for the magnetic modification of selected renewable polymer materials and microbial cells originating in the agricultural production or in the food industry. The solution will use magnetic nanoparticles.

OC 180 – Action COST D-41 **“Heterogenous catalysts for the oxidation of organic substances based on composite perovskite oxides”**, 1/2007–12/2010, the researcher is prof. RNDr. Jaroslav Cihlář, CSc., the total costs of CZK 1.742 million, thereof CZK 1.742 million from the state budget.

(Year 2008 – 0.500/0.500, 5b)

Objective of the solution: The studies of the preparation and of properties of heterogenous catalytic oxide nanomaterials.

OC08023 **“Optic fibres modified by the nanostructured photocatalytic layers with the high activity within the visible spectrum area”**, the researcher is Ing. Vlastimil Matějec, CSc., Institute of Photonics and Electronics of AS CR, v. v. i., Praha, the total costs of CZK 1.877 million, thereof CZK 0.793 million from the state budget.

(Year 2008 – 1.051/0.447, 2c)

Objective of the solution: The determination of the key variables in preparation processes related to quartz optic fibres with step and inverted gradient profiles of the index of refraction and capillare fibres modified by layers of nanostructured materials having the high photocatalytic effectiveness.

OC08030 **“Electromagnetic treatment of nanostructured materials based on 3d metals”**, 1/2008–12/2009, the researcher is Ing. Bc. František Fendrych, Ph.D., Institute of Physics of AS CR, v. v. i., Praha, the costs are CZK 0.750 million, thereof CZK 0.750 million from the state budget.

(Year 2008 – 0.500/0.500, 2d)

Objective of the solution: The finding of the most suitable types of magnetically soft nanocomposites, their repeatable and stable UHV plasma synthesis and the electromagnetic processing of deposited nanostructured thin layers suitable for applications in GHz frequencies and sensors.

OC08034 **“Advanced techniques of interferometric optical micro-manipulations”**, 1/2008-5/2011, the researcher is doc. RNDr. Pavel Zemánek, Ph.D., Institute of Scientific Instruments of AS CR, v. v. i., Brno, the total costs of CZK 1.750 million, thereof CZK 1.750 million from the state budget.

(Year 2008 – 0.500/0.500, 2c)

Objective of the solution: The deepening of knowledge in the area of optical micro manipulation techniques with interfering laser beams, their use for the arrangement, classification and transport of sub micrometre objects and applications in the Raman micro spectroscopy and in micro fluid systems.

3.5. INTERNATIONAL RESEARCH AND DEVELOPMENT PROJECTS BY MEYS (MŠMT) – THE PROGRAMME "KONTAKT" (ME) – BILATERAL COOPERATION

Projects solved in the area of nanotechnologies

ME 837 **"Treatment of machine parts and tools surfaces with the aim of the service live increase by surface modification and deposition of nanostructured thin films and coatings dispersively strenghtened with nanoparticles"**, 3/2006–6/2009, the researcher is doc. Ing. Jan Suchánek, CSc., Czech Technical University in Praha, Faculty of Mechanical Engineering, the total costs of CZK 1.153 million, thereof CZK 1.153 million from the state budget.

(Year 2008 – 0.330/0.330, 1d)

Objective of the solution: The studies of degradation processes of duplex surface treatments of adhesive wear, the attrition analyses, the tribological characterisation of duplex surface treatments.

ME 847 **"Material surface modification by conductive polymers"**, 3/2006–12/2010, the researcher is RNDr. Jaroslav Stejskal, CSc., Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, the total costs of CZK 2.065 million, thereof CZK 1.250 million from the state budget.

(Year 2008 – 0.413/0.250, 1d)

Objective of the solution: The combination of classical materials with electrically conductive polymers at the level of nanometres and the finding of potential applications.

ME 862 **"Biocompatible nanostructured coatings of implants for heavy duty load-bearing joints"**, 3/2006–12/2008, the head researcher is doc. RNDr. Rudolf Novák, DrSc., Czech Technical University in Praha, Faculty of Mechanical Engineering, the total costs of CZK 0.487 million, thereof CZK 0.487 million from the state budget.

(Year 2008 – 0.170/0.170, 3d)

Objective of the solution: The research of properties of multilayer coatings used on functioning implants' surfaces which replace load-bearing couplings.

ME 866 **"Synthesis and research of new semiconductor structures of quantum dots"**, 3/2006–12/2010, the head researcher is RNDr. Karel Král, CSc., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 2.645 million, thereof CZK 1.465 million from the state budget.

(Year 2008 – 0.512/0.276, 1a)

Objective of the solution: The clarification of impacts of structures and of the technological processes on transient properties of quantum dot-based nanostructural systems.

ME 892 **"Monitoring and remedy of the polluted environment with the assistance of advanced organic-inorganic materials – MOREPIM"**, 5/2007–12/2011, the researcher is Ing. Gabriela Kuncová, CSc., Institute of Chemical Process Fundamentals of AS CR, v. v. i., Praha, the total costs of CZK 4.590 million, thereof CZK 0.793 million from the state budget.

(Year 2008 – 0.865/0.120, 4b)

Objective of the solution: The use of new materials developed in the Oak Ridge National Laboratory (ORNL) in USA for constructions of optic sensors and in remedy processes studied in the Institute of Chemical Process Fundamentals of AS CR. The research includes the application of organic and organic-inorganic particles in constructions of optical sensors monitoring biotechnological processes and the preparation of new immobilised biocatalysts.

ME08040 **"Research of clay minerals and their influence on the frictional mechanism in friction composites destined for the automotive industry"**, 1/2008–12/2009, the researcher is Ing. Gražyna Simha Martínková, Ph.D., VŠB – Technical University of Ostrava, Nanotechnology Centre, the total costs of CZK 1.149 million, thereof CZK 0.445 million from the state budget.

(Year 2008 – 0.652/0.300, 1b)

Objective of the solution: The optimising of the composite composition considering the clay and definitions of its function in the friction process; the clay modification for the purpose of friction parameter adjustments allowing lower number of composite components; the determination of relations between the composition of volume materials and the function of the friction layer; the studies of mass transfer and of the friction characteristics of three material kinds (semi metallic, non metallic, and ceramic) which contain clay.

ME08109 **"Dynamic nano-clusters in polar perovskites"**, 1/2008–12/2012, the researcher is Ing. Jiří Hlinka, Ph.D., Institute of Physics of AS CR, v. v. i., Praha, the total costs of CZK 0.970 million, thereof CZK 0.970 million from the state budget.

(Year 2008 – 0.250/0.250, 6b)

Objective of the solution: The studies of nanoscopic dynamic clusters' reaction in polar perovskites with the assistance of spectroscopic experiments and computer-assisted simulations of effective Hamiltonian first principles.

3.6. INTERNATIONAL RESEARCH AND DEVELOPMENT PROJECTS BY MEYS (MŠMT) – THE PROGRAMME "EUREKA" (OE)

Projects solved in the area of nanotechnologies

OE08005 (E!4095 "NANOSILVER"), **"Application of antimicrobial effects of nanotechnologically treated silver particles in medicine (human and veterinary), healthcare equipment and cosmetics"**, 1/2008–12/2010, the researcher is Ing. Tomáš Hradil, ALTERMED CORPORATION, a.s., the total costs of CZK 8.200 million, thereof CZK 4.100 million from the state budget. There are 3 partners cooperating (CZ, SK, D). ALTERMED CORPORATION, a.s. is the coordinator.

(Year 2008 – 1.960/0.980, 1a)

Objective of the solution: The development of a new antibacterial preparation based on silver nanoparticles which is suitable for the use in humans and animals. In the case of humans that relates to medical preparations, while in animals, it should be applicable for both animals in the food chain and outside.

OE08012 (E!3963 "ICD") **"Contrast and detection in scanning electron microscopy"**, 1/2008–12/2010, the researcher is RNDr. Lubomír Tůma, FEI Czech Republic s.r.o., Brno, the total costs of CZK 18.270 million, thereof CZK 7.322 million from the state budget. There are 6 partners cooperating (NL – 2×, B, CZ – 2×). The coordinator is FEI Electron Optics B.V., Netherlands.

(Year 2008 – 5.146/1.399, 7a)

Co-researcher:

- Institute of Scientific Instruments of AS CR, v. v. i., Brno, RNDr. Luděk Frank, DrSc.

Objective of the solution: The development of computer models modelling interactions of electrons with materials. The summary process detecting scanned images, the creation of a new technique of contrast creation, and new detector types – their use in the imagining of new semiconductor materials and nanostructures.

4. PROVIDER: MINISTRY OF INDUSTRY AND TRADE (MIT, or MPO)

4.1. TOPICAL PROGRAMME "COMPETITIVENESS IN THE SUSTAINABLE DEVELOPMENT – PROGRESS" OF THE NATIONAL RESEARCH PROGRAMME I (1H)

Projects solved in the area of nanotechnologies

1H-PK/24 **"Microtechnology and nanotechnology in the chemical, process and biological engineering: Study methods of micro- and nano-structured materials and of designing microchemical equipment"**, 8/2004–12/2008, the researcher is doc. Ing. Dalimil Šnita, CSc., University of Chemical Technology, Faculty of Chemical Engineering, Praha, the total costs of CZK 10.197 million, thereof CZK 7.6 million from the state budget.

(Year 2008 – 1.072/0.882, 6c, the nanotechnology research share makes up 50 % of the allocated sum.)

Objective of the project: The theoretical and experimental analysis of possible useful, mostly chemical and biological processes and their combinations which could be done within the micro metric scale more effectively than in the macro metric scale, or which could be done only in the micro scale. There are functional samples of universal micro facilities, mostly based on the photosensitive glass – specific micro facilities (the electrolytic diode and transistor, analytical, reaction, separation, and electroseparation units), designed, manufactured and experimentally tested.

1H-PK2/46 **"Nanofibres and their composites for technical and biomedicinal application"**, 5/2005–12/2008, the researcher is prof. RNDr. Oldřich Jirsák, CSc., TU Liberec, Faculty of Textiles, the total costs of CZK 11.517 million, thereof CZK 6.050 million from the state budget.

(Year 2008 – 2.907/1.511, 1a)

Co-researchers:

- SYNPO, a. s., Pardubice, Ing. Jiří Zelenka, CSc.
- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, prof. Ing. Karel Ulbrich, DrSc.

Objective of the project: The research and development of polymer nanofibres and their composites for technical and biomedical applications.

1H-PK2/56 **"Nanodispersive Ti, Fe, Al, Zn, and Zr oxides and hydroxides for the destruction of chemical weapons"**, 4/2005–12/2009, the researcher is RNDr. Snejana Bakardjieva, Ph.D., Institute of Inorganic Chemistry AS CR, v. v. i., Řež, the total costs of CZK 16.347 million, thereof CZK 7.290 million from the state budget.

(Year 2008 – 3.300/1.485, 1a)

Co-researcher:

- Ministry of Defence, Military Institute of Defence Technology Brno, Ing. František Opluštil, CSc.

Objective of the project: The preparation and characterising of nano disperse oxides and Ti, Fe, Al, Zn, Zr oxido-hydroxides and binary systems Ti-Al, Ti-Fe, Ti-Zn, Ti-Zr, Al-Fe, Al-Zn, Al-Zr, Fe-Zn, Fe-Zr, Zn-Zr, the optimising of the synthesis, according to the reaction conditions, the characterising of prepared samples with the SEM, HRTEM, RTG, DTA-TG, and BET methods and porosity, and the determination of their detoxicating activity related to toxic chemical weapons – sarin, soman, mustard gas, and VX substance.

4.2. TOPICAL PROGRAMME "PERMANENT PROSPERITY" OF THE NATIONAL RESEARCH PROGRAMME II (2A)

Projects solved in the area of nanotechnologies

2A-1TP1/015 **"New procedures for microdispersion and nanodispersion lipid systems formulation as the transport systems for pharmaceutically effective substances"**, 7/2006–6/2011, the researcher is RNDr. Jan Mikeska, CSc., Biomedica, spol. s r.o., Praha, the total costs of CZK 14.905 million, thereof CZK 9.201 million from the state budget.

(Year 2008 – 2.645/1.640, 3a)

Co-researcher:

- Charles University in Praha, Faculty of Pharmacy in Hradec Králové, doc. RNDr. Pavel Doležal, CSc.

Objective of the project: The implementation of new technological preparation processes for lipide emulsions and solid lipide nanodispersions, and their use as carriers of lipophile medicine, especially for oral and top applications.

2A-1TP1/068 **"Synthesis of optimised polymer solutions for the preparation of nanofibres, the manufacturing of nanofibres and the application of non-woven fibre assemblies made of nanofibres"**, 10/2006–9/2011, the researcher is Ing. Dušan Kimmer, CSc., SPUR a.s., Zlín, the total costs of CZK 19.609 million, thereof CZK 12.705 million from the state budget.

(Year 2008 – 3.931/2.555, 1a)

Objective of the project: The research and development of polyurethane and polyurethane-carmabide-based nanofibres. The project's objective covers also the development and the industrial use of new and innovated products made of nanofibres (nanotextiles). The project researcher wishes to manufacture these non woven fibre materials and verify their use. The main project's objective is the research and development of materials and products which would be utilised, thanks to the technology of spinning process and their physical and chemical properties, in many industries. The stress will be put also on the testing of the material safety, the minimising of negative impacts on human health and on the environment.

2A-1TP1/087 **"In situ research of strengthened nanocomposite ceramic materials"**, 11/2006–12/2010, the researcher is Ing. Vladimír Šída, CSc., Saint – Gobain Advanced Ceramics, s.r.o., Turnov, the total costs of CZK 18.002 million, thereof CZK 10.206 million from the state budget.

(Year 2008 – 5.250/2.993, 1e)

Objective of the project: The finding of a new way of strengthening of matrices of nanocomposite ceramic materials in situ with the orientation on the maximal reduction of entry and processing costs. The focus on designs with nanoparticles inserted or created in the ceramic matrix should eliminate the danger of carcinogenicity occurring in current processes.

2A-1TP1/092 **"Research of preparation of nanoforms of layered piezoelectrics for the implementation of the high temperature ultrasonic transducers manufacture"**, 7/2006–12/2011, the researcher is Ing. Stanislav Štarman, Ph.D., STARMANS electronics, s.r.o., Praha, the total costs of CZK 23.467 million, thereof CZK 17.520 million from the state budget.

Co-researchers:

- PIEZOCERAM, s.r.o., Libřice, Bořivoj Tylš
- MOLECULAR CYBERNETICS, s.r.o., Praha, RNDr. Zdeněk Kváča
- Institute of Inorganic Chemistry AS CR, v. v. i., Řež, Mgr. Jiří Plocek, Ph.D.
- Institute of Physics of AS CR, v. v. i., Praha, RNDr. Přemysl Vaněk, CSc.

Objective of the project: The preparation and characterising of nanoforms of layered piesoelectrics for the manufacture of high temperature ultrasound transducers.

2A-1TP1/094 **"Magnetic composite materials"**, 11/2006–12/2011, the researcher is doc. Ing. Ivo Šafařík, DrSc., Institute of Systems Bilogy and Ecology of AS CR, v. v. i., České Budějovice, the total costs of CZK 6.391 million, thereof CZK 4.474 million from the state budget.

(Year 2008 – 1.316/0.921, 2d)

The objective of the project: The preparation of new kinds of magnetically marked biocompatible materials, their utilisation in different areas of biosciences, biotechnologies and environmental technologies (e.g. isolation and immobilisation of biologically active substances, detection, determination, and removal of environmental contaminants, the development of materials for the potential medical applications, etc.) and the complex characterising of the created materials.

2A-1TP1/113 **"Design of special textile machines manufacturing nanofibres"**, 11/2006–12/2009, the researcher is Ing. Jan Čmelík, ELMARCO s.r.o., Liberec, the total costs of CZK 21.105 million, thereof CZK 12.662 million from the state budget.

(Year 2008 – 6.455/3.873, 7d)

Co-researcher:

- Technical University in Liberec, doc. Ing. Ladislav Ševčík, CSc.

Objective of the project: The basic research of some functional machine parts manufacturing nanofibres and the design of solutions of individual selected functioning modules, the research of new mechanical phenomena occurring in the manufacture of nanofibres, the design and the research of module materials having higher functional reliability and higher safety from the points of view of the direct high voltage and chemical loading. There will be also the minimising of negative impacts of the machine on the operator's health and on the environment monitored.

2A-1TP1/124 **“Research of the effects of extreme deformation conditions on the metal sub microstructure and of testing methods for the diagnostics of their technological properties”**, 11/2006–3/2011, the researcher is Ing. Karel Malaník, CSc., VÚHŽ a.s., Dobrá, the total costs of CZK 23.030 million, thereof CZK 15.343 million from the state budget.

(Year 2008 – 5.840/3.913, 7d)

Co-researcher:

- VŠB – Technical University of Ostrava, Faculty of Mechanical Engineering, prof. Ing. Stanislav Rusz, CSc.

Objective of the project: The research of a new manufacturing technology for nanomaterials called by the abbreviation DRECE, by the processing of a suitable metallic material of aluminium and iron-based alloys. The research and development of new testing methods (processes) verifying technological properties of nanostructured metals will take at the same time. On this basis, there will be the comparison of ECAP and DRECE technologies done and there will be information prepared for the construction of a semi operational (or operational) facility processing the selected metals and preparing nanomaterials.

2A-1TP1/143 **“Research of new mechatronic MEMS structures suitable for the pressure measuring”**, 11/2006–12/2011, the researcher is Ing. Karel Mareček, BD SENSORS s.r.o., Buchlovice, the total costs of CZK 75.346 million, thereof CZK 45.0 million from the state budget.

(Year 2008 – 12.952/7.335, 2f)

Co-researcher:

- Brno University of Technology, Faculty of Electrical Engineering and Communication, prof. Ing. Radimír Vrba, CSc.

Objective of the project: The applied research of fully intelligent pressure sensors utilising the MEMS structures and related nanotechnological structures, including the research and experimental verification of new principles for the pressure recordings. The development of unique manufacturing technologies belongs among the objectives. They should allow: a) The manufacture or application of a membrane made of the optimal designed material, with the surface treatment by a suitably selected material, and of an ideal surface profile; b) The development of a suitable MEMS technology for the imagining and the creation of a pressure MEMS sensor with an optimal interface for the achievement of ideal sensors’ properties; c) The manufacture of a tablet of the pressure MEMS sensor of selected materials with the integrated ASIC circuit. The project’s results of mostly basic and applied research will be new MEMS methods and technologies for the sensor pressure measuring.

2A-2TP1/135 **“New polyfunctional hybrid polymers from renewable and recyclable materials allowing the utilisation of enzyme catalysts and nanoparticles”**, 7/2007–6/2011, the researcher is Ing. Tomáš Vlček, Ph.D., SYNPO, a. s., Pardubice, the total costs of CZK 22.000 million, thereof CZK 13.200 million from the state budget.

(Year 2008 – 5.051/3.031, 5c)

Co-researcher:

- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, Ing. Hynek Beneš

Objective of the project: The preparation of new polyfunctional hybrid monomers and polymers utilising domestic renewable and recycled waste materials, e.g. vegetable oils, esters of fatty acids, and waste glycerol from the overproduction of bio diesel fuel, bio spirit, waste polyethylene-terephthalate (PET) and waste polyurethane (PU) soft foams from wrecked car seats. Chemical modifications of entry materials will be done at the presence of standard and enzyme biocatalysts and they will include depolymerisation, esterification, transesterification, epoxying, ring-opening reactions, thermal oligomerisations, polycondensation, and also the in situ modifications of nanoparticles. The new kinds of monomers and polymers will be used for the development of special PU paints for the construction industry, PU climatic and barrier membranes and PU electroinsulation casting resins with the unique combination of utility properties like the hydrophobicity, flexibility, hardness, chemical resistance, and fire resistance.

2A-3TP1/120 **"Equipment for the preparation of nanofibres from polymer melts"**, 4/2008–12/2011, the researcher is Ing. Jan Čmelík, ELMARCO s.r.o., Liberec, the total costs of CZK 35.946 million, thereof CZK 17.074 million from the state budget.

(Year 2008 – 11.146/5.295, 7d)

Co-researcher:

- Technical University in Liberec, Faculty of Mechanical Engineering, doc. Ing. Ladislav Ševčík, CSc.

Objective of the project: The currently manufactured machines prepared fibres from polymer solutions with solvents. The disadvantage has been the environmental burden resulting from the solvent vapours and costs of their removal. The project will research, develop, and propose machines for the electrostatic polymer spinning by a different way.

2A-3TP1/126 **"Continual plasma and nanoplasma treatments of non-woven textiles"**, 4/2008–12/2011, the researcher is Ing. Zdeněk Mečl, PEGAS NONWOVENS, a.s., Znojmo, the total costs of CZK 50.000 million, thereof CZK 25.000 million from the state budget.

(Year 2008 – 6.254/3.142, 7c, the nanotechnology research share makes up 50 % of the allocated sum.)

Co-researchers:

- INOTEX spol. s r.o., Dvůr Králové n. L., Ing. Jan Marek, CSc.
- Masaryk University in Brno, Faculty of Science, prof. RNDr. Mirko Černák, CSc.

Objective of the project: The project's core relates to the application of an innovative resource which can generate cold diffusion plasma of the extremely high output density, up to 100 W/ /cm^3, for the activation or hydrophilisation of polypropylene non woven textiles of the spun melt type directly on production lines at the speed of at least 300 m/min.

2A-3TP1/140 **"Ion-exchangeable materials in the form of membranes and nanofibres prepared on the nanotechnological basis"**, 4/2008–12/2010, the researcher is Ing. Aleš Černín, Ph.D. MEGA a.s., Stráž pod Ralskem, the total costs of CZK 21.512 million, thereof CZK 11.832 million from the state budget.

(Year 2008 – 6.083/3.346, 5a)

Co-researcher:

- ELMARCO s.r.o., Liberec, Ing. Denisa Stránská

Objective of the project: The proposed project's substance is the implementation of the basic and applied research of the preparation of ion-exchanging membranes by the Nanospider technology that covers the area of material research of basic parts of spinning of polymer solutions with the consequent relations to heterogenous membrane composite preparation technology.

4.3. PROGRAMME "TANDEM" (TA)

Projects solved in the area of nanotechnologies

FT-TA2/018 **"High-tech energy beams technologies for deposition and treatment of films for electronics"**, 1/2005–12/2008, the researcher is Ing. Karel Strobl, ELCERAM a.s., Hradec Králové, the total costs of CZK 20.478 million, thereof CZK 13.215 million from the state budget.

(Year 2008 – 1.579/1.022, 7c, the nanotechnology research share makes up 30 % of the allocated sum.)

Co-researchers:

- TTS s. r. o., Praha, RNDr. Jaroslav Merta, CSc.
- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, prof. RNDr. Stanislav Nešpůrek, DrSc.
- Czech Technical University in Praha, Faculty of Mechanical Engineering, prof. RNDr. Bruno Sopko, DrSc.

Objective of the project: The research and development of advanced technologies related to microelectronics and sensors based on the combination of energy beam technologies (laser, UV rays, ion beams, microwave radiation, etc.) and micro and nano layered technologies applied with vacuum techniques, plasma techniques, and wet processes. The stress will be put on the selection of processes with very high resolution in the route and gap widths in created structures.

FT-TA3/048 **"DPP and CPP compounds based nanomaterials and functional systems for electronic equipment"**, 1/2006–12/2008, the researcher is Ing. Martin Kaja, Výzkumný ústav organických syntéz a.s., Rybitví, the total costs of CZK 12.063 million, thereof CZK 8.220 million from the state budget.

(Year 2008 – 3.760/2.480, 1d)

Co-researchers:

- Brno University of Technology, Faculty of Chemistry, doc. Ing. Oldřich Zmeškal, CSc.
- Institute of Macromolecular Chemistry of AS CR, v. v. i., Praha, prof. RNDr. Stanislav Nešpůrek, DrSc.

Objective of the project: The research of preparation of new diketone-pyrrolo-pyrrolo (DPP) and cyclopenta-pyrrolo (CPP) electron materials in the form of thin layers and nanocomposites for applications in the high-tech technologies OLED, FOLED, TOLED, SOLED, and photodetectors, or solar cells, FET transistors and sensors. The designed systems and nanocomposites will be used in the manufacture of molecular electronic elements.

FT-TA3/055 **“Intelligent polymer coatings containing nanoparticles”**, 3/2006–12/2009, the researcher is Ing. Jiří Zelenka, CSc., SYNPO, a. s., Pardubice, the total costs of CZK 14.893 million, thereof CZK 7.4 million from the state budget.

(Year 2008 – 4.300/2.150, 1g)

Co-researcher:

- Brno University of Technology, Faculty of Chemistry, prof. RNDr. Josef Jančář, CSc.

Objective of the project: The research of systems based on watery dispersions of acrylate copolymers or their solutions containing inorganic nanoparticles. The attention will be focussed on the preparation of suitable nanoparticles, the ways of their modification (hydrophobisation), the dispersion process and the impact of the structure of modifying substances on the dispersion. There will be the influence of concentration and modifications on selected properties of both system types monitored. There will be systems developed for applications in the construction industry, or for the protection of wooden structures.

FT-TA3/077 **“Remedy for underground waters using permeable reactive barriers”**, 5/2006–4/2010, the researcher is Ing. Josef Kozler, CSc., Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, the total costs of CZK 49.130 million, thereof CZK 34.055 million from the state budget.

(Year 2008 – 5.497/3.669, 1a, the nanotechnology research share makes up 40 % of the allocated sum.)

Co-researchers:

- DEKONTA, a.s, Praha, Ing. Lenka Veselá, Ph.D.
- AQUATEST a.s., Praha, Ing. Dr. Miroslav Černík, CSc.
- MikroChem LKT spol. s r.o., Třeboň, Ing. Karel Koranda
- Institute of Chemical Technology Praha, Faculty of Food and Biochemical Technology, prof. RNDr. Vladimír Jirků, DrSc.

Objective of the project: The permeable reactive barriers look like potentially effective remedy technologies for contaminated underground waters. Within this context, the project aims at the gaining of extensive applicable knowledge which could allow the design and implementing of these constructions in the way precisely corresponding with the character of underground water contamination and with the toxicity of present pollutants. There is the zero-valent nanoiron used.

FT-TA3/080 **“Synthesis of titanium silicates and their applications”**, 4/2006–12/2009, the researcher is Ing. Věnceslava Tokarová, CSc., Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, the total costs of CZK 11.204 million, thereof CZK 6.748 million from the state budget.

(Year 2008 – 3.168/1.928, 5b)

Co-researchers:

- Euro Support Manufacturing Czechia, s.r.o., Ing. Milan Říčánek, CSc.
- J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, prof. Ing. Jiří Čejka, DrSc.

Objective of the project: The development of technologically possible processes of the synthesis of titanium silicate zeolitic structures MFI, BEA and the mesoporous structure MCM-41. The synthesis of the most perspective of these materials should be implemented in a quarter operational scale and its applicability should be verified within the selected catalytic application.

FT-TA3/112 **"X-ray multilayer mirrors replication technology"**, 4/2006–12/2009, the researcher is doc. Ing. Ladislav Pína, DrSc., REFLEX s.r.o., Praha, the total costs of CZK 11.004 million, thereof CZK 7.397 million from the state budget.

(Year 2008 – 1.400/0.941, 2c, the nanotechnology research share makes up 50 % of the allocated sum.)

Co-researchers:

- TTS s.r.o., Praha, RNDr. Jaroslav Merta, CSc.
- Institute of Plasma Physics of AS CR, v. v. i., Praha, RNDr. Zbyněk Melich
- Czech Technical University in Praha, FJFI, Ing. Alexandr Jančárek, CSc.
- Optical development workshop of AS CR

Objective of the project: The development of a technology preparing super smooth aspheric X-rays reflection structures usable in the manufacture of rotationally symmetric X-rays lenses of the diameter 0.5 mm – 80 mm and the focus 10–100 mm. Parameters of these X-rays lenses would allow the application of these products in very advanced instruments. The developed technology would be based on the decomposition of multilayers to super smooth bases and on their replication with the assistance of galvanoplastic method to rotationally symmetric X-rays lenses.

FT-TA3/133 **"Set of laser interferometers for the length nanometrology"**, 3/2006–12/2009, the head researcher is Ing. Jan Kůr, MESING, spol. s r.o., Brno, the total costs of CZK 11.730 million, thereof CZK 6.797 million from the state budget.

(Year 2008 – 3.003/1.772, 7e)

Co-researchers:

- Czech Metrology Institute, Brno, RNDr. Petr Balling
- Institute of Scientific Instruments of AS CR, v. v. i., Brno, Ing. Ondřej Číp, Ph.D.

Objective of the project: The creation of a set of testing interferometers for nanotechnologies which would allow the measuring of distances and the calibration of sensors of action parts with a given certainty. These systems would be included in the national metrology system of the Czech Republic and will be accessible in accredited workplaces to Czech manufacturers and users of the top measuring technologies.

FT-TA3/151 **"Research and development of the surface layers' technology for antifriction and sliding bearings"**, 3/2006–12/2009, the researcher is Ing. Vladimír Vansa, ZKL – Výzkum a vývoj, a.s., Brno, the total costs of CZK 12.163 million, thereof CZK 8.530 million from the state budget.

(Year 2008 – 0.690/0.486, 1d, the nanotechnology research share makes up 20 % of the allocated sum.)

Co-researchers:

- ZKL Brno, a.s., Ing. Miroslav Dvořák
- SVÚM a.s., Praha, Ing. Jiří Krejčík, CSc.
- Brno University of Technology, FSI, prof. Ing. Jiří Švejcar, CSc.

Objective of the project: The research and development of modern technologies related to surface treatments of parts of antifriction and slide bearings. It is about the increasing of utility bearing parameters by optimising their tribologic properties. The objective is the reduction of energy losses in bearings, the increased limit revolution frequencies, the reliability, and the bearing life span. Activities within this project focus also on the development of nanostructural coatings for slide bearings on the basis of metallic and non metallic nanopowders, e.g. Ni, SiC, C (in the graphite form) with a suitable binder.

FT-TA3/156 **"Research and development of the new generation of protective filters"**, 6/2006–12/2008, the researcher is Ing. Jiří Šoukal, CSc., SIGMA Výzkumný a vývojový ústav, s.r.o., Lutín, the total costs of CZK 27.082 million, thereof CZK 13.500 million from the state budget.

(Year 2008 – 6.300/3.150, 5a, the nanotechnology research share makes up 70 % of the allocated sum.)

Co-researcher:

- ELMARCO s.r.o., Liberec, Ing. Ladislav Mareš

Objective of the project: The research and development of a new generation of protective breathing filters for the wide spectrum of uses. The filters should be based on the active filtration system and sorption with the use of the technology of nanofibres and ecological sorbent.

FT-TA4/025 **"Nanomaterials of the new generation and their industrial applications"**, 3/2006–12/2010, the head researcher is Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, the total costs of CZK 39.885 million, thereof CZK 18.945 million from the state budget.

(Year 2008 – 10.504/4.989, 1a)

Co-researchers:

- HET spol. s r.o., Ohníč, Ing. Martin Rozhon
- TELURIA, spol. s r.o., Skrchov, Ing. Luboš Mrázek
- ATG s.r.o., Praha, Ing. František Peterka, Ph.D.
- Nuclear Research Institute Řež a.s., RNDr. Vladimír Balek, DrSc.
- Institute of Chemical Technology Praha, Faculty of Chemical Technology, Dr. Ing. Josef Krýsa
- VŠB – Technical University of Ostrava, Nanotechnology Centre, prof. Ing. Pavla Čapková, DrSc.

Objective of the project: The research and development of nanomaterials for industrial applications: a) The photo active materials based on TiO_2; b) The UV absorbers based on TiO_2 for the improved stability of powder paints; c) The super hydrophile titanium white with the nanostructural surface modification.

FT-TA4/064 **"Paints fulfilling the new environmental requirements of EU"**, 7/2007–12/2010, the researcher is Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, the total costs of CZK 70.620 million, thereof CZK 34.417 million from the state budget.

(Year 2008 – 3.240/1.579, 4b, the nanotechnology research share makes up 20 % of the allocated sum.)

Co-researchers:

- Spolek pro chemickou a hutní výrobu, a. s., Ústí nad Labem, Ing. Jan Hyršl, CSc.
- COLOR SPEKTRUM a.s., Hodonín, Ing. František Drobný, CSc.
- BARVY A LAKY HOSTIVAŘ, a.s., Praha, Ing. Dariusz Jakubowicz
- TELURIA, spol. s r.o., Skrchov, Ing. Jaroslav Prudil
- BARVY TEBAS s.r.o., Praha, Ing. Jaroslav Prachař
- STAVEBNÍ CHEMIE SLANÝ a.s., Ing. Michael Koudelka
- University of Pardubice, FCHT, doc. Ing. Andrea Kalendová, Ph.D.

Project participant:

- Akzo Nobel Coatings CZ, a.s., Opava

Objective of the project: The contribution to the development of the field of coating compositions (CC) and its permanent prosperity and competitiveness within EU. The project counts on the formulation of antimicrobial CC containing varied kinds of nanoparticles and other additives, together with the selection of suitable assessment methods, and also the formulation of oxypolymer way of CC drying with new non toxic additives and with lower contents of volatile organic substances. Another part of the project relates to the formulation of anti corrosion CC, including the high dry matter containing CC based on polysiloxanes and water soluble CC based on hybrid binders. There will be non toxic anti corrosion pigments and fills used in these CC. Modern foaming CC, which limit fire spreading, will be developed on the basis of suitable binders, nanomaterials, and other special additives and they will be assessed. The project focuses also on the monitoring of the development in the legislature within EU.

FT-TA4/074 **“Rubberlike nanocomposites of extraordinary properties for rubber products suitable especially for the automotive and defence industries”**, 3/2007–12/2010, the researcher is Ing. Jiří Zelenka, CSc., SYNPO, a.s., Pardubice, the total costs of CZK 22.080 million, thereof CZK 11.481 million from the state budget.

(Year 2008 – 6.522/3.391, 1g)

Co-researchers:

- Gumárny Zubří, a. s., Ing. Aleš Maceček
- University of Pardubice, Faculty of Chemical Technology, doc. Ing. Ladislav Svoboda, CSc.

Objective of the project: The research of new composites containing nanoparticles of montmorillonite clay. Considering the targeted applications, it is expected that the developed nanocomposite systems will provide for significantly better barrier properties, size stability, higher solvent resistance, higher crack spreading resistance, higher thermal stress resistance, and lower inflammability. Extraordinary attention will be paid to the measuring of the final properties of modified systems with the assistance of intercalates. The research works will focus mainly on cleaning and modification of natural clays, the dispersion process, and the study of impacts of the modifying substances on the dispersion and on final properties.

FT-TA4/126 **“Research of semiconducting nanotubes for the implementation of cold-emission parts”**, 1/2007–12/2010, the researcher is Ing. Stanislav Štarman, Ph.D., STARMANS electronics, s.r.o., Praha, the total costs of CZK 18.0 million, thereof CZK 12.24 million from the state budget.

(Year 2008 – 4.500/3.060, 1a)

Co-researchers:

- Masaryk University, Faculty of Science, prof. RNDr. Josef Humlíček, CSc.
- DELONG INSTRUMENTS a.s., Brno, RNDr. Michal Drštička
- MOLECULAR CYBERNETICS, s.r.o., RNDr. Zdeněk Kváča
- Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, RNDr. Mariana Klementová

Objective of the project: The preparation of nanotube semiconducting titanates – the characterising of the chemical composition, structure, and nanomorphology – the characterising of semiconducting properties and the electron surface affinity – the construction of cold emission multipoint parts – the characterising of electron emission properties and the auto emissions – the characterising of volt-ampere and vacuum parameters, and the durability – the construction of voltage sources – the integration of voltage sources with cold emission parts.

FT-TA5/005 **"Progressive types of zeolites and their applications"**, 4/2008–12/2010, the researcher is Ing. Věnceslava Tokarová, CSc., Výzkumný ústav anorganické chemie, a.s., Ústí nad Labem, the total costs of CZK 28.500 million, thereof CZK 18.240 million from the state budget.

(Year 2008 – 9.500/6.080, 5b)

Co-researchers:

- VAKOS XT a.s., Ing. Josef Konečný
- J. Heyrovsky Institute of Physical Chemistry of AS CR, v. v. i., Praha, prof. Ing. Jiří Čejka, DrSc.

Objective of the project: The project focuses on the development of new processes for the synthesis of zeolites and nanosize crystals with inbuilt mesopores and the testing of their use in perspective catalytic reactions, among which the acylation of aromates looks currently the most interesting.

FT-TA5/007 **"Advanced research of nanomaterials for textiles"**, 3/2008–11/2010, the researcher is Ing. Antonín Mlčoch, České technologické centrum pro anorganické pigmenty a.s., Přerov, the total costs of CZK 15.320 million, thereof CZK 7.545 million from the state budget.

(Year 2008 – 4.780/2.404, 1a)

Co-researchers:

- INOTEX spol. s r.o., Dvůr Králové n. L., Ing. Lenka Martínková
- Technical University in Liberec, Faculty of Textiles, doc. Ing. Jakub Wiener, Ph.D.

Objective of the project: The research and development of the preparation of suitable modifications of transition metal oxides of photocatalytic and UV absorption properties in the form of powder materials and nanomaterials, and the development of suitable methods for their processing into fibrous materials.

4.4. PROGRAMME "IMPULS" (IM)

Projects solved in the area of nanotechnologies

FI-IM3/061 **"Preparation of conducting and semiconducting polymers doped with carbon based nanoparticles and nanotubes"**, 5/2006–12/2009, the researcher is Mgr. Václav Štengl, Ph.D., Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, the total costs of CZK 26.280 million, thereof CZK 11.880 million from the state budget.

(Year 2008 – 4.400/1.980, 1c)

Co-researchers:

- NANOGIES s.r.o., Praha, Petr Vláčil
- MEGA SYSTEM, spol. s r.o., Most, Ing. Josef Beneš
- Ing. Ladislav Horák, Praha
- University of Pardubice, FCHT, doc. Andréa Kalendová, Ph.D.

Project participant:

- IMEX International Trading and Contracting a.s., Praha

Objective of the solution: The preparation of conductive and semiconductive polymers doped with nanoparticles of the active phase of own manufacture (C, SnO_2, C-Si-P-In-Ga-As-Ge-Se, C60, C70, MWNT, and SWNT).

FI-IM3/085 **"Polyalkene based nanocomposites of extraordinary utility properties"**, 3/2006–12/2009, the researcher is Ing. Ivan Dobáš, CSc., SYNPO, a.s., Pardubice, the total costs of CZK 16.092 million, thereof CZK 5.6 million from the state budget.

(Year 2008 – 5.000/1.750, 1g)

Co-researcher:

- Tomáš Baťa University in Zlín, Faculty of Technology, Ing. Dagmar Měřinská, Ph.D.

Objective of the project: The research of new composites containing nanoparticles of montmorillonite clay. Considering the targeted applications, it is expected that the developed nanocomposite systems will provide for better barrier properties, stiffness, size stability, solvent resistance, crack spreading resistance, and thermal stress resistance. Extraordinary attention will be paid to the measuring of the final properties of modified systems with the assistance of intercalates.

FI-IM4/175 **"Research and development of a dispersion carrier in the non conducting environment for the new series of environmentally friendly paints"**, 4/2007–10/2009, the researcher is Ph.Dr. Antoním Kočař, CSc., ROKOSPOL a.s., Kaňovice, the total costs of CZK 12.666 million, thereof CZK 4.433 million from the state budget.

(Year 2008 – 1.422/0.497, 1a, the nanotechnology research share makes up 20 % of the allocated sum.)

Objective of the solution: The research and development of a suitable dispersion carrier in a non watery environment as a solvent of paints. The project focuses on the removal of negative effects of paints on the environment and on the removal of negative properties of currently common kinds of dispersions (water or synthetic). There are nanomaterials used.

FI-IM4/205 **“Nanotechnologies in medicine – a tissue carrier for the reconstructions of connective tissues”**, 3/2007–9/2010, the head researcher is Ing. Kateřina Knotková, Ph.D., CPN spol. s r.o., Dolní Dobrouč, the total costs of CZK 12.340 million, thereof CZK 4.936 million from the state budget.

(Year 2008 – 2.850/1.140, 3c)

Co-researchers:

- Charles University in Praha, 2nd Faculty of Medicine, MUDr. Milan Handl, Ph.D.
- Brno University of Technology, Faculty of Chemistry, doc. Ing. Miloslav Pekař, CSc.

Objective of the project: The reconstruction of bond tissues (joint cartilages and ligaments) after injuries or their degeneration is considered the most perspective and the most often used surgery interventions related to the locomotive apparatus. The project's objective is the improvement of surgery interventions, when scaffolds are used, even in endoscopy. The project includes the development of biodegradable scaffolds, the execution of tests on scaffolds, studies of their properties, the manufacture of a prototype, and the execution of pre clinical tests. The authors stress the simplicity and the safety of the procedure.

FI –IM5/124 **“Research of technologies for the application of new material nanolayers allowing the construction of economic and high performance sensors, regulators and action parts”**, 3/2008–12/2010, the researcher is Ing. František Veselý, SAFINA, a.s., Vestec, the total costs of CZK 10.000 million, thereof CZK 5.500 million from the state budget.

(Year 2008 – 3.700/2.035, 7c)

Co-researchers:

- TERMOSONDY Kladno, spol. s r.o., Ing. Vítězslav Hynek
- Czech Technical University in Praha, Faculty of Mechanical Engineering, prof. RNDr. Bruno Sopko, DrSc.

Objective of the project: The sub micron coatings of precious and rare metals, but also some more common metals (especially Pt, Rh, Au, Ir, Ag, REM, Sc, Ni, Cr, and Zr), carbon nanocoats (especially the DLC coats) and the X-O-C compound systems (X = Si, Ti, Zr) provide for the extraordinary and so far unsatisfactorily utilised potential, which could be useful in metallurgy and mechanical engineering, but also in physics, regulation technology, medicine, and other industries. The objective relates to the research of technologies applying nanolayers of the mentioned materials for the construction of economic and high performing sensors, regulators and action parts.

FI-IM5/231 **“Implementation of new nanostructures in nanodispersions of Ti, Cd, and Zn oxido-bisulphides as the active materials for the degradation of chemical weapons”**, 6/2008–12/2010, the researcher is Mgr. Václav Štengl, Ph.D., Institute of Inorganic Chemistry AS CR, v. v. i., Husinec – Řež, the total costs of CZK 17.150 million, thereof CZK 7.757 million from the state budget.

(Year 2008 – 5.950/2.870, 7b)

Co-researchers:

- Ing. Vladimír Havlín
- ROKOSPOL a.s., Ph.Dr. Antoním Kočař, CSc.

- VOP-026 Šternberk, s. p., Division of the Research Institute of Defence Technology in Brno, Ing. František Opluštil

Objective of the project: The synthesis of nanodispersion sulphide and Ti, Zn, and Cd oxides and their binary analogues with the method of homogenous condensing of thioacetamide and the consequent controlled annealing in the oxygen atmosphere. The prepared material samples will be characterised with the SEM methods as a standard.

Note by the translator: There have been the names of universities, their faculties and research institutes translated into English, while the names of commercial companies are presented in their original Czech forms. The academic titles are presented in their Czech forms. The English names of some projects could differ from the ones used by the research institutions, as it was impossible to check them all.

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