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NANOTECHNOLOGIES

IN THE CZECH REPUBLIC

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1. INTRODUCTION

In December 2005 and July 2008 The Czech Society for New Materials and Technologies published “Nanotechnologies in the Czech Republic", which mapped the development in the nanotechnology field in the Czech Republic from its inception at the end of the 1980s until 2005, and then until 2008. The publication which you are now holding builds on this pair. The publication presents an updated overview of the basic and applied research and development in nanotechnology and the production of specific applications in the Czech Republic in research institutes, at universities and other research workplaces from 2008–2011, continuing in following years. Private company sector involvement in this dynamic field did not escape the attention of our team of authors.

The present publication has the same structure as the previous two editions, which were prepared by the authorial team led by Ing.Tasila Prnka, DrSc. (1932–2010). It also contains chapters about education and standardisation. In addition it touches on the issue of protection of health and the environment in the research, development and production of nanomaterials.

The authors obtained their information from public sources and directly from the individual parties involved in nanotechnology in the Czech Republic. The team of authors would like to thank everyone who expressed an interest in the project for their participation and cooperation.

2. DEFINITIONS AND NOMENCLATURE

Nanosciences and nanotechnology have many more or less similar definitions. We have chosen the ones formulated in the British study "Nanoscience and Nanotechnologies: Opportunities and Uncertainties[1]" published in 2004.

Nanoscience is the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale.

Nanotechnologies are the design, characterisation, production and application of structures, devices and systems by controlling shape and size at nanometre scale.

It is important to define this interdisciplinary scientific and technological field in order to distinguish it from classic scientific and technical disciplines. For that reason words with the prefix nano– are often used, such as nanomaterials, nanomedicine, nanobiotechnology, nanoanalytics, nanoelectronics and a number of others, as well as nanochemistry and nanophysics, which may sometimes be misleading. On the other hand many authors, institutions and businesses do not use the prefix nano– in labelling their work in the field of nanometres. This makes it more difficult to identify their activities and may lead to imprecision in the research conducted here.

We have used the following nomenclature to characterise the field. This is a modified nomenclature, which was used in the 2005 and 2008 publications.

Nanotechnology – nomenclature

1. Nanomaterials
- a) Nanopowders, nanoparticles, quantum dots, nanofibres
- b) Composite materials containing nanoparticles
- c) Materials with carbon nanotubes or fullerenes
- d) Thin layers, nanolayers, and nano–coatings
- e) Nanostructural metals and alloys
- f) Nano ceramics
- g) Polymer nanocomposites, polymer nanomaterials

2. Nanotechnology for information storage and transfer, micro– and nanoelectronics
- a) Nanoelectronics, materials, and equipment
- b) Photonics
- c) Optical materials, structures, and equipment
- d) Magnetic materials and equipment, spintronics
- e) Organic photonics, bioelectronics
- f) MEMS, NEMS

3. Nanobiotechnology, nanomedicine
- a) Encapsulation of drugs
- b) Targeted drug delivery
- c) Tissue engineering
- d) Biocompatible and bioanalogical materials and layers
- e) Molecular analysis, DNA analysis

[1] "Nanoscience and Nanotechnologies: Opportunities and Uncertainties", Royal Society and Royal Academy of Engineering, 29.7.2004, www.nanotec.org.uk

f) Biological–inorganic interfaces and hybrids
g) Diagnostics and molecular recognition

4. Nanotechnology for application in sensors
a) Sensors utilising nanomaterials
b) Biomolecular sensors

5. Nanotechnology for (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 a wide range of applications
a) Self–assembly
b) Quantum physics, quantum phenomena in nanosizes, nanophysics
c) Nano– and mesoscopic systems
d) Chemical materials and processes – nanochemistry
e) Ultra–precision engineering

7. Instruments and equipment, research and application of technologies
a) Analytical instruments, methods, techniques, and research
b) Manufacture (preparation) of nanopowders (nanoparticles) and their processing
c) Equipment and methods for the creation of layers and coatings
d) Equipment and methods for the creation of objects (patterning, ECAP, fibre fabrication etc.)
e) Ultra–precision machining and nanometrology

8. **The health, environmental, ethical, social and other aspects of nanotechnologies**
a) Toxicity of nanoparticles
b) Environmental aspects
c) Social and ethical aspects
d) Standardisation
e) Patenting
f) Prognoses, foresight
g) Popularisation of nanotechnology
h) Trade in nanoproducts

3. NANOTECHNOLOGY RESEARCH AND DEVELOPMENT LABORATORIES IN THE CZECH REPUBLIC

This chapter contains characterisations of laboratories where the main activity is research and development. This involves primarily:

- Institutes of the Academy of Sciences of the Czech Republic, which are public research institutions,
- Laboratories of universities and institutions of higher education (faculties, departments, and institutes, which carry out research and development in parallel with pedagogical activities),
- Government ministry subsidized organisations, which carry out research and development in parallel with other activities,
- Private sector research organisations.

3.1 LABORATORIES OF THE ACADEMY OF SCIENCES OF THE CZECH REPUBLIC

The Academy of Sciences of the Czech Republic (AS CR) was founded by Act No. 283/1992 Coll. as the Czech successor to the former Czechoslovak Academy of Sciences. It is a network of 53 public research institutions and three service worksites, including the Head Office AS CR. More than half of the seven thousand employees working there are university–educated scholars.

The main mission of the Academy of Sciences and its laboratories is to carry out basic research in a broad spectrum of the natural, applied, and social sciences, and in the humanities. This research – whether highly specialized or interdisciplinary in nature – is striving towards the advancement of knowledge at the international level, while also respecting the current needs of Czech society and culture. The laboratories of the Academy of Sciences take part in education mainly through the training of young scholars participating in doctoral study programmes as well as through the pedagogical activity of Academy workers at institutions of higher learning. The Academy is also developing cooperation with applied research and industry. A series of joint international projects and exchanges of workers with foreign partner institutions are strengthening the integration of Czech science into an international context.

A conducted survey has shown that 29 institutes (i.e. 4 more institutes than in 2008) and the Technology Centre AS CR are currently working on nanotechnology research with varying degrees of intensity.

Institutes dealing with nanotechnologies are listed below in alphabetical order.

3.1.1 INSTITUTE OF BIOPHYSICS AS CR, a public research institution (IBP)

Královopolská 135, 612 65 Brno, ID: 68081707

www.ibp.cz

A brief description of the Institute

The Institute was created on 1 January 1955 from the Biophysics Laboratory of the Czechoslovak Academy of Sciences. On 1 January 2007, the Institute became a public research institution. The Institute's main area of activity is research on the structure, function and dynamics of biological systems (biomolecules, cell organellas, cells and cell populations) using methods of molecular biology, biophysics, biochemistry and bioinformatics. Through its activities, the Institute contributes towards raising the level of knowledge and learning, development of biotechnologies, and transfer of research results into practice, especially in the area of clinical medicine.

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

- Biophysical Chemistry and Molecular Oncology (director: M. Fojta)
- Structure and Dynamics of Nucleic Acids (J. Šponer)
- Molecular Biophysics and Pharmacology (V. Brabec)
- CD spectroscopy of Nucleic Acids (M. Vorlíčková)
- Molecular Epigenetics
- Molecular Cytology and Cytometry (S. Kozubek)
- Plant Developmental Genetics
- Cytokinetics (A. Kozubík)
- Free Radical Pathophysiology (A. Lojek)

Focus of research and development

Molecular biology, biotechnology, genomics and proteomics, and other bio–sciences. Several of the aforementioned topics belong to the area of nanosciences, nanobiotechnology, and nanomedicine.

In recent years, research at the Institute of Biophysics AS CR has concentrated mainly on questions arising from two research proposals:

AV0Z50040507 – **"Biophysics of dynamic structures and functions of biological systems,"** 1/2005–12/2010; Principal investigator: prof. RNDr. Stanislav Kozubek, DrSc., total costs for the entire study period: CZK 609,202,000, CZK 608,522,000 of which came from the state budget. Classification – area 3, share of nanotechnology research – 40%.

The research focused on relationships between the primary structure of DNA and their conformation properties with respect to the evolution of genomes, interaction of DNA with proteins (histones, HMG proteins, oncoproteins) and with antitumor active ingredients containing metals, interaction of DNA and proteins in interphases in relation to electrochemical sensors for genomics and proteomics, on the architecture of the cell nucleus, the arrangement and modification of chromatin, the structure and function of nucleoproteins

and telomeric complexes, the dynamics of genomes and of genome territories, relationships between gene expression, cellular differentiation, oncogenic transformation, and oncogenetic development, the influence of endo– and exogenous mediators modifying proliferation, differentiation, and apoptosis in cell populations, computer simulations of dynamic structures, and interactions of DNA/RNA with proteins and biologically active substances. The applications are directed towards medicine, agrobiology, ecotoxicology, and biotechnologies.

AV0Z50040702 **– "Genome and Epigenome: 1D and 3D Structure, Dynamics, Interactions with Proteins and Functions,"** 1/2007–12/2013; Principal investigator: prof. RNDr. Miroslav Fojta, CSc., total costs for the entire study period from the state budget: CZK 559,847,000. Classification – area 3, share of nanotechnology research – 10%.

The research is focused on the study of the molecular and spatial structure of the genome, the effect of epigenetic variations on arrangement of the genome in the cell nucleus, dynamics of the genome, epigenome and proteome during the cell cycle, and differentiation and malignant transformation of the cell. The mechanisms of epigenetic control of gene expression and role of the epigenome in heredity of the transcriptional profile and its changes in differentiation, ontogenesis and external (physical and chemical) factors at the level of the genome, epigenome, transcriptome, proteome and metabolome are being investigated. The results from carrying out the research proposal will find applications mainly in biomedicine, agricultural biotechnologies, and ecotoxicology.

In 2011, the Institute worked on a total of 74 programme research projects.

Selected areas of research related to nanotechnologies

- The application of new electrochemical methods combined with diffractive optical methods for the targeted creation of nanometric adsorbed layers of biomolecules on materials;
- The development of auxiliary electrochemical equipment (developed in the laboratory, for example, is the inverse microliter chemical cell for amplification of oligonucleotides);
- Diffractive optical studies of the phenomenon of adsorption/desorption and of the structure of adsorbed layers of proteins in modern materials usable in biomedicine (with regard to their surface modification);
- Study of the interaction of proteins with electrically charged surfaces; applications for the electrochemical analysis of proteins;
- Construction of designated/functionalized nucleic acids; Principal insertion of modified nucleotides into nucleic acids; application in a sequentially specific imaging of DNA (in cooperation with the group of prof. M. Hocek from the Institute of Organic Chemistry and Biochemistry AS CR in Prague);
- Microfluidic equipment for analyzing unmodified and designated (derived) biopolymers;
- Application of magnetic separation technologies for detection of nucleic acids and proteins;
- Research on self–assembled monolayers of nucleic acids modified with thiol on mercury and amalgam electrodes; formation of layers distinguishing bio–entities;

- Research focusing on the determination of molecular mechanisms of the anti–tumor effect of nanophamaceuticals.

Research on the character of nanobiotechnologies is being conducted mainly at the Laboratory of Biophysical Chemistry and Molecular Oncology (M. Fojta, S. Hasoň, V. Ostatná, V. Vetterl, P. Kostečka, E. Paleček, F. Jelen, L. Havran, S. Kozubek) as well as at the Laboratory of Molecular Biophysics and Pharmacology (V. Brabec, J. Kašpárková, E. Paleček, J. Šponer) and the Laboratory of Cytokinetics (A. Kozubík).

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project AS CR IAA400040804 – "Application of electrochemical methods focused on the microanalysis of nucleic acid bases and oligonucleotides," 2008–2010; Principal investigator: RNDr. František Jelen, CSc.

- Project GA CR GD204/09/H002 – "Developmental biology and genetics of plants," 2009–2012; Principal investigator: prof. RNDr. Boris Vyskot, DrSc., Co–principal investigator: prof. RNDr. Ladislav Havel, CSc., Mendel University in Brno/Faculty of Agronomy

- Project AS CR KAN200040651 – "Electrochemical and optical analysis of biomacromolecules at the microelectrodes modified by electroactive nanolayers," 2006–2010; Principal investigator: Mgr. Stanislav Hasoň, 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," 2008–2010; Principal investigator: prof. RNDr. Vladimír Vetterl, DrSc.

- Project GP203/08/P598 – "Electrochemical tools for the detection of mutations and polymorphisms in DNA," 2008–2010; Principal investigator: Mgr. Pavel Kostečka, Ph.D.

- Project Ministry of Education LC06035 – "Centre for Biophysical Chemistry, Bioelectrochemistry, and Bioanalysis. New Instruments for Genomics, Proteomics, and Biomedicine," 2006–2011; Principal investigator: as.prof. RNDr. Miroslav Fojta, CSc.

- Project GA AS CR IAA400040804 – "Application of electrochemical methods focused on the microanalysis of nucleic acid bases and oligonucleotides," 2008–2010; Principal investigator: RNDr. František Jelen, CSc.

b) *Projects on which the Institute has cooperated or is cooperating:*

- Project AS CR KAN400310651 – "Nanoparticle and supramolecular systems for targeted transport of therapeutic drugs," 2006–2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for the Institute of Biophysics: prof. RNDr. Viktor Brabec, DrSc. The Institute's task was the study of interaction of nanopharmaceuticals with biomacromolecules.

Results in nanotechnologies/cooperation

- Cooperation with the company HVM PLASMA, spol. s r.o., Prague, which is preparing appropriate, modern materials for basic research on adsorption and desorption with various surfaces treatments and structures with adsorbed biofilms of proteins usable in dentistry.
- The goal of cooperation with the company Zentiva, a.s., Prague, a potential user of the results, is to design, prepare and test new systems for targeted transport of nanopharmaceuticals.

Experts/field

- prof. RNDr. Viktor Brabec, DrSc. – molecular biophysics and pharmacology
- as.prof. RNDr. Miroslav Fojta, CSc. – Chemical modification of nucleic acids and proteins, construction of designated/functionalised nucleic acids, hybridisation of DNA, damaging of DNA, interaction of DNA with small molecules, interaction of DNA – protein, interaction of nucleic acids with electrically charged surfaces, development of biosensors, technologies of magnetic particles
- Mgr. Stanislav Hasoň, Ph.D. – physics of biopolymers, interactions of biomolecules with surfaces, analysis of the structure of surfaces, diffractive optical sensors
- as.prof. RNDr. Jana Kašpárková, Ph.D. – biochemistry, molecular biology, and pharmacology
- as.prof. RNDr. Stanislav Kozubek, DrSc. – molecular cytology and cytometry, radiobiology, biology of tumors, director of the Institute
- as.prof. RNDr. Alois Kozubík, CSc. – cytokinetics, cellular oncology, cytostasis based on metals, emulsion of lipids
- prof. RNDr. Emil Paleček, DrSc. – chemical reactivity of nucleic acids, interaction of DNA with proteins, electrochemistry of proteins and nucleic acids, self–assembled monolayers of DNA and proteins on electrodes
- as.prof. RNDr. Jirí Šponer, DrSc. – structure, dynamic and molecular interaction of RNA and DNA
- prof. RNDr. Vladimír Vetterl, DrSc. – physics of biopolymers, interactions of biomolecules with surfaces, impedance spectroscopy, nanobiotechnology

3.1.2 BIOLOGY CENTRE AS CR, a public research institution (BC)

Branišovská 1160/31, 370 05 České Budějovice, ID: 60077344

www.bc.cas.cz

A brief description of the Centre

The Centre's main area of activity is scientific research in the areas of general and applied entomology and related fields, hydrobiology–limnology and related fields, parasitology and related fields, molecular and cellular biology, genetics, physiology and pathogens of plants,

soil zoology, soil microbiology, soil chemistry, soil micromorphology and ecology and the use of knowledge gained for the protection of nature and the environment, in agriculture, water management, forestry, and medicine. The Biology Centre was created on 15 December 2005 **by the merger of five scientific institutes AS CR in České Budějovice** with the Joint Technical and Managerial Administration of Biology Laboratories AS CR, and at the time the name was changed to the Biology Centre AS CR, a public research institution. The Biology Centre AS CR has the following organisational components:

- Institute of Entomology
- Institute of Hydrobiology
- Institute of Parasitology
- Institute of Plant Molecular Biology
- Institute of Soil Biology
- Technical and Administrative Service

The director of the Biology Centre AS CR is prof. RNDr. František Sehnal, CSc.

In 2011, there was work at the Centre on 135 programme research projects. Research activity in nanobiotechnology has been identified at the Institute of Parasitology and at the Institute of Plant Molecular Biology.

3.1.2.1 Biology centre AS CR, Institute of Parasitology

www.paru.cas.cz

A brief description of the Institute

The Institute is active in the fields of protozoology, helmintology, and acaroentymology, including the study of certain agents of diseases transmitted by arthropods. It focuses mainly on:

- Diversity, phylogenesis, and pathogenicity of fish parasites
- Molecular biology and functional genomitics of parasitic protozoa and nematodes
- Biology of disease vectors and molecular interaction during the transmission of pathogens
- Molecular taxonomy, phylogenesis of parasites, and their coevolution with hosts
- Parasitic protozoa of humans and livestock, with an emphasis on agents of opportunistic diseases

The Institute is divided into six departments, which are further divided into thirteen laboratories. Research in the area of nanotechnologies is conducted mainly at the Electron Microscopy Laboratory (J. Nebesářová).

Focus of research and development

From 2005 to 2010, research at the Institute of Parasitology focused mainly on the issues of one research proposal and three programme research projects. In the area of nanotechnologies and microtechnologies, the Institute's workers are focusing mainly on new discoveries about studied objects, such as during the use of the technique of

immunolocalisation of cellular components at the electron microscopic level, finding new immunolocalisation procedures with the use of a scanning electron microscope with a self–emitting nozzle operating in the cryo regime and using low–voltage electron microscopy for biological preparations.

Project implemented in nanotechnologies

- Cooperation on project AS CR, "Nanotechnology for Society" programme, KAN200520704 – "New Nanoparticles for Ultrastructural Diagnostics," 01/2007–12/2011; Principal investigator: as.prof. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics AS CR, Prague; Principal investigator for the Institute of Parasitology: 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–definition electron microscopy

3.1.2.2 Biology centre of the AS CR, Institute of Plant Molecular Biology

www.umbr.cas.cz

A brief description of the Institute

The Institute's research activities range from plant molecular biology to agroecology studies. The activities focus mainly on the genetic engineering of plants, molecular genetics and cytogenetics, diagnostics of plant viruses and viroids, biophysics, and the physiology of photosynthesis. The Institute also takes part in applied research in the area of plant biotechnologies. The Institute is divided into five departments.

- Gene manipulation (department head: J. Bříza)
- Molecular cytogenetics (J. Macas)
- Molecular genetics (J. Matoušek)
- Photosynthesis (F. Vácha)
- Virology of plants (K. Petrzik)

Research in the area of nanobiotechnologies is conducted to a limited extent mainly in the Photosynthesis and Plant Virology departments.

Focus of research and development

From 2005 to 2010, research at the Institute focused mainly on the problems of a single research proposal encompassing elements of nanobiotechnology and on 5 programme research projects. Research proposal AV0Z50510513 – "**Research on molecular organisation of plants and their pathogens, induction and analysis of targeted changes in genome and plastome and study of photosynthesis processes and heritability in**

interaction with environment and pathogens," 1/2005–12/2010; Principal investigator: prof. Ing. Josef Špak, DrSc., total costs for the entire study period: CZK 216,985,000, CZK 197,549,000 of which came from the state budget. Classification – area 3, share of nanotechnology research – 10%.

The subjects of the proposed research were:

1) Molecular organisation of plant genomes and chromosomes and mechanisms of gene expression: sequencing repetitive DNA of legume genomes; genetic and physical mapping; functional genomics, transgenosis and molecular biodiversity of flax, hops, Arabidopsis; analyzing structure and function of chimeric cellular RNAs, aberrant RNAs and dsRNAs in relation to gene expression; genome and plastome transformation for nuclear gene expression, photosystem II function and foreign protein production,
2) Molecular plant–pathogen interactions: genomic variability, structural and functional features of viruses, viroids, and phytoplasmas; mechanisms of gene silencing and antisensing; development of high–throughput detection of pathogens,
3) Photosynthesis research: primary processes of light energy transformation into energy of chemical bonds; structure and function of the reaction centre complex of photosystem II; gas exchange and carbon dioxide fixation effects on regulation of photosynthesis.

Research in nanotechnologies

At the Virology of Plants Department, in the area of diagnostics and molecular differentiation, work is being carried out on the problem of development of biomarkers for the detection of fruit viruses with the use of array technologies. The Department of Photosynthesis is studying the molecular mechanisms of photosynthesis and the structures of the photosynthetic apparatus. Single molecules are being subjected to spectroscopy.

Experts/field

- prof. Ing. Josef Špak, DrSc. – virology
- as.prof. RNDr. František Vácha, Ph.D. – biochemistry, biochemistry and biophysics of photosynthesis, single molecule spectroscopy, kinetic spectroscopy

3.1.3 INSTITUTE OF BIOTECHNOLOGY AS CR, a public research institution (IBT)

Vídeňská 1083, 142 20 Prague 4, ID: 86652036

www.ibt.cas.cz

A brief description of the Institute

The IBT was founded on 1 January 2008 by the splitting off of the Biotechnology Sector from the Institute of Molecular Genetics AS CR. The IBT has seven scientific laboratories:

- Laboratory of Diagnostics for Reproductive Medicine – (director: J. Pěknicová)
- Laboratory of Ligand Engineering – (P. Šebo)
- Laboratory of Diagnostics of Autoimmune Diseases – (Š. Růžičková)

- Laboratory of Molecular Therapy – (J. Neužil)
- Laboratory of Chemical Genetics – (P. Bartůněk)
- Laboratory of Gene Expression – (M. Kubista)
- Laboratory of Structural Biology – (C. Bařinka)

The director of the Institute is prof. RNDr. Jana Pěknicová, CSc.

Focus of research and development

Research in the area of the preparation of transgenic production cell lines, animals and plants, molecular foundations of serious inflammatory, tumorous, and infectious illnesses, biochemistry and cellular biology of reproduction, biology of the effect of substances on cell function, biochemistry of protein interactions, genetic, cellular and protein engineering, and cell immunology. Under development in this connection is research on the bond interactions between proteins, diagnostic principles based on polymerized chain reactions, the interaction of cytokines with receptors, and T lymphocyte responses to vaccinations. Also the subject of research are procedures leading to the preparation of recombinant diagnostic and therapeutic proteins. In 2011, work was carried out at the Institute on 23 programme research projects and the research proposal identified below:

AV0Z50520701 **– "The Building of the Institute of Biotechnology AS CR,"** 1/2007–12/2013; Principal investigator: Ing. Peter Šebo, CSc., which also contains solutions to problems relating to nanobiotechnology. Classification – area 3, share of nanotechnology research – 10%.

The main goal of the research proposal is to build the foundation of a new, separate Institute of Biotechnology AS CR (IBT AS CR), the main task of which will be concentrated, biologically oriented, applied research and development in close cooperation with implementing organisations. The goal is to achieve significant results with applications primarily in the following subject areas: Diagnostics for reproductive medicine; development of recombinant antigens, vaccines, antibodies, and other diagnostic and therapeutic agents; development of advanced analytic and preparative methods for practical biotechnological applications; applied chemical genetics; preparation of transgenic animals. Two projects of the programme "Nanotechnology for Society" have been coordinated at the Institute.

The Institute is involved in the building of the **BioCev Centre of Excellence**. At a cost of CZK 3.2 billion during the years 2011–2015, the project's goal is to build a centre for excellent research in the Central Bohemian town of Vestec. The research will focus on detailed study of cellular mechanisms at the molecular level, research on and development of new therapeutic procedures, prompt diagnosis, biologically active substances including chemotherapy agents, natural antibiotics, development of tissue for the repairing of damaged organs, protein engineering, and other technologies. More information is available at www.biocev.eu.

Projects implemented in nanotechnologies

- Project AS CR KAN200520702 – "Nanoimmunosensors for cytokine detection," 1/2007–12/2011; Principal investigator: Ing. Peter Šebo, CSc.
- Project AS CR KAN200520703 – "Use of ultrasound in nanomedicine," 1/2007–12/2011; Principal investigator: as.prof. Ing. Jiří Neužil, CSc.

Experts/field

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

3.1.4 INSTITUTE OF BOTANY OF THE AS CR, a public research institution

Zámek 1, 252 43 Průhonice, ID: 67985939

www.ibot.cas.cz

A brief description of the Institute

The Institute of Botany AS CR was founded in 1962. The Institute has a park in Průhonice with an extensive collection of domestic and introduced plant life. Covering an area of 618 acres, this English natural landscaping park was founded in 1885 by Count A. E. Silva–Tarouca. The Institute has two scientific research departments, one in Průhonice and the other in Třeboň, South Bohemia.

Focus of research and development

Research is conducted on vegetation at the level of organisms, populations, communities, and ecosystems. The Institute's scientific tasks mainly involve **taxonomy, biosystematics,** and the evolution of vascular and non–vascular plants including selected groups of fungi (the projects *Flora of the Czech Republic* and *Atlas of the Distribution of Individual Species*, the study of plants that reproduce by non–sexual means, and cooperation on study of flora from various parts of Europe), **phycology** (the study of cyanobacteria, ecological and ecotoxicological aspects of their development, the function of individual groups of algae in stands with extreme conditions), **ecology of plants**(the study of meadow systems, the ecology of roots, relationships between plants and soil fungi, comparative ecology of closely related species, research on plant invasions, the dynamics of vegetation on anthropogenic stands, mapping of epiphytic lichens and the study of the influence of emissions), **dendrochronology, paleoecology and geobotany**(coordination of the Czech portion of Europe–wide synthesis of plant communities, participation in completion of the text portion of a geobotanical map of Europe, and a new version of a map of potential vegetation, vegetation, and flora of the Křivoklátsko Protected Landscape Area).

In 2011, the Institute worked on 61 programme research projects.

Project implemented in nanotechnologies

- Project Technology Agency of the Czech Republic TA01010356 – "Appropriate materials for nanotechnology applications for purifying and treating water and air," 2011–2014; Principal investigators: Ing. Karel Plotěný, Ing. Marek Holba, Ph.D., ASIO, spol. s.r.o., Co–principal investigator for the Institute of Botany AS CR: Ing. Miroslav Plotěný.

3.1.5 GLOBAL CHANGE RESEARCH CENTRE AS CR, A PUBLIC RESEARCH INSTITUTION (GCRC)

Bělidla 4a, Brno, 603 00, ID: 67179843

www.czechglobe.cz

A brief description of the Institute

The Institute was founded on 1 April 1993. It is the successor for part of the research activity of the former Institute of Systematic and Ecological Biology of the Czechoslovak Academy of Sciences in Brno and of the Institute of Landscape Ecology of the Czechoslovak Academy of Sciences in České Budějovice. On the basis of an evaluation and of changes to the main fields of research activity, in 2005 the Institute was renamed the Institute of Systems Biology and Ecology AS CR, and from 1 March 2011 it was renamed the Global Change Research Centre AS CR, a public research institution.

Focus of research and development

The main area of activity is comprehensive scientific research focused on the issues of global change and their manifestations in the atmosphere, terrestrial biota, and human society. The centre also uses tools based on an interdisciplinary approach, and it is developing new techniques and procedures. In 2011, there was work at the centre on 42 programme research projects. The Institute's primary project is a part of the Research and Development for Innovations Operational Programme (VaVpI) – European Centres of Excellence – "**CzechGlobe – Centre for Global Climate Change Impacts Studies**," ED1.1.00/02.0073, project implementation period: 2010–2014; budget: CZK 648 million, director of the centre: prof. RNDr. Ing. Michal V. Marek, DrSc.,http://www.czechglobe.cz. Its goal is the building of infrastructure for research and the realisation of four research programmes:

- The development of tools for modelling climatic extremes, tools for construction of local climate change scenarios, development of a regional climate model with very high spatial differentiation, and creation of a regional spatial study of the impact of global climate change on managed ecosystems

- The development of methodologies for increasing the ability of ecosystems to bind CO_2 from the atmosphere on the basis of long–term monitoring of greenhouse gasses, a methodology for a measure for limiting the negative impacts of global climate change on the hydrological and biogeochemical cycles of forest watersheds, the development of methods for remote sensing of the Earth for the purpose of creating a map of biochemical and biophysical parameters of vegetation and of ecosystems as indicators of processes of the carbon cycle and the effect of stress factors, and the development of methodologies for the limitation of the negative impacts of global climate change on biodiversity

- Methodologies of managing the adaptation and regulatory mechanisms of plants relating to the impacts of global climate change to the extent of reducing the vulnerability of ecosystems to changes taking place. The development of optical diagnostic methods intended for prompt diagnosis of stress, identification and use of metabolites with a biological effect as anti–stress substances, growth regulators, substances indicating resistance, antioxidants etc.

- Creation of tools and indicators for analysis of the impacts of global climate change on socioeconomic systems and prediction of the impacts of attenuation and adaptation measures.

Project implemented in nanotechnologies

- Project GA CR GAP503/11/2263 – "Magnetic nano– and microparticles for advanced membrane water treatment," 2011–2013; Principal investigator: prof. Ing. Ivo Šafařík, DrSc.

3.1.6 INSTITUTE OF PHYSICS AS CR, a public research institution (FZU)

Na Slovance 2, 182 21 Prague 8, ID: 68378271

www.fzu.cz

A brief description of the Institute

The Institute was founded on 1 January 1954 from the Nuclear Physics Laboratory of the Czechoslovak Academy of Sciences and the Experimental and Theoretical Physics Laboratory of the Czechoslovak Academy of Sciences, which had been established on 1 January 1953. In 1979, it was merged with the Low Temperature Physics Laboratory and with the Solid Substance Physics Institute of the Czechoslovak Academy of Sciences, which had been established before World War II as the Research Institute for the industrial concern Škoda Works. On 1 January 2007, the Institute became a public research institution.

The Institute's research programme includes elementary particle physics, physics of condensed systems, and plasma and optical physics. It focuses in particular on the following areas of research: mathematical physics, quantum thermodynamics, structure of elementary particles, diagnostics of plasma, detectors of particles, properties of substances with varying types and degrees of arrangement, surfaces, and interfaces in solid substances, quantum dimensional phenomena, quantum fluids, superconductivity, phase transitions, traditional and modern technologies for the preparation of crystals and thin layers, nonlinear and quantum optics, and special optical equipment.

The research is organized into six areas:

- Elementary particle physics (department head: P. Reimer)
- Condensed substances (V. Janiš)
- Solid substance physics (J. Mareš)
- Optics (A. Dejneka)
- High–power systems (J. Krása)
- ELI Beamlines project implementation (V. Růžička)

The director of the Institute is as.prof. Dr. Jan Řídký, CSc.

These areas are divided into 25 research divisions, which are further divided into laboratories or groups. Several teams of investigators are involved in research in the area of the nanosciences (nanophysics) and nanotechnology. The Institute is a coordinating MOSFET

worksite and is the initiator and coordinator of the Czech Nanoteam virtual centre for nanostructure physics.

Focus of research and development

From 2005 until 2010, research at the Institute of Physics AS CR was focused mainly on the carrying out of five research proposals, three of which concentrated to a certain extent on nanotechnologies, and in 2011 it worked on 259 programme research projects. The goals of implemented research proposals focusing on nanotechnologies to which current activities are also related are as follows:

AV0Z10100520 – "**Specific phenomena in condensed systems with a reduced space dimension and disturbed symmetry**," 1/2005–12/2010; Principal investigator: Milada Glogarová, CSc., total costs for the entire project period: CZK 806,003,000, of which CZK 805,091,000 was from the state budget. Classification – area 6b, share of nanotechnology research – 100%.

The subject matter of the activity was the study of dynamic and cooperative phenomena in condensed substances with noteworthy disruption of symmetry caused by reduced dimensions, defects, and irregularities of spatial arrangement (thin layers, superlattices, grain, domain and phase boundaries, impurities, clusters, nanocomposites, liquid crystals). There was study of the influence of electron correlations, admixtures, and inhomogeneities on formation of the electron structure of materials with complex crystalline structure. There was study of the dynamics of dielectric response of materials with noteworthy dielectric properties, as well as of the mechanical and structural properties of grain boundaries in selected metal polycrystals and phase transformations in intermetallic alloys with shape memory (high–temperature alloys, magnetic alloys etc.) in a polycrystalline state. Also studied is the structure of nanocrystalline metal materials, including the presence of microruptures and residual deformations, changes to the lattice parameter and structure of grain boundaries, which differ in these materials from the structures in usual polycrystals. Systems with noteworthy magnetic cooperative properties are prepared and tested. In the theoretical part of the proposal, the goal is a comprehensive microscopic description of the electronic and atomic properties of systems with a non–trivial structure, disrupted symmetry, reduced dimensions, or under extreme conditions, both in a state of thermodynamic equilibrium and outside of that state. On the one hand, taken as a departure point is the fundamental theory of electron and atomic processes described qualitatively by microscopic models of specific aspects of solid substances, while on the other hand, there is an attempt at the application of basic theory in the sphere of material research, which requires realistic calculations for concrete systems. The knowledge gained should be a foundation for further development of materials with required properties or of functional materials using the characteristic changes of their properties caused by external conditions.

AV0Z 10100521 **– "Physical properties and the preparation of nanostructures, surfaces, and thin layers,"** 1/2005–12/2008; Principal investigator: RNDr. Antonín Šimůnek, CSc., 1/2009–12/2011; RNDr. Jiří J. Mareš, total costs for stage one of implementation: CZK 1,051,394,000, CZK 1,050,027,000 of which came from the state budget. Classification – area 6b, share of nanotechnology research – 100%.

The main activity of the research proposal focused on scientific investigation of new forms of solid substances, the properties or behavior of which are determined to a decisive extent either by their surfaces or by their nanometric, layered, or aperiodic structure. Worldwide trends of research on such materials are strongly influenced not only by already successful or

at least promising practical applications, but also by a range of newly discovered physical phenomena. For research on these modern materials, the laboratory has created appropriate conditions given by many years of previous successful experimental and theoretical study of semiconductors and magnetic materials. The realisation of the research proposal represents the purposeful combination of advanced technologies for the preparation of the researched materials, unique methods for their experimental study in a wide range of external conditions, and the theoretical development of the acquired knowledge with the help of microphysical theoretical models and of *ab initio* calculations. The subject matter of the research activity focused on three topical directions (I, II and III):

I

The study of surfaces and of growth of thin layers and of nanostructures, especially of ceramics and diamonds, and also of scintillators, the determination of their microstructure with nanometric resolution, and the study of the influence of microstructure on transport and optical properties.

- Research on thin layers of Si focuses on the growth of micro– (nano–)crystalline Si, especially at low temperatures of deposition, the creation of a predictive model and its use for verifying the possibility of realizing non–traditional types of photovoltaic cells, and also on the possibility of use of these materials for nanolithography. Si nanostructures, whether prepared in the form of thin layers from nanoparticles obtained by photochemical etching or implantation of Si ions, e.g. on Infrasil, are studied with a focus on verifying the existence of optical gain and the subsequent possibility of preparing a silicon laser for ceramic nanophotonics.
- Important as a subject of study are the surfaces of semiconductors, their reconstruction at the atomic level, and the diffusion of adsorbed atoms. Scanning tunnelling microscopy is used, and observed topographic formations are characterized by the local density of electron states in real space, which definitively determines future applications in nanotechnologies. Scanning tunnelling microscopy enables chemical identification of observed objects, which will be interpreted by models and *ab initio* calculations as part of a DFT formalism.
- A diamond is prepared in the form of homoepitaxial and heteroepitaxial layers. There is study of structural, electron, and spectroscopic properties at an atomic scale, and there is optical and electrical characterisation of layers, spectroscopy of defects and admixtures in diamond layers including the macroscopic characterisation of samples. On the basis of diamond layers, electronic components (e.g. detectors) and bioactive surfaces for DNA biochips are prepared, with biosensors in the foreseeable future.
- On selected scintillating materials, there is study of the process of transmission and capture of energy, stability of materials under the conditions of scintillation conversion, and the influence of material defects. Methods used include time–differentiated spectroscopy and EPR, mostly on monocrystals of complex fluorides and oxides with a broad band gap, including modelling of the dynamics of excited states of luminescent centres.

II

Semiconductor structures on the basis of AIIBV compounds, and in particular, research on nanostructures, systems with reduced dimensions, and diluted ferromagnetic semiconductors.

The research included:

- Optimisation of growth of structures of required parameters of prepared MBE technologies, or MOVPE.
- Experimental study of electrical, optical, and magnetic properties of samples prepared from these structures. With nanostructures and low dimensional systems, this mostly involves luminescence spectroscopy and electron transport or magnetotransport and cyclotron resonance; with ferromagnetic semiconductors, transport measurements are accompanied by magneto–optical experiments and the study of magnetisation and magnetic susceptibility.
- A comprehensive quantitative theoretical description is made of observed phenomena in the context of quantum electrodynamics. For ferromagnetic semiconductors, there is development of the established method based on the model of magnetic interaction between local spin admixtures mediated by mobile carriers in the valence band of a semiconductor.
- Research on nonmagnetic nanostructures focuses on potential future applications in optoelectronics, while diluted ferromagnetic semiconductors will find applications in spin electronics (spintronics). The established method allows the quantitative modelling of spintronic functions associated with such phenomena as giant magnetoresistance, current–induced change of magnetisation, Kerr and Faraday rotation etc. Preliminary studies show that in semiconductors of this kind, these phenomena may be more powerful by several orders of magnitude than in traditional metal ferromagnetic materials.

III

Crystal structure, magnetic, and transport properties of selected materials.

The research focused on:

- Layered, nanosegmented, and special complex oxides and intermetallic compounds that exhibit a strong reaction to changes of external thermodynamic conditions and that are studied in combined extreme conditions, i.e. under very low and very high temperatures, high external pressures, and strong magnetic fields.
- In the nanostructures of superconductors, there is experimental and theoretical study of superconducting vortices, and *ab initio* and modeled calculations will be made of the electron structure of the system with strong electron correlation.
- Development of the methods of calculations of electron states from first principles based on spin density function theory, and in particular, methods appropriate for systems with strong correlation, where former approaches do not provide satisfactory agreement between theory and experimentation. In parallel with electron structure, there is experimental and theoretical study of the real structure of materials by diffractive and spectroscopic methods. Methods are being developed for the description of x–ray absorption spectra (XANES) for the purpose of structural analysis of clusters (cluster size, influence of the shape and surface of the cluster).

- Generalizing of discontinuous modulation functions for cases exhibiting one–dimensional modulation to two– or three–dimensional modulation. It has been shown that the high degree of symmetry of certain substances leads to the incidence of several modulation vectors.
- Introduction of a general multiphase description for analysis of the structures of materials composed of multiple phases.

Research activity carried out on these materials at the atomic level together with theoretical models and calculations maked possible not only analysis and interpretation of experimental data, but also the prediction of physical properties of the studied systems. Opening up new possibilities for solid substance physics will be the launch of full operations of the Czech Measuring Station at the Elettra synchrotron in Trieste.

AV0Z10100522 **– "Wave and Corpuscular Light Propagation, Optical Materials and Technology,"** 1/2005–12/2011; Principal investigator: as.prof. Dr. Jan Řídký, CSc., total costs for the entire study period: CZK 483,909,000, of which 463,618,000 came from the state budget. Classification – area 6b, share of nanotechnology research – 70%.

The plan was to study the properties of classical and quantum aspects of the propogation of light, optical materials, layered structures, and optical systems and technologies. In classical optics, the work focuses mainly on interferometry, holography, coherence and statistical behavior of light bundles, and fractal optics. In the area of quantum optics, various types of sources of quantum correlated photon pairs have been constructed, and in quantum information science, work has concentrated on the measurement of overlaps, fidelity, and purity of quantum states. For optical materials, research on selected multiple doped oxidic crystals with high polarisation and nano–structured materials concentrated primarily on anomalous behavior of optical characteristics in the vicinity of phase transitions. Optical technologies comprised a study of the physical principles of non–traditional optical and opto–plasmatic technologies suitable for preparation of new types of functional optical thin layered systems and nano–structures. In X–ray optics, work focused on crystal optics for synchrotron radiation.

In connection with nanotechnologies, there was study of the physical properties of thin layers prepared with the use of variously modified low–temperature plasmatic technologies. This mainly involved thin layers, multiple–layer systems or nanostructures intended for research and applications in optics or optoelectronics. Research was conducted on the basic micromechanical parameters of optical functional thin–layer systems, nanocomposites, interfaces, and nanostructured surfaces. Experimental research was concentrating mainly on structures prepared on the basis of various forms of doped carbon or perovskite oxides, including the study of processes of diffusion and adsorption on defined surfaces. Research was concentrating mainly on the following forms of optical materials: crystals, textures, ceramics, thin layers and their systems, interfaces, subsurface layers and surface structures, nanocomposites, nanoparticles and nanoporous systems, the formation of nanocrystalline, nanocomposite, and gradient layers of new and promising materials in a reactive surrounding environment. There was study and optimisation of the deposition process with the goal of creating stechiometric and crystalline layers at low deposition temperatures, on large area substrates (on the order of 3x3 cm2), with thickness inhomogeneity less than 10%.

Centre of Excellence: ELI (Extreme Light Infrastructure)

Total costs: CZK 6.8 billion

Project implementation: 2011–2015

Recipient: Institute of Physics AS CR, a public research institution

The chief coordinator of the project is the Institute of Physics AS CR, a public research institution.

The project partners are:

- the Ministry of Education, Youth, and Sports of the Czech Republic
- the Academy of Sciences of the Czech Republic
- the ELI–CZ consortium (coordinating Czech universities and research institutes interested in the ELI project)
- the Ministry of Foreign Affairs of the Czech Republic

Steering committee:

as. prof. Jan Řídký, DrSc. – director of the Institute of Physics AS CR

prof. Ing. Vlastimil Růžička CSc. – executive director of ELI Beamlines

The project Extreme Light Infrastructure (ELI) is a part of the European plan for building the next generation of big research facilities, which have been included in the roadmap for the European Strategy Forum on Research Infrastructures (ESFRI). Participating in the preparatory phase of the project were over forty institutions from 13 EU countries.

The main goal of ELI is the building of modern, new–generation laser facilities and the realisation of a number of research and application projects including the interaction of matter with a light pulse of an intensity that is many times greater than the values that are achievable at present.

The project comprises the construction of three laser centres in Hungary (ELI ALPS), Romania (ELI Nuclear Physics), and the Czech Republic (ELI Beamlines). The research centre ELI Beamlines with the most intense laser for user research is to be built in Dolní Břežany near Prague, and it is to go into operation in early 2016. About 300 jobs are to be created at the centre. It will be working in cooperation with the other two centres, and its goal will be to create a completely new generation of sources of high–energy particles for interdisciplinary applications in physics, medicine, biology, materials science, and nanotechnologies.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project Ministry of Education LD11076 – "Growth and optimisation of thin nanodiamond layers for applications in biology, medicine, and smart bioelectronics," 2011–2013; Principal investigator: Ing. Bc. František Fendrych, Ph.D.

- Project Ministry of Education LC510 – "Centre of Nanotechnology and Materials for Nanoelectronics," 2005–2011; Principal investigator: RNDr. Jan Kočka, DrSc., Co–principal investigator: prof. RNDr. Ladislav Kavan, CSc., J. Heyrovský Institute of Physical Chemistry AS CR, Charles University in Prague/Faculty of Mathematics and Physics

- Project Ministry of Education MEB0810081 – "Investigation of electrical and optical properties of nanodiamond and diamond–like thin films," 2010–2011; Principal investigator: Mgr. Zdeněk Remeš, Ph.D.

- Project Ministry of Education MEB0810082 – “Directed manipulation of surfaces of diamond nanostructures and their characterisation,” 2010–2011; Principal investigator: Ing. Alexander Kromka, Ph.D.

- Project AS CR KJB100100903 – “Nanocomposites from silicon and diamond nanocrystals for optoelectronic applications,” 2009–2012; Principal investigator: Mgr. Lukáš Ondič

- Project AS CR IAA100100903 – “Formation of nanostructures and ordered phases of metals on silicon surface,” 2009–2011; Principal investigator: as.prof. RNDr. Zdeněk Chvoj, DrSc.

- Project AS CR IAAX00100902 – “Electronically and chemically optimized nanocrystalline diamond structures for bio–applications,” 2009–2012; Principal investigator: RNDr. Milan Vaněček, CSc., Co–principal investigator: Dr. Lucie Bačáková, MD, CSc., Institute of Physiology AS CR

- Project AS CR IAA100100912 – “Magnetic Anisotropy of Nanointerfaces,” 2009–2012; Principal investigator: Ing. Alexander Shick, CSc., Co–principal investigator: as.prof. RNDr. Ladislav Havela, CSc., Charles University in Prague/ Faculty of Mathematics and Physics

- Project AS CR IAA100100718 – “Metal–Dielectric Nanostructures for Optics,” 2007–2009; Principal investigator: Dr. Ing. Jiří Bulíř, Co–principal investigator: prof. Ing. Pavel Fiala, CSc., Czech Technical University in Prague/Faculty of Nuclear Sciences and Physical Engineering

- Project GA CR GAP108/11/0807 – “Complex magnetic nanoparticles with monodisperse oxide cores and stable organic corona for biological research and biomedical applications,” 2011–2014; Principal investigator: Ing. Pavel Veverka, Ph.D., Co–principal investigator: Ing. Mgr. Ondřej Kaman, Ph.D., Charles University/Faculty of Natural Sciences

- Project GA CR GAP108/11/0853 – “Nanostructures with transition metals: Towards ab–initio material design,” 2011–2015; Principal investigator: RNDr. Ondřej Šipr, CSc., Co–principal investigator: as.prof. Dr. Ing. Miroslav Rozložník, Institute of Computer Science AS CR, Ing. Robert Cimrman, Ph.D., University of West Bohemia in Pilsen/New Technologies – Research Centre in the West Bohemia Region

- Project GA CR GAP108/11/1298 – “Detection layers based on composites of organocomplexes and nanoparticles for chemical sensors,” 2011–2014; Principal investigator: Ing. Jiří Bulíř, Ph.D., Co–principal investigator: as.prof. Ing. Martin Vrňata, Dr., Institute of Chemical Technology in Prague/Faculty of Chemical Engineering

- Project GA CR GAP204/11/0723 – “Multifunctional self–assembling materials on the nano–level,” 2011–2014; Principal investigator: RNDr. Vladimíra Novotná, CSc., Co–principal investigator: prof. Ing. Jiří Svoboda, CSc., Institute of Chemical Technology in Prague/Faculty of Chemical Technology

- Project GA CR GAP108/10/1296 – “Development and characterisation of active hybrid textiles with integrated nanograin NiTi micro wires,” 2010–2012; Principal investigator: Ing. Luděk Heller, Ph.D., Co–principal investigator: Ing. Petr Sedlák, Ph.D., Institute of Thermomechanics AS CR, Ing. Hynek Chlup, Czech Technical University/ Faculty of

Mechanical Engineering, as.prof. Ing. Bohdana Marvalová, CSc., Technical University of Liberec/Faculty of Mechanical Engineering

- Project GA CR GA202/09/0545 – "Theory of Electron Transport in Complex Nanosystems," 2009–2011; Principal investigator: Ing. Pavel Jelínek, Ph.D.
- Project GA CR GP202/09/P324 – "Advanced system for monitoring of the growth of metal nanostructures on dielectric substrate," 2009–2011; Principal investigator: Ing. Michal Novotný, Ph.D.
- Project GA CR GA202/08/0106 – "Magnetism and Spectroscopy of Nanostructures from First Principles," 2008–2010; Principal investigator: RNDr. Ondřej Šipr, CSc.
- Project GA CR GC202/07/J047 – "Towards a realistic theory of electron correlations in nanoscale magnetic materials," 2007–2010; Principal investigator: prof. RNDr. Václav Janiš, DrSc.
- Project GA CR P204/10/0212, – "Size effects and electron transport in boron–doped and hydrogenated diamond," 2010–2012; Principal investigator: RNDr. Pavel Hubík, CSc.
- Project GA CR P102/10/1201 – "Quantum Dots for Detectors and Other Devices," 2010–2012; Principal investigator: as.prof. Ing. Eduard Hulicius, CSc.
- Project GA CR 202/09/0676, – "Foundation Impact of capping layers on electronic states in quantum dots," 2009–2011; Principal investigator: Ing. Jiří Oswald, CSc.
- Project GA CR GA202/07/0601 – "GaAs and Ga1–xMnxAs nanolayer surfaces prepared by the low–temperature molecular beam epitaxy," 1/2007–12/2010; Principal investigator: as.prof. RNDr. Igor Bystroň, DrSc.
- Project IAA100100729 – "Development of novel hybrid deposition techniques for preparation of nanostructured fluoride thin films exhibiting outstanding fluorescent properties,"1/2007–12/2010; Principal investigator: Ing. Ján Lančok, Ph.D.
- Project 7E09057 (project support programme7FP EU) – "Flexible Production Technologies and Equipment Based on Atmospheric Pressure Plasma Processing for 3–D Nano–Structured Surfaces," 2009–2012; Principal investigator: RNDr. Milan Vaněček, CSc.
- Project Ministry of Education 7E08087 (project support programme7FP EU) – "Nanostructured magnetic materials for nano–spintronics," 2008–2011; Principal investigator: RNDr. Tomáš Jungwirth, Ph.D.

"Nanotechnology for Society" programme research projects

- KAN400100652 – "Structures for spintronics and quantum phenomena created by electron beam lithography," 7/2007–12/2010; Principal investigator: Ing. Ludvík Smrčka, DrSc.
- KAN400100653 – "Self–organized magnetic nanostructures," 7/2007–12/2010; Principal investigator: Ing. Ján Lančok, Ph.D.
- KAN300100702 – "Creating and probing nanostructures with X–Ray lasers," 01/2007–12/2011; Principal investigator: Ing. Bedřich Rus, Dr.

- KAN400100701 – "Functional hybrid nanosystems of semiconductors and metals with organic materials (FUNS)," 01/2007–12/2011; Principal investigator: RNDr. Bohuslav Rezek, Ph.D.

- KAN200100801 – "Bioactive biocompatible surfaces and novel nanostructured composites for applications in medicine and drug delivery," 01/2008–12/2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc.

- KAN300100801 – "Multifunctional bulk metallic materials with nanocrystalline and ultrafine–grained structure," 01/2008–12/2012; Principal investigator: prof. Ing. Pavel Lejček, DrSc.

- KAN300100802 – "Nanocomposite, ceramic and thin film scintillators," 01/2008–2/2012; Principal investigator: Ing. Martin Nikl, CSc.

b) *Selected projects on which the Institute has cooperated or is cooperating:*

"Nanotechnology for Society" programme research projects

- Project AS CR KAN200200651 – "Nanoparticle and supramolecular systems for targeted transport of therapeutic drugs," 07/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for the Institute of Physics: as.prof. Ing. Emil Pollert, DrSc.

- Project AS CR KAN401770651 – "Molecular nanosystems and nanodevices: electric transport properties," 7/2007–12/2010; Principal investigator: Ing. Martin Weiter, Ph.D., Brno University of Technology/Faculty of Chemistry, Co–principal investigator for the Institute of Physics: Ing. Irena Kratochvílová, Ph.D.

- Project AS CR KAN301370701 – "Nanostructured macroscopic systems – technology and characterisation," 01/2007–12/2011; Principal investigator: prof. RNDr. Miroslav Hrabovský, DrSc., Palacký University in Olomouc/Faculty of Science, Co–principal investigator for the Institute of Physics: Ing. Ivan Gregora, CSc.

- Project AS CR KAN400480701 – "Nanostructures based on carbon and polymers for use in bioelectronics and medicine," 01/2007–12/2011; Principal investigator: Mgr. Jiří Vacík, CSc., Institute of Nuclear Physics AS CR, Husinec, Co–principal investigator for the Institute of Physics: Ing. Bc. František Fendrych, Ph.D.

- Project AS CR KAN400720701 – "Hierarchic nanosystems for microelectronics," 1/2007–12/2011; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for the Institute of Physics: Mgr. Zdeněk Hubička, Dr.

GA projects

- GA Project AS CR IAA400720619 – "New laser–induced process for production of novel carbon based nanomaterials and carbon–based nanomaterials with incorporated Si, N and B heteroatoms," 1/2006–12/2010; Principal investigator: RNDr. Josef Pola, DrSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for the Institute of Physics: Ing. Miroslav Maryška, CSc.

- Project GA CR GD202/09/H041 – "Physics of nanostructures," 2009–2012; Principal investigator: prof. RNDr. Vladimír Matolín, DrSc. Charles University in Prague/Faculty

of Mathematics and Physics, Co–principal investigator for the Institute of Physics: RNDr. Antonín Fejfar, CSc

- Project GA CR GA203/09/1088 – "Preparation of nanostructured Si/Ge/C deposits," 2009–2011; Principal investigator: RNDr. Vladislav Dřínek, CSc., Institute of Chemical Processes AS CR, Co–principal investigator for the Institute of Physics: Ing. The–Ha Stuchlíková, CSc.

- Project GA CR GA203/08/0217 – "Measurement of vapor pressure of metal organic and related precursors for use in nanostructure production," 2008–2010; Principal investigator: prof. Ing. Vlastimil Růžička, CSc., Institute of Chemical Technology in Prague/Faculty of Chemical Engineering, Co–principal investigator for the Institute of Physics: as.prof. Ing. Eduard Hulicius, CSc.

- Project GA CR GAP204/10/0330 – "Nanostructured actinide–based materials: theory and experiment," 2010–2014; Principal investigator: as.prof. RNDr. Ladislav Havela, CSc. Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Physics: Ing. Alexander B. Shick, CSc.

- Project GA CR GAP204/10/0035 – "Hyperfine interactions in nanosized and low–dimensional iron oxides," 2010–2014; Principal investigator: as.prof. Mgr. Jaroslav Kohout, Dr., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Physics: Ing. Miroslav Veverka, Ph.D.

- Project GA CR GAP108/10/0253 – "Lattice mismatch compensation in heteroepitaxy on micro and nanoporous A3B5 semiconductors and deposition of metals and semiconductors into micropores," 2010–2012; Principal investigator: Ing. Jan Grym, Ph.D., Institute of Photonics and Electronics AS CR, Co–principal investigator for the Institute of Physics: as.prof. Ing. Eduard Hulicius, CSc.

- Project GA CRGAP108/11/0794 – "Visualisation of collagen production in osteogenic cells cultivated on nanocrystalline diamond films," 2011–2013; Principal investigator: RNDr. Lucie Kubínová, CSc., Co–principal investigator for the Institute of Physics: Ing. Alexander Kromka, Ph.D.

- Project GA CR GAP204/10/0952 – "Atomic scale study of bimetallic nanostructures on the Si(100) surface," 2010–2012; Principal investigator: as.prof. RNDr. Pavel Sobotík, CSc., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Physics: Ing. Pavel Jelínek, Ph.D.

- Project GA CR GAP204/11/1228 – "Theory of spin–dependent transport in magnetic solids and nanostructures," 2011–2014; Principal investigator: prof. RNDr. Ilja Turek, DrSc., Institute of Physics of Materials AS CR, Co–principal investigator for the Institute of Physics: RNDr. Václav Drchal, CSc.

- Project GA CR GAP205/11/0386 – "Advanced experimental research of discharge plasma sources applied for deposition of nanostructured thin films," 2011–2013; Principal investigator: prof. RNDr. Milan Tichý, DrSc., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Physics: Mgr. Martin Čada, Ph.D.

- Project GA CRGAP304/10/1951 – "Nanoliposomes for development of recombinant vaccines and targeted immunotherapeutics," 2010–2013; Principal investigator: RNDr.

Jaroslav Turánek, CSc., Veterinary Research Institute, Co–principal investigator for the Institute of Physics: as.prof. Ing. Irena Kratochvílová, Ph.D.

- Project GA CR GCP204/11/J042 – "Supercurrent and the AC Josephson effect in unconventional nanoscopic junctions," 2011–2013; Principal investigator: RNDr. Tomáš Novotný, Ph.D., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Physics: prof. RNDr. Václav Janiš, DrSc.

- Project GA CR GC202/07/J051 – "Full counting statistics in non–Markovian nano–systems," 2007–2010; Principal investigator: Mgr. Tomáš Novotný, Ph.D., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Physics: RNDr. Karel Netočný, Ph.D.

Other projects

- TA CR Project TA01011740 – "Hybrid high–density low–temperature microwave plasma sources in matrix configuration suitable for growth of advanced materials and their (nano–) composites on 2–D and 3–D substrates," 2011–2014; Principal investigators: Ing. Anton Piják, Ing. Jaroslav Dolák, Ing. Pavel Martinek, Ing. Jiří Pitrunk, SVCS Process Innovation, s.r.o., Co–principal investigators for the Institute of Physics: Ing. Alexander Kromka, Ph.D., Mgr. Martin Čada, Ph.D., Mgr. Zdeněk Hubička, Ph.D., RNDr. Lubomír Jastrabík, CSc. RNDr., and Vítězslav Straňák, Ph.D.

- Project Ministry of Education LC06040 – "Structures for nanophotonics and nanoelectronics," 2006–2011; Principal investigator: prof. RNDr. Tomáš Šikola, CSc., Brno University of Technology/Faculty of Mechanical Engineering, Co–principal investigator for the Institute of Physics: RNDr. Antonín Fejfar, CSc.

- Project Ministry of Education, "Research Centres" programme, 1M06002 – "Optical structures, detection systems and relevant technologies for low photon number applications," 2006–2011; Principal investigator: prof. RNDr. Miroslav Hrabovský, DrSc., Palacký University in Olomouc/Faculty of Science, Co–principal investigator for the Institute of Physics: RNDr. Ondřej Haderka, Ph.D.

- Industry and Trade ministry project FR–TI3/521 – "Technology of new magnetic nanoparticles for diagnostics and therapy in oncology," 2011–2015; Principal investigator: Ing. Jiří Zelenka, CSc. – SYNPO, a.s., Co–principal investigator for the Institute of Physics: as.prof. Ing. Emil Pollert, DrSc.

- Industry and Trade Ministry Project FR–TI2/736 – "Modular scanning electron microscope," 2010–2014; Principal investigator: TESCAN a.s., Co–principal investigator for the Institute of Physics: Ing. Alexander Kromka, Ph.D.

c) *<u>Projects with international cooperation:</u>*

EU Projects

- ERC EU Advanced Grant No. 268066 –grant for advanced research workers from the European Research Council – Project title: "Spintronics based on relativistic phenomena in systems with zero magnetic moment". Recipient: RNDr.Tomáš Jungwirth, Ph.D., project realisation: 2011–2015; project budget: EUR 2.5 million.

- 7FP EU project type: Large, thematic priority: NMP, project title: MULTIFUN – "Multifunctional nanotechnology for selective detection and treatment of cancer," 2011–

2015; 16 partners from 7 countries, project budget: EUR 13.17 million, coordinator: Blanca Jordan, Atos Origin Sociedad Anonima Espanola (Spain); the Institute of Physics is a project partner.

- 7FP EU project type: Large, thematic priority: NMP, project title: N2P – "Flexible production technologies and equipment based on atmospheric pressure plasma processing for 3–D nano–structured surfaces," 2008–2012; 22 partners from 8 countries, project budget: EUR 10.47 million, coordinator: Walter Krause, Fraunhofer–Gesellschaft zur Foerderung der Angewandten Forschung E.V. (Germany); the Institute of Physics is a project partner.

- 7FP EU project type: Small, thematic priority: NMP, project title: NAMASTE – "Nanostructured magnetic materials for nanospintronics," 2008–2011; 7 partners from 4 countries, project budget: EUR 3.25 million, coordinator: Paul Cartledge, University of Nottingham (United Kingdom); the Institute of Physics was a project partner.

- 7FP EU project type: INFRA, thematic priority: NMP, project title: ELI–PP – "Extreme light infrastructure preparatory phase," 2007–2010; 15 partners from 15 countries, project budget: EUR 7.96 million, coordinator: Catherine Sarrazin, Centre National de la Recherche Scientifique (France); the Institute of Physics was a project partner.

COST programme

- OC10007 – "Electron transport in III–N–V compounds nanostructures" 2010–2012, Principal investigator: Mgr. Miroslav Menšík, Dr., Institute of Macromolecular Chemistry AS CR, Co–principal investigator for the Institute of Physics: RNDr. Karel Král, CSc.

- OC 137 – "Transport of charge carriers in solid molecular substances and nanoparts," 3/2006–12/2010; Principal investigator: Ing. Irena Kratochvílová, Ph.D.

- OC09023 – "Nanoscopic ferroelectrics and their spectroscopic characterisation 2," 2009; Principal investigator: RNDr. Přemysl Vaněk, CSc.

- OC08030 – "Electromagnetic treatment of nanostructured materials based on 3d metals," 2008–2009; Principal investigator: Ing. Bc. František Fendrych, Ph.D.

KONTAKT Programme

- ME08109 – "Dynamic nano–clusters in polar perovskites," 2008–2012; Principal investigator: Ing. Jiří Hlinka, Ph.D.

- ME09048 – "Using the magic height metal islands for the study of reactivity and nanoscale physics," 2009–2012; Principal investigator: as.prof. RNDr. Zdeněk Chvoj, DrSc.

- ME10069 – "Material engineering for superconductors," 2010–2012; Principal investigator: RNDr. Miloš Jirsa, DrSc.

- ME10076 – "Assembling and characterisation at atomic scale using atomic force microscopy," 2010–2011; Principal investigator: Ing. Pavel Jelínek, Ph.D.

- MEB091125 – “Deposition and characterisation of nanostructured hard coatings with tailored optical properties,” 2011–2012; Principal investigator: Ing. Michal Novotný, Ph.D.
- MEB061012 – “Study of nanostructured heterogeneous materials using scanning probe methods,” 2010–2011; Principal investigator: RNDr. Antonín Fejfar, CSc., Co–principal investigators: Ing. Jiří Červenka, Ph.D., Veronika Kalusová, Mgr. Marie Krátká, RNDr. Martin Ledinský, Ph.D.
- MEB090901 – “Hexaferrite–spinel intergrowth nanocomposite particles for cancer treatment using magnetic fluid hyperthermia,” 2009–2010; Principal investigator: Ing. Pavel Veverka, Ph.D.
- MEB020914 – “Functionalisation of DNA and optical study of the transport of nanodiamond particles through the cell membrane for drug delivery application,” 2009–2010; Principal investigator: prof. Miloš Nesládek, Ph.D., HDR.
- ME 866 – “and research of new semiconductor structures of quantum dots,” 3/2006–12/2010; Principal investigator: RNDr. Karel Král, CSc.

Other international projects

- Project HQ0147–09–C–0005, MDA USA, 2009–2011; – “Characterisation of low defect density native gallium nitride materials,” Principal investigator for the Institute of Physics: as.prof. Ing. Eduard Hulicius, CSc.

Experts/field

- prof. RNDr. Igor Bartoš, DrSc. – theory of surfaces and interfaces
- RNDr. Miroslav Cukr, CSc. – technology of MBE
- 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. – deposition of nanogranular magnetic layers, magnetoresistance, spin–dependent tunnelling of electrons
- as.prof. Ing. Eduard Hulicius, CSc. – quantum dimensional semiconductor structures, epitaxial semiconductor technologies, especially MOVPE
- Ing. Alice Hospodková, Ph.D. – MOVPE technology of nanostructures, quantum wells and dots
- Ing. Vladimír Cháb, CSc. – surfaces of semiconductors at the atomic level, characterisation and calculations
- RNDr. Tomáš Jungwirth, CSc. – spintronics, nanoelectronics, theory of the Hall effect
- prof. Ing. Miroslav Jelínek, DrSc. – thin layers, laser deposition, laser applications
- Ing. Pavel Jelínek, Ph.D., – surfaces of semiconductors at the atomic level, AFM, modelling, calculations

- RNDr. Stanislav Kamba, CSc., – nanodielectrics
- RNDr. Jan Kočka, DrSc. – multifunctional materials in the area of non–crystalline semiconductors with an emphasis on nanotechnology, ceramic nanoelectronics
- RNDr. Miroslav Kotrla, CSc. – theory of surface growth processes, methodology of numerical simulations
- RNDr. Karel Král, CSc. – quantum theory of solids, quantum transport in nanostructures, quantum counting
- Ing. Luděk Kraus, CSc. – nanomagnetic materials
- RNDr. Jiří J. Mareš, CSc. – transport properties of low–dimensional semiconductor nanostructures
- Ing. Vít Novák, CSc., – MBE technologies, spintronics, nanoelectronics
- Ing. Jiří Oswald, CSc. – luminescence of low–dimensional semiconductor nanostructures
- prof. RNDr. Ivan Pelant, DrSc. – optical properties of nanocrystalline semiconductors, especially ceramics
- RNDr. Jan Petzelt. DrSc. – dielectric, ferroelectric, infrared and Raman spectroscopy
- as.prof. Ing. Emil Pollert, DrSc. – nanomagnetic materials for medical use
- Ing. Ludvík Smrčka, DrSc. – spintronics, theory of low–dimensional structures
- Ing. Pavel Středa, DrSc. – theory of low–dimensional structures and the Hall effect
- RNDr. Antonín Šimůnek, CSc. – electron states in volume and on the surfaces of solids and nanostructures
- RNDr. Milan Vaněček, CSc. – preparation and characterisation of diamond and nanodiamond layers.

3.1.7 INSTITUTE OF PHYSIOLOGY AS CR, a public research institution (FGÚ)

Vídeňská 1083, 142 20 Prague 4, ID: 67985823

www.biomed.cas.cz/fgu

A brief description of the Institute

The Institute was established on 1 January 1954. It was taken over from the physiology department founded in 1953 as part of the former Czechoslovak Institute of Biology. As a laboratory for basic biomedical research, the Institute focuses on the following main thematic areas:

- In neurophysiology it deals with a spectrum of problems ranging from mechanisms of the release of neurotransmitters to their membrane receptors to the regulation of bodily functions at the level of the entire organism.

- In cardiovascular physiology, it concentrates on developmental aspects of the contractile function of the myocardium, experimental hypertension, and the physiology of epithelia with special emphasis on the role of proteins and cell membranes and on finding appropriate genetic markers of certain illnesses that are a serious problem for our society (e.g. hypertension, diabetes etc.). Attention is also devoted to the construction of bioartificial blood vessels and heart valves by the methods of tissue engineering.
- In molecular and cell physiology, the Institute is working on problems related to cell metabolism, the transmission of signals, and the transport of substances with high energy content with the goal of contributing towards understanding of cellular processes and interactions among cells. Another new, modern discipline in physiology is the study of the interaction of cells with artificial materials for tissue replacement, representing synthetic analogs of the extracellular matrix.

The Institute's research activity is divided into 23 departments. Research focusing on the area of nanobiotechnology is being conducted mainly in the following departments:

- Department for analysis of biologically significant substances (department head: I. Mikšík)
- Department of protein structures (J. Teisinger)
- Department of biomaterials and tissue engineering (L. Bačáková)
- Department of biomathematics (L. Kubínová)

The director of the Institute is RNDr. Lucie Kubínová, CSc.

Focus of research and development

During the years 2005–2011, research at the Institute of Physiology focused mainly on issues from the research proposal AV0Z50110509 – "**Investigation of the molecular and cellular basis of physiological and pathophysiological processes in order to clarify the pathogenesis of important human diseases**,"1/2005–6/2010; Principal investigator: RNDr. Jaroslav Kuneš, DrSc., 7/2010–12/2011; Co–principal investigator: RNDr. Lucie Kubínová, CSc., classification – area 3, share of nanotechnology research – 30%.

The goal of the research proposal was to gain new knowledge about physiological and pathophysiological processes at the molecular, cellular, and whole organism level, leading towards a deepening of knowledge of the theoretical foundations of human medicine. At the level of molecular and cellular physiology, there was study of the relationship between the structure and function of key regulating molecules, metabolism, and energetic metabolism of cells, the transport function of cell membranes, mechanisms of rapid transmission of signals between and within cells, and the genetic determination of these functions. At the organ and system levels, there has been research on developmental aspects of the causes of obesity, arteriosclerosis, and hypertension, as well as on the function of the heart and the circulatory system and the integrative function of the nervous system. The results should contribute towards a greater understanding of the pathogenesis of serious human metabolic, cardiovascular and nervous disorders, with the goal of improving their diagnosis and finding new, effective means of therapy and prevention. The research proposal encompassed selected areas of nanobiotechnology and nanomedicine.

The Institute is involved in the building of the **BioCev Centre of Excellence**. At a cost of CZK 2.5 billion during the years 2012–2015, the project's goal is to build a centre for

excellent research in the Central Bohemian town of Vestec. The research will focus on detailed study of cellular mechanisms at the molecular level, research and development of new therapeutic procedures, prompt diagnosis, biologically active substances including chemotherapy agents, natural antibiotics, development of tissue for the repairing of damaged organs, protein engineering, and other technologies. More information is available at www.biocev.eu.

Focus of research and development in nanotechnologies

Research being conducted at the Institute of Physiology focuses on nanobiotechnologies and nanomedicine, such as:

- The study of adhesion, growth, differentiation, viability, and immune activation of cells (especially vascular and bone cells) in cultures on artificial stable and degradable materials for tissue replacement
- The influence of the nanostructure and microstructure of a material on cell behavior
- Innovation of existing bone and vascular replacements (e.g. improvement of the integration of composite joint replacements in cooperation with the company Beznoska, s.r.o., reconstruction of the tunica intima and tunica media in vascular prostheses made by the company VÚP, a.s. in Brno)
- Construction of bioartificial replacement blood vessels, heart valves, and bones
- Systems for the delivery of medications to autotransplanted blood vessels
- Microstructured surfaces for regionally selective cell adhesion for tissue engineering and biotechnology (e.g. microarrays)
- Confocal and two–photon microscopy: analysis of data, application of modern fluorescence methods and methods of two–photon microscopy, calibration measurements
- New methods for the identification and quantification of physiologically significant substances
- Interaction of cells with hard biocompatible layers constructed from carbon nanoparticles (nanodiamonds, fullerenes, nanotubes) with composites of a polymer–nanotube for construction of 3D scaffolds for bone replacement, with composites of a polymer–ceramic nanoparticle
- Interaction of vascular and bone cells with constructions made of nanofibers made by the company Elmarco from Liberec and at the Technical University of Liberec
- Covering of vascular prostheses with nanostructured layers of protein molecules and their endothelialisation
- Construction of systems for targeted delivery of medication to blood vessels with the aid of nanofiber carriers
- The use of nanofibers for construction of heart valves
- Cell interaction with materials with hierarchically organized micro– and nanostructure resembling the architectonic principle of physiological tissue

In 2011, the Institute worked on 128 programme research projects.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project GA CRGAP108/11/0794 – "Visualisation of collagen production in osteogenic cells cultivated on nanocrystalline diamond films," 2011–2013; Principal investigator: RNDr. Lucie Kubínová, CSc., Co–principal investigator: Ing. Alexander Kromka, Ph.D., Institute of Physics AS CR.

b) *Selected projects on whose implementation the Institute is cooperating:*

- GA Project AS CR IAAX00100902 – "Electronically and chemically optimized nanocrystalline diamond structures for bio–applications," 2009–2012; Principal investigator: RNDr. Milan Vaněček, CSc., Institute of Physics AS CR,Co–principal investigator for the Institute of Physiology AS CR: Dr. Lucie Bačáková, MD, CSc.

- Project GA CR GA106/09/1000 – "Bioinspired nanocomposite structures for bone tissue regeneration," 2009–2012; Principal investigator: Ing. Karel Balík, CSc., Institute of Rock Structure and Mechanics AS CR, Co–principal investigator for the Institute of Physiology AS CR: Dr. Lucie Bačáková, MD, CSc.

- Project GA CR GA203/09/0675 – "The utilisation of gold nanoparticles in capillary electrophoresis and capillary electrochromatography," 2009–2011; Principal investigator: Dr. RNDr. David Sýkora, Institute of Chemical Technology, Prague/Faculty of Chemical Engineering, Co–principal investigator for the Institute of Physiology AS CR: as.prof. Ing. Ivan Mikšík, DrSc.

- Project GA CR GAP107/11/1856 – "Metal–fullerene nanocomposites and their biological applications," 2011–2013;Principal investigator: Mgr. Jiří Vacík, CSc., Institute of Nuclear Physics AS CR, Co–principal investigator for the Institute of Physiology AS CR: Dr. Lucie Bačáková, MD, CSc.

- Project Ministry of Industry and Trade FR–TI3/088 – "Development of implants, tools and fixators with antibacterial coating on the basis of nanostructured surfaces," 2011–2013; Principal investigator: Ing. Zdeněk Čejka, Co–principal investigator for the Institute of Physiology: Dr. Lucie Bačáková, MD, CSc.

- Project Ministry of Education, "Centres for Basic Research" programme, LC066063 – "Fluorescence microscopy in biological and medical research," 6/2006–12/2011; Principal investigator and coordinator: as.prof. Martin Hof, Dr. rer. nat., J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for the Institute of Physiology: RNDr. Lucie Kubínová, CSc.

- Project GA CR P108/10/1106 – "The structure and properties of modified polymers for tissue engineering," 2010–2014; Principal investigator:prof. Ing. Václav Švorčík, DrSc., Institute of Chemical Technology, Prague, Co–principal investigator for the Institute of Physiology: Dr. Lucie Bačáková, MD, CSc.

- Project GA CR P108/10/1858 – "Stability and biocompatibility of surface of oxidic layer on a monophasic TiNb alloy," 2010–2012; Principal investigator: prof. RNDr. Vladimír Starý, CSc., Czech Technical University, Prague/Faculty of Mechanical Engineering, Co–principal investigator for the Institute of Physiology: Dr. Lucie Bačáková, MD, CSc.

- Project GA CR P108/11/1857 – “Polymer biomaterials for vascular tissue engineering,” 2011–2014; Principal investigator: RNDr. František Rypáček, CSc., Institute of Macromolecular Chemistry AS CR, Co–principal investigator for the Institute of Physiology: Dr. Lucie Bačáková, MD, CSc.

- Project Excellence Centre GA CR P108/12/G108 – “Preparation, modification and characterisation of materials by radiation,” 2012–2018; Principal investigator:prof. Ing. Václav Švorčík, DrSc., Institute of Chemical Technology, Prague, Co–principal investigator for the Institute of Physiology: Dr. Lucie Bačáková, MD, CSc.

- Project GA CR P108/12/1168 – “Carbon nanolayers, nanostructure, and nanoparticles on substrata for possible applications in medicine and electronics,” Principal investigator: prof. Ing. Václav Švorčík, DrSc., Institute of Chemical Technology, Prague, Co–principal investigator for the Institute of Physiology: Dr. Lucie Bačáková, MD, CSc.

- Project GA CR P107/12/1025 – “Comprehensive study of modern alloys of beta–titanium intended for biomedicine,” Principal investigator: as.prof. RNDr. Miloš Janeček, CSc., Charles University/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Physiology: Mgr. Marta Vandrovcová, Ph.D.

- Project Ministry of Agriculture NT 11 270 01 – “Tissue engineering for autologous pericardial valve replacement,” 2010–2013; Principal investigator: Dr. Jan Pirk, MD, DrSc., Institute of Clinical and Experimental Medicine, Prague, Co–principal investigator for the Institute of Physiology: Mgr. Elena Filová, Ph.D.

- Project TACR TA01011141 – “Comprehensive research on joint replacements, with improved functional characteristics, based on beta titanium alloys,” 2011–2014; Principal investigator: Ing. Jaroslav Fencl, BEZNOSKA, s.r.o., Kladno, Co–principal investigator for the Institute of Physiology: Dr. Lucie Bačáková, MD, CSc.

Results in nanotechnologies/cooperation

- Cooperation with the manufacturing and clinical spheres (Beznoska, s.r.o, Kladno; Prospon s.r.o., Kladno, VÚP, a. s., Brno; Synthesia, a.s., Pardubice; ELMARCO s.r.o., Liberec; IKEM, Praha; Bulovka Hospital, Prague),

- Patents:

Czech patent: Brynda, Eduard; Houska, Milan; Syková, Eva; Jendelová, Pavla; Dyr, J. E.; Filová, Elena; Riedel, Tomáš; Chlupáč, Jaroslav; Lesný, Petr; Bačáková, Lucie. *Method of preparation of regulated layers of fibrin on solid surfaces.* Institute of Molecular Chemistry AS CR, Institute of Experimental Medicine AS CR, Physiological Institute AS CR, and Institute of Hematology and Blood Transfusion. Prague: Industrial Property Office, 2008. Patent file number: 299687. Date of granting of the patent: 12 September 2008

European patent: Rezek, B. – Michalíková, L. – Kromka, A. – Kalbáčová, M. – Kmoch, S. – Grausová, L. – Bačáková, L. – Vaněček, M. – Kočka, J.: *Method of making arranged cell structures*, No. 09761298; Z 7584, 2012

Experts/field

- Dr. Lucie Bačáková, MD, CSc. – head of the Department of Biomaterials and Tissue Engineering. At this department, the following experts are working with nanotechnologies:
- Mgr. Elena Filová – blood vessel cells on defined nanostructured molecular layers of proteins of the extracellular matrix, on synthetic degradable polymers of functionalized adhesive oligopeptides, spatial bioresorbable scaffolds for tissue engineering, development of the extravascular system for the delivery of antiproliferative substances to the blood vessels
- Dr. Jaroslav Chlupáč, MD – practical use of molecular protein layers for the innovation and endothelialisation of clinically used polyethylene terephthalatevascular prostheses made at the Research Institute of Education (VÚP Brno)
- Mgr. Ľubica Grausová – interaction of bone cells with materials modified with carbon nanoparticles (nanodiamonds, nanotubes, fullerenes)
- Mgr. Martin Pařízek – nanofibrous materials with carbon ceramic particles for bone tissue engineering
- Mgr. Marta Vandrovcová – bone cells on hard biocompatible nanostructured layers of carbon–titanium, on layers of TiO_2, and on polymer composites with ceramic nanoparticles

3.1.8 INSTITUTE OF GEOLOGY AS CR, a public research institution

Rozvojová 269, 165 00 Prague 6 – Lysolaje, ID: 67985831

www.gli.cas.cz

A brief description of the Institute

The Institute's history reaches back to 1960, when in connection with the growing need for comprehensive scientific research, two geologically oriented institutes were founded: the Institute of Geology and the Institute of Geochemistry and Mineral Resources, both of the Czechoslovak Academy of Sciences. In 1964, they were merged into the united Institute of Geology of the Czechoslovak Institute of Sciences. In 1979, the Institute of Geology and Geotechnology was founded by the merger of the Institute of Mining and the Institute of Geology of the Czechoslovak Academy of Sciences. In 1990, the Institute of Geology of the Czechoslovak Academy of Sciences was restored, and it eventually became the Institute of Geology AS CR.

Focus of research and development

Structural geology, geological study of terrains, platform development, magnetostratigraphy, geochemistry of endogenous and exogenous processes, petrology of magmatic, metamorphic, and sedimentary rock, economic geology, phytopaleontology, including microphytopaleontology, zoopaleontology of vertebrates and invertebrates, and

paleoecology, together with Quaternary geology, geoarcheology, and environmental research represent the traditional subjects of research at the Institute of Geology. For the specialisations listed above, conditions were created at the Institute of Geology for postgraduate doctoral studies, and the Institute is used by Charles University and Masaryk University as a postgraduate study centre. Bilateral and multilateral cooperation for work on a wide range of internationally organized projects (e.g. IGCP, PAGES, Environmental History of the Egyptian Western Desert), and a number of grant projects are among the characteristic features of the research. In 2011 the Institute worked on 31 programme research projects.

Comprising a part of the Institute are chemical laboratories equipped with ICP EOS and ICP MS instruments for the determination of elemental composition and trace or ultratrace analysis, as well as an ultra–clean laboratory.

Project implemented in nanotechnologies

- Project GA CR GA202/09/1206 – "Nanocrystal Heterogeneous Solar Cells," 2009–2011; Principal investigator: prof. Ing. František Schauer, DrSc., Tomas Bata University in Zlín, Co–principal investigator for the Institute of Geology AS CR: RNDr. Jan Rohovec, Ph.D.

Results in nanotechnologies/cooperation

The result of implementation of the project in question at the Institute of Geology is a new nanocrystalline mineral on the basis of greenockite (hexagonal CdS), with surfaces modified with a surfactant from the group of amino alcohols (TEA, DEA). This material has been characterized by chemical analysis including trace and ultratrace analysis, as well as PXRD.

3.1.9 INSTITUTE OF MICROBIOLOGY OF THE AS CR, a public research institution (MBÚ)

Vídeňská 1083, 142 20 Prague 4, ID: 61388971

www.biomed.cas.cz

A brief description of the Institute

The groundwork for the institution was laid in 1950 with the creation of the microbiology department in the former Central Institute of Biology, which became the Institute of Biology of the Czechoslovak Academy of Sciences on 1 January 1953 after the founding of the academy. On 1 January 1962, the Institute of Biology of the Czechoslovak Academy of Sciences was split up into several independent institutions; the Institute of Microbiology of the Czechoslovak Academy of Sciences was created from several of the former Institute's departments and laboratories.

The activity of the Institute of Microbiology AS CR focuses on scientific research in the areas of physiology, biochemistry, and genetics of microorganisms, molecular biology and molecular microbiology, the study of microbial products and their creation, research on biodegradation activities of microorganisms, and on symbiotic relationships of biological models, including the development of new biotechnological procedures.

Research activity is being conducted in 5 sectors:

- Biogenesis and biotechnology of natural substances (department head: M. Flieger)
- Cellular and molecular microbiology (J. Nešvera)
- Ecology (F. Nerud)
- Immunology and gnotology (B. Říhová)
- Autotrophic microorganisms (O. Prášil)

The director of the Institute is RNDr. Martin Bilej, DrSc.

The sectors are divided into 29 laboratories. Research in the area of nanobiotechnology is being conducted mainly at the Laboratory of Characterisation of Molecular Structures (V. Havlíček), the Laboratory of Biotransformation (V. Křen), the Laboratory of Tumor Immunology (M. Kovář), and the Laboratory of Protein Architecture (K. Bezouška).

Focus of research and development

In the years 2005–2010, research focused on the questions of the following research proposal:

Research proposal AV0Z50200510 **– "Microorganisms in Research and Biotechnologies,"** 1/2005–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., total costs for the entire period of implementation: CZK 1,624,775,000, 1,551,887,000 of which was from the state budget. Classification – area 3, share of nanotechnology research – 20%.

Work focused on genomics, proteomics, bioinformatics, physiology, stress factors, differentiation, morphology, phylogenesis, and ecology of microorganisms, including their biodegratory activities, and on mechanisms of their long–term adaptation to unfavorable conditions. Also studied were biotransformations and recombinant and transgenic microbe technology. By breeding and molecular genetic methods, recombinant microorganisms were prepared, and their products were obtained at semi–operational scales. For algae and bacteria, there was study of the molecular mechanisms of photosynthetic processes and of phototropic and heterotrophic reproduction.

There was analysis of molecular aspects of bacterial pathogenicity, innate and acquired immune reactions in conventional and microbe–free animals, and their regulation under changed physiological and pathological conditions. Attention is dedicated to the study and possible influencing of autoimmune reactions and tumorous diseases, the preparation of vaccines, anti–tumor medications, and immunotherapy. Some studies fall within the area of nanotechnology and especially nanobiotechnology and nanomedicine, e.g.:

- Preparation of organometallic nanocomposites based on soluble exopolysaccharides, Al, Fe, Cu, and Cd (M. Flieger)
- Targeted transport of drugs – anti–tumor medication with covalent bonds to a polymeric carrier (B. Říhová)
- Development of electrochemical biosensors for the detection of herbicides (J. Masojídek)
- Genetic modification of Type I restriction modification enzymes for their use in nanobiotechnology – the molecular motor, a component of biosensors (M. Weiserová)

In 2011, the Institute worked on 160 programme grant projects. A key project primarily involving infrastructure is the **Centre for Algal Biotechnologies inTřeboň (Algatech),**

ED2.1.00/03.0110, 2011–2014, project budget: CZK 133,220,000. The director of the centre is prof. RNDr. Ondřej Prášil, Ph.D.. The goal of the project is integration and coordination of research capacity with the goal of creation and further development of a technological platform in the area of algal biotechnologies, and specifically to develop new types of cultivation facilities and procedures for highly productive, economical mass production of microalgae in an autotrophic regime, including its processing and fractionation, to develop and use new instruments and methods for monitoring the growth of microalgae, to develop research on the process of photosynthesis for algae and cyanophytes, and to develop and apply methodological procedures for heterotrophic fermentation for the production of algal biomass and its processing, including fractionation and isolation of valuable substances for making food supplements, animal feed, and other applications.

The Institute is involved in the building of the **BioCev Centre of Excellence**. At a cost of CZK 3.2 billion during the years 2011–2015, the project's goal is to build a centre for excellent research in the Central Bohemian town of Vestec. The research will focus on detailed study of cellular mechanisms at the molecular level, research and development of new therapeutic procedures, prompt diagnosis, biologically active substances including chemotherapy agents, natural antibiotics, development of tissue for the repairing of damaged organs, protein engineering, and other technologies. More information is available at www.biocev.eu.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project Ministry of Education 7E11026 – "Development of nanodiamond intracellular nanoprobes for oncogen transformation dynamics in living cells," 2011–2013; Principal investigator: Dr. Anna Fišerová, MD, Ph.D.

- Project Ministry of Education 2B08062 – "Genetic and physiological manipulations in bacterial degraders of aromatic pollutants and their application," 2008–2011; Principal investigator: Ing. Miroslav Pátek, CSc., Co–principal investigators: Ing. Ljuba Stehlíčková, DEKONTA,a.s., Mgr. Zdeněk Kozlíček, MikroChem LKT spol. s r.o., prof. RNDr. Vladimír Jirků, DrSc., Institute of Chemical Technology, Prague/Faculty of Food and Biochemical Technology, prof. Dr. Ing. Miroslav Černík, CSc., Technical University of Liberec/Faculty of Mechatronics, Informatics and Interdisciplinary Studies

- Project, "Nanotechnology for Society" programme, KAN200200651 – "Nanoparticulate and supramolecular systems for targeted drug delivery," 07/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc.

- Project Ministry of Education, "Basic Research Centres" programme, LC06010 – "Centre for Biocatalysis and Biotransformation," 3/2006–12/2011; Principal investigator: prof. Ing. Vladimír Křen, DrSc.

b) *Selected projects on whose implementation the Institute is cooperating:*

- 7FP EU project type: Small, thematic priority: KBBE, project title: DINAMO – "Development of diamond intracellular nanoprobes for oncogen transformation dynamics monitoring in living cells," 2010–2013; 8 partners from 5 countries, project budget: EUR 3,970,000, coordinator: Christine Van Houtven, Interuniversitair Micro–Electronica Centrum VZW (Belgium); the Institute of Microbiology AS CR is a partner.

- Project GA CR GA106/09/1378 – "Micro– and nanofibers from biodegradable polymers," 2009–2012; Principal investigator: as.prof. Ing. Jiří Brožek, CSc., Institute of Chemical Technology, Prague/Faculty of Chemical Technology, Co–principal investigator for the Institute of Microbiology AS CR: RNDr. Čeněk Novotný, Ph.D.

- Project GA CR GA104/09/0694 – "Advanced Photocatalytic Processes – Nanotechnology for the Environment," 2009–2011; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Processes AS CR, Co–principal investigator for the Institute of Microbiology AS CR: RNDr. Tomáš Cajthaml, Ph.D.

- Project AS CR KAN200520702 – "Nanoimmunosensors for cytokine detection," 01/2007–12/2011; Principal investigator: Ing. Peter Šebo, CSc., Institute of Biotechnology AS CR, Prague, Co–principal investigator for the Institute of Microbiology AS CR: Ing. Radim Osička, Ph.D.

- Project AS CR KAN400720701 – "Hierarchic nanosystems for microelectronics," 1/2007–12/2011; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for the Institute of Microbiology: RNDr. Tomáš Cajthaml, Ph.D.

- Project Ministry of Education 2B06053 – "New methods for the characterisation and identification of probiotic bacterial strains suitable for functional foods," 2006–2011; Principal investigator: as.prof. Ing. Bohuslav Rittich, CSc., Masaryk University/Faculty of Science, Co–principal investigator for the Institute of Microbiology: RNDr. Hana Kozáková, CSc.

- Project Ministry of Education 1M0505 – "Centre for Targeted Therapeutic Drugs," 1/2005–12/2011; Principal investigator: as.prof. Dr. Vladimír Viklický, MD, CSc., Nuclear Research Institute Řež a.s., Husinec – Řež, Co–principal investigator for the Institute of Microbiology: prof. RNDr. Blanka Říhová, DrSc.

- Project Ministry of Education 1M0506 – "Centre for Molecular and Cellular Immunology," 1/2005–12/2011; Principal investigator: prof. RNDr. Václav Hořejší, CSc., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for the Institute of Microbiology AS CR: Ing. Peter Šebo, CSc.

Experts/field

- as.prof. RNDr. Karel Bezouška, CSc. – molecular biology

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

- prof. RNDr. Blanka Říhová, DrSc. – the immune system and genetic regulation of production of antibodies, tumorous diseases

- RNDr. Marie Weiserová, CSc. – nanobiotechnology, molecular motors

3.1.10 INSTITUTE OF ANALYTICAL CHEMISTRY AS CR, a public research institution (IACH)

Veveří 97, 602 00 Brno, ID: 68081715

www.iach.cz/uiach

A brief description of the Institute

The Institute was founded from the Laboratory for the Analysis of Gases of the Czechoslovak Academy of Sciences on 1 January 1956 and was reorganized on 1 January 1966 as the Institute for Instrumental Analytical Chemistry of the Czechoslovak Academy of Sciences. On 1 January 1974 the name was changed to the Institute of Analytical Chemistry of the Czechoslovak Academy of Sciences. On 1 January 2007, the Institute became a public research institution.

Work at the Institute focuses mainly on research and development of new principles, methods, and instrumentation in the area of analytical methods usable for the development of other areas of science, especially biology, medicine, and the protection of human health and the environment. Basic research focuses in particular on separation and spectral methods, system miniaturisation and nanotechnology; in the area studied, the focus is on proteomics, genomics, trace element and special analysis, analysis of medications, bodily fluids, and monitoring of the environment. Research is conducted in seven scientific departments:

- Bioanalytical instrumentation (department head: F. Foret, CSc.)
- Electromigration methods (department head: prof. RNDr. P. Boček, DrSc.)
- Analytic chemistry of the environment (department head: Ing. Z. Večeřa, CSc.)
- Separation in the liquid phase (department head: prof. RNDr. K. Šlais, DrSc.)
- Proteomics and Glycomics (department head: Ing. J. Bobálová, CSc.)
- Separation of compressed liquids (department head: prof. RNDr. M. Roth, CSc.)
- Trace element analysis (Prague laboratory – department head: prof. RNDr. J. Dědina, CSc., DSc.)

Focus of research and development

In the years 2005–2011, research focused on the questions of the research proposal AV0Z40310501 – **"Advanced analytical techniques for bioanalysis, environmental analysis and nanotechnology,"** 1/2005–12/2011; Principal investigator: prof.RNDr. Ludmila Křivánková, CSc., total costs for the entire project period: CZK 421,477,000, CZK 400,947,000 of which came from the state budget. Classification – area 7a, share of nanotechnology research – 40%.

The goal of the research proposal was to gain theoretical and practical knowledge from the area of analytical chemistry for use also in other fields, and in particular in bioanalysis (e.g. genomics, proteomics), ecology, and nanotechnologies. Attention was focused on the development of theoretical principles, instrumentation, and applications of progressive separation and spectroscopic methods of analytical chemistry. The separation branch of research encompassed methods using as the driving force the separation of an electric field, sorption, the flow of liquids and the density dependence of their solvation ability, force fields, or chemical reactions and their mutual combinations. The branch of spectroscopy focused on mass spectrometry, atomic spectroscopy, and optical detection techniques,

including new color and fluorescence standards used in separation methods. Besides new fundamental knowledge, the results also include applications for medicine, environmental protection, the food industry, and preparation of ultra–clean materials.

In 2011, the Institute worked on 19 programme research projects.

Research in nanotechnologies

Many of the problems studied in the aforementioned departments fall under the areas of nanoanalysis, nanobiotechnologies, nanomedicine, and analysis of nanoparticles, although they are not so named at the Institute. Research in this area focuses on microfluids, luminescence detection with the use of quantum dots, nanostructured surfaces for biosensors, combining of microfluids with mass spectrometry, monolithic nanostructured materials, enzymatic microreactors with the use of immobilisation on surfaces of microchannels, polymer monoliths, magnetic nanoparticles etc. The laboratory also takes part in the discovery of the influence of nanoparticles on living organisms.

Projects implemented in nanotechnologies

- Project GA CR GAP503/11/2315 – "Study of transport of inhaled nano–sized particles (Pb, Cd) and their allocation in organs," 2011–2013; Principal investigator: Ing. Zbyněk Večeřa, CSc., Co–principal investigator: Ing. Jiří Smolík, CSc., Institute of Chemical Processes AS CR, RNDr. Marcela Buchtová, Ph.D., Institute of Animal Physiology and Genetics AS CR.
- Project GA CR GA203/08/1680 – "Nanotechnology in functional diagnostics of apoptotic and tumor cells," 1/2008–12/2011; Principal investigator: Ing. Karel Klepárník, CSc.
- Project GA CR GPP206/11/P004 – "Metal oxide nanoparticle modified monolithic supports for bioanalysis," 2011–2012; Principal investigator: Mgr. Jana Křenková, Ph.D.
- Project AS CR, "Nanotechnology for Society" programme, KAN400310651 – "Nanotechnologies for protein and gene diagnostics," 8/2007–12/2010; Principal investigator: Ing. František Foret, CSc.

Results in nanotechnologies/cooperation

The Institute of Analytical Chemistry cooperates with the Institute of Biophysics AS CR in Brno (prof. RNDr. Emil Paleček, DrSc., with the Currie Institute, Paris (prof. J. L. Viovy), and with universities in Hobart (Australia, prof. Macka, prof. Breadmore), Debrecen and Boston (Northeastern University, prof. Guttman).

Experts/field

- Ing. František Foret, CSc. – microfluidics, bioanalysis, laser detection in connection with mass spectrometry, detecting nanostructures
- Ing. Karel Klepárník, CSc. – microfluidics, bioanalysis, laser detection in connection with mass spectrometry, detecting nanostructures
- Mgr. Jana Křenková, Ph.D. – microfluidics, bioanalysis, mass spectrometry, monolithic materials, enzymatic microreactors
- Ing. Zbyněk Večeřa CSc. – nanoparticle sources and methods of detection

3.1.11 INSTITUTE OF INORGANIC CHEMISTRY AS CR, a public research institution (ÚACH)

Husinec – Řež 1001, 250 68 Husinec – Řež, ID: 61388980

www.iic.cas.cz

A brief description of the Institute

The Institute was created on 1 January 1959 from the Laboratory of Inorganic Chemistry. In 1972, the Institute was merged with the former Institute of Inorganic Syntheses of the Czechoslovak Academy of Sciences. The Institute engages in basic research in inorganic chemistry and related fields with solid state physics, ecology, and basic research in bioinorganic chemistry.

Research is conducted at three departments and two laboratories:

- Department of Syntheses (department head: B. Grüner)
- Department of Solid State Chemistry (Z. Černý)
- Centre for Instrument Techniques (J. Šubrt)
- Bioinorganic Chemistry Laboratory (K. Lang)
- Analytical Laboratory (T. Matys Grygar)

Some of the centre's workers take part in the activities of two joint laboratories:

- Joint Low Temperature Laboratory (together with the Institute of Physics AS CR and the Charles University Faculty of Science and Faculty of Mathematics and Physics)
- Laboratory for Material Research on Artworks (together with the Academy of Fine Arts, Prague)

Focus of research and development

In the years 2005–2011, research focused on carrying out a research proposal with individual tasks concentrating on nanotechnologies: AV0Z40320502 – "**Design, synthesis and characterisation of clusters, composites, complexes and other compounds based on inorganic substances; mechanisms and kinetics of their interactions,"** 1/2005–12/2011; Principal investigator: Ing. Jana Bludská, CSc., total costs for the entire project period CZK 271,302,000 from the state budget. Classification – area 1, share of nanotechnology research – 30%.

The research proposal focused on design and preparation of composite and crystalline materials with a defined particle size, borane clusters, special glass, organometallic and intercalation compounds with properties targeted for use in optoelectronics, magnetooptics, photocatalysis, medicine, and ecology. Characterisation encompassed a static and kinetic approach with the goal of defining the structure, reactivity, and other properties of the prepared substances.

In 2011, the Institute worked on 35 programme research projects.

Research in nanotechnologies

Research in the area of nanotechnologies is being conducted mainly at the Department of Solid State Chemistry and the Centre for Instrument Techniques. Research being conducted:

- Synthesis of nanostructured binary and composite oxides and sulfides. The prepared materials are tested as photocatalysts, materials for degrading organophosphorus pesticides, and detoxification catalysts (decomposition into nontoxic products) of chemical warfare agents.
- Synthesis of layered double hydroxides of intercalcated porphyrins and the study of their photophysical properties and bactericidal effects.
- Synthesis of multifunction nanoparticles of metal oxides in a SiO_2 matrix by the sol–gel method. Characterisation of the structure and the magnetic and optical properties of those materials.
- Preparation of nanocomposites of grapheme for environmental engineering
- Characterisation of resultant nanostructures by laser–initiated chemical reactions.

Since April 2004, a high–resolution transmission electron micrsoscope (HR–TEM) from the company JEOL has been in operation at the Institute.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute*

- Project GA CR P106/12/1116 – "Nanocrystalic metal oxides for safe, rapid degrading of organophosorus pesticides," 2011–2014; Principal investigator: Mgr. Václav Štengl, Ph.D.

- Project GA CR P208/10/2269 – "Development and structural characterisation of possible precursors of boron nanotubes based on linked icosahedra, shared icosahedra through a metal," 2010–2014; Principal investigator: RNDr. Drahomír Hnyk, CSc.

- Project GA AS CR IAA400320901 – "Gold and silver surfaces modified with functional derivatives of boron hydrides," 2009–2011; Principal investigator: Mgr. Tomáš Baše, Ph.D., Co–principal investigators: Mgr. Jiří Vacík, CSc., Institute of Nuclear Physics AS CR., and Dr. Lucie Bačáková, MD, CSc., Institute of Physiology AS CR.

- Project Ministry of Industry and Trade FR–TI1/006 – "Materials based on kaolinite modified by nano–oxides of transition metals," 2009–2012; Principal investigator: Mgr. Václav Štengl, Ph.D.

- Project Ministry of Industry and Trade FI–IM5/239 – "Methods of separation of nanoparticles from the liquid phase with emphasis on maintaining the quality of the solid nanophase," 2008–2010; Principal investigator: RNDr. Bakardjieva Snejana, Ph.D., Co–principal investigator for the company NANOGIES, s.r.o.: Ing. Petr Vláčil

- Project Ministry of Industry and Trade FI–IM5/231 – "Realisation of new nanostructures based on nanodispersive oxo–bisulphides Ti, Cd, Zn as active materials for degradation of warfare agents," 2008–2010; Principal investigator: Mgr. Václav Štengl, Ph.D.

- Project AS CR KJB200320801 – "Nanostructured doped oxides prepared from the medium of lyotropic liquid crystals," 2008–2010; Principal investigator: RNDr. Jakub Reiter, Ph.D.

b) *Selected projects on whose implementation the Institute is cooperating:*

- Project TA CR TA0210541 – "Progressive technologies for the manufacturing of ZnO multifunction nanoparticles," 2012–2014; Principal investigator: Ing. Jiří Zelenka, SYNPO, a.s., Co–principal investigator for the Institute of Inorganic Chemistry: Mgr. Václav Štengl, Ph.D..

- Project GA CR GAP205/10/0348 – "Sandwich nanocomposites: preparation, nucleation effects, electrical properties," 2010–2013; Principal investigator: RNDr. Miroslav Šlouf, Ph.D., Institute for Macromolecular Chemistry AS CR, Co–principal investigator for the Institute of Inorganic Chemistry: Mgr. Tomáš Baše, Ph.D.

- Project GA CR GAP204/10/0035 – "Hyperfine interactions in nanosized and low–dimensional iron oxides," 2010–2014; Principal investigator: as.prof. Mgr. Jaroslav Kohout, Dr., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Adriana Lančok, Ph.D.

- Project GA CR GAP108/10/1250 – "Multifunctional nanoparticles: smart preparation methods and study of their physical properties," 2010–2014; Principal investigator: RNDr. Jana Poltierová Vejpravová, Ph.D., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Inorganic Chemistry: RNDr. Jiří Plocek, Ph.D.

- Project GA CR GAP208/10/1678 – "Photophysics and photochemistry of self–assembled nanostructures," 2010–2012; Principal investigator: RNDr. Pavel Kubát, CSc., Jaroslav Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Kamil Lang, CSc.

- Project GA CR GA203/09/1088 – "Preparation of Nanostructured Si/Ge/C Deposits," 2009–2011; Principal investigator: RNDr. Vladislav Dřínek, CSc., Institute of Chemical Processes AS CR, Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Jan Šubrt, CSc.

- Project Ministry of Industry and Trade FR–TI1/595 – "Amorphous oxide nanolayers coated with aqueous solutions usable for industrial applications," 2009–2011; Principal investigator: Ing. Kateřina Koňáková, Optaglio s.r.o., Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Zbyněk Černý, CSc.

Projects within the "Nanotechnology for Society" programme

- KAN300100802 – "Nanocomposite, ceramic and thin film scintillators," 01/2008–12/2012; Principal investigator: Ing. Martin Nikl, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Ivo Jakubec, CSc.

- KAN400480701 – "Nanostructures based on carbon and polymers for use in bioelectronics and medicine," 01/2007–12/2011; Principal investigator: Mgr. Jiří Vacík,

CSc., Institute of Nuclear Physics AS CR, Husinec – Řež, Co–principal investigator for the Institute of Inorganic Chemistry: Mgr. Tomáš Baše, Ph.D.

- KAN100400702 – "Nanostructured materials for catalytic, electrocatalytic and sorption applications," 01/2007–12/2011; Principal investigator: prof. RNDr. Zdeněk Samec, DrSc., J. Heyrovský Institute of Physical Chemistry, AS CR, Prague, Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Ivo Jakubec, CSc.

- KAN400100653 – "Self–Organized Magnetic Nanostructures," 7/2007–12/2010; Principal investigator: Ing. Ján Lančok, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Adriana Lančok, Ph.D.

- KAN 300430651 – "Nanocrystallisation of plasma sprayed coatings based on eutectic ceramic alloys," 7/2006 – 12/2010; Principal investigator: prof. Ing. Dr. Pavel Chráska, DrSc., Institute of Plasma Physics AS CR, Co–principal investigator for the Institute of Inorganic Chemistry: ass.prof. Ing. Jiří Hostomský, CSc.

Other projects

- Project GA AS CR IAA400720619 – "New laser–induced process for production of novel carbon based nanomaterials and carbon–based nanomaterials with incorporated Si, N and B heteroatoms," 1/2006–12/2010; Principal investigator: RNDr. Josef Pola, DrSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for the Institute of Inorganic Chemistry: RNDr. Snejana Bakardjieva, Ph.D.

- Project GA CR GA104/07/1093 – "Composite nanoparticle synthesis by an aerosol process," 1/2007–12/2010; Principal investigator: Ing. Pavel Moravec, CSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for the Institute of Inorganic Chemistry: RNDr. Snejana Bakardjieva, Ph.D.

- Project GA CR GA203/08/0831 – "Nanofabrics producing singlet oxygen," 1/2008–12/2010; Principal investigator: RNDr. Jiří Mosinger, Ph.D., Charles University, Prague/Faculty of Science, Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Kamil Lang, CSc.

- Project Ministry of Education LC523 Research Centre – "Promising Inorganic Materials," 1/2005–12/2011; recipient: University of Pardubice; Principal investigator: prof. Ing. Miloslav Frumar, DrSc., Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Jan Šubrt, CSc.

- Project Ministry of Education LC 06041 Research Centre – "Preparation, modification, and characterisation of materials by energy radiation," 3/2006–12/2011; recipient: Institute of Nuclear Physics AS CR, Husinec – Řež; Principal investigator: as.prof. Ing. Vladimír Hnatowitcz, DrSc.,Co–principal investigator for the Institute of Inorganic Chemistry: Ing. Jan Šubrt, CSc.

- Project Ministry of Industry and Trade FT–TA4/126 – "Research on semiconductive nanotubes for implementation of cold emission components," 1/2007–12/2011, recipient: STARMANS electronics, s.r.o., Prague; Principal investigator: Ing. Stanislav Štarman, Ph.D., Co–principal investigator for the Institute of Inorganic Chemistry: RNDr. Mariana Klementová, Ph.D.

- Project Ministry of Industry and Trade FT–TA4/126 – "Research on semiconductive nanotubes for implementation of cold emission components," 7/2007–12/2006; recipient: STARMANS electronics, s.r.o., Prague; Principal investigator: Ing. Stanislav Štarman, Ph.D., Co–principal investigator for the Institute of Inorganic Chemistry: RNDr. Jiří Plocek, Ph.D.

Results in nanotechnologies/cooperation

- Coating materials with a self–cleaning effect using photocatalysts on the basis of TiO_2 (Detoxycolor, company: Rokospol a.s.) awarded in 2008 by the Association of Innovative Entrepreneurship as part of the Innovation of the Year event.

Experts/field

- RNDr. Snejana Bakardjieva, Ph.D. – electron microscopy
- Mgr. Tomáš Baše, Ph.D. – nanoparticles of metals, preparation, characterisation and application
- Ing. Zbyněk Černý, CSc. – synthesis, characterisation, and application of nanoparticles of metal oxides combined with geopolymeric materials
- RNDr. Mariana Klementová, Ph.D. – electron microscopy
- RNDr. Daniel Nižňanský, Ph.D. – synthesis of nanocomposites on the basis of nanoparticles of metal oxides in a SiO_2 matrix by the sol–gel method, characterisation of the structure and magnetic and optical properties of those materials
- Mgr. Václav Štengl, Ph.D. – synthesis, characterisation, and application of nanoparticles of metal oxides prepared by precipitation procedures from aqueous solutions.
- Ing. Jan Šubrt, CSc. – powdered inorganic oxide materials, applications of photocatalytically active TiO_2, pigments, electron microscopy

3.1.12 INSTITUTE OF EXPERIMENTAL BOTANY AS CR, a public research institution (ÚEB)

Rozvojová 263, 165 00 Prague 6 – Lysolaje, ID: 61389030

www.ueb.cas.cz

A brief description of the Institute

The Institute was created on 1 January 1962 from the departments of plant physiology and of phytopathology of the Institute of Biology of the Czechoslovak Academy of Sciences. On 1 July 1990 it was split into two independent units: the Institute of Experimental Botany with laboratories in Prague and Olomouc, and the Institute of Molecular Biology of Plants, established from a laboratory of the Institute of Experimental Botany in České Budějovice, which is now a part of the Biology Centre AS CR. The Institute is located on 4 campuses (4 are in Prague and 2 are in Olomouc), and it is divided into 17 laboratories and 1 research station.

The main areas of the Institute's research are plant genetics, physiology, and biotechnologies. Among the genetic problems studied by the Institute are the repairing of plant DNA, the structure of large plant genomes, and the molecular genetics of pollen. Among physiological questions, it deals primarily with hormonal and ecological control of growth and plant development, mechanisms of the effect of plant growth regulators, and physiological aspects of the effect of plant viruses. In the area of biotechnology, the Institute deals with the fundamentals of production and biotransformation of biologically active substances with plant tissue cultures. Research in the area of immunonanotechnology is conducted in the Laboratory of Growth Regulators (a joint laboratory of the Institute of Experimental Biology and of the Faculty of Science of Palacký University in Olomouc).

Focus of research and development

In the years 2005–2010, research focused on the questions of one research proposal concentrating on the biology of plants. In 2011, the Institute worked on 91 programme research projects.

Projects implemented in nanotechnologies

- Project Ministry of Education LH11047 – "Plants and nanoparticles – friends or foes?" 2011–2014; Principal investigator: RNDr. Tomáš Vaněk, CSc.
- Project AS CR, "Nanotechnology for Society" programme, KAN200380801 – "Immunonanotechnologies for hormone diagnostics," 1/2008–12/2012; Principal investigator: prof. Ing. Miroslav Strnad, DrSc.

Experts/field:

- prof. Ing. Miroslav Strnad, DSc. – physiology of plants
- RNDr. Tomáš Vaněk, CSc – biotechnology of plants

3.1.13 INSTITUTE OF EXPERIMENTAL MEDICINE AS CR, a public research institution (IEM)

Vídeňská 1083, 142 40 Prague 4, ID: 68378041

www.iem.cas.cz

A brief description of the Institute

The Institute was founded on 1 January 1975 by the merger of several laboratories of the Czechoslovak Academy of Sciences that had been founded between 1953 and '57. There was a gradual increase to the number of independent research groups. After merger with the Institute of Pharmacology AS CR in 2002, 4 new pharmacology departments were created at the Institute of Experimental Medicine.

The main activity of the IEM AS CR is scientific research on biomedicine, especially in the area of cell biology and pathology, genotoxicology, teratology, biochemistry, neuroscience, stem cells, tissue replacement, nanomedicine, and also the development and verification of analytical, diagnostic, and therapeutic methods based on the results of basic research. The IEM AS CR also conducts research in the area of pharmacology and immunopharmacology

in particular, as well as neuropsychopharmacology. Research is conducted in 10 departments and at two independent laboratories.

The Institute also manufactures and sells nanofibers and nanoparticles, hydrogels, and artificial cell carriers, stem cells and preparations containing stem cells, cartilaginous implants, specific cultivation media, and auxiliary medical preparations.

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

Focus of research and development

During the period from 2005 until 2013, research at the Institute has been focused mainly on carrying out two research proposals:

AV0Z50390512 – **"Molecular, cellular, and system mechanisms of serious human illnesses, their diagnosis, therapy, and pharmacotherapy,"** 1/2005–12/2010; Principal investigator: Dr. Eva Syková, MD, DrSc., total costs for the entire project period: CZK 492,126,000, of which CZK 490,463,000 came from the state budget. Classification – area 3, share of nanotechnology research – 10%.

The goal was research in the area of biomedicine and finding possible practical use of the results attained in the following fields: molecular and cellular biology, molecular embryology and pharmacology, neurophysiology, neurochemistry, neuropathology, neuropharmacology and immunopharmacology, genotoxicology, and teratology. The research focused on the study of mechanisms of cell function, sub–cellular structure, receptors and mediators, interactions of cells, the activity of cell tissue and organs, and pathological changes caused to living organisms by the effects of harmful agents in the internal and external environment. The goal was to find a method of diagnosing and treating illnesses and to perfect them for practical use. Areas of application include healthcare (therapeutic procedures in neurosurgery, traumatology, especially of spinal injuries, immunology, ophthalmology, plastic surgery, and otolaryngology), the pharmaceutical industry (medications and diagnostic kits), and hygiene and epidemiology (evaluation of risks to the human population from chemical substances).

In the area of nanosciences and nanotechnologies, work was focusing on:

- Tagging cells with superparamagnetic nanoparticles and their monitoring *in vivo* with the use of nuclear magnetic resonance (NMR).
- *In vivo* testing of materials on the basis of nanofibers as a reconstruction matrix for tissue, especially of the central nervous system, and connective tissue (cartilage).

AV0Z50390703 – **"New biotechnologies, nanomaterials and stem cells for use in regenerative medicine,"** 1/2007–12/2013; Principal investigator: prof. Dr. Eva Syková, MD, DrSc., total costs for the entire project period: CZK 448,891,000,of which, CZK 307,897,000 came from the state budget. Classification – area 3, share of nanotechnology research – 70%.

The goal of the proposal is research in the modern medical field known as regenerative medicine. Attention focuses on research and development on procedures for the use of adult and embryonic stem cells, biomaterials for tissue engineering, nanomaterials, new biotechnologies, and diagnostic methods. The goal is to find therapies for serious illnesses that are difficult to treat at present. The results of the research will be especially useful for healthcare in the following fields: neurosurgery (artificial replacements and bridging of defects), traumatology (brain and spinal cord injuries), neurology (Parkinson's disease,

multiple sclerosis), immunology (immune disorders), pediatrics (birth defects, perinatal damage), orthopedics (cartilage and bone replacement), ophthalmology (cornea replacement), otolaryngology, dentistry (dental implants), plastic surgery, and dermatology. The goal is the development of specific products that are useful for clinical study and treatment, in the pharmaceutical industry for the development of diagnostic kits, new drugs, and their testing on cell lines. In the area of the nanosciences and nanotechnology, work is underway focusing on cell marking with superparamagnetic nanoparticles and their monitoring *in vivo* with the use of nuclear magnetic resonance (NMR) and on *in vivo* testing of materials on the basis of nanoparticles as a reconstruction matrix for tissue, especially of the central nervous system and connective tissue (cartilage).

The Institute is involved in the building of the **BioCev Centre of Excellence**. At a cost of CZK 3.2 billion during the years 2011–2015, the project's goal is to build a centre for excellent research in the Central Bohemian town of Vestec. The research will focus on detailed study of cellular mechanisms at the molecular level, research and development of new therapeutic procedures, prompt diagnosis, biologically active substances including chemotherapy agents, natural antibiotics, development of tissue for the repairing of damaged organs, protein engineering, and other technologies. More information is available at www.biocev.eu.

Research in nanotechnologies

Research in the area of nanomedicine and nanobiotechnology is being conducted mainly at the Department of Neuroscience (department head: prof. Dr. E. Syková, MD, DrSc.), the Laboratory of Tissue Cultures and Stem Cells (RNDr. P. Jendelová, Ph.D.), the Department of Neurophysiology of Hearing (prof. Dr. Josef Syka, MD, DrSc.), and the Department of Tissue Engineering (prof. RNDr. E. Amler, CSc.). In 2011, a total of 62 programme research projects were conducted at the Institute, some of which involved nanotechnologies/nanomaterials.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project AS CR IAA500390702 – "Scaffolds from liposome nanofibers for tissue engineering," 2007–2011; Principal investigator: as.prof. RNDr. Evžen Amler, CSc., Co–principal investigator: prof. RNDr. CSc. David Lukáš, Technical University of Liberec/Faculty of Textiles

- Project GA CR GAP304/10/1307 – "Smart nanofiber/liposome composite scaffold for bone regeneration," 2010–2012; Principal investigator: as.prof. RNDr. Evžen Amler, CSc.

- Project GA AS CR IAA500390702 – "Scaffolds from liposome nanofibers for tissue engineering," 1/2007–12/2011; Principal investigator: as.prof. RNDr. Evžen Amler, CSc.

b) *Selected projects on whose implementation the Institute is cooperating:*

- Project GA CR GA203/09/1242 – "Surface–modified magnetic nanoparticles for cell labeling and *in vivo* and in vitro diagnostics," 2009–2011; Principal investigator: Ing. Daniel Horák, CSc.

- Project GA CR GA304/07/1129 – "Polarized cultures of hepatocytes and mesenchymal cells on the nanofiber membranes in the experimental bioreactor," 2007–2011; Principal investigator: prof. Dr. Miroslav Ryska, MD, CSc., Charles University in Prague/2nd Faculty of Medicine, Co–principal investigator for the Institute of Experimental Medicine: RNDr. Pavla Jendelová, Ph.D.

- Project Ministry of Industry and Trade FR–TI3/521 – "Technology of new magnetic nanoparticles for diagnostics and therapy in oncology," 2011–2015; Principal investigator: Ing. Jiří Zelenka, CSc. – SYNPO, a.s., Co–principal investigator for the Institute Experimental Medicine: RNDr. Pavla Jendelová, Ph.D.

- Project AS CR, "Nanotechnology for Society" programme, KAN200520801 – "Targeted expression and transport of bioactive molecules," 1/2008–12/2012; Principal investigator: Mgr. David Staněk, Ph.D., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for the Institute of Experimental Medicine: RNDr. Karel Kaberna, CSc.

- Project AS CR, "Nanotechnology for Society" programme, KAN200520804 – "Biocompatible nanofiber scaffolds forming novel drug matrices for the application of biologically and pharmacologically active substances," 1/2008–12/2012; Principal investigator: as.prof. RNDr. Vladimír Holáň, Institute of Molecular Genetics AS CR, Co–principal investigator for the Institute of Experimental Medicine: prof. Dr. Eva Syková, MD, DrSc.

- Project AS CR, "Nanotechnology for Society" programme, KAN201110651 – "Combined contrast agents for molecular MR imaging," 7/2006–12/2010; Principal investigator: prof. Ivan Lukeš, DrSc., recipient: Charles University in Prague/Faculty of Science, Co–principal investigator: prof. Dr. Eva Syková, MD, DrSc.

- Project Ministry of Education 1M0538 – "Centre for Cell Therapy and Tissue Repair," 1/2005–12/2011; Principal investigator: prof. Dr. Eva Syková, MD, DrSc., recipient: Charles University in Prague/2nd Faculty of Medicine, Co–principal investigator for the Institute of Experimental Medicine: as.prof. RNDr. Alexandr Chvátal, CSc.

- Project Ministry of Education 2B06130 – "Synthesis of new biomaterials and preparation of stem cell derived cells, and their applications in for the treatment of diseases affecting human tissues derived from mesoderm: cartilage, bone, ligament and meniscus," 7/2006–6/2011; Principal Investigator: prof. MVDr. Alois Nečas, Ph.D., University of Veterinary and Pharmaceutical Sciences, Brno/Faculty of Veterinary Medicine, Co–principal investigator for the Institute of Experimental Medicine: prof. Dr. Eva Syková, MD, DrSc.

c) *Projects with international cooperation:*

- Project 7FP EU project type: Large, thematic priority: NMP, project title: BIOSCENT – "Bioactive highly porous and injectable scaffolds controlling stem cell recruitment, proliferation and differentiation and enabling angiogenesis for Cardiovascular Engineered Tissues," 2009–2013; 16 partners from 8 countries, project budget: EUR 8,340,000, coordinator: Elisabetta Rosellini, Universita di Pisa (Italy); the Institute of Experimental Medicine is a project partner.

- Project 6FP EU DiMI/512146, project title: "Diagnostic Molecular Imaging: A Network of Excellence for Identification of New Molecular Imaging Markers for Diagnostic

Purposes," 4/2005–3/2010; project coordinator: prof. Andreas Jacobs, University of Cologne, Germany. Network of Excellence with 45 participants. Principal investigator at the Institute of Experimental Medicine, AS CR: prof. Dr. Eva Syková, MD, DrSc.

- Project 6FP EU NMP4–CT–2006–02556: – "3g–Nanotechnology based targeted drug delivery using the inner ear as a model target organ," 11/2006–10/2010; coordinator: prof. Ilmari Pyykko, University of Tampere, Finland. Principal investigator at the Institute of Experimental Medicine, AS CR: prof. Dr. Josef Syka, MD, DrSc. The project focused on the development and use of nanoparticles as carriers for the application of substances to the inner ear.

Results in nanotechnologies/cooperation

Patents:

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

Experts/field

- as.prof. RNDr. Evžen Amler, CSc. – stem cells, connective tissue
- RNDr. Pavla Jendelová, Ph.D. – stem cells, nanoparticles, biomaterials, neurosciences
- prof. Dr. Eva Syková, MD, DrSc. – stem cells, nanoparticles, artificial biomaterials, neurosciences
- prof. Dr. Josef Syka, MD, DrSc. – use of nanoparticles as carriers for the application of substances to the inner ear

3.1.14 INSTITUTE OF PHOTONICS AND ELECTRONICS AS CR, a public research institution (IPE)

Chaberská 57, 182 51 Praha 8, ID: 67985882
www.ufe.cz

A brief description of the Institute

The Institute was established on 1 January 1955 as the Institute for the Theoretical Radiotechnology of the Czechoslovak Academy of Sciences. On 1 January 1956 the Institute's name was changed to the Institute of Radiotechnology and Electronics. The current name was adopted on 1 January 2007, when the Institute became a public research institution. In the organizational structure of the Academy of Sciences CR the Institute is

included under the Institutes of Mathematics, Physics and Earth Sciences, in the Section of Applied Physics.

Research and development

The research and development activities of UFE AS CR focus on three main areas: photonics, optoelectronics, and signals and systems.

From 2005–2011, research focused on the following research plan:

AV0Z20670512 "Materials, structures, systems and signals in electronics, optoelectronics and photonics," 1/2005–12/2011; Principal investigator: Ing. Vlastimil Matějec, CSc., during the entire period the project received CZK 426.72 million from the state budget. Classification – area 2b, share of nanotechnology research – 30 %.

Along with the Institute's basic division into the basic areas of electronics, optoelectronics and photonics, the research plan also focused on three further areas – photonic structures, materials for optoelectronics, and the systems generating, transmitting and processing signals. The research in the area of photonic structures focused on promising passive, active and non-linear photonic structures and on systems using the principles of fibrous and planar waveguides, diffractive structures and photonic crystals applied in optical communications and sensors. The research of materials for optoelectronics targeted the preparation and diagnostics of new materials, structures and nanostructures which can be used mostly for special optical waveguides, radiation sources, optic amplifiers, detectors, and solar cells. In the area of systems and signals, research focused on processes of generation, transmission and signal processing in relation to frequencies and time in multi user communication networks, and in voice systems. Mechanisms generating electromagnetic and mechanic-electric signals in living cells were also examined.

Research focused on nanotechnologies is conducted by the Photonics Section, in the Department of Optical Sensors (J. Homola), in the Department of Optical Fibres (I. Kašík, J. Mrázek, V. Matějec and O. Podrazký), in the Section of materials, in the Department of Diagnostics (D. Nohavica, J. Grym, P. Gladkov, J. Walachová, R. Yatskiv, J. Zavadil and K. Žďánský). Nanotechnology is also applied in the Section of Signals in the research of electromagnetic fields in living cells (M. Cifra and J. Pokorný).

In 2011 the Institute conducted 34 research projects, some of which were related to nanotechnologies/nanomaterials.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project of Ministry of Education, programme COST, OC09061 – "Analysis and optimization of the properties of photonic metallic nanostructures for information technology," 2009–2012; Principal investigator: prof. Ing. Jiří Čtyroký, DrSc.
- Project of Ministry of Education, COST programme, OC09058 –"Plasmonic nanostructures and functionalization for new optic affinity biosensors," 2009–2012; Principal investigator: assoc. prof. Ing. Jiří Homola, CSc., DSc.
- Project of Ministry of Education, COST programme, OC10021 – "Study of metal nanoparticle layers deposited by electrophoresis on semiconductor III-V-N compounds," 2010–2012; Principal investigator: Mgr. Roman Yatskiv, Ph.D.

- Project Ministry of Education, KONTAKT programme, LH11102 – "Surface plasmon resonance based biosensing using hybrid nanoplasmonic materials fabricated by self-assembly processes," 2011–2013; Principal investigator: assoc. prof. Ing. Jiří Homola, CSc., DSc.

- Project Ministry of Education, KONTAKT programme, LH11038 – "Chemical and biochemical sensors based on functionalized micro-and nanostructured optical waveguides," 2011–2014; Principal investigator: Ing. Jiří Kaňka, CSc.

- Project GA CR GAP102/10/P454 – "Measurement and analysis of local electrical oscillations and optical emission of biomolecular nanostructures," 2010–2012; Principal investigator: Ing. Michal Cifra, Ph.D.

- Project GA CR GA102/09/1037 – "Metallic nanolayers for semiconductor sensor and detector structures," 2009-2011; Principal investigator: RNDr. Olga Procházková, CSc., Co-investigator for the Czech Technical University in Prague, Faculty of Nuclear Science and Physical Engineering: Ing. Kateřina Piksová

- Project GA CR GAP102/10/2139 – "Preparation and properties of silica-based optical glasses containing rare earth and chromium doped nanoparticles," 2010–2013; Principal investigator: Dr. Ing. Ivan Kašík

- Project GA CR GAP108/10/0253 – "Lattice mismatch compensation in heteroepitaxy on micro and nanoporous A3B5 semiconductors and deposition of metals and semiconductors into micropores," 2010–2013; Principal investigator: Ing. Jan Grym, Ph.D., Co-investigator for Institute of Physics AS CR: assoc. prof. Ing. Eduard Hulicus

- Project to promote excellence in basic research GAP205/12/G118 GA CR, "Nanobiophotonics for medicine of the future," 2012–2018; Principal investigator: assoc. prof. Ing. Jiří Homola, CSc., DSc., Co-investigators: prof. Ing. Jan Evangelista Dyr, DrSc., Institute of Haematology and Blood Transfusion, assoc. prof. Ing. Ivan Richter, Dr., Czech Technical University in Prague, Faculty of Nuclear Science and Physical Engineering, prof. RNDr. Petr Štěpánek, CSc., Charles University, Faculty of Mathematics and Physics, RNDr. Eduard Brynda, CSc., Institute of Macromolecular Chemistry AS CR

b) *Selected projects on which the Institute is cooperating*

- Project GA CR GAP 102/110649 – "Research and measurement of signals generated by nanostructures," 2011–2013; Principal investigator: prof. Ing. Jan Vrba, CSc., CTU, Faculty of Electrical Engineering, Co-investigator for IPE: Ing. Jiří Pokorný, DrSc.

- Project of Ministry of Education, "Nanotechnology for Society" programme, KAN401220801 – "Nanostructures of controlled size and dimensions," 1/2008–12/2012; Principal investigator: prof. Ing. Pavel Fiala, CSc., Czech Technical University in Prague, Faculty of Nuclear Science and Physical Engineering, Co-investigator for IPE: RNDr. Jiří Zavadil, Ph.D.

Results in nanotechnology/cooperation

- New methods using processes of deposition from gas phase (MCVD) and from solution (sol-gel method) that allow the preparation of multicomponent glass materials with embedded nanocrystals of rare earth elements in a matrix of vitreous silica doped by

oxides of germanium, phosphorus or zirconium have been developed. These methods were used for the preparation of new types of optical fibres used in fibre lasers and amplifiers.

- In cooperation with the University of Washington, Seattle (USA) "quasi-3D" plasmonic nanostructures, which consist of a thin metal layer perforated by nano-holes and a layer of metal nano-discs separated by a thin dielectric layer, were examined. Theoretical and experimental studies demonstrated that the Fabry-Pérotov resonance in these structures allows obtaining very strong localization of electromagnetic fields. Therefore, they are very promising for biosensors based on surface enhanced Raman spectroscopy (SERS). Furthermore, in cooperation with the Karl-Franzens Universität Graz (Austria) properties of fields of plasmonic nanoparticles were examined. The subject of this theoretical and experimental study was local sensitivity of gold nanotubes to refractive index changes. Based on research in these fields a new biosensor based on fields of gold nanotubes has been developed. This sensor is able to detect DNA molecules at low concentrations (up to 100 pM).

- The surface of mono-crystals of n-InP and n-GaN types has been coated by nanoparticles of Pd, Pt, Au and of Pd/Pt and Au alloy using the initial process of electrophoretic deposition of colloidal solution of metal nanoparticles. Electrical properties of prepared diode structures with Schottky barrier made from graphite and coated with nanoparticles of Pd, Pt and of Pd/Pt and Au alloy were studied. Structures with nanoparticles of Pd, Pt and of Pd/Pt alloy are sensitive to the presence of hydrogen – highly sensitive detection of hydrogen was measured in the range of 1 ppm to 1000 ppm of hydrogen mixed with nitrogen.

- New electrical nanosensors have been developed and used for analysis and measurement of the electromagnetic field generated by living yeast cells in frequencies up to 2 kHz and 8-9 MHz. The measurements indicated increased electromagnetic activity in certain stages of cell division (mitotic spindle development).

- In cooperation with the University of Rennes (France) a new procedure using application of photocatalytically active coatings applied to optical fibres in the process of their drawing has been developed. This procedure was applied in preparation of optical fibres coated with anatase nanoparticles. These layers demonstrated high efficiency in the breakdown of organic dyes.

Experts/fields

- Ing. Michal Cifra, Ph.D. – nanotechniques for measuring electromagnetic and mechanoelectric signals generated in living cells

- ass.prof. Petar Gladkov, Ph.D. – porous semiconducting materials and characterization of nanostructures by FL spectroscopy

- Ing. Jan Grym, Ph.D. – self-organised porous semiconducting nanostructures, electrophoretic deposition of metal nanoparticles

- ass. prof. Ing. Jiří Homola, CSc., DSc. – optical chemical sensors and biosensors using optical plasmonic nanostructures, director of the Institute

- Dr. Ing. Ivan Kašík – preparation of nanostructured pre-forms of optical fibres by deposition from gas phase and from solution

- RNDr. Jan Lorinčík, CSc. – characterisation of nanostructures by mass spectroscopy of secondary ions
- Ing. Vlastimil Matějec, CSc. – preparation of optical fibres with nanostructured functional layers by the sol-gel method
- Ing. Jan Mrázek, Ph.D. – preparation of nanostructured thin layers for photonics by the sol-gel method
- Ing. Dušan Nohavica, CSc. – technology of epitaxial structures A3B5 and nanostructures, semiconducting lasers, photodetectors and solar cells
- Ing. Ondřej Podrazký, Ph.D. – preparation of nanostructured optical fibres for lasers and amplifiers
- Ing. Roman Yatskiv, Ph.D. – sensor structures using electrical properties of metal nanoparticles
- Ing. Jarmila Walachová, CSc. – characterisation of nanostructures by the scanning tunnel microscopy and ballistic emission electron microscopy
- RNDr. Jiří Zavadil, CSc. – characterisation of semiconducting nanostructures with the assistance of the low-temperature FL spectroscopy
- Ing. Karel Žďánský, CSc. – electrophoretic deposition of metal nanoparticles on semiconducting materials

3.1.15 J. HEYROVSKÝ INSTITUTE OF PHYSICAL CHEMISTRY AS CR, a public research institution (JH INST)

Dolejškova 3, 182 23 Prague 8, ID: 61388955

www.jh–inst.cas.cz

A brief description of the Institute

The Institute was founded on 1 March 1972 and was named the J. Heyrovský Institute of Physical Chemistry and Electrochemistry of the Czechoslovak Academy of Sciences. It was formed by the merger of the Institute of Polarography, which was founded in 1950 and on 1 January 1953 became part of the Czechoslovak Academy of Sciences, with the Institute of Physical Chemistry of the Czechoslovak Academy of Sciences, which was created on 1 January 1955 from the former Laboratory of Physical Chemistry, founded within the Czechoslovak Academy of Sciences on 1 January 1953. The Institute got its present name on 1 August 1993. Since 1 January 2007, the Institute has been a public research institution.

The Institute is conducting research on physical chemistry and chemical physics with a focus on relationships between the structure and reactivity of substances. It is concentrating in particular on theoretical and experimental research on chemical and physical–chemical events at the atomic and molecular level (the structure and dynamics of substances and the mechanism of reactions) in the gaseous, liquid, and solid phases and at their transitions, especially in systems of importance for chemical catalysis and sorptive, electrochemical and biological processes (including preparation and characterisation of new catalytic, sorptive, electrode, and other special materials).

Research activity is being conducted in 7 departments:

- Department of Theoretical Chemistry (J. Bittner, P. Čársky)
- 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 Structure and Dynamics in Catalysis (Z. Sobalík, J. Rathouský, P. Hrabánek, M. Kočiřík, B. Wichterlová)
- Department of Synthesis and Catalysis (J. Čejka)
- Department of Electrochemical Materials (L. Kavan, J. Jirkovský, P. Janda)
- Department of Electrochemical Processes (Z. Samec, M. Gál, M. Hromadová)

Department heads are named first in parentheses, followed by other workers focusing on nanotechnology research.

Focus of research and development

During the years 2005–2010, research at the JH INST AS CR focused mainly on the questions of a single research proposal:

AV0Z40400503 – "**Structure, reactivity and dynamics of molecular and biomolecular systems: theory, experiment, and application**," 1/2005–12/2010; Principal investigator: prof. RNDr. Zdeněk Samec, DrSc., total costs for the entire project period: CZK 842,972,000, of which CZK 842,846,000 came from the state budget. Classification – area 3, share of nanotechnology research – 70%.

The goal of the research proposal was identification and clarification of relationships between the structure and interactions in molecular and biomolecular systems and their chemical or electrochemical reactivity and physical dynamics.

Subject matter of research:

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

In 2011, a total of 95 programme research projects were conducted at the Institute, some of which involved nanotechnologies/nanomaterials.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

Projects of the GA AS CR

- Project GA AS CR IAA400400804 – "Supramolecular assemblies with carbon nanotubes," 1/2008–12/2012; Principal investigator: prof. RNDr. Ladislav Kavan, DrSc.
- Project GA AS CR IAA400400911 – "Spectroscopy and spectroelectrochemistry of chemically doped carbon nanostructures," 2009–2012; Principal investigator: RNDr. Ing. Martin Kalbáč, Ph.D.
- Project GA AS CR IAA400400906 – "Nanocrystalline oxides for selective anodic electrocatalysis," 2009–2012; Principal investigator: Ing. Petr Krtil, CSc.
- Project GA AS CR GAP208/10/1678 – "Photophysics and photochemistry of self–assembled nanostructures," 2010–2012; Principal investigator: RNDr. Pavel Kubát, CSc., Co–principal investigators: Ing. Kamil Lang, CSc., Institute of Inorganic Chemistry AS CR, as.prof. RNDr. Jiří Mosinger, Ph.D., Charles University, Prague/Faculty of Science, prof. RNDr. Tomáš Polívka, Ph.D., University of South Bohemia, České Budějovice/Institute of Physical Biology
- Project GA AS CR KJB400400902 – "Imaging photochemical processes in free nanoparticles," 2009–2011; Principal investigator: Mgr. Viktoriya Poterya, Ph.D.
- Project GA CR GC203/07/J067 – "The electronic interactions of SWCNT and conducting polymers in nanotube/polymer composites," 2007–2010; Principal investigator: RNDr. Ing. Martin Kalbáč, Ph.D.
- Project GA AS CR IAA400720619 – "New laser–induced process for production of novel carbon based nanomaterials and carbon–based nanomaterials with incorporated Si, N and B heteroatoms," 1/2006–12/2010; Principal investigator: RNDr. Zdeněk Bastl, CSc.
- Project GA AS CR IAA400400621 – "DNA condensation: Monte–Carlo simulations, light scattering, fluorescence correlation spectroscopy *in vitro* and *in vivo*," 1/2006–12/2010; Principal investigator: Teresa Kral, Dr.

Projects of the GA CR

- Project GA CR GAP204/10/1677 – "Magnetic properties of carbon nanostructures in neutral and doped state," 2010–2014; Principal investigator: RNDr. Ing. Martin Kalbáč, Ph.D., Co–principal investigator: RNDr. Jana Poltierová Vejpravová, Ph.D., Charles University in Prague/Faculty of Matematics and Physics
- Project GA CR GA203/09/0422 – "Study of photochemical processes in free nanoparticles of atmospheric and biophysical relevance," 2009–2013; Principal investigator: Mgr. Michal Fárník, Ph.D., Co–principal investigator: as.prof. RNDr. Petr Slavíček, Ph.D., Institute of Chemical Technology, Prague/Faculty of Chemical Engineering
- Project GA CR GA104/09/0561 – "Supported nanoparticle catalysts for C–C bond forming reactions," 2009–2013; Principal investigator: prof. Ing. Jiří Čejka, DrSc., Co–principal investigator: as.prof. RNDr. Petr Štěpnička, Ph.D., Charles University/Faculty of Science

- Project GA CR GA203/09/1627 – "Study of the dynamics of active sites of crystalline nanoporous alumosilicates employing molecular modelling," 2009–2013; Principal investigator: RNDr. Štěpán Sklenák, Ph.D.

- Project GA CR GA104/08/0435 – "Smart structure mesoporous TiO_2 layers with antibacterial and switchable wetting properties," 1/2008–12/2010; Principal investigator: Ing. Jiří Rathouský, CSc.

- Project GA CR GA203/08/0604 – "Advanced molecular sieves for capture and storage of CO_2 and H_2," 1/2008–12/2010, Principal investigator: as.prof. Ing. Jiří Čejka, CSc.

- Project GA CR GA203/08/1157 – "Tailoring the lock and key motifs in novel low–dimensional structures at electrified interface," 1/2008–12/2010; Principal investigator: Mgr. Magdaléna Hromadová, Ph.D.

- Project GA CR GA104/08/1501 – "Formation, characterisation and chemical properties of supported gold–based bimetallic nanoparticle," 2008–2010; Principal investigator: Ing. Jan Plšek, Ph.D.

- Project GA CR GC203/07/J067 – "The electronic interactions of SWCNT and conducting polymers in nanotube/polymer composites," 2007–2010; Principal investigator: RNDr. Ing. Martin Kalbáč, Ph.D.

"Nanotechnology for Society" programme research projects

- KAN100400701 – "Hybrid nanocomposite materials," 1/2007–12/2011; Principal investigator and coordinator: prof. Ing. Jiří Čejka, DrSc.

- KAN100400702 – "Nanostructured materials for catalytic, electrocatalytic and sorption applications," 1/2007–12/2011; Principal investigator and coordinator: prof. RNDr. Zdeněk Samec, DrSc.

- KAN400400651 – "Experimental and theoretical studies of free nanoparticles: 'flying nanoreactors' for investigations of processes at molecular level," 7/2006–12/2010; Principal investigator and coordinator: Mgr. Michal Fárník, Ph.D.

Other projects

- Project Ministry of Culture DF11P01OVV012 – "New materials and technologies for the conservation of the materials of historical monuments and for preventive care," 2011–2015; Principal investigator: Ing. Jiří Rathouský, CSc., Co–principal investigators: RNDr. Jaromír Jirkovský, CSc., Ing. Jiří Kalousek

- Project Ministry of Education, "Basic Research Centres" programme, LC066063 – "Fluorescence microscopy in biological and medical research," 3/2006–12/2011; Principal investigator and coordinator: as.prof. Martin Hof, Dr. rer. nat.

- Project Ministry of Education 7E09117 – "Ordered inorganic–organic hybrids using ionic liquids for emerging applications," 2010–2013; Principal investigator: prof. RNDr. Ladislav Kavan, Co–principal investigators: Ing. Jan Procházka and RNDr. Markéta Zukalová, Ph.D.

- Project Ministry of Education ME09060 – “The electrochemical gating of individual and bundled Single Walled Carbon Nanotubes,” 2009–2012; Principal investigator: RNDr. Ing. Martin Kalbáč, Ph.D.
- Project Ministry of Education OC09048 – “Nanocrystalline oxidic semiconductors for optoelectronic applications,” 2009–2010; Principal investigator: prof. RNDr. Ladislav Kavan, DrSc.
- Project Ministry of Education LD11084 – “Nanostructured thin layers of semiconducting oxides for optoelectronic applications,” 2011; Principal investigator: prof. RNDr. Ladislav Kavan, DrSc.
- Project Ministry of Education 7E11004 – “Sensitizer activated nanostructured solar cells,” 2011–2013; Principal investigator: prof. RNDr Ladislav Kavan, DrSc.

b) *Selected projects on whose implementation the Institute is cooperating or has cooperated:*

- Project Ministry of Education ME09114 – "Collaboration in energy and nanoscience: USA and Europe," 2009; Principal investigator: RNDr. Zdeněk Havlas, DrSc., Institute for Organic Chemistry and Biochemistry AS CR, Co–principal investigator for the JH INST: as.prof. RNDr. Lubomír Pospíšil, CSc.

- Project Ministry of Industry and Trade FT–TA5/005 – "Advanced Types of Zeolites and Their Applications," 2008–2010; Principal investigator: Ing. Věnceslava Tokarová, CSc., Inorganic Chemistry Research Institute, Co–principal investigator for the JH INST: prof. Ing. Jiří Čejka, DrSc.

- Project GA CR GAP106/10/0196 – "Advanced nanostructured vanadium–based catalysts for oxidative dehydrogenations," 2010–2014; Principal investigator: as.prof. Ing. Roman Bulánek, Ph.D., University of Pardubice/Faculty of Chemical Technology, Co–principal investigator for the JH INST: Ing. Jana Mayerová, Ph.D.

- Project GA CR GAP108/11/1661 – "Organic nanoporous polymers derived from arylacetylenes as materials for hydrogen storage," 2011–2013; Principal investigator: RNDr. Jan Sedláček, Dr., Charles University in Prague/Faculty of Science, Co–principal investigator for the JH INST: RNDr. Hynek Balcar, CSc.

"Nanotechnology for Society" programme research projects

- KAN100500652 – "Heterogeneous and hybrid nanocomposite materials for solar cells," 7/2006–12/2010; Principal investigator: RNDr. Jiří Pfleger, CSc., Institute for Macromolecular Chemistry AS CR, Prague, Co–principal investigator for the JH INST: as.prof. RNDr. Svatopluk Civiš, CSc.

- KAN400720701 – "Hierarchic nanosystems for microelectronics," 1/2007–12/2011; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for the JH INST: Ing. Pavel Hrabánek, Ph.D.

- KAN200100801 – "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and drug delivery," 01/2008–12/2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc. HDR, Institute of Physics AS CR, Prague, Co–principal investigator for the JH INST: prof. Ladislav Kavan, DrSc.

Other projects

- Project Ministry of Education, "Research Centres" programme, 1M4531433201 – "Research Centre for Nanosurface Engineering – NANOPIN," 1/2005–12/2011; Principal investigator and coordinator: Ing. František Peterka, Ph.D., ATG s.r.o., Prague, Co–principal investigator for JH INST: RNDr. Jaromír Jirkovský, CSc.

- Project Ministry of Education, "Basic Reseach Centres" programme, LC510 – "Research centre for nanotechnologies and materials for nanoelectronics," 2/2005–12/2011; Principal investigator and coordinator: RNDr. Jan Kočka, DrSc., Institute of Physics AS CR, Prague, Co–principal investigator for JH INST: prof. RNDr. Ladislav Kavan, CSc.

- Project GA AS CR IAA400720619 – "New laser–induced process for production of novel carbon based nanomaterials and carbon–based nanomaterials with incorporated Si, N and B heteroatoms," 1/2006–12/2010; Principal investigator: RNDr. Josef Pola, DrSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for the JH INST: RNDr. Zdeněk Bastl, CSc.

- Project GA CR GA203/08/0831 – "Nanofabrics producing singlet oxygen," 1/2008–12/2010; Principal investigator: RNDr. Jiří Mosinger, Ph.D., Charles University in Prague/Faculty of Science, Co–principal investigator for the JH INST: RNDr. Pavel Kubát, CSc.

- Project Ministry of Industry and Trade FT–TA5/005 – "Advanced types of zeolites and their applications," 2008–2010; Principal investigator: Ing. Věnceslava Tokarová, CSc., Inorganic Chemistry Research Institute; Ústí nad Labem, Co–principal investigator for the JH INST: prof. Ing. Jiří Čejka, CSc.

c) *European projects implemented as part of the 6th and 7th EU Framework Programme:*

- 7FP EU project type: Small, thematic priority: NMP, project title: SANS – "Sensitizer activated nanostructured solar cells," 2011–2013; 11 partners from 7 countries, project budget: EUR 5.7 million, Coordinator: Linda Polik, The Chancellors masters and scholars of the University of Oxford (United Kingdom); the JH INST is a partner.

- 7FP EU project type: Large, thematic priority: NMP, project title: ORION – "Ordered inorganic–organic hybrids using ionic liquids for emerging applications," 2009–2013; 17 partners from 8 countries, project budget: EUR 9.69 million, Coordinator: Jon Lacunza, Fundación CIDETEC (Spain); the JH INST is a partner.

- 7FP EU project type: Large, thematic priority: NMP, project title: MACADEMIA – "MOFs as catalysts and adsorbents: discovery and engineering of materials for industrial applications," 2009–2013; 17 partners from 9 countries, project budget: EUR 11.56 million, Coordinator: Francis Luck, TOTAL S.A. (France); the JH INST is a partner.

- Project 6FP EU: DESANNS – "Advanced separation and storage of carbon dioxide: design, synthesis and application of novel nanoporous sorbents," 1/2006–12/2008; Coordinator: Dr. Philips Llewellyn, CNRS, France, Co–principal investigator for the JH INST: prof. Ing. Jiří Čejka, DrSc.

- Project 6FP EU: NMP3–CT–2005–516982 – "Nanocrystalline heterosupermolecular materials for optoelectronic applications," 2005–2008; Principal investigator for the JH INST: prof. RNDr. Ladislav Kavan, CSc.

- Project 6FP EU: NMP3–CT–2005–011730 – "Integrated design of catalytic nanomaterials for sustainable production," 2005–2010; Principal investigator for the JH INST: Ing. Blanka Wichterlová, DrSc.

Experts/field

- RNDr. Zdeněk Bastl, CSc. – study of nanostructured materials by the electron spectroscopy method

- as.prof. RNDr. Svatopluk Civiš, CSc. – laser spectroscopy and photochemistry

- prof. RNDr. Petr Čársky, DrSc. – development of quantum chemical methods
- prof. Ing. Jiří Čejka, CSc. – zeolites and molecular sieves
- Mgr. Michal Fárník, Ph.D. – molecular clusters, experimental and theoretical study of free nanoparticles
- as.prof. Martin Hof, Dr. rer. nat. – fluorescence spectroscopy
- Ing. Pavel Janda, CSc. – study of nanostructured materials by the AFM and STM method
- RNDr. Jaromír Jirkovský, CSc. – photocatalysis, nanosurfaces of TiO_2, applications in the area of self–cleaning surfaces
- RNDr. Ing. Martin Kalbáč, Ph.D. – carbon nanostructures, spectroelectrochemistry
- prof. RNDr. Ladislav Kavan, DrSc. – carbon and oxide nanostructures, electrochemistry, spectroelectrochemistry
- RNDr. Pavel Kubát, CSc. – laser spectroscopy and photochemistry
- Mgr. Jiří Pittner, Dr. rer. nat. – development of quantum chemical methods
- prof. RNDr. Zdeněk Samec, DrSc. – electrocatalysis,
- Ing. Zdeněk Sobalík, CSc. – development of structures of catalysts for significant processes of transformation of NO_x into nitrogen, selective oxidation of hydrocarbons

3.1.16 INSTITUTE OF PHYSICS OF MATERIALS AS CR, a public research institution (IPM)

Žižkova 22, 606 62 Brno, ID: 68081723

www.ipm.cz

A brief description of the Institute

The Institute was created from the Laboratory for the Study of Metal Properties of the Czechoslovak Academy of Sciences established in 1955 and transformed in 1963 into the Institute of Metal Properties of the Czechoslovak Academy of Sciences and then (on 1 January 1969) into the Institute of Physical Metallurgy of the Czechoslovak Academy of Sciences. Its present name was adopted on 1 January 1994. Since 1 January 2007 the Institute has been a public research institution.

The activity of the Institute focuses on the interdisciplinary area of materials science. The balance of its activity consists mainly of basic research on metal materials. The Institute focuses on the physical basis of processes taking place in metal materials during creep, fatigue, and creep–fatigue interaction, and during other types of mechanical stress, and research on structure and selected physical properties of materials. In both of these areas of research, the goal is to explain the relationship between the behavior and properties of materials and their structural characteristics. Research is conducted in two departments which are divided into groups:

- Department of Mechanical Properties (department head: L. Kunz)
  - Creep of metal materials group (F Dobeš)

- Advanced high–temperature materials group (V. Sklenička)
- High cycle fatigue group (P. Hutař)
- Low cycle fatigue group (T. Kruml)
- Brittle fracture group (I. Dlouhý)

- Department of Structure (M. Svoboda)
  - Diffusion and thermodynamics group (J. Čermák)
  - Phase structure group (M. Svoboda)
  - Electrical and magnetic properties group
- Department of CEITEC IPM structures (L. Náhlík)
  - Transport and magnetic properties group (B. David)
  - Advanced metal materials and composites group (L. Kunz)

Focus of research and development

During the years 2005–2010, research at the IPM AS CR focused mainly on implementing single research proposal: AV0Z20410507 – "**Physical properties of advanced materials in relation to their microstructure and processing**," 1/2005–12/2010; Principal investigator: prof. RNDr. Petr Lukáš, CSc., total costs for the entire research period: CZK 561,855,000, of which CZK 561,639,000 came from the state budget. Classification – area 1, share of nanotechnology research – 30%.

Project goal:

The physical properties of the following advanced materials have been studied experimentally and theoretically in relation to their microstructure and manner of preparation: ultra–fine grained, microcrystalline, nanocrystalline, and amorphous materials; Principal intermetallic compounds; monocrystals of superalloys; advanced steel; advanced Mg, FE, and Ni alloys; shape–memory alloys; composites and nanocomposites; metal laminates; lead–free solder; magnetic semiconductors; metalloid magnets; magnetic multilayers; silicides of transition metals. The goal was to explain, describe, and quantify mechanisms of processes and the development of microstructures taking place in advanced materials during creep, fatigue, and fracture. Diffusion, thermodynamics, phase structure, and electrical and magnetic characteristics are studied in relevant temperature ranges.

Research relating to nanotechnology is being conducted at the Advanced High Temperature Materials Group (V. Sklenička, J. Dvořák, P. Král), the High Cycle Fatigue Group (L. Kunz), the Phase Structure Group (J. Buršík), the Diffusion and Thermodynamics Group (V. Rothová), and the Electrical and Magnetic Properties Group (O. Schneeweiss, Y. Jirásková, M. Šob).

The Institute is involved in the building of the research centre**CEITEC – Central European Institute of Technology**, ED1.1.00/02.0068, project period: 2011–2015, project cost: CZK 5,246,000, (www.ceitec.cz). The goal of research carried out by a total of six research organisations in Brno (Masaryk University, Institute of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences in Brno, Brno University of Technology/Faculty of Information Technology, Mendel University in Brno/Faculty of Agronomics, Institute of Physics of Materials) is to discover the mechanisms for the incidence and spreading of serious illnesses, methods of their prevention, prompt diagnosis and therapy, use of plant

systems as renewable resources for materials and biologically active substances; development of advanced materials and functional nanostructures for medicine, energy, and information and communications technologies; use of information and communications technologies for biomedicine. The principal investigator for the project is Mgr. Tomáš Hruda from Masaryk University in Brno, and the party responsible for the project for the IPM is prof. Vladimír Večerek, CSc.

In 2011, a total of 47 programme research projects were conducted at the Institute, some of which involved nanotechnologies/nanomaterials.

Projects implemented in nanotechnologies and nanomaterials

a) *Projects implemented by the Institute:*

- Project Ministry of Education OC10029 – "Thermodynamic Modelling of Microstructure Evolution in Nanocomposites," 2010–2012; Principal investigator: RNDr. Jiří Svoboda, DrSc.
- Project Ministry of Education OC10008 – "Strength and magnetism of nanocomposites," 2010–2012; Principal investigator: prof. RNDr. Mojmír Šob, DrSc.
- Project Ministry of Education LD11024 – "The theoretical and experimental evaluation of phase diagrams of nanomaterials," 2011–2014; Principal investigator: RNDr. Aleš Kroupa, CSc.
- Project Ministry of Education MEB061005 – "High–temperature solders based on ternary Sn–Sb–Ni Alloys in bulk and nanoscopic form," 2010–2011, Principal investigator: Ing. Adéla Zemanová, Ph.D.
- Project GA CR GP106/09/P556 – "Nanocrystalline materials containing 3d metals for hydrogen storage," 2009–2011; Principal investigator: Ing. Pavla Roupcová, Ph.D.
- Project GA CR GAP108/10/1781 – "The role of the stress state and vacancy supersaturation in formation of binary–phase hollow nanospheres," 2010–2012; Principal investigator: RNDr. Jiří Svoboda, DSc.
- Project GA CR GAP108/11/1350 – "Effects of cores and boundaries of nanograins on structural and physical properties of ball milled and mechanically alloyed iron–based materials," 2011–2014; Principal investigator: Ing. Yvonna Jirásková, CSc., Co–principal investigator: as.prof. Mgr. Jakub Čížek, Ph.D.– Charles University in Prague/Faculty of Mathematics and Physics, Mgr. Dalibor Jančík, Ph.D., Palacký University, Olomouc/Faculty of Science
- Project GA CR GAP204/11/1228 – "Theory of spin–dependent transport in magnetic solids and nanostructures," 2011–2014; Principal investigator: as.prof. RNDr. Ilja Turek, DrSc., Co–principal investigators: RNDr. Václav Drchal, CSc., Institute of Physics AS CR, RNDr. Karel Carva, Ph.D., Charles University/Faculty of Mathematics and Physics
- Project GA CR GA106/08/1440 – "Iron and iron oxide nanoparticles with applications in the magnetic separation processes," 1/2008–12/2011; Principal investigator: Ing. Oldřich Schneeweiss, DrSc.

- Project GA CR KJB200410801 – "Study of nano–structure materials consolidated from powder compacts by ECAP technique," 1/2008–12/2010; Principal investigator: Ing. Jiří Dvořák, Ph.D.

b) *Selected projects on whose implementation the Institute is cooperating:*

- Project GA CR GA106/09/0700 – "Thermodynamics and microstructure of environmentally friendly nanoparticle solders," 2009–2011; Principal investigator: as.prof. RNDr. Jiří Sopoušek, CSc., Masaryk University, Brno/Faculty of Science, Co–principal investigator for the Institute of Physics of Materials: RNDr. Jiří Buršík, CSc.

- Project Ministry of Education programme – "Research Centres" 1M0512 – "Research Centre for Powdered Nanomaterials," 1/2005–12/2011; Principal investigator: prof. RNDr. Miroslav Mašláň, CSc., Palacký University Olomouc/Faculty of Science, Co–principal investigators for the Institute of Physics of Materials: Ing. Oldřich Schneeweiss, DrSc., and Ing. Bořivoj Million, DrSc.

- Project GA CR GA202/08/0178 – "Synthesis of Fe–based magnetic nanoparticles in low–temperature microwave plasma," 1/2008–12/2010; Principal investigator: Mgr. Vít Kudrle, Ph.D., Masaryk University in Brno/Faculty of Science, Co–principal investigator for the Institute of Physics of Materials: Ing. Bohumil David.

Experts/field

- RNDr. Jiří Buršík, CSc. – electron microscopy of nanostructures prepared using plasma technologies

- Ing. Yvonna Jirásková, CSc. – nanocrystalline materials prepared by controlled crystallisation of amorphous alloys, structure, phase composition, electrical and magnetic properties

- prof. Ing. Václav Sklenička, DrSc. – ultra–fine grained materials prepared by extreme plastic deformation (ECAP), nanocomposite materials and layers, mechanical properties and microstructure of nanomaterials

- Ing. Oldřich Schneeweiss, DrSc. – nanocrystalline materials of metals, oxides, and interstitial compounds, nanocomposites, structure, phase composition, electrical and magnetic properties

3.1.17 INSTITUTE OF PLASMA PHYSICS AS CR, a public research institution (IPP)

Za Slovankou 3, 182 21 Prague 8, ID: 61389021

www.ipp.cas.cz

A brief description of the Institute

The Institute was established on 1 January 1959 as the Institute of Vacuum Electronics of the Czechoslovak Academy of Sciences. In connection with further development of its focus, the Institute's present name was adopted on 1 January 1964. Starting on 1 January 2006, the Institute Optical Development Workshop AS CR in Turnov has been attached to the Institute. Research is being conducted in 6 departments:

- Tokamak Department (department head: J. Stöckel)
- Department of Impulse Plasma Systems (K. Koláček)
- Department of Thermal Plasma (M. Hrabovský)
- Department of Material Engineering (P. Chráska, Sr.)
- Department of Laser Plasma (J. Ullschmied)
- Department of Optical Diagnostics (Z. Melich)

Focus of research and development

The Institute conducts research and development on controlled thermonuclear fusion, use of electrical discharges, plasma generators, plasma interaction with other states of matter, waste liquidation in plasma flows, plasma spray processes, and solving of other problems related to plasma.

In the years 2005–2010, research focused on the questions of one research proposal:

Research proposal AV0Z20430508 – "**Physical and chemical processes in plasmas and their applications**," 1/2005–12/2010; Principal investigator: prof. Dr. Pavel Chráska, DrSc., total costs for the entire project period: CZK 610,147,000, 607,155,000 of which came from the state budget. Classification – area 7c, share of nanotechnology research – 10%.

Project goal: nuclear fusion, plasma technologies, laser plasma, and the use of discharges in plasma, as well as generation of various types of plasma and development of new methods for studying them, description of behavior of hot plasma in tokamaks, dense or unbalanced plasma in discharges, thermal plasma and its interaction with other states of matter; experimental measurements have been confronted with theoretical calculations and numerical modelling. The results should have a direct impact on a number of fields, ranging from participation in the ITER project to ecological methods of cleaning, generating of soft x–ray radiation, plasma technologies, and plasma waste liquidation, and the development of new materials for use under extreme conditions.

In the area of nanotechnology research, work was under way on the following:

- The creation of amorphic and nanocrystalline coatings as well as of free–standing parts made of ceramic materials with the help of plasma spraying with a plasma torch (WSP), during which very rapid hardening occurs with the formation of unbalanced structures.
- The production of nanocrystalline ceramic parts with the aid of controlled crystallisation with appropriate thermal processing from originally amorphous parts containing multi–component ceramic material with a eutectic point.
- Production of ordinary plasma sprays, the basic structural unit of which is a thin, round disk known as a splat, which is usually made in parallel with arranged column grains running across the thickness of the splat. The diameter of column grains in a splat is typically on the order of tens of nanometers.

Research focusing on nanotechnologies is being conducted to a limited extent at the Department of Material Engineering (T. Chráska) and the Department of Impulse Plasma Systems (K. Koláček).

In 2011, the Institute worked on 30 programme research projects. A key project that primarily involves infrastructure is the **"Regional Centre for Specialized Optical and**

Optoelectronic Systems (TOPTEC)," ED2.1.00/03.0079, http://www.toptec.eu/, project period: 2010–2013; project budget: CZK 447,000,000, director of the centre: Ing. Vít Lédl, Ph.D. The goal of the project is modernisation and expansion of existing research and development capacity of the optics group of the Institute of Plasma Physics AS CR in Turnov. In the research portion, the centre will be focusing on precise and special optics, optoelectronic systems, and optical measuring methods.

Projects implemented in nanotechnologies

- Project Ministry of Industry and TradeFR–TI2/702 – "Development of stabilized plasma (WSP) torch based technology," 2010–2013; Principal investigator: Ing. Vladivoj Očenášek, CSc. – VÚK Panenské Břežany a.s., Co–principal investigator for the Institute of Plasma Physics: Ing. Tomáš Chráska, Ph.D.
- Project GA CR GPP205/11/P712 – "Nonlinear processes in the initial phase of the high power nanosecond laser pulse – target interaction," 2011–2013; Principal investigator: Ing. Jan Dostál, Ph.D.
- Cooperation on a project of the Ministry of Education, programme: – "Nanotechnology for Society," KAN300100702 – "Creating and probing nanostructures with X–ray lasers," 2007–2011; Principal investigator: Ing. Bedřich Rus, Dr., Institute of Physics AS CR, Prague, Co–principal investigator for the Institute of Plasma Physics: RNDr. Karel Koláček, CSc.

Experts/field

- prof. Ing. Dr. Pavel Chráska, DrSc. – structure and phase transformation
- Ing. Tomáš Chráska, Ph.D. – transmission electron microscopy, plasma spray layers (mostly nanocrystalline ceramics), semiconductor nanostructures

3.1.18 INSTITUTE OF CHEMICAL PROCESS FUNDAMENTALS AS CR, a public research institution (ICPF)

Rozvojová 135, 165 02 Prague 6, ID: 67985858

www.icpf.cas.cz

A brief description of the laboratory

The Institute was founded on 1 January 1960 from the Department of Organic Technology of the Institute of Chemistry of the Czechoslovak Academy of Sciences and from the Laboratory of Chemical Engineering of the Czechoslovak Academy of Sciences. It was originally named the Institute of Theoretical Foundations of Chemical Technology of the Czechoslovak Academy of Sciences, and it adopted its present name on 1 July 1993. Since 1 January 2007 the Institute has been a public research institution.

The main activity of the ICPF is scientific research and development in the area of the theory of chemical processes, especially in the fields of chemical engineering, physical chemistry, and bioengineering, focusing in particular on chemical and statistical thermodynamics, separation processes, catalysis, reactor engineering, applied organometallic chemistry, multiphase chemical reactors, biotechnologies and technology of processes for the

environment, as well as chemical reactions initiated or accelerated with laser or microwave radiation, and processes of creation and transformation of aerosols.

Research is conducted at five departments and four laboratories:

- Department of Separation Processes (department head: V. Jiřičný)
- E. Hála Laboratory of Thermodynamics (K. Aim)
- Department of Catalysis and Reaction Engineering (O. Šolcová)
- Department of Multiphase Reactors (J. Drahoš)
- Department of New Processes in Chemistry and Biotechnology (J. Čermák)
- Laboratory for Environmental Protection Processes (M. Punčochář)
- Department of Analytical Chemistry (J. Schraml)
- Laboratory for Aerosol Chemistry and Physics (J. Smolík)
- Laboratory for Laser Chemistry (J. Pola)

Focus of research and development

In 2005–2010 research focused, among other things, on the questions of the research proposal AV0Z40720504 – **"Investigation of multiphase reacting systems for the design of processes important in synthesis and preparation of novel materials, in energy production and in environmental protection,"** 1/2005–12/2010; Principal investigator: prof. Ing. Jiří Hanika, DrSc., total costs for the entire project period: CZK 845,876,000, of which CZK 801,205,000 came from the state budget. Classification – area 5, share of nanotechnology research – 20%.

The goal of the research was identification of characteristic systems at the molecular level and their integration with phenomenological knowledge about the behavior of systems depending on process conditions.

The main directions of research were: study of the balanced behavior of multiphase systems with chemical reactions; thermo– and hydrodynamics of multiphase systems under extreme conditions; fundamentals of extraction, sorption, and membrane separation processes and of processes using supercritical fluids; dynamic transport processes in chemical, electrochemical, combustion, and biotechnological reactors; explaining the mechanisms of catalyzed reactions and destruction reactions of toxic organic substances; preparation of new materials by reactions induced by microwave and laser radiation. The results make possible a quantitative description of the behavior of reacting multiphase systems with the aid of mathematical models useful for the optimum design of process equipment, meeting demands for maximum environmental friendliness.

In 2011, the Institute worked on 69 programme research projects.

Research in nanotechnologies

Research focusing on nanotechnology is being conducted at the Department of Separation Processes (P. Uchytil), the E. Hála Laboratory of Thermodynamics (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), the Laboratory for Aerosol Chemistry and Physics (J. Smolík, P. Moravec, V. Levdanski) and the Laboratory for Laser Chemistry (J. Pola, R. Fajgar). Research is focused

mainly on nanoporous materials, nanocatalysis, and synthesis of nanoparticles, e.g. by aerosol processes and laser technology.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute*

Projects of the GA CR

- Project GA CR GCP106/10/J038 – "Liquid Layers Immobilized Between Nanoparticles–filled Membranes for Gas Separation," 2010–2011; Principal investigator: Ing. Petr Uchytil, CSc.
- Project GA CR GA203/09/1088 – "Preparation of Nanostructured Si/Ge/C Deposits," 2009–2011; Principal investigator: RNDr. Vladislav Dřínek, CSc., Co–principal investigators: Ing. Jan Šubrt, CSc., Institute of Inorganic Chemistry AS CR, The–Ha Stuchlíková, CSc., Institute of Physics AS CR.
- Project GA CR GA104/09/0694 – "Advanced Photocatalytic Processes – Nanotechnology for the Environment," 2009–2011; Principal investigator: Ing. Olga Šolcová, CSc., Co–principal investigators: RNDr. Tomáš Cajthaml, Ph.D., Institute of Microbiology AS CR, Ing. Oldřich Machalický, University of Pardubice/Faculty of Chemical Technology
- Project GA CR GP104/09/P290 – "Innovative preparation of nanocrystalline metal oxides with high–ordered mesoporous structure by extraction techniques," 2009–2011; Principal investigator: Ing. Lenka Matějová, Ph.D.
- Project GA CR GA104/07/1093 – "Composite nanoparticle synthesis by an aerosol process," 1/2007–12/2010; Principal investigator: Ing. Pavel Moravec, CSc.
- Project GA AS CR IAA400720804 – "Influence of surface processes and electromagnetic radiation on transfer phenomena in aerosol systems with nanoparticles and porous bodies with nanopores," 1/2008–12/2011; Principal investigator: Ing. Valeri Levdanski, DrSc.
- Project AS CR KAN400720701 – "Hierarchic nanosystems for microelektronics," 1/2007–12/2011; Principal investigator: Ing. Olga Šolcová, CSc.
- Project GA AS CR IAA400720619 – "New laser–induced process for production of novel carbon based nanomaterials and carbon–based nanomaterials with incorporated Si, N and B heteroatoms," 1/2006–12/2010; Principal investigator: RNDr. Josef Pola, DrSc.

Other projects

- Project AS CR 1ET400720409 – "Application of advanced simulation methods for studying the structure, physico–chemical properties, and preparation of composites and nanomaterials," 2004–2008; Principal investigator: prof. RNDr. Ivo Nezbeda, DrSc., Co–principal investigators: as.prof. RNDr. Stanislav Novák, CSc. – Jan Evangelista Purkyně University in Ústí nad Labem/Faculty of Science; as.prof. RNDr. Stanislav Novák, CSc., Jan Evangelista Purkyně University in Ústí nad Labem/Faculty of Education

- Project Ministry of Education ME 892 – "Monitoring and remediation of environmental pollution with advanced organic–inorganic materials – MOREPIM," 5/2007–12/2011; Principal investigator: Ing. Gabriela Kuncová, CSc.

- Project Ministry of Education ME 893 – "Whole cell optical sensors – WOCOS," 5/2007–12/2011; Principal investigator: Ing. Gabriela Kuncová, CSc.

b) *Selected projects on whose implementation the Institute is cooperating:*

- Project AS CR IAA200760905 – "Thermophysical properties of water in unexplored, technologically significant areas," 2009–2013; Principal investigator: Ing. Jan Hrubý, CSc., Institute of Thermomechanics, AS CR, Co–principal investigator for the ICPF: Ing. Vladimír Ždímal, Dr.

- Project AS CR IAAX08240901 – "Novel inorganic–organic hybrid nanomaterials," 2009–2013; Principal investigator: prof. Ing. Pavel Lhoták, CSc., Institute of Chemical Technology, Prague, Co–principal investigator for the ICPF: Ing. Stanislav Šabata

- Project GA CR GAP503/11/2315 – "Study of transport of inhaled nano–sized particles (Pb, Cd) and their allocation in organs," 2011–2013; Principal investigator: Ing. Zbyněk Večeřa, CSc., Institute of Analytical Chemistry AS CR, Co–principal investigator for the ICPF: Ing. Jiří Smolík, CSc.

- Project GA CR GA203/08/0094 – "Computer modelling of structural, dynamical and transport properties of fluids in nanospace," 1/2008–12/2011; Principal investigator: Mgr. Milan Předota, Ph.D., University of South Bohemia, České Budějovice/Faculty of Science, Co–principal investigator for the ICPF: prof. Ing. Martin Lísal, DrSc.

Experts/field

- Ing. Květa Jirátová, CSc. – heterogeneous catalysis, preparation of catalysts and evaluation of their properties

- Ing. Gabriela Kuncová, CSc. – development of enzyme–based bio–optoelectronic sensors

- as.prof. Ing. Martin Lísal, DrSc. – applied statistical thermodynamics, molecular and multicomponent modelling

- Ing. Pavel Moravec, CSc. – aerosol processes

- prof. RNDr. Ivo Nezbeda, DrSc. – molecular physics of fluids, intermolecular interactions

- RNDr. Josef Pola, DrSc. – laser chemistry, organometallic chemistry

- Ing. Olga Šolcová, CSc. – texture of porous solids, transport of mass in solids

3.1.19 INSTITUTE OF COMPUTER SCIENCE, a public research institution

Pod vodárenskou věží 2, 182 07 Prague 8, ID: 67985807

www.cs.cas.cz

A brief description of the Institute

The Institute was created from the Central Computer Centre of the Czechoslovak Academy of Sciences, founded on 1 July 1975 as a shared Czechoslovak Academy of Sciences laboratory, and on 1 November 1980 it was classified as a scientific laboratory. In 1993 it was renamed as the Institute of Computer Science and Computer Technology AS CR, and then on 1 July 1998 the name was again changed to the Institute of Computer Science AS CR. On 1 January 2007, the Institute became a public research institution.

Focus of research and development

The activity of the Institute focuses on theory and applications in computer science, artificial intelligence and computational mathematics, and in particular on:

- foundations of computer science in mathematics, algorithms, and logic, classical and unconventional computation models, theory of computational complexity, computational statistics, soft computing, data mining, web technology, and software architecture,
- numerical linear algebra and computation with matrices, optimisation, mathematical modelling of problems with inexact data and elastoplasticity problems, verification of hybrid systems,
- theory and applications of artificial neural networks, non–linear modelling and prediction, environmental information science,
- biomedical computer science and biomedical statistics applied to various areas of research in medicine (e.g. in preventive cardiology, epidemiology, genetics, dentistry).

The Institute participate actively in doctoral programmes at the following faculties: Charles University/Faculty of Mathematics and Physics, Czech Technical University/Faculty of Electrical Engineering and Faculty of Nuclear Sciences and Physical Engineering, Technical University of Liberec/Faculty of Mechatronics and Interdisciplinary Engineering Studies.

In 2011, the Institute worked on 31 programme research projects, one of which is focused on nanotechnologies.

Project implemented in nanotechnologies

- Project GA CR GAP108/11/0853 – “Nanostructures with transition metals: Towards ab–initio material design,” 2011–2015; Principal investigator: RNDr. Ondřej Šipr, CSc., Institute of Physics AS CR, Co–principal investigator for the Institute of Computer Science: as.prof. Dr. Ing. Miroslav Rozložník

Experts/field

- as.prof. Dr. Ing. Miroslav Rozložník, computational methods, numerical linear algebra
- prof. RNDr. Jiří Wiedermann, DrSc., nanocomputing (unconventional models)

3.1.20 INSTITUTE OF NUCLEAR PHYSICS AS CR, a public research institution (ÚJF)

Husinec – Řež 130, 250 68 Husinec – Řež, ID: 61389005

www.ujf.cas.cz

A brief description of the Institute

The Institute was established on 1 January 1972 from the physics section of the Institute for Nuclear Research of the Czechoslovak Academy of Sciences, which had been founded in 1955. In 1972 the bulk of the Institute was placed under the authority of the Czechoslovak Atomic Energy Commission. On 1 July 1994 the former Institute of Radiation Dosimetry AS CR was joined to the Institute of Nuclear Physics as an external laboratory. On 1 January 2007, the Institute became a public research institution.

The Institute's activity mainly involves nuclear physics in the area of both theoretical and experimental low– and medium–energy nuclear physics. The Institute is involved with nuclear spectroscopy of beta radiation, the study of nuclear reactions including showers of heavy ions and hypernuclear physics. Its activities also focus on certain related fields, such as the study of the solid phase and materials research with the use of dispersion of neutrons and charged ions, mathematical physics, and theoretical subnuclear physics, dosimetry of ionizing radiation including biophysical aspects and radiopharmacology.

The research activity is divided into 7 departments:

- Department of Theoretical Physics (department head: J. Hošek)
- Department of Nuclear Spectroscopy (A. Kugler)
- Department of Nuclear Reactions (V. Kroha)
- Department of Neutron Physics (P. Mikula)
- Department of Radiopharmacology (O. Lebeda)
- Department of Radiation Dosimetry (M. Davídková)
- Department of Accelerators (J. Štursa)

Focus of research and development

In the years 2005–2011, research focused on the problems of the research proposal AV0Z10480505 – **"Nuclear Physics and Related Fields in the Basic, Applied and Interdisciplinary Research,"** 1/2005–12/2011; Principal investigator: Jan Dobeš, CSc., total costs for the entire project period: CZK 718,843 million, of which 718,843,000 came from the state budget. Classification – area 6b, share of nanotechnology research – 10%. Research focused on the experimental study of strongly interacting matter in showers of heavy ions, nuclei far from the line of stability, nuclear reactions of importance for astrophysics, preparation of measuring of mass of neutrinos using electron spectroscopy, use of nuclear analytical methods and neutron diffraction in research of condensed substances and materials and in the life sciences. Another area of research and development is radiopharmacology. Theoretical research as conducted in the area of nuclear, subnuclear, and mathematical physics.

In 2011, a total of 52 programme research projects were conducted at the Institute, some of which focused on nanotechnologies.

Research in nanotechnologies

Research relating to nanotechnologies is being conducted at the Department of Neutron Physics (V. Hnatowicz, J. Vacík, V. Lavrentěv, A. Macková, V. Havránek, V. Peřina et al.), the Department of Theoretical Physics (P. Exner et al.), and the Department of Radiopharmacology (O. Lebeda).

The Department of Neutron Physics – Laboratory of Nuclear Analytical Methods is working the area of micro– and nanosciences in the following areas:

- Study (preparation, modification, and characterisation) of thin and ultra–thin layers of hybrid composites based on carbon allotropes (e.g. fullerene C_{60}) and transition metals (Ni, Co, Ti etc.); hybrid materials of the C_{60}–Ni type exhibit unique structural properties, often in the form of systems that organize themselves spontaneously in the submicroscopic area.

- Preparation of nanoparticles by modified deposition in UHV (MBE) systems.

- Preparation of LIPSS (Laser Induced Periodic Surface Structures); cooperation with the Institute of Physics AS CR.

- Use of ion and neutron bundles for analysis of micro– and nanostructures with the use of nuclear analytical methods: RBS (Rutherford backscattering), ERDA and ToF–ERDA (detection of particles shot forwards), RBS channeling (structural study of crystalline materials), PIXE (x–ray fluorescence), ITS (ion transmission spectroscopy), NDP (neutron depth profiling); cooperation with the Institute of Chemical Technology, Institute of Physics, Charles University Faculty of Mathematics and Physics, Masaryk University in Brno, Brno University of Technology, Czech Metrology Institute in Brno, Institute of Scientific Instruments, University of Pardubice, University of West Bohemia in Pilsen, Physical–Technical Institute Kazan, Helmholtz Zentrum Dresden–Rossendorf, University of Helsinki et al.).

- Modification and synthesis of new micro– and nanostructures by the ion implantation method (e.g. implantation in glass, crystals, and polymers for optics, opto–electronics, laser technologies, spintronics, magnetic recording media etc.).

- Application of an ion microprobe for the study of biological materials, cellular structures, geological samples, archeometry samples etc.

- Study is still ongoing at the Department of Neutron Physics on the microstructure of steels and other materials with small–angle neutron dispersion.

At the Department of Theoretical Physics, a group of mathematical physicists are working on mathematical models of nanosystems of the quantum waveguide type.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project GA CR GAP107/11/1856 – "Metal–fullerene nanocomposites and their biological applications," 2011–2013; Principal investigator: Mgr. Jiří Vacík, CSc., Co–principal investigator: Dr. Lucie Bačáková, MD, CSc., Institute of Physiology AS CR

- Project GA CR GAP106/09/0125 – “Preparation and characterisation of metal/polymer structures,” 1/2009–12/2013; Principal investigator: RNDr. Anna Macková, Ph.D., Co–principal investigators: prof. Ing. Václav Švorčík, DrSc.,Institute of Chemical Technology in Prague/Faculty of Chemical Technology, as.prof. Ing. Olga Bláhová, Ph.D., University of West Bohemia in Pilsen/New Technologies Research Centre of the West Bohemia Region

- Project GA CR GAP203/11/0701 – “Guided Quantum Dynamics,” 1/2011–12/2013; Principal investigator: prof. RNDr. Pavel Exner, DrSc.

b) *Selected projects on whose implementation the Institute is cooperating:*

- Project GA CR GAP108/11/0958 – “Investigation of point defects in ZnO and their interaction with hydrogen and nitrogen,” 1/2011–12/2015; Principal investigator: as.prof. Mgr. Jakub Čížek, Ph.D., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for the Institute of Nuclear Physics: RNDr. Vladimír Havránek, CSc.

- Project GA CR GAPP108/12/0640 – “Biocompatible nanodiamond probes for multimodal *in vivo* imaging,” 1/2012–12/2014; Principal investigator: Mgr. Petr Cígler, Ph.D., Institute of Organic Chemistry and Biochemistry AS CR, Co–principal investigator for the Institute of Nuclear Physics: Ing. Jan Štursa

- Project GA CR Centres of Excellence P108/12/G108 – “Preparation, modification and characterisation of materials by radiation,” 1/2012–12/2018; Principal investigator: prof. Ing. Václav Švorčík, DrSc., Institute of Chemical Technology in Prague/Faculty of Chemical Technology, Co–principal investigator for the Institute of Nuclear Physics: Mgr. Jiří Vacík, CSc.

Results in nanotechnologies/cooperation

The Laboratory of Analytical Methods is collaborating with Czech and foreign institutes and universities (Helmholtz Zentrum Dresden Rossendorf, Zavoisky Physical Technical Institute – Kazan Scientific Centre Uppsala University, European Space Agency, Joint Institute for Nuclear Research in Dubna, Japan Atomic Energy Agency Takasaki) on many individual projects in the area of nanosciences (e.g. preparation of nanostructured materials for biosensorics, optoelectronics, and tissue engineering, as well as for elemental and profile characterizing of nanostructured materials by nuclear analytical methods).

The Results in mathematical physics involve in particular the approximation of thin quantum waveguides by quantum graphs.

Experts/field

- prof. RNDr. Pavel Exner, DrSc. – unstable systems, quantum mechanics of tubes and surfaces, resonance phenomena etc.

- RNDr. Vladimír Havránek, CSc. – analysis of aerosols, thin solid layers, and biological materials by the PIXE method; analysis of biological and geological samples using ion microprobes.

- as.prof. Ing. Vladimír Hnatowicz, DrSc. – experimental nuclear physics, nuclear analytical methods.

- Dr. Vasyl Lavrentěv, Ph.D.. – study of hybrid systems, preparation of nanoparticles, analysis of surface morphology, and properties of nanostructures using AFM/STM methods.

- RNDr. Anna Macková, Ph.D. – modification of materials with ion bundles for applications in microelectronics and optics; use of nuclear analytical methods, RBS channeling, ERDA, ERDA–TOF for elemental and structural analysis of amorphous and crystalline materials and complex multilayered systems

- RNDr. Vratislav Peřina, CSc. – growth, modification, and elemental and structural analysis of thin layers and multilayers used in microelectronics and optics, for surfaces of implants, and for research on very hard, thermally resistant layers etc.

- RNDr. Pavel Strunz, CSc. – study of the microstructure of steels and other materials with small–angle neutron dispersion.

- Mgr. Jiří Vacík, CSc. – study of hybrid systems of metal fullerenes, spontaneous self–organisation etc.

3.1.21 INSTITUTE OF MACROMOLECULAR CHEMISTRY CR, a public research institution (IMC)

Heyrovského nám. 2, 162 06 Prague 6, ID: 61389013

www.imc.cas.cz

A brief description of the Institute

The Institute was founded on 1 January 1959 from the Laboratory of High–Molecular Compounds, which had been established as a part of the Czechoslovak Academy of Sciences of 1 January 1957. Since 1 January 2007, the Institute has been a public research institution. The IMC is involved in scientific research in the area of macromolecular chemistry, organic chemistry, macromolecular physical chemistry, and macromolecular physics, including related interdisciplinary fields, aimed at learning and understanding the principles and relationships between the structure and properties of macromolecular substances and the possibilities of controlled formation of supramolecular structures, focusing in particular on the development of new synthetic and technological procedures, new polymeric materials, and their use in applications technologies in practice, for the study of the behavior and durability of macromolecular systems under ecologically difficult conductions, the properties and structure of substances by newly developed methods, for electronics, medical chemistry, and the study of mechanisms of the effect of biologically active polymeric substances and interactions of polymeric materials in living organisms, and the development of polymeric systems usable for medical, pharmaceutical, and biotechnological purposes.

Research is being conducted in 11 departments, some of which are divided into workgroups:

- Department of Controlled Polymerisation
- Department of Polymeric Networks and Mechanical Properties (L. Matějka, K. Dušek, M. Špírková, J. Kotek)
- Department of Polymeric Materials
  - **Workgroup for Development and Recycling of Polymeric Materials** (I. Kelnar)

- **Workgroup for Morphology of Polymers**(M. Šlouf)
- Workgroup for Thermodynamics and Rheology
- **Workgroup for Electronic Phenomena**(J. Pfleger, M. Menšík, S. Nešpůrek, P. Toman, K. Podhájecká, H. Beneš)

- Department of Hydrogels for Medical and Technical Practice
- Department of Biomedical Polymers (K. Ulbrich, M. Hrubý)
- Department of Bioanalogous and Special Polymers
  - **Workgroup for Bioactive and Degradable Polymers** (F. Rypáček)
  - **Workgroup for Special Polymers** (D. Výprachtický, V. Cimrová)
  - **Workgroup for Polymeric Particles** (D. Horák)
- Department of Polymeric Membranes
  - **Workgroup for Polymeric Membranous Materials** (E. Brynda, Z. Sedláková)
  - **Workgroup for Polymeric Membranes and Bioanalogous Phase Interfaces** (Z. Pientka, M. Bleha)
- Department of Solid State Chemistry
  - Group – Intercalcation Compounds
  - Group – Semiconducting Glass
  - Group – Thermoelectric Materials

The department is a Joint Laboratory of Solid State Chemistry of the Institute of Macromolecular Chemistry and of the University of Pardubice, and it is based in Pardubice.

- Department of Supramolecular Polymeric Systems
  - **Workgroup for Optical Phenomena** (P. Štěpánek, Č. Koňák, J. Stejskal)
  - Workgroup for Transport and Separation Processes
  - Workgroup for Photonics and Paramagnetic Phenomena
- Department of Structural Analysis
  - **Workgroup for Molecular Spectroscopy** (J. Dybal, M. Trchová)
  - Joint Laboratory for Solid State NMR of the Institute of Macromolecular Chemistry and of the JH INST (J. Brus)
  - Workgroup for X–Ray and Neutron Analysis
  - **Workgroup for Structural Analysis of Molecules** (J. Hašek)
- Department of Analytical Chemistry (P. Holler)

Note: Research in nanotechnologies is being conducted in departments and workgroups that are indicated in bold print. Scientists working on this research are listed in parentheses.

Focus of research and development

In the years 2005–2010, research focused on the questions of the research proposal AV0Z40500505 **– "Advanced polymer materials and supramolecular systems: Synthesis**

and research on properties, phenomena and implementation in special applications and innovative technologies," 1/2005–12/2010; Principal investigator: RNDr. František Rypáček, CSc., total costs for the entire project period: CZK 1,332,390,000, of which CZK 1,319,045,000 came from the state budget. Classification – area 6d, share of nanotechnology research – 30%.

Research focused on the controlled synthesis of polymeric substances and of supramolecular systems of synthetic macromolecules and hybrid systems of synthetic and biological macromolecules, leading to products with a uniform, defined structure and specific useful properties, and on the development of new theories of explanatory physical and chemical behavior of studied systems. At the centre of attention was the study of arranged systems generated by the mutual interactions of synthetic or synthetic and natural macromolecules and low–molecular substances performed at the atomic, molecular and supramolecular level. With respect to potential applications, development involved new intelligent materials reacting to stimuli in the environment, materials for bioengineering and biomimetics, with an emphasis on tissue engineering, bioconjugates for delivery of medications and gene therapy, materials applicable in membranes for separation processes and fuel cells, materials and systems for sensors, photonics, and microelectronics.

Research on technical polymers focused on the development of hybrid organo–inorganic nanocomposites and polymeric nanostructured materials, on the improvement of the useful properties of polymeric mixtures, and on the development of recyclable and biodegradable materials and materials arising from renewable natural resources.

Since 2011, the Institute has been involved in the building of the **BioCev Centre of Excellence**. At a cost of CZK 3.2 billion during the years 2011–2015, the project's goal is to build a centre for excellent research in the Central Bohemian town of Vestec. The research will focus on detailed study of cellular mechanisms at the molecular level, research and development of new therapeutic procedures, prompt diagnosis, biologically active substances including chemotherapy agents, natural antibiotics, development of tissue for the repairing of damaged organs, protein engineering, and other technologies. More information is available at www.biocev.eu.

In 2011, a total of 83 programme research projects were conducted at the Institute, some of which involved nanotechnologies.

Research in nanotechnologies

At the Institute, rather extensive research is being conducted focusing on nanobiotechnologies, nanomedicine, organic nanoelectronics, and nanomaterials (polymeric nanocomposites and nanostructures), and on the development of the nanosciences and of experimental methods applicable in macromolecular nanotechnologies.

This includes three main areas:

- Nanomaterials

- Organo–inorganic composites of polymers containing nanofillers.
- Nanocomposite polymeric membranes for hydrogen and methanol fuel cells, separation of gasses and ultrafiltration
- Surface modification of materials by conductive polymers.

- Magnetic nanoparticles.

- Development of new types of organo–inorganic structures, networks from precursors with original molecular architecture, liquid–crystal networks, and smart gels.

- Preparation of two–compound interpenetrating networks of hydrophile polymers and supramolecular structures containing liquid–crystal and amorphous areas.

- Finding possibilities for controlled self–organisation of molecules in supramolecular systems by variation of external parameters such as temperature, pH, or ion strength, and use of controlled self–organisation in solid state, the intermediate phase, in solution, and on the surface for improvement or creation of useful properties of polymers used in biomolecular engineering, delivery of medication, microelectronics, sensors, and membranes.

  - Nanomedicine

- Nanoparticulate and supramolecular systems for targeted delivery of medications and genetic information.

- Bioanalogous polymers for tissue engineering. Preparation of new polymers and semisynthetic hybrid macromolecular structures containing nanostructural motifs of biologically active biopolymers or their analogues, and the study of their role for the creation of specific interactions of the polymeric matrix with biomacromolecules, cells, and tissue.

- Magnetic nanoparticles for selected applications in medicine, magnetic resonance imaging, and magnetic hypertheria.

- Biosensors and the preparation of functional bioanalogous nanostructures on the surface of artificial objects. By the gradual depositing of biological and synthetic macromolecules, in accordance with composition planned in advance, there is preparation of detection layers of biosensors, affinity surfaces of separation media, coatings of artificial surfaces compatible with blood, and coatings stimulating the growth of cells and tissue.

  - Organic nanoelectronics (molecular electronics)

- Molecular nanosystems and nanocomponents for electronics and photonics based on electronic phenomena in polymers, and in particular electrical conductivity, photoconductivity, generation and transport of charge carriers, electroluminescence, photochromy, the transistor phenomenon and effects of spatial charge

- Heterogeneous organic and hybrid nanocomposite materials for solar cells.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project GA AS CR IAA400500905 – “Preparation and properties of nanostructures produced by conducting polymers,” 2009–2012; Principal investigator: RNDr Jaroslav Stejskal, CSc., Co–principal investigator: RNDr. Jan Prokeš, CSc., Charles University in Prague/Faculty of Mathematics and Physics

- Project GA AS CR IAA200500904 – “Optimizing structure and properties of multiphase thermosets using self–assembled nanofiller–based inclusions,” 2009–2012; Principal investigator: Ing. Ivan Kelnar, CSc.
- Project GA AS CR IAA100500902 – “Surface–enhanced Raman scattering of conducting polymers,” 2009–2012; Principal investigator: as.prof. RNDr. Miroslava Trchová, CSc.
- Project GA AS CR IAA400500701 – “Nanostructured organic–inorganic polymers,” 1/2007–12/2011; Principal investigator: RNDr. Libor Matějka, CSc.
- Project GA AS CR IAA500500701 – “Self–organisation, crystallisation and structure determination of protein based macromolecular systems,” 1/2007–12/2011; Principal investigator: RNDr. Jindřich Hašek, DrSc.
- Project GA AS CR IAA400500602 – “Development and application of solid–state NMR techniques to measure dipolar couplings – determination of three–dimensional structure and amplitude of internal motions in microcrystalline and highly organized self–assembled polymer systems,” 2006–2010; Principal investigator: Ing Jiří Brus, Ph.D.
- Project GA AS CR IAA4050409 – “Polymers for Photonics,” 2004–2008; Principal investigator: RNDr. Věra Cimrová, CSc.
- Project GA CR GAP208/10/1600 – “Polymeric particles and nanostructured materials stabilized by surface active molecules,” 2010–2014; Principal investigator: RNDr. Petr Štěpánek, CSc.
- Project GA CR GAP205/10/0348 – “Sandwich nanocomposites: preparation, nucleation effects, electrical properties,” 2010–2013; Principal investigator: RNDr. Miroslav Šlouf, Ph.D., Co–principal investigator: Mgr. Tomáš Baše, Ph.D., Institute of Inorganic Chemistry AS CR
- Project GA CR GAP108/11/2151 – “Novel nanocomposite resins filled with functional stannoxane nanoparticles,” 2011–2014; Principal investigator: RNDr. Adam Strachota, Ph.D.
- Project GA CR GAP205/11/1657 – “The control of biocompatible thermosensitive polymer nanoparticles by low–molecular weight additives: the study of underlying interactions,” 2011–2013; Principal investigator: Mgr. Larisa Starovoytova, Ph.D.
- Project GA CR GPP108/11/P763 – “Carbonisation of polyaniline nanostructures and composites based on carbon nanotubes/polyaniline,” 2011–2013; Principal investigator: Ing. Elena Konyushenko, Ph.D.
- Project GA CR GA202/09/2078 – “Bioinspired nanoparticles sensitive to environmental stimules,” 2009–2013; Principal investigator: RNDr. Petr Štěpánek, CSc.
- Project GA CR GA203/09/1242 – “Surface–modified magnetic nanoparticles for cell labeling and *in vivo* and in vitro diagnostics,” 2009–2011; Principal investigator: Ing. Daniel Horák, CSc., Co–principal investigators: Mgr. Vít Herynek, Ph.D., Institute for Clinical and Experimental Medicine, RNDr. Pavla Jendelová, Ph.D., Institute of Experimental Medicine, AS CR

- Project GA CR GA203/08/0543 – “Hybrid macromolecular systems based on hydrophilic polymers and stimuli–responsive peptides,” 2008–2011; Principal investigator: Ing. Michal Pechar, CSc.

- Project GA CR GA106/09/1348 – “Synthesis and mechanical properties of nanocomposites with tailored organoclays,” 2009–2011; Principal investigator: Ing. Petr Vlček, DrSc.

- Project GA CR GA203/08/6686 – “Spectroscopic study of the development of polyaniline nanostrutcures,” 1/2008–12/2011; Principal investigator: as.prof. RNDr. Miroslava Trchová, CSc.

- Project GA CR GA203/07/0267 – “Ternary skutterudites for thermoelectric applications: from bulks to thin films,” 2007–2009; Principal investigator: Ing. Jiří Navrátil, CSc., Co–principal investigators: Ing. Jarmila Walachová, CSc., Institute of Photonics and Electronics, AS CR, prof. Ing. Miroslav Jelínek, DrSc., Institute of Physics AS CR

- Project GA CR GA305/07/1073 – “Molecular interactions of polymers for biomedical applications,” 1/2007–12/2009; Principal investigator: RNDr. Jindřich Hašek, DrSc.

Other projects

- Project Ministry of Education ME09058 – “Preparation and characterisation of hybrid organic–inorganic nanocomposites,” 2009–2012; Principal investigator: Ing. Zdeňka Sedláková, CSc.

- Project Ministry of Education ME 847 – “Surface modification of materials by conducting polymers,” 2006–2010; Principal investigator: RNDr. Jaroslav Stejskal, CSc.

- Project Ministry of Education 7E09109 – “Integrated Micro–Nano–Opto Fluidic systems for high–content diagnosis and studies of rare cancer cells,” 2009–2012; Principal investigator: Ing. Daniel Horák, CSc., Co–principal investigators: Ing. Milan Beneš, CSc., Ing. Petr Šálek

- Project Ministry of Education MEB040920 – “Study on the behavior of non–porous (nanostructure) membranes for gas separation and pervaporation by various testing methods,” 2009–2010; Principal investigator: RNDr. Zbyněk Pientka, Ph.D.

- Project Ministry of Education, program COST, OC10007 – “Electron transport in III–N–V compounds nanostructures” 2010–2012; Principal investigator: Mgr. Miroslav Menšík, Dr., Co–principal investigator: RNDr. Karel Král, CSc., Institute of Physics AS CR

- Project Ministry of Education, program COST, OC 138 – “Molecular photoconductive and photorefractive systems: from macroscopic devices to nanostructures,” 2006–2010; Principal investigator: prof. RNDr. Stanislav Nešpůrek, DrSc.

- Project Ministry of Education, program COST, OC 138 – “Molecular photoconductive and photorefractive systems: from macroscopic devices to nanostructures,” 3/2006–2/2010; Principal investigator: prof. RNDr. Stanislav Nešpůrek, DrSc.

- Project Ministry of Education, program KONTAKT, ME 847 – “Surface modification of materials by conducting polymers,” 3/2006–12/2010; Principal investigator: RNDr. Jaroslav Stejskal, CSc.

- Project AS CR KAN100500652 – "Heterogeneous and hybrid nanocomposite materials for solar cells," 7/2006–12/2010; Principal investigator: RNDr. Jiří Pfleger, CSc.

b) *Selected projects on whose implementation the Institute is cooperating:*

"Nanotechnology for Society" programme research projects

- Project AS CR KAN400720701 – "Hierarchic nanosystems for microelectronics," 1/2007–12/2011; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for the Institute of Macromolecular Chemistry: prof. RNDr. Stanislav Nešpůrek, DrSc.

- Project AS CR KAN200200651 – "Nanoparticle and supramolecular systems for targeted transport of therapeutic drugs," 07/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for the Institute of Macromolecular Chemistry: prof. Ing. Karel Ulbrich, DrSc.

- Project AS CR KAN200520704 – "New nanoparticles for ultrastructural diagnostics," 7/2007–12/2011; Principal investigator: as.prof. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for the Institute of Macromolecular Chemistry: RNDr. Miroslav Šlouf, Ph.D.

- Project AS CR, "Nanotechnology for Society" programme, KAN200520804 – "Biocompatible nanofiber scaffolds forming novel drug matrices for the application of biologically and pharmacologically active substances," 1/2008–12/2012; Principal investigator: as.prof. RNDr. Vladimír Holáň, Institute of Molecular Genetics AS CR, Co–principal investigator for the Institute of Macromolecular Chemistry: Ing. Jiří Michálek, CSc.

- Project AS CR KAN200670701 – "Surface plasmon resonance biosensors and protein arrays for medical diagnostics," 1/2007–12/2011; Principal investigator: Ing. Jiří Homola, CSc., Institute of Photonics and Electronics AS CR, Prague, Co–principal investigator for the Institute of Macromolecular Chemistry: RNDr. Eduard Brynda, CSc.

- Project AS CR KAN401220801 – "Nanostructures of controlled size and dimensions," 1/2008–12/2012; Principal investigator: prof. Ing. Pavel Fiala, CSc., Czech Technical University/Faculty of Nuclear Sciences and Physical Engineering, Co–principal investigator for the Institute of Macromolecular Chemistry: Ing. Daniel Horák, CSc.

- Project AS CR KAN401770651 – "Molecular nanosystems and nanodevices: electric transport properties," 7/2006–12/2010; Principal investigator: Ing. Martin Weiter, Ph.D., Brno University of Technology/Faculty of Chemistry, Co–principal investigator for the Institute of Macromolecular Chemistry: prof. RNDr. Stanislav Nešpůrek, DrSc.

Other projects

- Project Ministry of Education 1M0505 – "Centre for Targeted Therapeutic Drugs," 1/2005–12/2011; Principal investigator: as.prof. Dr. Vladimír Viklický, MD, CSc., Nuclear Research Institute Rež a.s., Co–principal investigator for the Institute of Macromolecular Chemistry: prof. Ing. Karel Ulbrich, DrSc.

- Project Ministry of Education 1M0538 – "Centre for Cell Therapy and Tissue Repair," 1/2005–12/2011; Principal investigator: prof. Dr. Eva Syková, MD, DrSc., Charles

University in Prague/2nd Faculty of Medicine, Co–principal investigator for the Institute of Macromolecular Chemistry: RNDr. František Rypáček, CSc.

- Project Ministry of Education 2B06053 – "New methods for the characterisation and identification of probiotic bacterial strains suitable for functional foods," 2006–2011; Principal investigator: as.prof. Ing. Bohuslav Rittich, CSc., Masaryk University in Brno/Faculty of Science, Co–principal investigator for the Institute of Macromolecular Chemistry: Ing. Daniel Horák, CSc.

- Project Ministry of Industry and Trade 2A–1TP1/116 – "Functional polymers in membranes for alternative energy and bio–specific sources," 2006–2009; Principal investigator: Ing. Aleš Černín, Ph.D., MemBrain, s.r.o., Co–principal investigator for the Institute of Macromolecular Chemistry: Ing. Miroslav Bleha, CSc.

- Project Ministry of Industry and Trade 2A–2TP1/135 – "Novel polyfunctional hybrid polymers from renewable and recyclable raw materials with potential utilisation of enzyme catalysts and nanoparticles," 7/2007–6/2011; Principal investigator: Ing. Tomáš Vlček, Ph.D., SYNPO, a. s., Pardubice, Co–principal investigator for the Institute of Macromolecular Chemistry: Hynek Beneš

- Project AS CR IAAX08240901 – "Novel inorganic–organic hybrid nanomaterials," 2009–2013; Principal investigator: prof. Ing. Pavel Lhoták, CSc., Institute of Chemical Technology, Prague, Co–principal investigator for the Institute of Macromolecular Chemistry: Ing. Milena Špírková, CSc.

- Project GA AS CR IAA401770601 – "Molecular–scale electronic processes in materials suitable for organic photosensitive devices," 2006–2009; Principal investigator: Ing. Martin Weiter, Ph.D.., Brno University of Technology/Faculty of Chemistry, Co–principal investigator for the Institute of Macromolecular Chemistry: RNDr. Petr Toman, Ph.D.

- Project GA CR GAP208/10/0941 – "Engineering of surface–modified optical processes in molecules and semiconductor quantum dots by plasmon resonances in metal nanoparticle assemblies," 2010–2014; Principal investigator: prof. RNDr. Blanka Vlčková, CSc., Charles University, Prague/Faculty of Science, Co–principal investigator for the Institute of Macromolecular Chemistry: RNDr. Jiří Pfleger, CSc.

- Project GA CRGAP304/10/1951 – "Nanoliposomes for development of recombinant vaccines and targeted immunotherapeutics," 2010–2013; Principal investigator: RNDr. Jaroslav Turánek, CSc. – Veterinary Research Institute, Co–principal investigator for the Institute of Macromolecular Chemistry: RNDr. Zbyněk Pientka, CSc.

- Project GA CR GAP208/10/0353 – "Nanoparticles based on hydrophilic block polyelectrolyte complexes with ionic surfactants," 2010–2012; Principal investigator: RNDr. Miroslav Štěpánek, Ph.D., Charles University in Prague/Faculty of Science, Co–principal investigator for the Institute of Macromolecular Chemistry: RNDr. Miroslav Šlouf, Ph.D.

- Project GA CR GA106/09/1000 – "Bioinspired nanocomposite structures for bone tissue regeneration," 2009–2012; principal investigator: Ing. Karel Balík, CSc., Institute of Rock Structure and Mechanics AS CR, Co–principal investigator for the Institute of Macromolecular Chemistry: Mgr. Dana Kubies, CSc.

- Project GA CR GA304/07/1129 – "Polarized cultures of hepatocytes and mesenchymal cells on the nanofiber membranes in the experimental bioreactor," 2007–2011; Principal investigator: prof. Dr. Miroslav Ryska, MD, CSc., Charles University in Prague/2nd Faculty of Medicine, Co–principal investigator for the IMC: Ing. Jiří Michálek, CSc.

c) *Selected projects with international cooperation:*

- 7FP EU project type: Small, thematic priority: NMP, project title: CAMINEMS – "Integrated Micro–Nano–Opto Fluidic systems for high–content diagnosis and studies of rare cancer cells," 2009–2012; 9 partners from 5 countries, project budget: EUR 4.6 million; Coordinator: Corinne Min, Institut Curie (France); the IMC is a partner.

- Project 7FP EU, thematic priority: FP7–REGPOT–2007–3, project title: RP DEMATEN – "Reinforcement of research potential of the Department of Materials Engineering in the field of processing and characterisation of nanostructured materials," 2008–2011; 6 partners from 5 countries, Coordinator: Vladimir Srdič, University of Novi Sad (Serbia); the Institute of Macromolecular Chemistry was a partner.

- Cooperation within the network Marie Curie–6FP EU–BIMORE – "Bio–inspired Molecular Optoelectronics," 10/2006–9/2010; Coordinator: Dr. Larry Luer, Consiglio Nazionale Delle Richerche ISMN Instituto per lo Studio dei Materiali Nanostrutturati, INFM Centre for Ultrafast and Ultraintense Optical Science (ULTRAS), Italy, 7 partners, Co–principal investigator for the IMC: prof. RNDr. Stanislav Nešpůrek, DrSc.

Experts/field

- RNDr. Eduard Brynda, CSc. – nanobiotechnologies and nanomedicine (organized sets of biological and synthetic macromolecules for tissue engineering and biosensors)

- RNDr. Jiří Dybal, CSc. – computer modelling of chemical structures

- Ing. Daniel Horák, CSc. – nanomedicine (polymeric magnetic nanoparticles)

- as.prof. RNDr. Čestmír Koňák, DrSc. – nanomaterials, nanomedicine (optical methods for supramolecular polymeric materials, nanoclusters and nanoparticles)

- RNDr. Libor Matějka, CSc. – nanomaterials (nanocomposites, organo–inorganic and polymeric nanostructured materials)

- prof. RNDr. Stanislav Nešpůrek, DrSc. – organic semiconductors, molecular electronic discharge of one–dimensional silicon

- RNDr. Jiří Pfleger, CSc. – nanoelectronics (organic molecular electronics, nanoparticles in polymeric matrices for solar cells)

- Ing. Josef Pleštil, CSc. – X–ray and neutron structural analysis

- RNDr. František Rypáček, CSc. – nanomedicine (materials for tissue engineering)

- RNDr. Miroslav Šlouf, Ph.D. – morphology, TEM

- RNDr. Petr Štěpánek, CSc. – nanomaterials (supramolecular nano polymeric materials)

- prof. Ing. Karel Ulbrich, DrSc. – nanomedicine (molecular systems for targeted delivery of medications and genes)

3.1.22 INSTITUTE OF MOLECULAR GENETICS AS CR, a public research institution (IMG)

Vídeňská 1083, 142 20 Prague 4, ID: 68378050

www.img.cas.cz

A brief description of the Institute

The Institute was established on 1 January 1962 as the Institute of Experimental Biology and Genetics of the Czechoslovak Academy of Sciences. Its foundation wasa department established within the former Institute of Biology of the Czechoslovak Academy of Sciences. Transferred to the Institute in 1976 were parts of the department of molecular biology and of the department of protein biochemistry from the Institute of Organic Chemistry and Biochemistry of the Czechoslovak Academy of Sciences. At the same time, the Institute was renamed as the Institute of Molecular Genetics. On 1 January 2007, the Institute became a public research institution. The main area of activity of the IMG is scientific research in the area of the molecular basis of serious illnesses (leukemia, cancer, AIDS), the biology of normal and malignant cell transformation, and immune responses involved in the protection of an organism. Research is being conducted in connection with this on selected retroviruses, oncogenes, cell surface receptors, and cytoskeleton. Also the subject of research are the processes of regulation of gene expression and the transmission of signals within the cell, as well as the molecular mechanisms of fertilisation. On 1 January 2008, the Biotechnology Sector of the IMG split off, and the Biotechnology Institute AS CR was founded in Prague.

At the departments listed below, the following research scientists are working on particular programme research projects focusing on nanotechnologies:

- Department of Cell Nucleus Biology – Pavel Hozák
- Department of RNA Biology – David Staněk
- Department of Cellular Signaling and Apoptosis – Ladislav Anděra
- Department of Molecular Virology – Jarmila Králová
- Department of Signal Transduction – Petr Dráber
- Department of Transplantation Immunology – Vladimír Holáň

Focus of research and development

In the years 2005–2010, research focused on the questions of the following research proposal:

Research proposal AV0Z50520514 **– "Molecular Genetics and Cellular Bases of Key Biological Processes: Gene Expression, Oncogenesis, Virus Replication, Immunity and Development of the Organism",** 2005–2010; Principal investigator: prof. RNDr. Václav Hořejší, CSc. Classification – area 3, share of nanotechnology research – 20%.

Studied at the molecular and cellular level were the fundamental processes of life and of pathology disrupting the structural and physical integrity of living organisms. The goal of the research proposal was to make a contribution in particular towards understanding of the complex mechanisms of regulation of gene expression, the role of the products of those genes in controlling basic cell functions for normal and pathologically altered cells, in gametogenesis and the development of the organism, and in the regulation of immune responses during infectious, tumorous, or autoimmune diseases. Knowledge of the structure

of selected genes and of the general principles involving their regulation and function for microorganisms of cellular or animal models is a necessary theoretical precondition for the development of procedures both for the future diagnosis of pathological conditions and for any targeted therapeutic intervention.

In 2011, the Institute worked on 95 programme research projects.

Since 2011, the Institute has been involved in the building of the **BioCev Centre of Excellence**, www.biocev.eu.

The IMG is the main recipient of this project, and the project partners are: Charles University, Prague/ Faculty of Sciences and 1st Faculty of Medicine; the Institute of Biotechnology AS CR, Institute of Physiology AS CR; the Institute of Microbiology, AS CR; the Institute of Experimental Medicine AS CR; the Institute of Macromolecular Chemistry AS CR.

Project costs: CZK 3.2 billion; portion from subsidies: CZK 2.3 billion

By the year 2015, the project's goal is to build a centre for excellent research covering an area of 26,000 m^2. The research will focus on detailed study of cellular mechanisms at the molecular level, research and development of new therapeutic procedures, prompt diagnosis, biologically active substances including chemotherapy agents, natural antibiotics, development of tissue for the repairing of damaged organs, protein engineering, and other technologies.The centre should employ up to 600 people including scientists and other workers.

The scientific coordinator of the project is prof. RNDr. Václav Pačes, DrSc. – chairman of the Czech Society for Biochemistry and Molecular Biology and chairman of the Academy of Sciences in 2005–2009.

Members of the centre's scientific team:

- prof. RNDr. Pavel Hozák, DrSc. – project subcoordinator for the AS
- prof. RNDr. Jan Tachezy, Ph.D. – project subcoordinator for Charles University and head of the Cell Biology and Virology research programme
- as.prof. Radislav Sedláček, Ph.D. – head of the research programme Functional Genomics
- Ing. Bohdan Schneider, Ph.D. – head of the research programme Structural Biology and Protein Engineering
- RNDr. Eduard Brynda, CSc. – head of the research programme Biomaterials and Tissue Engineering
- prof. MUDr. Pavel Martásek, DrSc. – head of the research programme Development of Therapeutic and Diagnostic Procedures

Within the framework of the centre's research programmes, there will also be research focusing on nanotechnology.

Research in nanotechnologies

The IMG deals with research in the area of nanomaterials and nanotechnologies with an emphasis on biosensors and new methods of detection. Specific work includes:

- Development of a new system of ultrasensitive detection of proteins on the basis of immuno–PCR.
- Development of new nanoparticles with a size of 5–15 nm with various shapes or surface compositions, which will be usable for detection with the aid of electron microscopy.
- Development of sensitive, specific, and robust nanoimmunosensors for the detection or biological ligands, and especially cytokines.
- Development of very effective diagnostic and treatment procedures for neoplastic and cardiovascular diseases.
- Development of new generations of nanopharmaceuticals and medications of controlling systems and magnetic nanoparticles for the purposes of diagnosis and treatment.
- Preparation of conjugates of nanoparticles of gold, antibodies, and oligonucleotides.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

"Nanotechnology for Society" programme research projects

- Project AS CR KAN200520701 – "Nano–PCR – ultrasensitive test for detection of specific proteins in body fluids," 1/2007–12/2011; Principal investigator: RNDr. Petr Dráber, DrSc.
- Project AS CR KAN200520704 – "New nanoparticles for ultrastructural diagnostics, – "1/2007–12/2011; Principal investigator: prof. Pavel Hozák, DrSc.
- Project AS CR KAN200520801 – "Targeted expression and transport of bioactive molecules," 1/2008–12/2012; Principal investigator: Mgr. David Staněk, Ph.D.
- Project AS CR KAN200520804 – "Biocompatible nanofiber scaffolds forming novel drug matrices for the application of biologically and pharmacologically active substances," 1/2008–12/2012; Principal investigator: as.prof. RNDr. Vladimír Holáň, DrSc.

b) *Selected projects on whose implementation the Institute is cooperating:*

"Nanotechnology for Society" programme research projects

- Project AS CR KAN200200651 – "Nanoparticle and supramolecular systems for targeted transport of therapeutic drugs," 07/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for the Institute of Molecular Genetics: RNDr. Jarmila Králová, Ph.D.
- Project AS CR KAN200520702 – "Nanoimmunosensors for cytokine detection," 01/2007–12/2011; Principal investigator: Ing. Peter Šebo, CSc., Institute of Biotechnology AS CR, Prague, Co–principal investigator for the Institute of Molecular Genetics AS CR: Ing. Radim Osička, Ph.D.
- Project AS CR KAN200520703 – "The use of ultrasound in nanomedicine," 1/2007–12/2011; Principal investigator: prof. Ing. Jiří Neužil, CSc., Institute of Biotechnology AS CR, Co–principal investigator for the IMG: RNDr. Ladislav Anděra, CSc.

Other projects

- Project Ministry of Education LC066063 – "Fluorescence microscopy in biological and medical research," 3/2006–12/2011; Principal investigator: as.prof. Martin Hof, Dr. rer. nat., J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for the Institute of Molecular Genetics: prof. Pavel Hozák, DrSc.

- Project Ministry of Education 1M0505 "Centre for Targeted Therapeutic Drugs," 1/2005–12/2011; Principal investigator: prof. Dr. Vladimír Viklický, MD, CSc., Nuclear Research Institute Rež a.s., Husinec – Rež, Co–principal investigator for the Institute of Molecular Genetics: RNDr. Milan Fábry, CSc.

Selected results in nanotechnologies/cooperation

New system of ultrasensitive detection of proteins on the basis of immuno–PCR.

Within the framework AS CR project KAN200520701, a new method has been developed and validated for ultra–sensitive, quick, and easy detection of proteins on the basis of a nano–immuno–polymerase chain reaction (nano–iPCR). The key component for this method consists of particles of colloidal gold (with a diameter of 30 nm), which are conjugated with an oligonucleotide DNA template and an antibody against the target protein. The method consists of the immobilisation of the monitored protein on an antibody that is anchored in pits of polycarbonate plates for PCR. Subsequently, colloidal gold bonds to the studied protein with the bonded antibody and oligonucleotide DNA. The antibody secures the bond of the particles to the immobilized protein, while the oligonucelotide DNA serves as a template for quantification of the signal with the use of quantitative PCR. Studies focused on the detection of cytokines have shown that nano–iPCR is easier to perform than immuno–PCR (iPCR) or ELISA tests. Nano–iPCR, on the other hand, is more sensitive than iPCR and ELISA. The findings have been published: Potůčková, L., Franko, F., Bambousková, M., and Dráber, P. (2011). – "Rapid and sensitive detection of cytokines using functionalized gold nanoparticle–based immuno–PCR, comparison with immuno–PCR and ELISA," *Journal of Immunological Methods*, vol. 371, pp. 38–47.

New nanoparticles with a size of 5–15 nm with various shapes or surface compositions, which are usable for detection with the aid of electron microscopy.

As part of implementation of the project AS CR KAN200520704, a new detection system has been developed and validated, enabling the simultaneous sensitive detection of up to five different antigens by electron microscopy methods. The system is based on the use of new metal nanoparticles of various shapes and elemental composition with a size of 6 – 15 nm that are conjugated with antibodies. The detection of target molecules takes place on ultra–thin sections of cells, tissue, or other biological material put into resin in the usual manner for subsequent immunolabeling. The primary antibodies bond themselves specifically to target proteins. During the next step, secondary antibodies conjugated with nanoparticles bond to the proteins. The resulting sample is analyzed under an electron microscope, enabling observation of fine details of cell structure with high definition and analysis of the distribution of protein complexes in cell compartments. This system of multiple ultrastructural immunolabeling was applied in our research on the lipid PIP2, the localisation of which in the cell nucleus has recently been described. For the very first time, we have succeeded in mapping five antigens simultaneously on one sample, obtaining thereby valuable information about the distribution of PIP2 in cell compartments and its interactions with other key molecules of the cell nucleus. Another advantage of our new system is its

variability. Nanoparticles can be conjugated not only with antibodies but also with other bioactive molecules. It is furthermore still possible to increase the number of simultaneously detected target molecules, if we combine routine differentiation of particles according to shape with differentiation according to elemental composition. A key publication has been publishrd: V.V. Philimonenko, A.A. Philimonenko, I. Šloufová, M. Hrubý, F. Novotný, Z. Halbhuber, M. Krivjanská, J. Nebesářová, M. Šlouf, and P. Hozák (2012). Simultaneous detection of multiple targets for ultrastructural immunocytochemistry. (submitted). The results have also been protected in 6 cases (2 Czech patents and 4 utility models).

Use of ultrasound for detection, diagnostics, and treatment

Within the framework of implementation of the multidisciplinary project AS CR KAN200520703 (Contractor: Institute of Biotechnology AS CR; Principal investigator: prof. Jiří Neužil), several important results have been achieved. (1) Establishment of an ultrasound imaging facility as a world–class core facility for use by a number of academic laboratories or for use by the sphere of private enterprise. (2) Introduction of the technology of the use of commercially available microbubbles for contrast ultrasound imaging of the blood stream and targeted microbubbles for diagnostic purposes and – "molecular targeting *in vivo*." (3) Preparation, characterisation, and use of newly specified bubbles with varied applications: contrast ultrasound imaging, diagnostic use, study of expression of surface markers, study of apoptosis *in vivo*, transfection *in vivo* in real time. A total of 14 articles have been published, and 4 more have been accepted for publication. 5 patents have also been granted, and two patents are pending. Also issued were 3 utility models and 8 prototypes/functional models. the Institute of Molecular Genetics has taken part in this project by analysis of apoptotic signalisation from receptors for the cytotoxic ligand TRAIL.

Expression and transport of bioactive molecules

Within the framework of the project AS CR – "Targeted expression and transport of bioactive molecules" (KAN200520801), attention was focused on the development and testing of small molecules and modified nucleotides and deoxynucleotides that would penetrate across the cell membrane and would specifically inhibit key steps of genetic expression (transcription and pre–mRNA splicing) and DNA replication. At the IMG, research focused on the influence of small molecules on pre–mRNA splicing. A unique system has been developed on the basis of Foerster resonance energy transfer, which enables the use of fluorescence microscopy to monitor interaction of proteins with pre–mRNA directly in live cells. It was determined that the natural substance isoginkgetin inhibits the active forming of the splicing complex by extending interaction between U1 snRNP and pre–mRNA. Also analyzed was the influence of small molecules on the regulation of alternative splicing, and it was determined that histone deacetylase inhibitors that are used for treating tumors and neurological diseases such as epilepsy influence alternative pre–mRNA splicing. It was determined the histone deacetylase inhibiting leads to changes of alternative splicing for nearly 700 genes, and the molecular mechanism was found by which these inhibitors influence pre–mRNA splicing. Within the context of the project, several publications were written at the IMG: M Huranová, JA Jablonski, A Benda, M Hof, D Stanek, M Caputi. (2009) *In vivo* detection of RNA–binding protein interactions with cognate RNA sequences by fluorescence resonance energy transfer. RNA.15(11):2063–71; M Huranová, I Ivani, A Benda, I Poser, Y Brody, M Hof, Y Shav–Tal, KM Neugebauer, D Stanek. (2010) The differential interaction of snRNPs with pre–mRNA reveals splicing kinetics in living cells. J Cell Biol 191(1):75–86; J Hnilicová, S Hozeifi, E Dušková, J Icha, T Tománková, D Staněk. (2011) Histone deacetylase activity modulates alternative splicing. PLoS One. 6(2):e16727

New photodynamic therapy with the use of gold nanoparticles

During implementation of the project AS CR KAN200200651, new porphyrin–brucine conjugates bonded to gold nanoparticles were prepared. The nanoparticulate carriers strongly influenced the bioavailability and biological activity of porphyrin *in vivo*. For forms immobilized on gold nanoparticles, after activation with laser light, there was observation of much higher photodynamic effectiveness, manifesting itself through complete regression of the subdermal experimental tumor of the epithelium in mice than with forms that were not bonded. These studies showed that gold nanoparticles may serve as effective vectors for the delivery of photosensitive substances to tumors, thus representing a new strategy for improving photodynamic therapy.

The findings have been published: K Záruba, J Králová, P Řezanka, P Poučková, L Veverková, and V Král. Modified porphyrin–brucine conjugated to gold nanoparticles and their application in photodynamic therapy. Org. Biomol. Chem., 2010, 8 (14), 3202–3206; Králová J, Záruba K, Řezanka P, Poučková P, and Veverková L, Král V. Combined therapy for squamous carcinoma cells: application of porphyrin–alkaloid modified gold nanoparticles. In Squamous Cell Carcinoma, 2012, Ed. Xiaoming L. Intech Open Access Publisher. ISBN 978–953–51–0024–9, www.intechopen.com/books/show/title/squamous–cell–carcinoma, pp. 93–118

Use of polymeric nanofibers for regenerative medicine and local immunosuppression

Within the framework of implementation of the grant project AS CR KAN200520804 with cooperation between the Institute of Molecular Genetics AS CR, the Institute of Experimental Medicine AS CR, the Institute of Macromolecular Chemistry AS CR, and the company Elmarco, s.r.o., nanofibers were prepared with the incorporated immunosuppressant substance cyclosporine A (CsA). Used for the preparation of the nanofibers were the biocompatible polymers poly(L–lactide) and polyamide, and their fibers were spun with Nanospider production equipment using original, patented technology. In vitro and *in vivo* studies demonstrated the favorable kinetics of the release of CsA from the nanofibers and the usefulness of fibers prepared in this manner for local suppression of inflammation and other immune reactions controlled by T cells. Additionally, such prepared nanofibers support the growth of various types of stem cells (Fig. 1). The results obtained on an experimental model of healing of a damaged cornea showed that prepared nanofiber constructions can serve as carriers of stem cells for regenerative and reparative medicine, and at the same time as carriers of immunosuppressant substances for local suppression of the immune reaction. The findings have been published: V. Holáň, M. Chudíčková, P. Trošan, E. Svobodová, M. Krulová, S. Kubinová, E. Syková, J. Širc, J. Michálek, M. Jukličková, M. Munzarová, and A. Zajícová (2011). Cyclosporine A–loaded and stem cell–seeded electrospun nanofibers for cell–based therapy and local immunosuppression. J. Control. Release 156, pp. 406–412.

Experts/field

- RNDr. Ladislav Anděra, CSc. – Department of Cell Signalling and Apoptosis
- RNDr. Petr Dráber, DrSc. – Department of Signal Transduction
- as.prof. RNDr. Vladimír Holáň, DrSc. – Department of Transplantation Immunology
- prof. RNDr. Pavel Hozák, DrSc. – Department of Cell Nucleus Biology
- RNDr. Jarmila Králová, CSc. – Department of Molecular Virology

3.1.23 INSTITUTE OF ORGANIC CHEMISTRY AND BIOCHEMISTRY AS CR, a public research institution (ÚOCHB)

Flemingovo nám. 2, 166 10 Prague 6, ID: 61388963

www.uochb.cas.cz

A brief description of the Institute

The Institute was created from the Central Institute of Chemistry, which was founded in 1950 and became a part of the Czechoslovak Academy of Sciences on 1 January 1953. After the dividing up of the Institute of Chemistry AS CR, the Institute of Organic Chemistry and Biochemistry was formed on 1 January 1960 from the bulk of the former Institute. On 1 January 2007, the Institute became a public research institution. The main area of activity of the Institute of Organic Chemistry and Biochemistry is scientific research in the areas of organic chemistry, biochemistry, molecular and cellular biology, computational chemistry, physical organic and biochemistry and in related fields, i.e. medical chemistry, bioorganic chemistry, bioinorganic chemistry, and molecular pharmacology. The research focuses mainly on medical applications, applications focused on the protection of plants and animals, development of new synthetic, biotechnological, analytical, and computational procedures, development of functional molecules, study of the structure, properties, and biological activity of substances, the chemistry and biochemistry of peptides, proteins, nucleic acids, and natural substances and their components and analogues. The Institute's research activity is being conducted in areas that involve the work of 24 research teams. Research service work is being carried out at the Institute's 9 laboratories. Nanotechnology research is being conducted in the following areas (some of the investigators of programme research projects are listed in parentheses):

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

Research service teams

Biochemical pharmacology of antimetabolites (Helena Mertlíková–Kaiserová)

Electromigration methods (Václav Kašička)

Radioisotope laboratory (Tomáš Elbert)

Mass spectrometry (Josef Cvačka)

Medical chemistry (Pavel Majer)

NMR spectroscopy (David Šaman)

Structural biology (Pavlína Řezáčová)

Virology (Jan Weber)

Bioinformatics (Jiří Vondrášek)

Focus of research and development

In 2005–2010, research at the Institute focused, among other things, on the questions of one research proposal – AV0Z40550506 – **"Regulation of Life Processes: Chemical Modulators of Selected Biological Systems Relevant to Medicine and**

Agriculture,"1/2005–12/2010; Principal investigator: RNDr. Zdeněk Havlas, DrSc., Classification – area 3, share of nanotechnology research – 10%.

The goal was the use of the results of basic research for the creation of new or perfecting of existing therapeutic strategies or strategies for plant protection. With an emphasis on vertically integrated approaches to the study of biomolecular structures and functions, research was oriented around four topics:

(1) chemistry of biologically important molecules involving serious diseases, (2) chemistry of infochemicals, infochemicals of importance for the plant–insect–microorganism system, (3) synthetic approaches to biologically active and functional materials, and (4) physical chemical methods, spectroscopy and molecular modelling focusing on learning the mechanism of the effect of target molecules.

In 2011, a total of 112 programme research projects were conducted at the Institute, that were supported from public support programmes for research and development, some of which involved nanotechnologies.

Research in nanotechnologies

Basic research is focused on molecular equipment and nanomotors in particular, the use of which is aimed at non–traditional sources of energy, on research on conductive polymers, namely carboranes containing polyacetylenes, and research in the area of self–assembled monolayers (SAM) on the basis of organometallic compounds. Nanoobjects are also studied theoretically, within the framework of the programme for modelling of the chemical properties of nano– and biostructures.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project Ministry of Education LH11027 – "Biocompatibilisation and Targeting of Nanoparticles for Diagnostic and Therapeutic Applications," 2011–2014; Principal investigator: Mgr. Petr Cígler, Ph.D.
- Project Ministry of Education ME09020 – "2–D and 3–D Arrays of Molecular Rotors: New Materials for Nanotechnology," 2009–2012; Principal investigator: RNDr. Jaroslav Vacek, Ph.D.
- Project Ministry of Education 7E09054 – "Multi–scale Formation of Functional Nanocrystal–Molecule Assemblies and Architectures," 2009–2011; Principal investigator: RNDr. Ivo Starý, CSc.
- Project GA AS CR IAA400550704 – "Fullerene Containers. Design, Synthesis, Properties and Possible Application," 1/2007–12/2011; Principal investigator: Ing. Petr Holý, CSc.
- Project GA AS CR IAA400550708 – "Polyacetylenes with Carborate Anions in Side Chains," 1/2007–12/2010; Principal investigator: prof. Josef Michl, DrSc.
- Project GA CR P108/12/640 – "Biocompatible nanodiamond probes for multimodal imaging *in vivo*," 1/2012 – 12/2014; Principal investigator: Mgr. Petr Cígler, Ph.D.

b) *Selected projects on whose implementation the Institute is cooperating:*

- Project GA CR GA203/09/0675 – "The utilisation of gold nanoparticles in capillary electrophoresis and capillary electrochromatography," 2009–2011; principal investigator: Dr. RNDr. David Sýkora, Institute of Chemical Technology in Prague/Faculty of Chemical Engineering, Co–principal investigator for the Institute of Organic Chemistry and Biochemistry: RNDr. Václav Kašička, CSc.

- Project GA CRGAP304/10/1951 – "Nanoliposomes for development of recombinant vaccines and targeted immunotherapeutics," 2010–2013; Principal investigator: RNDr. Jaroslav Turánek, CSc., Veterinary Research Institute, Co–principal investigator for the Institute of Organic Chemistry and Biochemistry: RNDr. Miroslav Ledvina, CSc.

- Project AS CR KAN200100801 – "Bioactive Biocompatible Surfaces and Novel Nanostructured Composites for Applications in Medicine and Drug Delivery," 01/2008–12/2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc. HDR, Institute of Physics AS CR, Co–principal investigator for the Institute of Organic Chemistry and Biochemistry: RNDr. Miroslav Ledvina, CSc.

- Project AS CR KAN200200651 – "Nanoparticle and supramolecular systems for targeted transport of therapeutic drugs," 07/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for the Institute of Organic Chemistry and Biochemistry: RNDr. Ladislav Kohout, DrSc.

- Project AS CR KAN200520703 – "The use of ultrasound in nanomedicine," 1/2007–12/2011; Principal investigator: as.prof. Ing. Jiří Neužil, CSc., Institute of Biotechnology AS CR, Co–principal investigator for the Institute of Organic Chemistry and Biochemistry: RNDr. Miroslav Ledvina, CSc.

- Project AS CR KAN200520801 – "Targeted expression and transport of bioactive molecules," 1/2008–12/2012; Principal investigator: Mgr. David Staněk, Ph.D., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for the Institute of Organic Chemistry and Biochemistry: Ing. Ivan Rosenberg, CSc.

- Project GA CR P206/12/0453 – "Affinity capillary electromigration methods for selective nanoanalysis of biomolecules and study of their interactions," 1/2012–12/2014; Principal investigator: prof. Ing. Ivan Mikšík, DrSc., Institute of Physiology AS CR, Co–principal investigator for the Institute of Organic Chemistry and Biochemistry: RNDr. Václav Kašička, CSc.

- Project GA CR CE P106/12/G015 – "Development of new nanoporous absorbents and catalysts," 1/2012–12/2018; Principal investigator: prof. Jiří Čejka, DrSc., J. Heyrovský Institute of Physical Chemistry, Co–principal investigator for the Institute of Organic Chemistry and Biochemistry: RNDr, Ota Bludský, CSc.

c) *Selected projects with international cooperation:*

- 7FP EU project type: Small, thematic priority: KBBE, project title: DINAMO – "Development of diamond intracellular nanoprobes for oncogen transformation dynamics monitoring in living cells," 2010–2013; 8 partners from 5 countries, project budget: EUR 3,970,000, coordinator: Christine Van Houtven, Interuniversitair Micro–

Electronica Centrum VZW (Belgium); the Institute of Organic Chemistry and Biochemistry is a partner.

- 7FP EU project type: Small, thematic priority: NMP, project title: FUNMOL – "Multi–scale Formation of Functional Nanocrystal–Molecule Assemblies and Architectures," 2008–2012; 9 partners from 8 countries, project budget: CZK 5.0 million, coordinator: Cliodhna Horan, Cork, Ireland; the Institute of Organic Chemistry and Biochemistry is a partner.

Experts/field

- RNDr. Zdeněk Havlas, DrSc. – theoretical, quantum, and computational chemistry and chemical physics
- prof. Ing. Pavel Hobza, DrSc. – theoretical, quantum, and computational 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

3.1.24 INSTITUTE OF HYDRODYNAMICS AS CR, a public research institution

Pod Paťankou 5, 16612 Prague 6, ID: 67985874

www.ih.cas.cz

A brief description of the Institute

The Institute of Hydrodynamics AS CR conducts research in the areas of fluid mechanics and disperse systems, rheology, hydrodynamics of the biosphere, hydrology, water management, structural, mechanical, chemical, and physical engineering, and the environment.

Focus of research and development

Flow properties of non–Newtonian substances: reduction of friction losses, rheological properties of selected non–Newtonian substances, psychorheology, biorheology of cells, electrorheology

Hydrodynamics of flow systems: Flow properties and behavior of suspensions, development of numerical methods for describing the flow of liquids, numerical simulation of the movement of particles in a flowing liquid, vortical character of shear flows, optimizing water treatment processes

Transformation processes in the hydrosphere: Forming of runoff from a hydrologically defined whole depending on the status and changes of vegetation cover, semidistributed and distributed precipitation–runoff models, the influence of climate and geomorphologic factors and cover on runoff, modelling of water quality in a flood reservoir system

In 2011, the Institute worked on 17 programme research projects.

Project implemented in nanotechnologies

- Project AS CR IAA200600803 – "The influence of nanoscale reinforcement on the yield and creep behavior of glassy polymers and their thermal consolidation," 2008–2010; Principal investigator: Ing. Pavel Říha, CSc.

Experts/field

- Ing. Pavel Říha, CSc. – rheology of suspensions and polymers, aging of polymers, cell and tissue mechanics

3.1.25 INSTITUTE OF SCIENTIFIC INSTRUMENTS AS CR, a public research institution (ISI)

Královopolská 147, 612 64 Brno, ID: 68081731

www.isibrno.cz

A brief description of the Institute

The Institute was founded on 1 January 1957 from the Development Workshop of the Czechoslovak Academy of Sciences in Brno. On 1 January 2007, the Institute became a public research institution. The ISI conducts research on physical methods, special technologies, and unique instrument principles in advanced areas of electron microscopy, nuclear magnetic resonance, and quantum light generators. It creates breakthrough technological components and procedures in the fields of ultra–high vacuum, cryotechnology, and superconductivity. The goal of interdisciplinary research on the microstructure of mass is the obtaining of results that are useful in biology, chemistry, medicine, ecology, and physics. The research is being conducted in 13 research groups that are topically assigned to six departments:

Department of Electron Microscopy (I. Müllerová)

Research groups: *Electron Optics* (T. Radlička), *Microscopy and Spectroscopy of Surfaces* (I. Müllerová, L. Frank), *Microscopy and Microanalysis* (F. Mika), *Microscopy for Biomedicine* (V. Krzyžánek)

Department of Special Technologies (J. Sobota)

Research groups: *Electron Lithography* (V. Kolařík), *Thin Layers* (J. Sobota), *Electron Technology* (M. Zobač)

Department of Micromanipulation Techniques (P. Zemánek)

Department of Medical Signals (P. Jurák)

Department of Coherence Optics (J. Lazar)

Research groups: *Coherent Lasers and Interferometry* (O. Číp), *Laser Technologies* (L. Mrňa).

Department of Magnetic Resonance and Cryogenics (Z. Starčuk, Jr.)

Research groups: *Magnetic Resonance* (Z. Starčuk, Jr.), *Cryogenics and Superconductivity* (A. Srnka).

Focus of research and development

In 2005–2010 research focused on the problems of one research proposal – AV0Z20650511 **– "Research into experimental methods for examination of the physical properties of matter and their application in advanced technologies,"** 1/2005–12/2010; Principal investigator: RNDr. Luděk Frank, DrSc., total costs for the entire project period: CZK 493,460,000, of which CZK 469,879,000 came from the state budget. Classification – area 7a, share of nanotechnology research – 60%.

The focus of the research proposal was on the area of applied physics and technical sciences with the goal of developing a methodology for obtaining imaging and spectral information from atomic, molecular, and cellular structures, including the recording and processing of biosignals and their selected applications in biology, medicine, and materials science. Electron bundles generated, controlled, and detected by newly developed procedures are used for the study of substances and holographic phenomena and for the joining and micromachining of materials. Radiation from quantum light generators is used for making various kinds of optical traps for the nondestructive manipulation of microobjects, and highly coherent lasers are being developed for the metrology of optical frequencies and interferometric measurements. The potential of the methods of nuclear magnetic resonance for the study of living mass has been used an expanded by the creation of imaging contrast by laser–polarized noble gasses and techniques of spectroscopic imaging.

Since 2009, using EU structural funds, the Institute has been building **Application Laboratories of Advanced Microtechnologies and Nanotechnologies** (project ED0017/01/01). The goal of this project consisting primarily of investment with a total budget of CZK 433 million is to build a centre with modern equipment for comprehensive study and research on materials, structures, and surfaces in the micro– and nanoworld by the year 2013. The centre will be focused on the area of applied diagnostics and advanced technologies using the methods of electron microscopy and lithography, magnetic resonance, laser interferometry, electron and laser beam welding, magnetron sputtering, cryogenics, and the construction of new scientific instruments. A wide range of imaging, diagnostic, analytical, and measuring methods is to offer a view of samples and objects on the basis of various physical principles and with varying degrees of accuracy, scale, and definition. The responsible person for this project is prof. RNDr. Pavel Zemánek, Ph.D.

In 2011, a total of 41 research projects were conducted at the Institute, which were supported from public support programmes, some of which involved nanotechnologies.

Research in nanotechnologies

New methods of imaging with electron microscopy, microlithography technologies using an electron beam lithograph, and the deposition of thin layers by magnetron sputtering. New, methods of laser interferometry allow measurements of changes of length in the tens of nanometers, equipment has been constructed (optical tweezers) using the mechanical effect of focused laser bundles for the spatial capture and relocation of nanoobjects in a liquids.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project Ministry of Education – "Application and Development Laboratories for Advanced Microtechnologies and Nanotechnologies," 2009–2013; Principal investigator: prof. RNDr. Pavel Zemánek, Ph.D.

- Project Ministry of Education, COST programme, OC08034 – "Advanced techniques of interferometric optical micro–manipulations," 1/2008–5/2011; Principal investigator: prof. RNDr. Pavel Zemánek, Ph.D.

- Project Ministry of Industry and Trade FR–TI2/705 – "Non–contact optical measuring methods and systems for precise engineering," 7/2010–12/2014; Principal investigator: Ing. Ondřej Číp, Ph.D.

- Project GA CR GPP102/11/P820 – "Interferometric measurement techniques for nanopositioning," 2011–2013; Principal investigator: Ing. Jan Hrabina, Ph.D.

- Project GA CR GA202/09/0348 – "Self–organizing of sub–micrometer particles in laser beams," 2009–2011; Principal investigator: prof. RNDr. Pavel Zemánek, Ph.D.

- Project GA AS CR IAA100650803 – "Coherent imaging of nanostructures in a low–energy scanning electron microscope with an area detector of electrons," 1/2008–12/2010; Principal investigator: Ing. Miroslav Horáček, Ph.D.

- Project GA CR GAP102/10/1813 – "Methods for generation of a length etalon by means of stabilized femtosecond mode–locked laser," 1/2010–12/2014; Principal investigator: Ing. Ondřej Číp, Ph.D.

- Project GA CR GAP102/12/1104 – "Study of metabolism and localisation of high grade glioma using MR imaging techniques," 1/2012–12/2014; Principal investigator: prof. Ing. Karel Bartušek, DrSc.

- Project GA CR GAP108/11/2270 – "Mapping of the local crystalline structure by backscattered electrons," 1/2011–12/2013; Principal investigator: RNDr. Luděk Frank, DrSc.

- Project GA CR GAP205/11/1687 – "Non–invasive contactless methods of identification and characterisation of living microorganisms by optical spectroscopy and micromanipulation," 1/2011–12/2014; Principal investigator: Mgr. Ota Samek, Dr.

- Project GA CR GPP205/11/P294 – "Optical manipulations of microscopic particles in air," 1/2011–12/2013; Principal investigator: Mgr. Oto Brzobohatý, Ph.D.

- Project GA CR GPP205/12/P868 – "Phototermal interactions at the microscale," 1/2012–12/2014; Principal investigator: Mgr. Martin Šiler, Ph.D.

- Project GA CR GA102/09/1276 – "Interferometer with full in–line compensation of the fluctuations of refractive index," 1/2009–12/2012; Principal investigator: as.prof. Ing. Josef Lazar, Dr.

b) *Selected projects on whose implementation the Institute is cooperating:*

- Project Ministry of Industry and Trade FR–TI1/241 – "Components for nano–diagnostics of length fluctuations, deviation of shapes and surface defects," 2009–2013; Principal investigator: Ing. Jan Kůr – MESING, spol. s r.o., Co–principal investigator for the ISI: Ing. Ondřej Číp, Ph.D.

- Project AS CR KAN311610701 – "Nanometrology using methods of scanning probe microscopy," 1/2007–12/2011; Principal investigator: Mgr. Petr Klapetek, Ph.D., Czech

Metrology Institute, Brno, Co–principal investigators for the ISI: Ing. Ondřej Číp, Ph.D., and Ing. Josef Lazar, Dr.

- Project AS CR KAN300100702 – "Creating and probing nanostructures with X–ray lasers," 01/2007–12/2011; Principal investigator: Ing. Bedřich Rus, Dr., Institute of Physics AS CR, Co–principal investigator for the ISI: Ing. Jaroslav Sobota, CSc.

- Project GA CR GA202/07/1669 – "Deposition of thermomechanically stable nanostructured diamond–like thin films in dual frequency capacitive discharges," 1/2007–12/2011; Principal investigator: RNDr. Věra Buršíková, Ph.D., Masaryk University, Brno/Faculty of Science, Co–principal investigator for the ISI: Ing. Jaroslav Sobota, CSc.

- Project GA CR GA202/08/0178 – "Synthesis of Fe–based magnetic nanoparticles in low–temperature microwave plasma," 1/2008–12/2010; Principal investigator: Mgr. Vít Kudrle, Ph.D., Masaryk University, Brno/Faculty of Science, Co–principal investigator for the ISI: Mgr. Jiřina Matějková.

- Project Ministry of Education, "Basic Research Centres" programme, LC06007 – "Centre of Modern Optics," 3/2006–12/2011; Principal investigator: prof. Mgr. Jaromír Fiurášek, Ph.D., Palacký University, Olomouc/Faculty of Science, Co–principal investigator for the ISI: prof. RNDr. Pavel Zemánek, Ph.D.

- Project Ministry of Education, EUREKA programme, OE08012 – "Contrast and detection in scanning electron microscopy," 1/2008–12/2010; Principal investigator: RNDr. Lubomír Tůma, FEI Czech Republic s.r.o., Brno, Co–principal investigator for the ISI: RNDr. Luděk Frank, DrSc.

c) *Selected projects with international cooperation:*

- 7FP EU project type: SME, thematic priority: NMP, project title: 3D NanoChemiscope – "Combined SIMS–SFM Instrument for the 3–Dimensional Chemical Analysis of Nanostructures," 2008– 2012; 8 partners from 6 countries, project budget: EUR 5.28 mil., coordinator: Ewald Niehuis, ION–TOF TECHNOLOGIES Gmbh (Germany); the ISI is a partner.

- Project EU – PERG06–GA2009–256526 – "Fuel making algae – Real–time non–invasive characterisation and selection of oil–producing microalgae at the single–cell level," 4/2010–3/2013; Principal investigator: Mgr. Ota Samek, Dr.

Experts/field

- Ing. Ondřej Číp, Ph.D. – laser interferometry
- RNDr. Luděk Frank, DrSc. – electron microscopy
- as.prof. Ing. Vladimír Kolařík, CSc. – electron lithography, holography
- Ing. Vladislav Krzyžánek, Ph.D. – REM with high resolution, REM metrology
- Ing. Josef Lazar, Dr. – nanometrology
- Ing. Ilona Müllerová, DrSc. – electron microscopy

- Ing. Antonín Rek, CSc. – EDS (energy dispersive) and WDS (wavelength dispersive) x–ray microanalysis
- Mgr. Ota Samek, Ph.D. – Raman spectroscopy
- Ing. Jaroslav Sobota, CSc. – deposition of thin layers by magnetron sputtering
- Ing. Aleš Srnka, Ph.D. – thermal properties of surfaces, cryogenics
- Ing. Zenon Starčuk, Jr., Ph.D. – NMR spectral tomography
- prof. RNDr. Pavel Zemánek, Ph.D. – optical tweezers, optical micromanipulation
- Ing. Martin Zobač, Ph.D. – micromachining with an electron bundle

3.1.26 INSTITUTE OF ROCK STRUCTURE AND MECHANICS AS CR, a public research institution (IRSM)

V Holešovičkách 41, 182 09 Prague 8, ID: 67985891

www.irsm.cas.cz

A brief description of the Institute

The Institute was established on 1 January 1958 as the Institute of Mining of the Czechoslovak Academy of Sciences. On 1 March 1979, it was merged with the Institute of Geology and the Institute of Geology and Geotechnology, both of the Czechoslovak Academy of Sciences. Its present name was adopted on 1 January 1994. Since 1 January 2007 the Institute has been a public research institution.

Research activity at the IRSM ranges from care for the local seismic network and estimates of seismic threats to important structures to determining the structure, tension, and faulting of rock through the traveling of seismic waves, testing of rock for the purpose of stabilizing underground structures, surveying dangerous slope movements and landslides, determining geological risks threatening historical landmarks and other structures, and the use of carbon materials for processing waste and preparing carbon composites. Research is being conducted in 6 departments:

Research in nanotechnologies is being conducted to a limited extent in the Department of Composites with Carbon Materials (K. Balík) and the Department of Geochemistry (Z. Weishauptová).

Focus of research and development

In the years 2005–2010, research focused on the questions of one research proposal:

Research proposal – AV0Z30460519 **– "Research into the properties of geomaterials, development of methods of their ecological exploitation and interpretation of geodynamic processes,"** 1/2005–12/2010; Principal investigator: Ing. Karel Balík, CSc., total costs for the entire project period: CZK 644,661,000, of which CZK 618,655,000 came from the state budget. Classification – area 1, share of nanotechnology research – 5%.

Research on natural geomaterials (rock and the rock environment), artificially generated geomaterials (geopolymers) and related materials based on carbon and silicon in a wide range

of sizes of structural elements with dimensions on the scale of nanometers, micrometers, millimeters, meters, and kilometers. Chemical, mineralogical, and petrographic composition, mechanical, physical, and physical–chemical properties of studied materials and their heterogeneity, especially with regard to areas of discontinuity and their spatial and temporal development. The influence of heat and pressure on the properties and behavior of materials. Multidisciplinary research was focused mainly on:

- Evaluation of the dangerous effects of geodynamic processes both natural and caused by human activity;
- Dynamics of the Bohemian Massif and structure of the Earth's crust;
- Ecological use of raw materials including in connection with liquidation of hazardous waste;
- Development of materials from non–traditional precursors: biomaterials, refractory, structural, construction, and sorptive materials.

Research in the area of nanotechnologies was focused on fiber composite materials such as bone replacement, the mechanical properties of which must be matched with the properties of human bone. The matrix was modified by adding bioactive nanocomponents such as hydroxyapatite and tricalcium phosphate, which support the growth of bone cells. Particulate composites such as filler for interbody spacers for spine treatment were prepared on the basis of carbonized natural seeds and, once again, nanoparticles of hydroxyapatite and tricalcium phosphate. Monitored in particular were mechanical properties, i.e. mechanical strength and modulus of elasticity under pressure.

In 2011, a total of 24 programme research projects were conducted at the Institute, two of which involved nanotechnologies.

Projects implemented in nanotechnologies

- Project TA CR TA01020348 – "Reversible storage of energy in the rock massif," 2011–2014; Principal investigators: Mgr. Michal Vaněček, Mgr. Jana Michálková, RNDr. Dagmar Trpkošová, ISATech, s.r.o., Co–principal investigators for the IRSM: Mgr. Ing. Milan Brož, CSc., Ing. Jaroslav Štrunc
- Project GA CR GA106/09/1000 – "Bioinspired Nanocomposite Structures for Bone Tissue Regeneration," 2009–2012; Principal investigator: Ing. Karel Balík, CSc., Co–principal investigators: Ing. Marcela Munzarová – ELMARCO s.r.o., Mgr. Dana Kubies, CSc., Institute of Macromolecular Chemistry AS CR, Dr. Lucie Bačáková, MD, CSc., Institute of Physiology AS CR

Experts/field

- Ing. Karel Balík, CSc. – composites as biomaterials
- Mgr. Ing. Milan Brož, CSc. – seismology
- Ing. Jaroslav Štrunc – seismology
- Ing. Zuzana Weishauptová, DrSc. – adsorption and absorption, porous structures, carbonaceous materials

3.1.27 INSTITUTE OF THEORETICAL AND APPLIED MECHANICS AS CR, a public research institution (ITAM)

Prosecká 76, 190 00 Prague 9, ID: 68378297

www.itam.cas.cz

A brief description of the Institute

The Institute was established on 1 January 1953 from the Klokner Institute for Research and Testing of Matter and Structures, which was founded in 1921. On 1 January 2007, the Institute became a public research institution. The Institute conducts theoretical and experimental research in the field of construction theory (with a primary focus on building construction), and it focuses mainly on construction dynamics (stochastic dynamics, aerodynamics, aeroelasticity), non–linear mechanics, mechanical breakdown of materials and structures, micromechanics, biomechanics, and mechanics of soil, experimental methods in mechanics and for monitoring and evaluation of structural reliability. The Institute fosters research on historic materials and structures and on technologies for their protection and repair, and it works on problems connected with protecting historic buildings and sites. The Institute is divided into 10 specialized departments, the Centre for Experimental Mechanics, and other divisions. A component of the Institute is the European Centre of Excellence in Telč (CET – "ARCchip") with special research infrastructure described below.

Focus of research and development

Research in the years 2012–2017 will focus on implementing the institutional programme for long–term conceptual development of the research organisation in areas of research receiving long–term support. During a given year, it will typically work on ca. 25 research projects mainly supported by the Czech Grant Agency, the Ministry of Culture, Ministry of Industry and Trade and from abroad, primarily from research framework programmes of the European Commission.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project Ministry of Education ED1.1.00/02.0060 – "**Centre of Excellence Telč**," 2010–2018. The goal of the investment portion of the project for the total amount of CZK 238.6 million (funded from EU structural funds in the years 2010–2013) is the building and operation of an excellence centre for research producing mainly scientific documentation supporting the preservation of cultural and natural heritage and achieving a long lifespan for historical and modern construction materials and structures. The infrastructure being built consists in particular of an aerodynamic and climatic wind tunnel of a size ecologically and economically optimized for research on construction materials and technologies and equipped with measuring and simulation instruments developed at the Institute, a unique laboratory for large–surface high–definition x–ray micro– and nano–tomography, and other modules of specific databases and instruments for monitoring the influence of climate and its changes on the behavior and lifespan of historic architectural materials and structures, and with a unique mobile system for specific tasks of cultural heritage preservation in emergencies. The scientific guarantor of the research programme, including topics on the development of new materials and technologies on a nano–basis is prof. Ing. Miloš Drdácký, DrSc.

- Project GA CR GAP105/10/2305 – “Morphometry and mechanical properties of trabecular bone assessed by methods of micromechanics and numerical modelling,” 2010–2013; Principal investigator: as.prof. Ing. Ondřej Jiroušek, Ph.D.
- Project GA CR P105/12/G059 – “Cumulative time–dependent processes in building materials and structures,” 2012–2018; Co–principal investigator: prof. Ing. Miloš Drdácký, DrSc.
- Project Ministry of Culture CR NAKI DF11P01OVV012 – “New materials and technologies for the conservation of the materials of historical monuments and the preventive care,” 2011–2015; Co–principal investigator: Ing. Zuzana Slížková, Ph.D.
- Project GA CR P105/12/0824 – “Determination of structural and mechanical properties of metal foams with the use of nanoindentation, microstructural MKP models and mechanical tests,” 2012–2014; Co–principal investigator: as.prof. Ing. Ondřej Jiroušek, Ph.D.

Experts/field:

- prof. Ing. Miloš Drdácký, DrSc. – nanomaterials for care for historical monuments
- as.prof. Ing. Ondřej Jiroušek, Ph.D. – mechanics of biomaterials and metal foams
- Ing. Jiří Minster, DrSc. – mechanics of rheonomic materials
- Ing. Zuzana Slížková, Ph.D. – nanomaterials for care of historical monuments

3.1.28 INSTITUTE OF THERMOMECHANICS AS CR, a public research institution (IT)

Dolejškova 5, 182 00 Prague 8, ID: 61388998

www.it.cas.cz

A brief description of the Institute

The Institute was founded as the Laboratory of Mechanical Engineering of the Czechoslovak Academy of Sciences on 1 January 1953. On 1 January 2006 the Institute of Electronics was merged with the Institute of Thermomechanics. On 1 January 2007, the Institute became a public research institution. The Institute is active in selected areas of technical physics, focusing both on traditional fields – fluid dynamics, thermodynamics, dynamics of mechanical systems, mechanics of deformable bodies and material diagnostics, and also on the solving of interdisciplinary problems, such as interaction of fluids with solid bodies, environmental aerodynamics, biomechanics, and mechatronics. Research on high–voltage electromechanical systems focuses mainly on electrical machines, instruments and other equipment with respect to their physical parameters, dynamics, control, and operating media.

The IT is divided into 7 departments (fluid dynamics; thermodynamics; dynamics and vibration; Principal impacts and waves in solids; ultrasonic methods; electrical engineering; electrophysics). The IT has 4 branches: in Pilsen (Laboratory of Material Diagnostics), Brno (Centre for Mechatronics), Prague District 6 (Centre of Power Engineering), and Ostrava (Centre of Intelligent Systems and Structures).

In 2011, a total of 66 programme research projects were conducted at the Institute, two of which focused on nanotechnologies.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project AS CR IAA200760905 – "Thermophysical properties of water in unexplored, technologically significant areas," 2009–2013; Principal investigator: Ing. Jan Hrubý, CSc., Co–principal investigator for the ICPF: Ing. Vladimír Ždímal, Dr., Institute of Chemical Processes AS CR, Ing. Jan Hošek, Ph.D., Czech Technical University/Faculty of Mechanical Engineering, prof. Ing. Radim Mareš, CSc., University of West Bohemia in Pilsen/Faculty of Mechanical Engineering

- Project GA CR GA101/09/0702 – "Mechanical properties of functional surface layers of submicron thicknesses," 2009–2014; Principal investigator: Ing. Michal Landa, CSc., Co–principal investigators: RNDr. Jaromír Kopeček, Ph.D., Institute of Physics AS CR and as.prof. Ing. Nikolaj Ganev, CSc., Czech Technical University, Prague/Faculty of Nuclear Sciences and Physical Engineering

b) *Projects on which the Centre is cooperating:*

- Project GA CR GAP108/10/1296 – "Development and characterisation of active hybrid textiles with integrated nanograin NiTi micro wires," 2010–2012; Principal investigator: Ing. Luděk Heller, Ph.D., Institute of Physics AS CR, Co–principal investigators: Ing. Petr Sedlák, Ph.D., Institute of Thermomechanics AS CR, Ing. Hynek Chlup, Czech Technical University in Prague/Faculty of Mechanical Engineering, as.prof. Ing. Bohdana Marvalová, CSc., Technical University of Liberec/Faculty of Mechanical Engineering

- Project GA CR P107/10/0824 „Cobalt–based ferromagnetic shape memory alloys," 2010–2012; Principal investigator: RNDr. Jaromír Kopeček, Institute of Physics AS CR, Co–principal investigator for Institute of Thermomechanics AS CR: Ing. Michal Landa, CSc.

- Project GA CR P108/10/0698 – "New approaches to investigation of fatigue crack propagation in Modes II, III and II+III," 2010–2013; Principal investigator: prof. RNDr. Jaroslav Pokluda, CSc., Brno University of Technology/Faculty of Mechanical Engineering, Co–principal investigator for Institute of Thermomechanics AS CR: Ing. Anna Machová, CSc.

Experts/field

- as.prof. Ing. Petr Hora, CSc. – propagation of waves in solids, acoustic emission, signal processing

- Ing. Jan Hrubý, CSc. – thermodynamics, kinetics of phase transitions

- Ing. Michal Landa, CSc. – characterisation of mechanical properties of advanced materials

- Ing. Anna Machová, CSc. – mathematical modelling, molecular dynamics of materials

- Ing. Petr Sedlák, Ph.D. – mathematic modelling of properties and structure of materials

- Ing. Hanuš Seiner, Ph.D. – mathematic modelling of properties and structure of materials

3.1.29 INSTITUTE OF ANIMAL PHYSIOLOGY AND GENETICS AS CR, a public research institution (IAPG)

Rumburská 89, 277 21 Liběchov, ID: 67985904

www.iapg.cas.cz

A brief description of the Institute

The Institute was established on 1 Feb. 1973 as the Institute of Physiology and Genetics of Livestock of the Czechoslovak Academy of Sciences. On 31 December 1992, it was renamed the Institute of Animal Physiology and Genetics AS CR. On 1 January 2007, the Institute became a public research institution.

The activities of the IAPG AS CR involve basic scientific research mainly of the physiological functions, genetic structures, and interactions in the genome of animals. This involves in particular research on species/populations of importance for medicine (model species), ecology (protected or otherwise important species), or agriculture (livestock), and research in the area of food quality and safety. The result of all of the Institute's activities is not only the production of prioritized scientific results impacting the area of basic research, but also the creating of the conditions for the rapid application of knowledge gained in medicine, ecology, and agriculture. The IAPG consists of four departments that are further divided into 11 laboratories located in Liběchov, Prague, and Brno.

Focus of research and development

In the years 2005–2011, research focused on the questions of one research proposal:

Research proposal – AV0Z5040515 **– "Genetic, functional and development potential of animal cells, tissues and organisms: their utilisation in medicine, ecology and agriculture,"** 1/2005–12/2011; Principal investigator: Ing. Jan Kopečný, DrSc., total costs for the entire project period: CZK 422,330,000, of which CZK 422,330,000 came from the state budget. Classification – area 3, share of nanotechnology research – 5%.

The project goal was research on the physiology and genetics of animals in four basic directions:

- Study of the growth and maturing of oocytes including their proteomic analysis, research on gene expression in early embryonic development, and study of organ–specific stem cells.
- Research on the development, differentiation, and function of the cells and tissue of mammals, and monitoring of the role of cell proliferation and programmed cell death including their signaling paths, both during physiological development and during neoplasia.
- Detailed phylogeographic study with the goal of learning the evolutionary and distributional history, population structure, and developmental stability of modeled groups of fish and mammals, including the study of expressed and candidate genes influencing the useful features of livestock.
- Research on microflora of the digestive tract and study of the effects and detection of substances disrupting the function of the endocrine system with the goal of using the results obtained in the area of food quality and safety.

Involved in research related to nanotechnologies are workers at the Department of Reproduction and Developmental Biology of Mammals under the leadership of prof. MVDr. Jan Motlík, DrSc., and the Department of Animal Embryology and Cellular and Tissue Differentiation under the leadership of prof. MVDr. Ivan Míšek, DrSc.

In 2011, the Institute worked on 53 programme research projects.

Projects implemented in nanotechnologies

- Project GA CR GAP503/11/2315 – "Study of transport of inhaled nano–sized particles (Pb, Cd) and their allocation in organs," 2011–2013; Principal investigator: Ing. Zbyněk Večeřa, CSc., Institute of Analytical Chemistry AS CR, Co–principal investigators: Ing. Jiří Smolík, CSc., Institute of Chemical Processes AS CR, RNDr. Marcela Buchtová, Ph.D., Institute of Animal Physiology and Genetics AS CR

- Project GA CR GA203/08/1680 – "Nanotechnology in functional diagnostics of apoptotic and tumor cells," 1/2008–12/2011, Principal investigator: Ing. Karel Klepárník, CSc., Institute of Analytical Chemistry AS CR, Brno, Co–principal investigator for the IAPG: MVDr. Ivan Míšek, DrSc.

- Project Ministry of Education 2B06130 – "Synthesis of new biomaterials and preparation of stem cell derived cells, and their applications in for the treatment of diseases affecting human tissues derived from mesoderm: cartilage, bone, ligament and meniscus," 7/2006–6/2011; Principal investigator: prof. MVDr. Alois Nečas, Ph.D., University of Veterinary and Pharmaceutical Sciences, Brno/Faculty of Veterinary Medicine, Co–principal investigator for the Institute of Animal Physiology and Genetics AS CR: prof. Dr. Jan Motlík, MD, DrSc.

- Project Ministry of Education, "Research Centres" programme, 1M0538 – "Centre for Cell Therapy and Tissue Replacement," 1/2005–12/2011; Principal investigator: prof. Dr. Eva Syková, MD, DrSc., Institute of Experimental Medicine AS CR, Prague, Co–principal investigator for the IAPG: prof. Dr. Jan Motlík, MD, DrSc.

Experts/field

- prof. MVDr. Ivan Míšek, DrSc. – developmental anatomy, odontogenesis, and morphogenetic system of teeth, central nervous system, sensory organs

- prof. MVDr. Jan Motlík, DrSc. – nerve stem/progenitor cells, regeneration and renewal of the central nervous system with a focus on the spinal cord; stem cells of the skin and mezenchymal stem cells, and their targeted differentiation

3.2 UNIVERSITIES

3.2.1 CHARLES UNIVERSITY IN PRAGUE (CU)

Ovocný trh 3–5, 116 36 Prague 1, ID: 00216208

www.cuni.cz

Charles University, founded in 1348, is one of the oldest universities in the world. Today it is one of the most important educational and scientific institutions in the Czech Republic, having earned renown in both the European and global context.At the present time the university has 17 faculties (14 in Prague, 2 in Hradec Králové and 1 in Pilsen), 3 university institutes, 6 additional institutions for educational, scientific, research and development and other creative activities and for the provision of information services, 5 university–wide institutions and the Chancellorship as the executive office which manages CU.The university has more than 7,000 employees, 4,000 of which are academic and scientific researchers.More than 42,400 students are enrolled at CU (roughly one fifth of all the Czech Republic's students), studying in more than 270 accredited study programmes with almost 600 fields of study.There are 7,200 students in the undergraduate study programmes, 29,000 master's students and more than 6,200 doctoral students.

Research and scientific activity is a priority for the university. Doctoral and master's study programmes must also rely on this activity.The scientific output of CU institutions accounts for roughly one third of the volume of received funds which are provided to universities in the Czech Republic.According to the current laws, Charles University is a public university, in other words it is an autonomous scientific and educational institution.

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

Research and development in nanotechnology were identified in the following organisational units of the university:

- 1st Faculty of Medicine
- 2nd Faculty of Medicine
- 3rd Faculty of Medicine
- Faculty of Medicine at Charles University in Pilsen
- Faculty of Pharmaceuticals Hradec Králové
- Faculty of Science
- Faculty of Mathematics and Physics

3.2.1.1 1st Faculty of Medicine CU (1st LF)

Kateřinská 32, 121 08 Prague 2

www.lf1.cuni.cz

A brief description of the Faculty

The 1st Faculty of Medicine has been part of Charles University in Prague since 1348 and is the oldest faculty of medicine in Central Europe.It trains future doctors in the fields of medicine and dentistry, solely through full–time study programmes.The Faculty further offers

university undergraduate programmes in the fields of nursing, ergotherapy, physiotherapy, medical technology and connected master's programmes in the fields of medical technology and informatics, and healthcare programmes for teaching on the secondary school level.The Faculty is divided into 74 institutes and clinics.The largest teaching base of the 1st Faculty of Medicine is provided by the General Univerzity Hospital located on Charles Square in Prague.The Faculty also has institutions at the Na Bulovce University Hospital, the Thomayer University Hospital with Polyclinic, the Central Military Hospital Prague and the Motol University Hospital.

Research work includes biodemedical theoretical and preclinical fields and issues in diagnostics, treatment and preventive methods, and clinical procedures used in medicine and dentistry.The Institute of Dental Research, a joint institution with the Institute of Rheumatology, the Rheumatologic Clinic of the 1st LF, a joint institution with the Institute of Haematology and Blood Transfusion – the Institute of Clinical and Experimental Haematology – have been added to the Faculty.

Focus of research and development

The 1st LF of CU implemented four research proposals in the period2005–2011. Three of these contained nanobiotechnology and nanomedicine elements.

Research proposal MSM0021620806 – "**Studies at the molecular and cellular levels in normal and in selected clinically relevant pathological states**," 1/2005–12/2011; Principal investigator: prof. MUDr. Milan Elleder, DrSc.; total costs for the entire period of the project equalled CZK 1000.869 million, CZK 961.775 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 5%.

The research proposal represented twelve basic areas in biomedicine focused on selected problems of normal and pathological states.The overriding objective is to bring together biomedicine–focused institutions through research on the common molecular and cell level and establishment of methodical centres as the necessary prerequisite for promising biomedical research.Research oriented in this manner is an important source of relevant information on cell processes taking place in normal and pathological states, and understanding them will enable the development of new treatments.Priorities include structural biological studies of the nuclear compartment, in particular description of the nucleus structure from the perspective of rRNA synthesis and replication of ribosomal genes, studies of chromosome territory dynamics in connection with their replication and analysis of the mutual chromosome positions in the nucleus, analysis of the "linker" histone position in chromatin fibre, study of the function of the Cajal body and nuclei stains, modification and remodulation of the chromatin in the regulation of transcription, identification of new proteins, etc.

Research proposalMSM0021620808 – "**The molecular biological, geneticand epigenetic aspects of the inception and development of model tumours in adults.Relation to epidemiology, early diagnostics and treatment**," 1/2005–12/2011; Principal investigator: prof. MUDr. Pavel Klener, DrSc.; Total costs for the entire period of the project equalled CZK 281.412 million,CZK 232.727 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 20%.

Research work yielded new knowledge in cellular and molecular biology and physiology, important both from the perspective of basic research (understanding certain regulating growth mechanisms, differentiation and transformation of cells) as well as clinically (cells for

cytostatic treatment).The results of the research project should allow the identification of molecular targets and cell regulatory processes, allowing prediction, early diagnosis and on–going monitoring of disease development etc.Another goal was the design of new biologically active substances which interfere with tumour progress, both on the level of the transformed cell itself as well as by influencing the immune system.

Research proposal MSM002162087 – "**Metabolic, endocrine and genetic aspects of prevention, diagnostics and therapy of cardiovascular, cerebrovascular and renovascular diseases**," 2005–2011; Principal investigator: prof. MUDr. Jan Škrha, DrSc.; total costs for the entire period of the project equalled CZK 127.764 million,CZK 102.924 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 5%.

The topic of the clinical part of the research project was the definition, diagnostics and impact on treatment of the threatened risks of vascular damage (in the cardiovascular, cerebrovascular and renovascular area) among the population with an increased endogenic and exogenic tendency for such damage.Analysis of genetic, metabolic, endocrine and humoral causes leading to blood vessel wall damage among identified high–risk individuals and the testing of new treatment procedures were conducted.The research project addressed issues concerning diseases which lead to vascular complications and which have a significant impact on morbidity and mortality of the affected population.The solution should result in measures leading to primary prevention of vascular damage.The part devoted to basic research focused in particular on analysis of factors influencing the development of vascular changes from the perspective of pathogenic mechanisms.

In addition 109 programme research projects were implemented at the Faculty in 2011.

Work with characteristics of bionanotechnology and nanomedicine is carried out at the following institutes and laboratories:

The development of bioaffinity, immunoaffinity and enzyme reactors as part of microchip devices for searching auto–antigen epitopes is conducted at the Institute of Pathological Physiology.Magnetic micro– or nanoparticles are used to prepare the enzyme reactors.

At the Laboratory of Gene Expression at the Institute of Cell Biology and Pathology research of the functional organisation of the cell nucleus is carried out.

At the 1st Internal Clinic molecular diagnostics of haematological malignant diseases using PCR (polymer chain reaction) are carried out in the Laboratory of Molecular Haematology.

In the Department of Clinical Pharmacology of the Institute of Pharmacology DNA gene analysis for xenobiotic metabolism and transport is carried out.

At the Research Angiological Laboratory of the 2nd Internal Clinic separation of lipoproteins and characterising of their subfraction (5–1200 nm) are carried out.

At the Institute of Hereditary Metabolic Disorders molecular biology techniques (analysis of genes connected with the disease studied – PCR sequencing, positional cloning, gene expression study and protein studies) are used in the study of genetic metabolic diseases.

At the Laboratory for Endocrinology and Metabolism at the 3rd Clinic of Internal Medicine DNA analyses are carried out in research in hyperlipoproteinaemia, arterial hypertension and diabetes.

Projects implemented in nanotechnologies

"Nanotechnology for Society" programme research projects

- Project AS CR KAN400100701 – "Functional hybrid nanosystems of semiconductors and metals with organic materials (FUNS)," 1/2007–12/2011; Principal investigator: RNDr. Bohuslav Rezek, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for the 1st LF CU: Ing. Stanislav Kmoch, CSc.

- Project AS CR KAN200200651 "Nanoparticulate and supramolecular systems for targeted drug transport," 7/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for the 1st LF CU: prof. MUDr. Pavel Martásek, DrSc.

Other projects

- Project Ministry of Education, Youth and Sports (MŠMT in Czech or MEYS) OE09011 – "Using non–metallic materials in fixing bone fractures in traumatology and orthopedics," 2009–2011; Principal investigator: Ing. Jan Dolejší – ProSpon, spol. s r.o., Co–principal investigator for the 1st LF CU: prof. MUDr. Antonín Sosna, DrSc.

- Project Ministry of Health (MZ in Czech or MH) – NS9834 – "Changes in the profile of steroids and their neuroactive metabolites in relation to term," 2009–2011; Principal investigators: Ing.Martin Hill, DrSc., prof. MUDr. Luboslav Stárka, DrSc., Institute of Endocrinology, Co–principal investigator for the 1st LF CU: as.prof. MUDr. Antonín Pařízek, CSc. and prof. MUDr. David Cibula, CSc., General University Hospital in Prague

- Project MH – NR9156 – "20 alfa–Hydroxy–metabolites neuroactive pregnenolone isomers, progesterone and pregnenolone around labour and its meaning in physiology and diagnostics," 2007–2009; Principal investigators: Ing. Martin Hill, DrSc., MUDr.Lyudmila Kancheva, MUDr. Radmila Kancheva, CSc., prof. MUDr. Luboslav Stárka, DrSc., Mgr. Helena Včeláková, Institute of Endocrinology, Co–principal investigator for 1st LF CU: as.prof. MUDr. Antonín Pařízek, CSc.

Experts/field

- prof. MUDr. Milan Elleder, DrSc.– anatomical pathology

- prof. MUDr. Pavel Martásek, DrSc.– molecular medicine

- as.prof. MUDr. Karel Smetana, DrSc.– cell biology and tissue engineering

3.2.1.2 2nd Faculty of Medicine CU (2nd LF)

V Úvalu 84, 150 06 Prague 5

www.lf2.cuni.cz

A brief description of the faculty

The 2nd Faculty of Medicine was created when the Faculty of Medicine of Charles University was divided.The Faculty was established in 1953 as the Faculty of Paediatrics of Charles University in Prague. In 1990 the Faculty's name was changed to the 2nd Faculty of

Medicine of Charles University in Prague.The Faculty's main mission is the teaching of medicine and conducting scientific research in medicine.The Faculty is divided into 3 centres, 27 institutes and 24 clinics.The science and research sector at the 2nd LF CU is linked to the scientific and research activities at the University Hospital in Motol.

Focus of research and development

The 2nd LF CU implemented four research proposals from 2005–2011, one of which contained nanobiotechnology and nanomedicine elements.

Research proposal MSM0021620813 – "**The molecular basis of childhood malignancies and therapeutic applications**," 1/2005–12/2011; Principal investigator: prof. MUDr. Jan Starý, DrSc.; total costs for the entire period of the project equalled CZK 166.742 million, CZK 124.013 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 3%.

The research project's topic was selected genetic factors associated with immune system breakdowns, functional pathological mechanisms leading to damage to the organism and options for immunotherapy.

In 2011 a total of 76 programme research projects were implemented at the Faculty.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project GA CR GA304/07/1129 – "Polarised cultures of hepatocytes and mesenchymal cells on nanofibre layers in the experimental bioreactor," 2007–2011; Principal investigator: prof. MUDr. Miroslav Ryska, CSc., Co–principal investigators: Ing. Jiří Michálek, CSc., Institute of Macromolecular Chemistry AS CR, and prof. MUDr. Eva Syková, DrSc., Institute of Experimental Medicine AS CR.

- Project MEYS 1M0538 – "Centre for Cell Therapy and Tissue Repair," 1/2005–12/2011; Principal investigator: prof. MUDr. Eva Syková, DrSc.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project MEYS ME10145 – "Modification of nanofibre materials by plasma technologies for biological applications," 2010–2012; Principal investigator: prof. Ing. Petr Louda, CSc., Technical University of Liberec/Faculty of Engineering, Co–principal investigator for 2nd LF: as.prof. RNDr. Evžen Amler, CSc.

- Project MIT FI–IM4/205 – "Nanotechnology in medicine – tissue support for connective tissue reconstruction," 2007–2010; Principal investigator: Mgr.Marcela Foglarová, CPN, spol. s r.o., Co–principal investigator for 2nd LF: MUDr.Milan Handl, Ph.D.

- Project Ministry of Health NR9076 – "Genomic profiling in predicting the response to chemotherapy for patients with locally advanced colorectal carcinomas," 2006–2010; Principal investigator: prof. MUDr. Rostislav Vyzula, CSc., Masaryk Memorial Cancer Institute in Brno, Co–principal investigator: prof. MUDr. Jiří Hoch, CSc.,University Hospital in Motol

Experts/field

- as.prof. MUDr. Milan Handl, Ph.D. – orthopaedics
- prof. MUDr. Miroslav Ryska, CSc.– issues in liver transfers, liver failure and bioreactor use
- prof. MUDr. Jan Starý, DrSc.– paediatric malignant and non–malignant haematology
- prof. MUDr. Eva Syková, DrSc.– stem cells, nanoparticles, artificial biomaterials and neurosciences

3.2.1.3 3rd Faculty of Medicine CU (3rd LF)

Ruská 87, 100 00 Prague 10

www.lf3.cuni.cz

A brief description of the Faculty

Like the other Prague Faculties of Medicine at Charles University, the 3rd Faculty of Medicine was created through the division of the Charles University Faculty of Medicine.It was originally established in 1953 as the Medical Faculty of Hygiene.The activities of the 3rd LF are closely linked to the University Hospital Královské Vinohrady.The 3rd LF is divided into 32 clinics and 23 institutes.

Focus of research and development

The research activities of the 3rd LF are focused on a broad spectrum of medical problems. From 2005–2011 the activities were implemented through three research projects, none of which was focused on nanotechnology. In 2011 a total of 46 grant projects were implemented at the Faculty.

Projects implemented in nanotechnologies

- Project Ministry of Health NS10093 – “Nanofabrics as a photosensitizer carrier for aseptic leg ulcer dressing improve the life quality for patients with chronic wound,” 2009–2011; Principal investigators from University Hospital Královské Vinohrady: prof. MUDr. Petr Arenberger, DrSc., MBA, MUDr. Monika Arenbergerová, PhD., as.prof. MUDr. Marek Bednář, CSc., Mgr. Eliška Stránská, Co–principal investigators:RNDr. Jiří Mosinger, Ph.D., RNDr. Jan Sedláček, CSc.CU, Faculty of Science
- Project Technology Agency of the Czech Republic TA01010964 – “Osteograft," 2011–2013; Principal investigators: MUDr. Barbara Kubešová, Jana Komárková, RNDr. Eva Matějková, Mgr. Lucie Štrajtová, Ph.D., Národní tkáňové centrum a.s., Co–principal investigators for the 3rd LF:as.prof. MUDr. Martin Krbec, CSc., MUDr. Filip Fridrich, MUDr. Jiří Záhora
- Project AS CR KAN200100801 – "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and drug delivery," 1/2008–12/2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of

Physics AS CR, Prague, and Co–principal investigator for the 3rd LF CU: As. MUDr. Viktor Kočka, FESC.

- Project AS CR KAN200520701 – "Nano–PCR – an ultrasensitive test for the detection of specific proteins in body fluids," 1/2007–12/2011; Principal investigator: RNDr. Petr Dráber, DrSc., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for the 3rd LF: MUDr. Aleš Bartoš, Ph.D. The Neurology Clinic participated in the project for the 3rd LF. Its task was classification of patients and collection of cerebrospinal fluid and serum/plasma from suitable individuals.

Experts/field

- MUDr. Monika Arenbergerová, PhD., dermatalogical venereology
- prof. MUDr. Petr Arenberger, DrSc., MBA – dermatology
- MUDr. Aleš Bartoš, Ph.D. – cognitive neurology
- as.prof. MUDr. Marek Bednář – medical microbiology

3.2.1.4 Charles University Faculty of Medicine in Pilsen (LF in Pilsen)

Husova 3, 306 05 Pilsen

www.lf3.cuni.cz

A brief description of the Faculty

The Faculty of Medicine in Pilsen was founded in 1945. Two fields of study are taught at the Faculty: general medicine and dentistry.In 2011 a total of 25 grant projects were implemented at the Faculty.

Project implemented in nanotechnologies

- Project MIT FR–TI1/415 – "Research and development of nanostructured materials for medical applications," 2009–2012; Principal investigator: Ing. Michal Zemko, Ph.D., COMTES FHT a.s., Co–principal investigator for LF in Pilsen: MUDr. Daniel Hrušák, Ph.D.

Expert/field

- MUDr.Daniel Hrušák, Ph.D.

3.2.1.5 Faculty of Pharmaceuticals in Hradec Králové (FAF)

Heyrovského 1203, 500 05 Hradec Králové

www.faf.cuni.cz

A brief description of the Faculty

The Faculty of Pharmaceuticals (FaF) of Charles University in Hradec Králové was established in 1969. Its scientific research activities in the scientific fields of pharmaceuticals

and connected with pharmacy are an integral part of the Faculty's study programme (including, among others, master's level studies in pharmacy).

Focus of research and development

In the past 6 years the research activities at FaF have been focused on implementing research proposal MSM0021620822 – "**Research of new drug structures**," 1/2005–12/2011; Principal investigator: prof. RNDr. Rolf Karlíček, DrSc.In 2011 a total 23 programme research projects connected with the development of new drugs and procedures were implemented at the Faculty.At the Department of Pharmaceutical Technology cooperation on the implementation of an applied research project using nanotechnology was noted.

Project implemented in nanotechnologies

- Project MIT 2A–1TP1/015 – "New procedures of lipid microdispersion and nanodispersion systems formulation as the transport systems of pharmacological active substances," 7/2006–6/2011; Principal investigator: RNDr. Jan Mikeska, CSc., Biomedica, spol. s r.o., Co–principal investigator for FaF: as.prof. RNDr. Pavel Doležal, CSc.

Expert/field

- as.prof. RNDr. Pavel Doležal, CSc.– pharmaceutical technologies

3.2.1.6 Faculty of Science, Charles University (FS CU)

Albertov 5, 128 43 Prague 2

www.natur.cuni.cz

A brief description of the Faculty

The Faculty of Science was established in 1920. The Faculty focuses on biology, chemistry, geography, geology and environmental studies.Two institutions are affiliated with the Faculty: The Botanical Garden of Charles University and Hrdlička Museum of Man.The Faculty's activities are focused on the teaching of and research in modern natural sciences, characterized by its interdisciplinary and transdisciplinary nature. The primary representative of this science is the comprehensive study of the human environment.In addition FS CU also offers teaching and research in biomedical science, the complex field of geological–geographical studies of natural resources and their use and protection, and chemistry of modern technological materials.

The Faculty is divided according to its scientific fields into biology, chemistry, geography and geology sections and the Institute for Environmental Studies.

Focus of research and development

In the past 6 years research at FS CU has been focused on the implementation of 5 research proposals, one of which also contains the search for solutions to problems related to nanotechnologies.

Research proposal MSM0021620857– "**New molecular systems for advanced applications beneficial to health and friendly to the environmen**t," 1/2007–12/2013; Principal

investigator: prof. RNDr. Karel Procházka, DrSc.; total costs for the entire period of the project equalled CZK 214.275 million, CZK 186.399 million of which was from the state budget. For nomenclature – area 6d, the nanotechnology research share equalled 20%.

The research proposal is the long–term research proposal of the chemistry departments of FS CU in the area of the preparation of new materials and processes for environmentally friendly technically advanced applications.Within the framework of the plan the following are carried out: (a) the development of environmentally friendly synthetic processes and the preparation of new compounds, (b) the preparation of sensitive analytical methods for their characterisation and (c) the study of the complex of relations between structure and function of prepared systems.The proposed topics include the study of multifunctional nanomaterials, the development and study of the function of anti–tumour drugs and a number of other areas.

Research focused on nanotechnologies takes place in the following sections and departments or institutes:

- Biology section – Department of Genetics and Microbiology (Z. Palková)
  Laboratory of 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 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)

In 2011 a total of 245 grant projects were implemented at the Faculty.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project GA CR GAP208/10/0941 – "Engineering of surface–modified optical processes in molecules and semiconductor quantum dots using plasmon resonances of metal nanoparticle assemblies," 2010–2014; Principal investigator: prof. RNDr. Blanka Vlčková, CSc., Co–principal investigators: RNDr. Jiří Pfleger, CSc., Institute of Macromolecular Chemistry AS CR, RNDr. Martin Michl, Ph.D., CTU/Faculty of Nuclear Sciences and Physical Engineering
- Project GA CR GA104/09/1435 – "New catalytic processes for the preparation of organic photoelectronic materials," 2009–2013; Principal investigator: prof. RNDr. Jiří Vohlídal, CSc.
- Project GA CR GAP108/11/1661 – "Organic nanoporous polymers derived from arylacetylenes as materials for hydrogen storage," 2011–2013; Principal investigator: RNDr. Jan Sedláček, Dr., Co–principal investigator: RNDr. Hynek Balcar, CSc., J. Heyrovský Institute of Physical Chemistry AS CR
- Project GA CR GAP208/10/0179 – "Computer study of fullerene–based nanomaterials," 2010–2012; Principal investigator: RNDr. Filip Uhlík, Ph.D.

- Project GA CR GAP208/10/0353 – “Nanoparticles based on hydrophilic block polyelectrolyte complexes with ionic surfactants,” 2010–2012; Principal investigator: RNDr. Miroslav Štěpánek, Ph.D., Co–principal investigator: RNDr. Miroslav Šlouf, Ph.D., Institute of Macromolecular Chemistry AS CR

- Project AS CR KAN201110651 – “Combined contrast agents for molecular MR imaging,” 1/2006–12/2010; Principal investigator: prof. RNDr. Ivan Lukeš, CSc., Co–principal investigators: Ing. Milan Hájek, DrSc., IKEM, Ing. Ivan Hlaváček, CSc., Interpharma Praha, a.s., prof. MUDr. Eva Syková, DrSc., Institute of Experimental Medicine AS CR

- Project GA AV IAA401110702 – “Associating amphiphilic miktoarm and heteroarm star polyelectrolytes,” 01/2007–12/2011; Principal investigator: prof. RNDr. K. Procházka, DrSc.

b) *Projects on whose implementation the Faculty is cooperating or cooperated:*

“Nanotechnology for Society” programme research projects

- Project AS CR KAN300100802 – “Nanocomposite, ceramic and thin film scintillators,” 1/2008–12/2011; Principal investigator: Ing. Martin Nikl, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for FS CU: RNDr. Daniel Nižňanský, Ph.D.

- Project AS CR KAN200200651 – “Nanoparticulate and supramolecular systems for targeted drug transport," 7/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for FS CU: as.prof. Ing. Josef Hájíček, CSc.

- Project AS CR KAN100500652 – “Heterogeneous organic and hybrid nanocomposite materials for solar cells,” 7/2006–12/2010; Principal investigator: RNDr. Jiří Pfleger, CSc., Institute of Macromolecular Chemistry AS CR, Prague, Co–principal investigator for FS CU: prof. RNDr. Jiří Vohlídal, CSc.

Other projects

- Project GA CR GAP108/11/0807 – “Complex magnetic nanoparticles with monodisperse oxide cores and stable organic corona for biological research and biomedical applications,” 2011–2014; Principal investigator: Ing. Pavel Veverka, Ph.D., Institute of Physics AS CR, Co–principal investigator for FS CU: Ing. Mgr. Ondřej Kaman, Ph.D.

- Project GA CR GAP108/10/1250 – “Multifunctional nanoparticles:smart preparation methods and study of their physical properties,” 2010–2014; Principal investigator: RNDr. Jana Poltierová Vejpravová, Ph.D. Charles University in Prague/Faculty of Science

- Project GA CR GA104/09/0561 – “Deposited nanoparticle catalysts for C–C bond forming reactions,” 2009–2013; Principal investigator: prof. Ing. Jiří Čejka, DrSc.,J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for FS CU: as.prof. RNDr. Petr Štěpnička, Ph.D.

- Project GA CR GAP208/10/1678 – “Photophysics and photochemistry of self assembled nanostructures,” 2010–2012; Principal investigator: RNDr. Pavel Kubát, CSc.,J.

Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for FS CU: as.prof. RNDr. Jiří Mosinger, Ph.D.

- Project GA CR P205/11/J043 – “Complex study of randomly branched amphiphilic copolymers,” 1/2011–12/2013, Principal investigator: RNDr. Miloš Netopilík, CSc., Institute of Macromolecular Chemistry AS CZ, Co–principal investigator for FS CU: as.prof. Ing. Zuzana Limpouchová, CSc.

- Project GA CR 106/07/0949 – “New methods for the preparation of magnetic nanocomposites (spinel ferrites) and study of their physical properties,"2007–2009; Principal investigator: RNDr. Daniel Nižňanský, Ph.D., Charles University in Prague/Faculty of Science

- Project Ministry of Health NS10093 – “Nanofabrics as a photosensitizer carrier for aseptic leg ulcer dressing improve the life quality of life in patients with chronic wound,” 2009–2011; Principal investigators: prof. MUDr. Petr Arenberger, DrSc., MBA, MUDr.Monika Arenbergerová, PhD., as.prof. MUDr. Marek Bednář, CSc., Mgr. Eliška Stránská, University Hospital Královské Vinohrady, Co–principal investigators for FS CU:RNDr. Jiří Mosinger, Ph.D., RNDr. Jan Sedláček, CSc.

- Project MEYS LC06035 – "Centre of biophysical chemistry, bioelectrochemistry and bioanalysis.New tools for genomics, proteomics and biomedicine,” 3/2006–12/2011; Principal investigator: as.prof. RNDr. Miroslav Fojta, CSc., Biophysical Institute AS CR, Brno, Co–principal investigator for FS CU: prof. RNDr. Jiří Barek, CSc.Since 2012 a new GACR project for the support of excellence in basic research has been underway. Nanotechnology principles are also used for analytical purposes.This is the project P206/12/G151 "Centre of new approaches to bioanalysis and molecular diagnostics.”It is under the Biophysical Institute AS CR in Brno, Principal investigator: as.prof. RNDr. M. Fojta, CSc., Co–principal investigator for FS CU: prof. RNDr. J. Barek, CSc.

- Project MEYS LC06063 – “Fluorescence microscopy in biological and medical research,” 3/2006–12/2011; Principal investigator: as.prof. Martin Hof, Dr. rer. nat., J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for FS CU: as.prof. RNDr. Zdena Palková, CSc.

- Project MEYS 1M0505 – “Centre for Targeted Therapy,” 1/2005–12/2011; Principal investigator: as.prof. MUDr. Vladimír Viklický, CSc., Institute of Nuclear Research, Husinec – Řež, Co–principal investigator for FS CU: as.prof. RNDr. Karel Bezouška, CSc.

- Project 7FP EU Large type, NMP thematic priority, project name:MACADEMIA – "MOFs as Catalysts and Adsorbents:Discovery and Engineering of Materials for Industrial Applications,” 2009–2013; 17 partners from 9 countries, project budget:EUR 11.56 million, Coordinator: Francis Luck, TOTAL S.A.(France), Charles University in Prague, FS CU is a partner in the project.

- Project 7FP EU Large type, NMP thematic priority, project name:MULTIFUN – "Multifunctional Nanotechnology for Selective Detection and Treatment of Cancer,” 2011–2014; 15 partners from 7 countries, project budget:EUR 10.2 million, Coordinator: Javier Avila Jimenez, ATOS Research (Spain), Charles University in Prague/FS CU is a partner in the project (Third party), FS CU representative: Daniel Nižňanský

Results in nanotechnologies/cooperation

The focus of the research of as.prof. Mosinger's group is the study of nanofibrous photoactive materials.These materials doped with photosensitizers are effective producers of cytotoxic singlet oxygen; they exhibit strong bactericidal and virucidal effects and have already been successfully tested in the treatment of leg ulcers.Doped polymer nanofibres can be also used for very sensitive oxygen detection and singlet oxygen imaging on the basis of delayed fluorescence.

Experts/field

- prof. RNDr. Ivan Lukeš, CSc.– magnetic and surface modified nanoparticles for applications in MRI
- as.prof. RNDr. Jiří Mosinger, Ph.D. – photoactive nanofibrous materials
- RNDr. Daniel Nižňanský, Ph.D. – nanocomposites of magnetic and optical materials
- prof. RNDr. Karel Procházka, DrSc.– self–organizing polymers
- as.prof. RNDr. Blanka Vlčková, CSc.– nanomaterials and nanocomposite materials with Ag and Au nanoparticles, plasmonics
- prof. RNDr. Jiří Vohlídal, DrSc.– nanoporous heterogeneous catalysts for polymerisation reactions

3.2.1.7 Faculty of Mathematics and Physics (MFF)

Ke Karlovu 3, 121 16 Prague 1

www.mff.cuni.cz

A brief description of the Faculty

The MFF was created in 1952, when it separated from the Faculty of Science, Charles University.The Faculty brings together educational activities in physics, informatics and mathematics with research activities in these fields.The Faculty is divided into three sections: the School of Physics, School of Computer Science and the School of Mathematics.

Focus of research and development

From 2005–2013 research at MFF CU has been focused on issues presented by six research proposals, two of which contain assignments related to nanotechnology research.

Research proposal MSM0021620834 – "**Condensed matter physics:new materials and technologies**," 1/2005–12/2010;, Principal investigator: RNDr. Pavel Höschl, DrSc.; total costs for the entire period of the project equalled CZK 563.401 million, CZK 426.041 million of which was from the state budget. For nomenclature – area 6d, the nanotechnology research share equalled 70%.

Research was focused on condensed matter physics, on a number of materials with unique physical properties, ranging from very pure materials for electronics, superconductors, to materials with a low–dimensional structure all the way to the synthetic diamond.This is connected with research in new technologies, which regularly use molecular beams in an

ultrahigh vacuum, reactions which take place in plasma and high–performance microwave generators or which take place at high temperatures and pressures.Work was also focused on materials which do not occur in nature, such as super grids, delta–quantum structures, quantum wires and quantum dots.

Research proposal MSM0021620835 – "**Physical of molecular, macromolecular and biological systems**", 1/2005 – 12/2010; Principal investigator: prof. MUDr. Jan Starý, DrSc.; total costs for the entire period of the project equalled CZK 285.386 million, CZK 249.942 million of which was from the state budget. For nomenclature – area 6b, the nanotechnology research share equalled 70%.

Research was focused primarily on physical behaviour of natural and modified nucleotides, natural and artificial photosynthetic systems, photosensitisers of yeasts, polymer networks including nanocomposites and polyelectrolyte hydrogels.The theoretical interpretation uses quantum theory, quantum–chemical calculations and modelling in the study of the physical qualities of biologically significant complexes, intercalates and macromolecular structures.Existing spectroscopic methods were further developed and applied to the examination of the structure, function, interactions and dynamics of biological and macromolecular structures on the level of molecules, macromolecules, membranes and cells.

Research focused on nanotechnology is carried out at the School of Physics in the following departments and institutions:

- Institute of Physics (V. Baumruk, Š. Višňovský, M. Kučera)
- Department of Surface and Plasma Science (V. Matolín, I. Ošťádal, P. Řepa)
- Department of Physics of Materials (M. Janeček, P. Málek, P. Lukáč, F. Chmelík, M. Cieslar)
- Department of Low Temperature Physics (L. Skrbek, 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 Physic and Optics (P. Malý, J. Valenta, J. Dian, J. Pospíšil)

In 2011 in total 249 programme research projects were implemented at the Faculty.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

Projects of GA CR

- Project GA CR GAP204/10/0330 – "Nanostructured actinide–based materials:theory and experiment," 2010–2014; Principal investigator: as.prof. RNDr. Ladislav Havela, CSc., Co–principal investigator: Ing. Alexander B. Shick, CSc., Institute of Physics AS CR
- Project GA CR GAP204/10/0035 – "Hyperfine interactions in nanoparticles and low–dimensional iron oxides," 2010–2014; Principal investigator: as.prof. Mgr. Jaroslav Kohout, Dr., Co–principal investigators: Ing. Adriana Lančok, Ph.D., Institute of Inorganic Chemistry AS CR, Ing. Miroslav Veverka, Ph.D., Institute of Physics AS CR

- Project GA CR GAP108/11/1396 – "The effect of substitutional elements and grain boundaries on the properties of nanocrystalline oxide zirconia–based materials," 2011–2015; Principal investigator: RNDr. Ivan Procházka, CSc.

- Project GA CR GAP108/11/1539 – "Nanocrystalline materials – X–ray characterization of their structure and its thermal stability," 2011–2013; Principal investigator: as.prof. RNDr. Radomír Kužel, CSc.

- Project GA CR GAP204/10/0952 – "Atomic scale study of bimetallic nanostructures on the Si(100) surface," 2010–2012; Principal investigator: as.prof. RNDr. Pavel Sobotík, CSc., Co–principal investigator Ing. Pavel Jelínek, Ph.D., Institute of Physics AS CR

- Project GA CR GAP204/11/0785 – "Self–organized growth and structure transformation of nanocrystals," 2011–2013; Principal investigator: prof. RNDr. Václav Holý, CSc.

- Project GA CR GAP205/11/0386 – "Advanced experimental research of discharge plasma sources applied for deposition of nanostructured thin films," 2011–2013; Principal investigator: prof. RNDr. Milan Tichý, DrSc., Co–principal investigators: Mgr. Martin Čada, Ph.D. – Institute of Physics AS CR and RNDr. Vítězslav Straňák, Ph.D., University of South Bohemia, České Budějovice/Faculty of Sciences

- Project GA CR GCP204/11/J042 – "Supercurrent and the alternating Josephson effect in unconventional nanoscopic junctions," 2011–2013; Principal investigator: RNDr. Tomáš Novotný, Ph.D., Co–principal investigator: prof. RNDr. Václav Janiš, DrSc.,Institute of Physics AS CR

- Project GA CR GAP204/10/1169 – "A new catalyst for hydrogen polymer membrane fuel cell: CNT covered Pt–CeO_2 thin films;" 2010–2013, Principal investigator: prof. RNDr. Vladimír Matolín, DrSc.

- Project GA CR GD202/09/H041 – "Physics of nanostructures," 2009–2012; Principal investigator: prof. RNDr. Vladimír Matolín, DrSc., Co–principal investigator: RNDr. Antonín Fejfar, CSc., Institute of Physics AS CR

- Project GA CR GPP204/10/P346 – "Spectroscopy of magnetic nanostructures," 2010–2012; Principal investigator: RNDr. Martin Veis, Ph.D.

- Project GA CR GPP204/10/P326 – "Spin–spin interactions and spin transport in semiconductor nanostructures," 2010–2012; Principal investigator: RNDr. Tomáš Ostatnický, Ph.D.

- Project GA CR GP202/09/P033 – "Growth of organised nanostructures of IIIA group metals on the Si(111)–5x5 surface," 2009–2011; Principal investigator: Mgr. Pavel Kocán, Ph.D.

- Project GA CR GP202/09/P355 – "The theory of dynamic excitations and switching of spin vortex states in thin cylindrical ferromagnetic nanodiscs," 2009–2011; Principal investigator: Mgr. Roman Antoš, Ph.D.

- Project GA CR GC202/07/J051 – "Full counting statistics in Non–Markovian nanosystems," 2007–2010; Principal investigator: Mgr. Tomáš Novotný, Ph.D., Co–principal investigator: RNDr. Karel Netočný, Ph.D., Institute of Physics AS CR

- Project GA CR GP202/08/P158 – “Nanocomposite layers of metal/polyethylene oxide plasma polymer thin films for biomedical applications,” 2008–2010; Principal investigator: Ing. Andrey Shukurov, Ph.D.

- Project GA AS CR IAA101120804 – “Silicon nanostructures for photonics,” 1/2008–12/2012; Principal investigator: prof. RNDr. Petr Malý, DrSc.

- Project GA AS CR IAA101120803 – “Structure stability of fine grain materials prepared using severe plastic deformation,” 2008–2011; Principal investigator: as.prof. RNDr. Miloš Janeček, CSc.

- Project GA AS CR KJB101120803 – “Electron structure and transport properties of noncollinear magnetic nanostructures,” 1/2008–12/2010; Principal investigator: Mgr. Karel Carva, Ph.D.

Other projects

- Project TA CR TA01011363 – “Research and development of a sensory system for determining diacetyl content in beer,” 2011–2013; Principal investigator: as.prof. RNDr. Juraj Dian, CSc., Co–principal investigator: Juraj Lomen, Centec automatika, spol. s r.o., RNDr. Miroslav Dienstbier, Mgr. Tomáš Horák, Research Institute of Brewing and Malting

- Project MEYS 7E11021 – “Silicon Nanodots for Solar Cell Tandem,” 2011–2013; Principal investigator: as.prof. RNDr. Jan Valenta, Ph.D.

- Project AS CR KAN101120701 Nanotechnology for Society programme – “Nanocomposite layers and nanoparticles prepared in low pressure plasma for surface modifications,” 1/2007–12/2011; Principal investigator: prof. RNDr. Hynek Biederman, DrSc.

b) *Projects on whose implementation the Faculty is cooperating:*

“Nanotechnology for Society” programme research projects

- Project AS CR KAN300100801 – “Multifunctional bulk metallic materials with nanocrystalline and ultra–fine grain structure,” 1/2008–12/2012; Principal investigator: prof. Ing. Pavel Lejček, DrSc., Institute of Physics AS CR, Prague, Co–principal investigator for MFF CU: RNDr. Ivan Procházka, CSc.

- Project AS CR IAA100100912 – "Magnetic nano interface anisotropy,” 2009–2012; Principal investigator: Ing.Alexander Shick, CSc., Institute of Physics AS CR, Co–principal investigator for MFF CU: as.prof. RNDr. Ladislav Havela, CSc.

- Project AS CR KAN400720701 – “Hierarchic nanosystems for microelectronics,” 1/2007–12/2011; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for MFF CU: as.prof. RNDr. Radomír Kužel, CSc.

- Project AS CR KAN100400702 – “Nanostructured materials for catalytic, electrocatalytic and sorption applications,” 1/2007–12/2011; Principal investigator: prof. RNDr. Zdeněk Samec, DrSc., J. Heyrovsky Institute of Physical Chemistry AS CR, Prague, Co–principal investigator for MFF CU: prof. RNDr. Vladimír Matolín, DrSc.

- Project AS CR KAN300100802 – “Nanocomposite, ceramic and thin film scintillators,” 1/2008–12/2011; Principal investigator: Ing.Martin Nikl, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for MFF CU: as.prof. RNDr. Miroslav Kučera, CSc.

- Project AS CR KAN400100701 – “Functional hybrid nanosystems of semiconductors and metals with organic materials (FUNS),” 1/2007–12/2011; Principal investigator: RNDr.Bohuslav Rezek, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for MFF CU: prof. RNDr. Petr Malý, DrSc.

- Project AS CR KAN400100652 – “Structures for spintronics and quantum phenomena in nanoelectronices created by electron beam lithography,” 7/2006–12/2010; Principal investigator: Ing.Ludvík Smrčka, DrSc., Institute of Physics AS CR, Prague, Co–principal investigator for MFF CU: prof. RNDr., Václav Holý, CSc.

- Project AS CR KAN100100653 – “Self–organized magnetic nanostructures,” 7/2006–12/2010; Principal investigator: Ing.Ján Lančok, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for MFF CU: prof. RNDr. Vladimír Čechovský, DrSc.

Other projects

- Project GA CR GAP107/11/1918 – “Research of zinc and cadmium sulphide nanoparticles deposited on phyllosilicates for photocatalytic reduction of carbon dioxide,” 2011–2013; Principal investigator: as.prof. Ing. Petr Praus, Ph.D., VSB–Technical University of Ostrava/Faculty of Metallurgy and Material Engineering, Co–principal investigator for MFF CU: RNDr. Miroslav Pospíšil, Ph.D.

- Project GA CR GAP108/11/1057 – “Synthesis, structure and properties of conductive polymer/phyllosilicate nanocomposites,” 2011–2013; Principal investigator: prof. RNDr. Pavla Čapková, DrSc., VSB–Technical University of Ostrava/Nanotechnology Centre, Co–principal investigator for MFF CU: as.prof. RNDr. Ing. Jaroslav Burda, CSc.

- Project GA CR GAP108/11/1350 – “Effects of cores and boundaries of nanograins on structural and physical properties of ball milled and mechanically alloyed iron–based materials,” 2011–2014; Principal investigator: Ing.Yvonna Jirásková, CSc. Institute of Physics of Materials AS CR, Co–principal investigator for MFF CU: as.prof. Mgr. Jakub Čížek, Ph.D.

- Project GA CR GAP204/11/1228 – “The theory of spin–dependent transport in magnetic solids and nanostructures,” 2011–2014; Principal investigator: as.prof. RNDr. Ilja Turek, DrSc.,Institute of Physics of Materials AS CR, Co–principal investigator for MFF CU: RNDr.Karel Carva, Ph.D.

- Project GA CR GAP205/11/2137 – “Magnetophotonic interactions in realistic nanostructures,” 2011–2013; Principal investigator: prof. Ing. Jaromír Pištora, CSc., VSB–Technical University of Ostrava/Faculty of Mining and Geology, Co–principal investigator for MFF CU: prof. Ing. Štefan Višňovský, DrSc.

- Project GA CR GA205/08/0869 – “Clay minerals as host matrices for functional nanostructures,” 2008–2010; Principal investigator: prof. RNDr. Pavla Čapková, DrSc.–VSB–Technical University of Ostrava, Co–principal investigator for MFF CU: RNDr.Miroslav Pospíšil, Ph.D.

- Project GA CR GAP106/09/0482 – "Mechanical properties and microstructure development of ultra–fine grain magnesium alloys prepared by various technologies," 2009–2012;Principal investigator: as.prof. RNDr. Miloš Janeček, CSc.

- Project GA CR GA202/09/1206 – "Nanocrystalline heterogeneous photovoltaic solar cells," 2009–2011; Principal investigator: prof. Ing. František Schauer, DrSc., Tomas Bata University, Zlín, Co–principal investigator for MFF CU: as.prof. RNDr. Jana Toušková, CSc.

- Project MEYS LC 510 – "Centre of Nanotechnology and Materials for Nanoelectronics," 1/2005–12/2011; Principal investigator: RNDr.Jan Kočka, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for MFF CU: as.prof. RNDr. Jan Valenta, Ph.D.

- Project GA AV CR IAA400500905 – "Preparation and properties of conductive polymer nanostructures," 2009–2012; Principal investigator: RNDr Jaroslav Stejskal, CSc., Co–principal investigator for MFF CU: RNDr.Jan Prokeš, CSc.

- Project GA AV CR IAA100100729 – "The development of new hybrid deposition techniques for the preparation of nanostructured fluoride thin layers exhibiting distinct fluorescent properties," 1/2007–12/2010; Principal investigator: Ing.Ján Kančík, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for MFF CU: as.prof. RNDr. Radomír Kužel, CSc.

c) *Projects involving international cooperation:*

EU projects

- Project 7FP EU Small type, NMP thematic priority, project name: NASCENT – – "Silicon nanodots for solar cell tandem," 2010–2013; 8 partners from 4 countries, project budget: EUR 4.21 million, Coordinator: Maximilian Steiert, Fraunhofer–Gesellschaft zur Foerderung der Angewandten Forschung E.V. (Germany), MFF CU is a partner in the project.

- Project 7FP EU Small type, NMP thematic priority, project name: NAMASTE – "Nanostructured Magnetic Materials for Nanospintronics," 2008–2011; 7 partners from 4 countries, project budget: EUR 3.25 million, Coordinator: Paul Cartledge, The University of Nottingham (Great Britain); MFF UK was a partner in the project.

- Project 7FP EU CSA type, NMP thematic priority, project name: NaPolyNet – – "Setting up research intensive clusters across the EU on characterization of polymer nanostructures," 2008–2011; 16 partners from 10 countries, project budget: EUR 1.46 mil., Coordinator: Cosimo Carfagna, Consiglio Nazionale Delle Ricerche (Italy); MFF CU was a partner in the project.

KONTAKT programmeprojects

- Project MEYS LH11017 – "Investigation of catalytic processes using inverse model catalysts," 2011–2014; Principal investigator: prof. RNDr. Vladimír Matolín, DrSc.

- Project MEYS LH12217 – "Production and investigation of nanostructured Ti–based alloys designed for medical implants and components," 2012–2015; Principal investigator: as.prof. RNDr. Miloš Janeček, CSc.

- Project MEYS ME08056 – “Structure–properties studies on metal oxide single crystal and thin–film surfaces: model catalysts," 2008–2012; Principal investigator: prof. RNDr. Vladimír Matolín, DrSc.

- Project MEYS MEB101106 – “Microstructure evolution and mechanical properties of ultra–fine grain magnesium alloys processed by HPT,” 2011–2012; Principal investigator: as.prof. RNDr. Miloš Janeček, CSc.

- Project MEYS ME09045 – “Magnetic nanostructures for optical sensing of high–frequency fields,” 2009–2012; Principal investigator: prof. Ing. Štefan Višňovský, DrSc.

- Project MEYS MEB020927 – “The growth of nanostructures by electron beam,” 2009–2010; Principal investigator: prof. RNDr. Vladimír Matolín, DrSc.

COST programme projects

- Project MEYS LD11047 – “Model systems of nanostructured bimetallic catalysts for environmental applications,” 2011–2014; Principal investigator: prof. RNDr. Vladimír Matolín, DrSc.

- Project MEYS LD11032 – “Nanocomposite, nanostructured films and plasma modification for improving polymer nanomaterials for food packaging,” 2011–2014; Principal investigator: prof. RNDr. Hynek Biederman, DrSc.

Other projects

- Project MEYS 7E08093 – “Nanostructured Magnetic Materials for Nano–spintronics,” 2009–2011; Principal investigator: prof. RNDr. Václav Holý, CSc.

Results in nanotechnologies/cooperation

- IWW TU Clausthal, Germany (prof. L. Wagner) – “Research in the structure and properties of nanocrystalline structured materials on an Mg base”

- Clemson University, Clemson, USA (prof. H. J. Rack) – “Phase transformation in nanocrystalline materials on a Ti base for structural and biomedical applications”

- POHANG University of Science and Technology, Pohang, South Korea (prof. H. S Kim) – “The structure and properties of nanocrystalline materials prepared using high–pressure torsion”

- Ufa State Aviation Technical University, Russia (prof. R. Valiev) – “The structure and properties of nanocrystalline materials on a Ti base designed for dental and medical implants”

Experts/field

- prof. RNDr. Hynek Biederman, DrSc.– plasma polymers, their nanostructures and nanocomposites, surface modification of macromolecular substances using low–temperature plasma

- prof. RNDr., Václav Holý, CSc.– the study of nanostructures using X–ray dispersion methods

- as.prof. RNDr. František Chmelík, CSc.– acoustic emissions in solids, the structure and physical properties of aluminium and magnesium–based alloys and composites, plastic instability (doubling, Portevin–Le Châtelier phenomenon), materials with submicrocrystalline and nanocrystalline structures
- as.prof. RNDr. Radomír Kužel, CSc.– the study of polycrystalline materials (nanostructured materials) using X–ray diffraction
- prof. RNDr. Pavel Lukáč, DrSc.– physics of materials, nanostructures
- as.prof. RNDr. Miloš Janeček, CSc.– submicrocrystalline and nanocrystalline materials – structure and properties
- as.prof. RNDr. Přemysl Málek, CSc.– ultra–fine grain and nanostructured materials
- as.prof. RNDr. Petr Malý, DrSc.– quantum optics and optoelectronics, ultra high speed laser spectroscopy, semiconductor nanocrystals, spintronics
- prof. RNDr. Vladimír Matolín, DrSc.– the physics of surfaces and thin layers, research in the structure and reactivity of single and multicomponent metal systems
- as.prof. Mgr. Iva Matolínová, Dr. – the preparation and electron microscopy of nanocatalysts and nanosensors, SEM–FIB–GIS–EBL
- RNDr. Josef Mysliveček, Ph.D. – heteroepitaxial growth of oxides on metals, the STM technique
- as.prof. RNDr. Ivan Ošťádal, CSc.– heteroepitaxial growth of metals on silicon surfaces, the STM technique
- RNDr. Miroslav Pospíšil, Ph.D. – the development of polymer/clay–based nanocomposite materials
- as.prof. RNDr. Petr Řepa, CSc.– the vacuum technique and technology, measurement of nanomaterial property, methods for nanostructure creation
- prof. RNDr. Vladimír Sechovský, DrSc.– condensed matter physics, electron structures and new material properties, magnetism
- as.prof. RNDr. Jan Valenta, Ph.D. – semiconducting nanocrystals, nanophotonics, optical spectroscopy of individual molecules and nanocrystals
- prof. Ing. Štefan Višňovský, DrSc.– the optics of magnetic nanostructures (nanostructures with ferromagnetic metals, multilayer magnetic oxides with colossal magnetoresistance)

3.2.2 MASARYK UNIVERSITY IN BRNO (MU)

Žerotínovo nám.9, 601 77 Brno, ID: 00216224

www.muni.cz

Masaryk University is the second largest public university in the Czech Republic, and the largest in Moravia.It was founded in 1919. The university has 4,000 employees, and approximately 31,000 students.It is comprised of nine faculties with more than 200

departments, institutes and clinics.Science and research are one of Masaryk University's basic priorities.The study opportunities the university offers come from the disciplines nurtured in the faculties with studies in law, medicine, the natural sciences, philosophy, teaching, economics and administration, informatics, social and sports studies.

Research in nanotechnologies is conducted at the Faculty of Science, and since 2011 it has also been carried out in the newly built European centre of excellence –**CEITEC**–**Central European Institute of Technology,** www.ceitec.cz.This is project ED1.1.00/02.0068, with a total budget of CZK 5.246 billion, scheduled from 2011–2015. Masaryk University is the main recipient of the project, and the other participants in the project are the Research Institute of Veterinary Medicine, the University of Veterinary and Pharmaceutical Sciences Brno, the Institute of Physics of Materials, Brno Institute of Technology and the Faculty of Agronomy at Mendel University in Brno.

3.2.2.1 Central European Institute of Technology (CEITEC)

CEITEC VUT, Technická 3058/10, 616 00 Brno

www.ceitec.cz

A brief description of the Centre

CEITEC is a centre of scientific excellence in living nature and advanced materials sciences and technology. Its primary mission is the creation of a major European centre of science and education with top–notch facilities and the conditions for the best people in science.The centre's results will contribute to improvements in quality of life and human health.

The scientific research centre, named CEITEC – the Central European Institute of Technology – is a project of six Brno universities and research institutes.The project's two largest partners are Masaryk University and the Brno University of Technology, which is also a guarantor of material sciences at CEITEC.Its other partners are the Research Institute of Veterinary Medicine, the University of Veterinary and Pharmaceutical Sciences Brno, the Institute of Physics of Materials and the Faculty of Agronomy at Mendel University in Brno. This is project ED1.1.00/02.0068, with a total budget of CZK 5.246 billion, scheduled from 2011–2015. In 2011 the University Institute CEITEC BUT was created at the Brno University of Technology. The institute oversees two of seven research programs – Advanced nanotechnology and microtechnology and Advanced materials.

Eleven research groups, which are involved in using a variety of techniques and technologies in nanotechnology, are associated through the Advanced nanotechnology and microtechnology research programme.Scientists from Brno University of Technology, Masaryk University and the Institute of Physics of Materials of the Academy of Sciences of the Czech Republic are also integrated here.

At Masaryk University nanotechnology research is carried out at the Faculty of Sciences. At the Brno University of Technology it is conducted at the Faculty of Mechanical Engineering and at the Faculty of Electrical Engineering and Communication.

Focus of research and development

The Advanced nanotechnology and microtechnology programme is focused in general on the nanotechnology of materials and structures which are typically suitable for nanoelectronics and nanophotonics.It includes both the preparation and the characterisation of nanostructures

with unique properties, which make qualitatively new applications possible.This includes in particular research on 2D– 0D nanostructures prepared by lithographic (top–down) and self–assembling (bottom–up) methods.Specifically semiconductor nanostructures, metal and magnetic nanostructures, oxide superconductors, and magnetics, nanotubes, nanofibres, supermolecules and nanoelectronic elements extending beyond the limits of Moore Law etc. are and will be investigated.

The research programme connects research groups which are already engaged in a specific research activity.Specifically there are eleven such groups, and although each one is engaged in individual research in nanotechnology, thanks to their active cooperation CEITEC has competitive advantages which it can offer not only to industry, this is the linking of living and non–living sciences.This cooperation is particularly marked in nanotechnologies.

The following research groups are in the Advanced nanotechnology and microtechnology research programme: Functional Properties of Nanostructures, Submicron Systems and Nanodevices, Experimental Biophotonics, Fabrication and Characterisation of Nanostructures, Development of Methods for Analysis and Measuring, X–Ray Micro CT and Nano CT, Optoelectronic Characterisation of Nanostructures, Micro and Nanotribology, Synthesis and Analysis of Nanostructures, and Transport and Magnetic Properties.

Research proposals of individual research groups

1. Functional Properties of Nanostructures – electronic and vibronic structures of materials and metamaterials, optical spectroscopy and polarimetry of micro– and nanostructures, X–ray analysis of micro– and nanostructures.
2. Submicron Systems and Nanodevices – experimental research in the field of systems, including electronic, optoelectronic and micromechanical systems and heterosystems in connection with nanotechnology and biotechnology.The creation of hybrid nanosystems for nanomedicine and diagnostics is also expected.
3. Experimental biophotonics – advanced imaging and measuring methods which use light, in particular coherence controlled holographic microscopy, confocal microscopy and applications of these techniques in live cell biology and in research of their interactions with nanostructures and nanomaterials.
4. Preparation and characterisation of nanostructures – electron beam lithography, lithography using focused ion beam and scanning probe microscopy, as well as top–down methods using vacuum deposition as well as hybrid methods.
5. Development of methods for analysis and measuring – the development of methods for scanning microscopy, both equipment and methodology, and in areas related to numerical simulations as well.
6. X–ray micro CT and nano CT – the development and application of computer tomography methods in different fields.Besides the use of these non–invasive imaging techniques for 3D analysis and metrology of samples, research will be focused on connection of µ and nano CT with other analytical approaches, such as spectrometry using laser–induced microplasma.
7. Optoelectronic characterisation of nanostructures – the characterisation of semiconductor materials and structures, their modelling, the development of advanced measurement methods, diagnostics of defects and surface physics.
8. Micro and Nanotribology – comprehensive solution of continuum mechanics specialising in the simulation of processes taking place in tribological and biotribological systems in micro– and nanoscale using advanced numerical algorithms.

9. Plasma technologies – the preparation of nanoparticles and thin layers using plasma.Plasma technologies such as plasma initiated deposition from the vapour phase and surface functionalisation using plasma.
10. Synthesis and analysis of nanostructures – sonochemical synthesis of nanomaterials, preparation of nanomaterials by means of ultrasound and thermolytic methods, the synthesis of inorganic–organic materials, the development of methods for the preparation of molecular building blocks for the construction of new functional materials using the bottom–up approach, magnetic nanostructures.
11. Transport and magnetic properties – the study of transport and magnetic properties of materials depending on their chemical composition, method of preparation, temperature and mechanical processing, finding the correlation between structure, phase composition and selected physical parameters of materials researched.

Selected projects of the Centre in nanotechnologies

- Structures for nanophotonics and nanoelectronics
- Functional hybrid semiconductor and metal nanosystems with organic materials
- Inorganic nanomaterials and nanostructures:formation, analysis, properties
- Resonance of plasmonic antennas investigated using electron energy loss spectroscopy
- Modular scanning electron microscopes
- The connection between local emission of light with stochastic properties in PN solar cell junction at very low temperatures
- Schottky diagnostics and cold–emission cathodes with the help of electronic noise
- The application of laser technologies in the crystalline silicon solar cell manufacturing process
- The development and application of short–wave radiation using capillary discharge
- The use of laser–induced plasma spectrometry for spectrochemical analysis of plant samples with high resolution
- The development of calibration–free quantitative element analysis using microplasma laser–induced spectrometry
- Inorganic nanomaterials and nanostructures:formation, analysis, properties
- Experimental study of the impact of molecular lubricant degradation on the creation of lubrication film
- Study of the behaviour of surface roughness in lubricated Hertz contacts
- Study of thin EHD lubrication films under non–steady state conditions
- Elements for nanometric diagnostics of changes in length, deviations in shape and surface defects
- Development and characterisation of thermally stable DLC layers
- Metrology using scanning probe microscopy
- Imaging theory in light, particularly confocal and holographic microscopy
- Development and application of coherence controlled holographic microscopy
- Research centre for powdered nanomaterials

- Research in live cell dynamics and biophysics of tumour cells using CCHM
- Iron and iron–oxide nanoparticles for magnetic separation processes
- Impacts of the core and surface of nanograins on the structural and physical properties of iron–based mechanically alloyed materials
- Nanocrystalline materials containing 3D metals for hydrogen storage

Selected academic partners in the Czech Republic

1. Charles University in Prague/Faculty of Science/Laboratory of Cancer Cell Invasion, Department of Cell Biology
2. Palacký University Olomouc/Faculty of Science/Department of Optics and Laboratory of Quantum Optics
3. Czech Technical University in Prague/Faculty of Electrotechnics/Department of Microelectronics
4. Charles University in Prague/Institute of Physics

Selected foreign partners

1. National Physical Laboratory (NPL, UK)
2. Physikalisch–Technische Budesanstalt (PTB, Germany)
3. Federal Office of Metrology (METAS, Switzerland)
4. Vienna University of Technology (Institute of Applied Physics, Austria)
5. Johannes Kepler University Linz (Department of Physics, Germany)
6. Imperial College London (Department of Physics, UK)
7. MEISEI University Tokyo (Japan)
8. The Nano–fs Laboratory, South Dakota (Rapid City, South Dakota, USA)
9. University of Missouri (St.Louis, Missouri, USA)
10. ASAHI KAISEI Mikrosystem, Ltd.(Japan)
11. University of L´Aquila, Faculty of Physics (L´Aquila, Italy)
12. Federal Office of Metrology (METAS, Sweden)

Experts/field

- prof. RNDr., Václav Holý, CSc. – Masaryk University in Brno/Faculty of Sciences – functional properties of nanostructures, condensed matter physics, mechanical solid matter properties
- as.prof. Ing. Jaromír Hubálek, Ph.D. – Brno University of Technology/Institute of Microelectronics/Department of Electrical Engineering and Communication– organic electronics, semiconductor structures, biosensors, microsensors
- prof. RNDr. Josef Humlíček, CSc. – Masaryk Universityin in Brno/Faculty of Sciences/Institute of Condensed Matter Physics– condensed matter physics, material chemistry, wave and particle optics
- as.prof. Ing. René Kizek, Ph.D – Mendel University/Faculty of Agronomy Institute of Chemistry and Biochemistry– the use of electrochemical methods in proteomics and genomics

- Mgr. Petr Klapetek, Ph.D. – Czech Metrology Institute/Nanometrology Division– measurement of the morphology of micro– and nanostructures using atomic force microscopy and scanning tunnelling microscopy
- prof. RNDr. Jiří Pinkas, Ph.D. – Masaryk University/Faculty of Sciences/Laboratory for Synthesis and Analysis of Nanostructures – inorganic chemistry, material chemistry
- prof. RNDr. Tomáš Šikola, CSc. – Brno University of Technology/Institute of Physical Engineering/Department of Civil Engineering– solid state physics and physics of surfaces, surfaces and thin layers, nanophotonics and plasmonics
- as.prof. Mgr. Lenka Zajíčková, Ph.D. – Masaryk University in Brno/Faculty of Sciences/Department of Physical Electronics– plasma physics

3.2.2.2 Faculty of Sciences (FS MU)

Kotlářská 2, 611 37 Brno

www.muni.cz/sci

A brief description of the Faculty

The Faculty of Sciences, founded in 1919, is profiled as a research faculty which provides university education closely connected with basic and applied research in mathematics, physics, chemistry, biology and the Earth sciences.Research in the physical sciences is concentrated on thin–layers and lateral structures on semiconductor surfaces as well as the study of plasma chemical reactions in low–temperature plasma, and in the field of theoretical physicals optics of charged particles beams, string theory and the general theory of relativity.Research in chemistry is focused on structure and bond relations, properties and the analysis of synthetic and natural molecules and their grouping.In the biological sciences the time–space dynamics of biodiversity in Central European ecosystems are investigated, as well as genomes and their function in various organisms including humans.FS MU is divided into 11 institutes and 2 centres.

Nanotechnology research is carried out at the Department of Physical Electronics (J. Janča, I. Ohlídal and L. Zajíčková) and the Institute of Condensed Matter Physics (J. Humlíček and D. Munzar).

Focus of research and development

From 2005–2011 eight research proposals were implemented at FS MU, three of which were in selected spheres focused on nanotechnology, nanomaterials and bionanotechnologies.

Research proposalMSM0021622410 "**Physical and chemical properties of advanced materials and structures**," 1/2005 – 12/2011; Principal investigator: prof. RNDr. Josef Humlíček, CSc.; total costs for the entire period of the project equalled CZK 88.203 million, CZK 86.203 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 70%.

The topic of the research proposal was the study of new materials and phenomena, which require a comprehensive physical and chemical approach.The plan was focused on:(1) self–assembling nanostructures, supergrids, quantum holes, wires and dots, (2) high–temperature superconductors, (3) technologically important bulk materials and admixtures in them, (4)

polymers with silicon backbones, (5) thermodynamic properties, phase transformation, diffusion and assembling processes in advanced intermetallic compounds and thin layers, (6) the fabrication of materials using unconventional methods and the study of the mechanisms of these processes.

Research proposal MSM0021622411 "**The study and application of plasma chemical reactions in low–thermal, low–temperature plasma and their interactions with the surface of solid states**," 1/2005–12/2010; Principal investigator: prof. MUDr. Jan Janča, DrSc.; total costs for the entire period of the project equalled CZK 105.482 million, CZK 92.985 million of which was from the state budget. For nomenclature – area 7c), the nanotechnology research share equalled 30%.

The research proposal was focused on the study of the kinetics of plasma–chemical processes using optical, mass and microwave diagnostic methods, research and methodology of the technology of plasma chemical application of thin polymer, nanocomposite, super–hard, semi–permeable, semi–sorption layers and research of mechanical, chemical and electrical properties of prepared deposits.Other activities:New low–temperature plasma powdered methods of fabrication of W, WC, TiC, WTi and chemical catalysts on the basis of these metals.The design and structure of individual plasma chemical reactor types.The study of new methods of plasma–based diagnostics and plasma chemical process monitoring.The use of a variety of plasma types for the restoration and conservation of historical artefacts and objects in museums.The use of pulsed stimulated radio frequency and microwave plasma for the breakdown of harmful substances.

Research proposal MSM0021622415 "**The molecular foundation of cell and tissue regulation**," 1/2005–12/2011; Principal investigator: prof. RNDr. Jiří Fajkus, CSc.; total costs for the entire period of the project equalled CZK 105.482 million, CZK 92.985 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 25%.

The implementation of the plan was carried out in four areas:

1. Regulatory mechanisms of animal cells;
2. Functional domains of eukaryotic chromosomes;
3. Genomics and proteomics of regulatory circuits in plants;
4. Functional analysis of clinically and biologically significant genomes.

The goal of plan implementation was to use approaches from structural biology, functional genomics, proteomics and bioinformatics to explain the molecular nature of processes which are important in terms of promising biomedical and biotechnological applications.

In 2011 in addition 204 programme research projects were implemented at the Faculty.These include 3 ambitious investment projects financed from structural funds – Operational Programme "Research and Development for Innovation".

- Project **CETOCOEN**, ED0001/01/01. From 2010–2013 a central trace laboratory accredited according to European standards is to be built at a cost of CZK 543.97 million.In the laboratory, research focused on the solution of high–priority problems concerning the environment and sustainable development, in particular the development of new chemical and toxicology tools for monitoring environmental quality and analysing the impact of the presence of toxic substances of both anthropogenic and natural origin on population health, the behaviour model of these substances and the

technique for their destruction.The project's principal investigator is as.prof. RNDr. Jana Klánová, Ph.D.

- "**The Centre for Experimental, Systematic and Ecological Biology**" (CESEB), ED4.1.00/04.0149.From 2011–2014 new high–quality, modern infrastructure should be built at a cost of CZK 929.190 million for two institutes of the Faculty of Sciences at MU:the Institute of Experimental Biology and the Institute of Botany and Zoology.As part of the project it is planned that four new pavilions will be built in the UKB campus in Brno, two of which will be used for teaching and scientific–research work in fields within systematic ecology and two of which will be dedicated to fields in experimental biology.The centre's director is as.prof. RNDr. Jan Helešic, PhD.

- Project "**Regional R&D Centre for Low–cost Plasma and Nanotechnology Surface Finishes**," ED2.1.00/03.0086.From 2010–2014 a regional R&D Centre is to be built at a cost of CZK 213.568 million. The Centre will be capable of quickly, flexibly and professionally reacting to the needs of, in particular, small and medium enterprises and business industrial partners in the provision of low–cost plasma nanotechnology surface finishes which implement strict environmental legislation in traditional industrial sectors in the Czech Republic.The Centre plans on providing practical and economically feasible plasma–chemical solutions to technological problems, focused from the start in particular on small and medium Czech enterprises.With the help of the Centre's professional services these enterprises, whose own research base is highly limited, should be able to respond to the limitations dictated by the EU (REACH regulations). The Centre's director is prof. RNDr. Mirko Černák, CSc.

Research in nanotechnologies

Research focused on nanotechnology is carried out at the Faculty in the following institutes:

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

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

Projects of GA CR

- Project GA CR GAP205/10/1374 – "Plasmachemical processes for synthesis of carbon nanotubes and study of their functional properties," 2010–2014, Principal investigator: Mgr. Lenka Zajíčková, Ph.D., Co–principal investigator: as.prof. Ing. Jaromír Hubálek, Ph.D., Brno University of Technology/Faculty of Electrical Engineering and Communication

- Project GA CR GCP206/10/J012 – "Analysis of biomolecules using mass spectrometry with laser desorption/ionization with the participation of nanomaterials," 2010–2012; Principal investigator: as.prof. Mgr. Jan Preisler, Ph.D.
- Project GA CR GA106/09/0700 – "Thermodynamics and microstructure of environmentally friendly nano–powdered soldering compounds," 2009–2011; Principal investigator: as.prof. RNDr. Jiří Sopoušek, CSc., Co–principal investigator: RNDr. Jiří Buršík, CSc., Institute of Physics of Materials AS CR
- Project GA CR GA202/07/1669 – "Deposition of thermomechanically stable nanostructured diamond–like thin layers in dual–frequency capacitive discharges," 1/2007–12/2011; Principal investigator: RNDr. Vilma Buršíková, Ph.D.
- Project GA CR GP202/08/P038 – "Study of hybrid deposition process behaviour and its use for thin layer preparation," 1/2008–12/2010; Principal investigator: Mgr. Petr Vašina, Ph.D.

Other projects

- Project MEYS – LD11046 – "Phase diagrams of nanoalloys, their calculations and verifications," 2011–2014; Principal investigator: prof. RNDr. Jiří Pinkas, Ph.D.
- Project MEYS EE2.4.12.0061 – "Educational and Contact Centre for Industrial Nanotechnology Surface Finishes," 2009–2013; Principal investigator: prof. RNDr. Mirko Černák, CSc.
- Project MEYS EE2.3.09.0167 – "Nanobiotechnology and biosensors in the study of biointeractions – making modern technology accessible to experts in biology," 2009–2012; Principal investigator: Petr Skládal
- Project MEYS 2B06053 – "New methods for the characterisation and identification of probiotic bacteria strains suitable for functional foods," 2006–2011; Principal investigator: as.prof. Ing. Bohuslav Rittich, CSc., Co–principal investigators:Ing.Vladimír Dráb, MILCOM, as.prof. Ing. Vojtěch Rada, CSc., Czech University of Agriculture, Prague/Faculty of Agrobiology, Food and Natural Resources, RNDr.Hana Kozáková, CSc.,Institute of Microbiology AS CR, Ing. Daniel Horák, CSc.,Institute of Macromolecular Chemistry AS CR
- Project MEYS 2B06056 – "Nanotechnological and bioanalytical detection of DNA damage by polyaromatic compounds for early carcinoma detection," 7/2006–6/2010; Principal investigator: Mgr. Jan Přibyl, Ph.D.
- Project MEYS MEB091120 – "Sonochemical synthesis and characterisation of transition metal ferrites," 2011–2012; Principal investigator: prof. RNDr. Jiří Pinkas, Ph.D.
- Project AS CR KAN101630651 – "Preparation of nano–films and nano–coatings on fabrics using plasma surface treatment at atmospheric pressure," 7/2006–12/2010; Principal investigator: prof. RNDr. Mirko Černák, CSc.

b) *<u>Projects on whose implementation the Faculty is cooperating:</u>*

"Nanotechnology for Society" programme projects

- Project AS CR KAN100190701 – "Nanometrology using scanning probe microscopy methods," 1/2007–12/2011; Principal investigator: Mgr. Petr Klapetek, Ph.D., Czech

Metrology Institute, Brno, Co–principal investigator for FS MU: RNDr.Vilma Buršíková, Ph.D.

- Project MIT 2A–3TP1/126 – "In–line plasma treatments and surface nano–plasma treatments of non–woven fabrics," 4/2008–12/2011; Principal investigator: Ing. Zdeněk Mečl, PEGAS NONWOVENS s.r.o., Znojmo, Co–principal investigator for FS MU: prof. RNDr. Mirko Černák, CSc.

- Project AS CR KAN108040651 – "Research of production and use of zero–valent iron nanoparticles for remediation of contaminated groundwater," 7/2006–12/2008; Principal investigator: Dr. Ing. Miroslav Černík, CSc., Technical University of Liberec/Faculty of Mechatronics and Interdisciplinary Engineering Studies, Co–principal investigator for FS MU: as.prof. RNDr. Josef Zeman, CSc.

Other projects

- Project GA CR GAP503/10/0975 – "Nanostructured imprinted polymers as highly selective sorbents for the determination of endocrine disrupting compounds," 2010–2012; Principal investigator: Mgr. David Matějíček, Ph.D., Mendel University, Brno/Faculty of Agronomy, Co–principal investigator for FS MU: Mgr.Jan Přibyl, Ph.D.

- Project MIT 2A–2TP1/147 – "Research and semiconductive nanotubes for the implementation of photoelectric components," 5/2007–12/2011; Principal investigator: Ing. Stanislav Štarman, Ph.D., STARMANS electronics, s.r.o., Praha, Co–principal investigator for FS MU prof. RNDr. Josef Humlíček, CSc.

- Project MIT FT–TA4/126 – "Research of semiconductive nanotubes for implementation of cold–emission components," 1/2007–12/2010; Principal investigator: Ing.Stanislav Štarman, Ph.D., STARMANS electronics, s.r.o., Praha, Co–principal investigator for FS MU: prof. RNDr. Josef Humlíček, CSc.

c) *Projects involving international cooperation:*

- Project 7FP EU CSA type, NMP thematic priority, project name:NanoCharM – "Multifunctional nanomaterials characterisation exploiting ellipsometry and Polarimetry," 2008–2010; 8 partners from 7 countries, project budget:EUR 1.59 million, Coordinator: Maria Losurdo, Lio Nazionale Delle Ricerche (Italy); Masaryk University in Brno/Faculty of Science was a partner in the project.

Experts/field

- RNDr. Vilma Buršíková, Ph.D. – carbon material nanostructures

- prof. RNDr. Mirko Černák, CSc.– plasma technologies

- prof. RNDr. Josef Humlíček, CSc.– physics of thin layers and nanostructures, spectroscopy, ellipsometry

- prof. RNDr. Jan Janča, DrSc.– plasmochemical preparation of nanocomposite thin layers, plasma diagnostics

- as.prof. Mgr. Dominik Munzar, Dr.– electron structure theory

- prof. RNDr. Ivan Ohlídal, DrSc.– optics of thin layers and surfaces of solid matter, AFM

- as.prof. RNDr. Jiří Pinkas, Ph.D. – sonochemical synthesis of nanoparticles, waterless sol–gel methods
- Mgr.Lenka Zajíčková, Ph.D. – carbon nanostructure preparation and study of their properties

3.2.3 CZECH TECHNICAL UNIVERSITY, PRAGUE (CTU)

Zikova 4, 166 36 Prague 6, ID: 68407700

www.cvut.cz

The Czech Technical University in Prague (CTU) is the oldest civil technical university in Central Europe.It was founded in 1707. In 2011 more than 24,000 students were enrolled here.CTU has seven faculties, three university institutes and other institutions.Research in nanotechnology is carried out to a varying degree at the following faculties:

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

3.2.3.1 Faculty of Civil Engineering (FCE CTU)

Thákurova 7, 166 23 Prague 6

www.fsv.cvut.cz

A brief description of the Faculty

The Faculty of Civil Engineering was founded at the initiative of Josef Christiann Willenberg on the basis of the foundation charter issued by Emperor Joseph I, written in Czech and dated 18 January 1707, as the first public engineering school in Central Europe. It was called the Estates School of Engineering in Prague. The present–day Faculty of Civil Engineering is divided into 26 departments and additional institutions.

Focus of research and development

From 2005–2011 four research proposals were implemented at FCE CTU, one of which contained elements of nanotechnology research in its sphere of activity.In 2011 a total114 programme research projects were further implemented at the Faculty.

Research proposalMSM6840770003– "**Development of computer simulation algorithms and their application in engineering,**" 1/2005–12/2011; Principal investigator: prof. Ing. Zdeněk Bittnar, DrSc.; total costs for the entire period of the project equalled CZK 160.986 million, CZK 160.986 million of which was from the state budget. For nomenclature – area 6b, the nanotechnological research share equalled 5%.

The research proposal's main topic was multiscale modelling and simulation (MMS).The primary applications of MMS are in material engineering.MMS is used to understand the

most important properties of materials and structures.A description of materials (constitutive relations) started on the nano scale and moves in progression all the way to the macro scale.Besides a description of the mechanical behaviour of materials, this also involves a description of their mutual interactions.At the Department of Mechanics research was conducted in the options for applying nanotechnology in making concrete and other building materials and nanoindentation methodologies are developed, e.g. in investigating the properties of cement paste.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project GA CR GA103/09/1748 – "Integration of experimental nanoindentation with computational tools for the homogenisation of nanomechanical properties of heterogeneous materials," 2009–2011; Principal investigator: as.prof. Ing. Jiří Němeček, Ph.D.
- Project GA CR GA103/08/1639 – "Microstructure of inorganic aluminosilicate polymers," 1/2008–12/2010; Principal investigator: prof. Ing. Zdeněk Bittnar, DrSc.
- Project GA CR GA106/07/1244 – "Geometric and physical modelling of porous carbon–carbon composites," 2007–2009; Principal investigator: prof. Ing. Michal Šejnoha, Ph.D., DSc.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project 7FP EU Large type, NMP thematic priority, project name:Clear–up – "Clean buildings along with resource efficiency enhancement using appropriate materials and technology," 2008–2012; 22 partners from 11 countries, project budget:MEUR 12.02, Coordinator: Udo Weimar, Eberhard–Karls–Universität Tuebingen, German; FCE CTU is a partner in the project.
- Project 6FP EU, Mobility programme, NANOCEM – "Fundamental understanding of cementitious materials for improved chemical, physical and aesthetic performance," 3/2006–2/2010; Coordinator: K. Scrivener, EPL, Switzerland, Responsible investigator for FCE CTU: prof. Ing. Zdeněk Bittnar, DrSc.
- Project AS CR IAA200710801 – "Conversion from micro– and nano–indentation data acquired using instrumented measurements to mechanical characteristic of visco–elastic materials," 2008–2010; Principal investigator: Ing.Jiří Minster, DrSc.,Institute of Theoretical and Applied Mechanics AS CR, Co–principal investigatorfor FCE CTU: Ing.Jiří Němeček, Ph.D.

Experts/field

- prof. Ing. Zdeněk Bittnar, DrSc.– application and development of numerical methods in construction mechanics, research in quasi–brittle materials using unique experimental equipment
- Ing. Jiří Němeček, Ph.D. – nanoindentation and micromechanics, concrete structures and bridges, numerical simulation and modelling

- RNDr. Lubomír Kopecký – optical polarisation microscopy, electron microscopy, microanalysis, nanoindentation (micromechanics of cement paste, concrete and composite materials)

3.2.3.2 Faculty of Mechanical Engineering (FME CTU)

Technická 4, 166 07 Prague 6

www.fs.cvut.cz

A brief description of the Faculty

Mechanical engineering was first taught as a separate field at CTU in 1864, and for that reason this year is considered to be the year of the Faculty's founding.At the present time the Faculty has 17 institutes and 7 scientific centres.

Focus of research and development

From 2005–2013 research and development at FME CTU is focused in particular on the implementation of four research proposals, none of which relates to nanotechnology. In 2011 the faculty participated in the implementation of 111 programme research projects.

Nanotechnology research is carried out at the following Faculty departments:

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

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project SGS CTU – "Experimental testing of Schottky diode properties for use in dosimetry," 2012–2014; Principal investigator: prof. RNDr. Bruno Sopko, DrSc.
- Project SGS CTU – "Special applications of ion and electron beams in mechanical engineering," 2010–2012; Principal investigator: prof. Ing. František Černý, DrSc.
- Project SGS CTU "Research of technical and biological composite materials," 2010–2012; Principal investigator: Ing.Josef Šepitka
- Project TA CR "New materials and surface layers for bionic joint replacement design," 2011–2014; Principal investigator: as.prof. RNDr. Matej Daniel, Ph.D.
- Project GA CR GPP108/10/P446 – "Multipurpose nanostructured carbon–based coatings for tribological applications," 2010–2012; Principal investigator Ing. Tomáš Vítů, Ph.D.
- Project MEYS MEB091143 – "Nanomechanics and electrostatics of interactions between implants and live tissues," 2011–2012; Principal investigator: as.prof. RNDr. Matej Daniel, Ph.D.

- Project MEYS – “Innovation of teaching Nanotechnology,” 2010, Principal investigator: as.prof. Ing. Jan Hošek, Ph.D.

- Project MEYS, KONTAKT programme, ME 837 – “Surface treatment of machine parts, clusters and tools to achieve multi–fold increase in service life by modification and deposition of nanostructured layers and surfaces dispersively strengthened with fixed nanoparticles,” 3/2006–9/2009; Principal investigator: as.prof. Ing. Jan Suchánek, CSc.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project AS CR IAA200760905 – “Thermophysical properties of water in unexplored, technologically significant regions," 2009–2013; Principal investigator: Ing. Jan Hrubý, CSc., Institute of Thermomechanics AS CR, Co–principal investigator for FME CTU: Ing.Jan Hošek, Ph.D.

- Project GA CR GAP108/10/1296 – “Development and characterisation of active hybrid fabrics with integrated micron diameter NiTi fibres with a nano grain structure,” 2010–2012; Principal investigator: Ing. Luděk Heller, Ph.D., Institute of Physics AS CR, Co–principal investigator for FME CTU: Ing.Hynek Chlup

- Project GA CR GA101/08/0299 – “Research of smart composite elements of machine tools made of ultra high modulus fibres and modified matrix nanoparticles,” 2008–2011; Principal investigator: as.prof. Ing. Václava Lašová, Ph.D., University of West Bohemia in Pilsen/Faculty of Mechanical Engineering, Co–principal investigator for FME CTU: prof. Ing. Milan Růžička, CSc.
- Project GA AS CR KJB201240701 – “Nanocomposite coatings with improved wear resistance” 1/2007–12/2009; Principal investigator: Ing.Tomáš Polcar, Ph.D., CTU/Faculty of Electrical Engineering, Co–principal investigator for FME CTU: Ing. Tomáš Vítů

- Project AS CR KAN101120701 – “Nanocomposite layers and nanoparticles created in low pressure plasma for surface modification,” 1/2007–12/2011; Principal investigator: prof. RNDr. Hynek Biederman, DrSc., Charles University in Prague/MFF, Co–principal investigator for FME CTU: as.prof. RNDr. Vladimír Starý, CSc.

- Project MIT FI IM5/124 – “Coating technology research of new material nanolayers for energy–saving, high–output sensors, regulators and actuators,” 3/2008–12/2010; Principal investigator: Ing.František Veselý, SAFINA, a.s., Vestec, Co–principal investigator for FME CTU: prof. RNDr. Bruno Sopko, DrSc.

- Cooperation with the Excellence Network of the 6FP EU NMP 515846 NAPOLYDE – “Control and Smart Devices,” 4/2005–3/2009; Coordinator: P. Chequet, Recherche et Développment du Groupe Cockerill Sambre, Liege, Belgium, 23 participants, Co–principal investigator for FME CTU: prof. Ing. František Černý, DrSc., Topic: “Processes for deposition of nanostructured layers for energy and intelligent systems.”

Experts/field

- prof. Ing. František Černý, DrSc.– modification of surface qualities of materials

- as.prof. RNDr. Matej Daniel, Ph.D. – nanobiomechanics, interaction of cells with implants

- as.prof. Ing. Jan Hošek, Ph.D. – actuators for nanoapplications, the use of nanomaterials in machining applications, technical standardisation of nanotechnology
- Ing. Jaroslav Lukeš, Ph.D. – the development of new nanomechanical Hysitron TriboIndenter systems for material research
- as.prof. RNDr. Ing. Rudolf Novák, DrSc.– thin layer physics, plasma coating deposition, evaluation of coating parameters
- prof. RNDr. Bruno Sopko, DrSc.– semiconductor physics, Chairman of "Nanotechnology" in the Technical Standardisation Committee
- as.prof. RNDr. Vladimír Starý, CSc.– materials for biomedical applications
- prof. Ing. Josef Steidl, CSc.– plastics and composites/nanocomposites
- Ing. Josef Šepitka – dynamic nanoindentation and its application for examining very elastic properties of materials

Results of research in nanotechnologies/cooperation

Publication– Introduction to Nanotechnology, Hošek Jan, CTU Publishers, 2010

Other activities

Active participation in the Czech Technical Standardisation Committee TNK 144 – Nanotechnology– Experts: prof. RNDr. Bruno Sopko, DrSc.,as.prof.Ing. Jan Hošek, Ph.D.

The preparation of Czech standards:

ČSN P CEN ISO/TS 27687 Nanotechnology – Terms and definition of nano–objects: Nanoparticles, nanofibres and nano boards;

ČSN EN ISO 29701 Nanotechnology – Endotoxin test of nanomaterial samples using in vitro systems – the Limulus amebocyte lysate (LAL) test

ČSN EN ISO 10808 Nanotechnology – Characteristics of nanoparticles in inhalation exposure chambers for inhalation toxicity testing

ČSN EN ISO 10801 Nanotechnology – Generation of metal nanoparticles for inhalation toxicity testing using the vapour/condensation method

ČSN P ISO/TS 80004–3 Nanotechnology – Dictionary – Part 3:Carbon nano–objects

Active participation in the European Committee for Standardisation CEN/TC 352 – Nanotechnology – Deputy chairman of the technical committee: as.prof.Ing. Jan Hošek, Ph.D.

3.2.3.3 Faculty of Electrical Engineering (FEE CTU)

Technická 2, 166 07 Prague 6

www.fel.cvut.cz

A brief description of the Faculty

The Czech Technical University was created in Prague in 1920 with six independent universities (faculties).One of these was the University of Machine and Electrical Engineering, which was divided into two departments, machining and electrical engineering.Today's Faculty of Engineering CTU develops scientific work, trains new scientific workers and is a centre for scientific and educational activities in electrical engineering, communication technologies, automation, informatics and computer science.The Faculty is structured into 20 departments and centres.

Focus of research and development

From 2005–2011 research and development at FEE CTU was focused in particular on the solution of four research proposals, none of which is related to nanotechnology.In 2011a total 135 programme research projects were further implemented at the Faculty.

Nanotechnology research is carried out at the following Faculty departments:

Department of Mechanics and Materials (V. Bouda, J. Sedláček, A. Mlích)

- Research in composite materials containing colloid functional particles for electronics and electrical engineering is focused on the spontaneous growth of conductive and semi–conductive carbon nanoparticle aggregates in a non–conductive environment and controlling themusing electric fields and the composition of the surrounding environment.Modelling of muscle cell functions and nanotechnology for implementation are carried out.Thin layer properties are prepared and studied.
- In addition cooperation also takes place on research proposal MSM6840770021 – "Diagnostics of materials," 1/2005–12/2010; Principal investigator: prof. Ing. Stanislav Vratislav, CSc., CTU/Faculty of Nuclear Sciences and Physical Engineering

Department of Microelectronics (M. Husák, J. Voves, P. Hazdra)

- The following activities take place:The design of microelectronic and nanoelectronic semiconductor structures using commercial and own design systems and programs; designs, simulations and characterisation of nanometric quantum structures (resonance tunnel diodes, lasers etc.); the characterisation of nanometric semiconductor layers and quantum dots prepared using MOVPE and MBE methods, designs and characterisations of spintronic materials and structures; research and development of sensors for applications in electronics.

Department of Electrotechnology (P. Mach)

- Work is concentrated on research and development of conductive glues.

Department of Measuring (P. Ripka)

- Research and development of sensors for applications in electronics and electrical engineering are carried out here, and nanostructured magnetic layers are studied.

Department of Electromagnetic Fields (J. Macháč)

Department of Control Engineering, Control Theory Group (T. Polcar)

- Research is conducted in the preparation of gradient optical layers in nano dimensions, nano composite, abrasion proof surface coatings etc.

In 2011 in Kladno the Faculty started to build an applied research centre, **the University Centre of Energy Efficient Buildings (UCEEB)**, as part of the ED2.1.00/03.0091 project, scheduled from 2011–2014 and with a budget of CZK 672 million.The Centre's director is prof. Ing. Zdeněk Bittnar, Dr.Sc.

Focus of the Centre:Innovative technologies and structural solutions for buildings and their elements integrating new materials, advanced sensors and renewable energy sources so that, in addition to energy and material efficiency, a healthy interior environment is also provided for; the use of renewable, recyclable and recycled domestic raw materials on a base of wood, ceramics, waste products such as ashes from coal–burning power plants, low–quality sheep's wool, waste plastics etc.; the creation of policies, methods, directives and technical standards for the needs of the government administration and professionals in the field.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project MEYS 7H10019 – "Nanoelectronics for Mobile Ambient Assisted Living (AAL) Systems," 2010–2013; Principal investigator: prof. RNDr. Olga Štěpánková, CSc.

- Project GA CR GP106/07/P014 – "Self–lubricating layers on a dichalcogenide transient metal base," 2007–2009; Principal investigator: Ing. Tomáš Polcar, Ph.D.

- Project GA CR GA102/09/1601 – "Intelligent micro– and nanostructures for microsensors realised using nanotechnologies," 2009–2012; Principal investigator: prof. Ing. Miroslav Husák, CSc., Co–principal investigator: prof. Ing. Radimír Vrba, CSc., Brno University of Technology/Faculty of Electrical Engineering and Communication

- Project GA CR GAP102/11/0649 – "Research and measurement of signals generated by nanostructures," 2011–2013; Principal investigator: prof. Ing. Jan Vrba, CSc., Co–principal investigator: Ing.Jiří Pokorný, DrSc., Institute of Photonics and Electronics AS CR

- Project GA AS CR KJB201240701 – "Nanocomposite coatings with improved wear resistance at elevated temperatures," 1/2007–12/2009; Principal investigator: Ing.Tomáš Polcar, Ph.D.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project 7FP EU SME type, NMP thematic priority, project name: REBIOFOAM – "Development of a flexible and energy–efficient pressurised microwave heating process to produce 3D–shaped REnewable BIO–polymer FOAMs for a novel generation of transportation packaging," 2009–2013; 10 partners from 8 countries, project budget:MEUR 5.14, Coordinator: Gaetano Lo Monaco, NOVAMONT S.p.a., Italy; FEE CTU is a partner in the project.

- Project 7FP EU Large type, NMP thematic priority, project name: MORGaN - "Materials for Robust Gallium Nidride," 2008–2011; 24 partners from 11 countries,

project budget: MEUR 13.86, Coordinator: Louise Pillon, El Thales III V Lab, Greece; FLE CTU was a partner in the project.

- Project AS CR KAN400100652 – "Structures for spintronics and quantum phenomena in nanoelectronices created by electron beam lithography," 7/2006–12/2010; Principal investigator: Ing.Ludvík Smrčka, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for FEE CTU: prof. RNDr. Jan Valenta, Ph.D.
- Project GA CR GA202/06/0718 – "Quantum dot engineering," 1/2006–12/2008; Principal investigator: Ing.Jiří Oswald, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for FEE CTU: as.prof. Ing. Pavel Hazdra, CSc.

Experts/field

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

3.2.3.4 Faculty of Nuclear Science and Physical Engineering (FNSPE CTU)

Břehová 7, 115 19 Prague 1

www.fjfi.cvut.cz

A brief description of the Faculty

The Faculty of Nuclear Science and Physical Engineering was founded as part of the Czechoslovak nuclear programme in 1955. It gradually expanded its activities to include a wide range of fields in mathematics, physics and chemistry.The Faculty was the first in the Czech Republic to implement teaching and research in nanomaterials and took over studies in this prestigious field from foreign institutions.Research and teaching in nanostructure has a high–level, prestigious resource base at the Faculty, and FNSPE CTU is among the world leaders in this area.The Faculty is divided into 10 departments, at least four of which are involved in nanotechnology research.

Focus of research and development

From 2005–2012 research and development at FNSPE CTU has been focused in particular on the implementation of programme research projects (55 programme research projects were

implemented at the Faculty in 2011) and offive research proposals. Certain aspects of two of these touch on issues in nanotechnologie and nanomaterials.

Research proposalMSM6840770021 – "**Diagnostics of materials**," 1/2005–12/2010; Principal investigator: prof. Ing. Stanislav Vratislav, CSc.; total costs for the entire period of the project equalled CZK 124.980 million, CZK 110.172 million of which was from the state budget. For nomenclature – area 6d, the nanotechnology research share equalled 50%.

Complete diagnostics of materials in the project included the following areas:application of X–ray and neutron beam diagnostic methods on polycrystalline materials, research in the relations between structurally sensitive properties of substances, their technological history and usable parameters.There was also the determination of electron structures of defects and admixtures with the goal of achieving material properties suitable for technical applications in optoelectronics and laser technologies.The Department of Mechanics and Materials and the Department of Electrical Engineering of CTU contributed to work in nanotechnology on the research proposal.

Research proposalMSM6840770022 – "**Laser systems, radiation and advanced optical applications**," 1/2005–12/2010; Principal investigator: prof. Ing. Pavel Fiala, CSc.; total costs for the entire period of the project equalled CZK 121.200 million, CZK 106.842 million of which was from the state budget. For nomenclature – area 2b, the nanotechnology research share equalled 10%.

The topic of the plan was modern laser systems and the study of selected optical interactive processes of coherent and non–coherent electromagnetic radiation with an environment in a spectrally broad scope (from XUV to IR).The goals included the acquisition of knowledge and understanding of new processes in optical methods, optoelectronics, technologies, in medicine, as well as in additional research in optical physics.The research proposal was thematically divided into several mutually connected topics:

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

(2) Modelling dense high–temperature plasma and its use in optics – as plasma X–ray sources;

(3) Applied X–ray photonics – focused on the generation of point–focused X–ray radiation from Kai to laser generation as well as X–ray diagnostics;

(4) Optic waves and their formation by the environment – the study of non–linear photorefractive processes, spatial solitons and diffractive structures, with their options for use in optical applications etc.

Research in nanotechnologies

Four departments were examining the following issues in nanotechnology within the framework of both research proposals and programme research projects:

- *Department of Solid State Engineering (S. Vratislav, N. Ganev)*

Research is focused on:

1. The study of macro and microstructures of technologically important materials and optical properties of solid states, in the past few years also on the study of the properties of polymers

and polymer nanocomposites in connection with technological processing and resulting properties.

2. The perfection of methods and diagnostics of technically important materials, study leading to clarification of influences in phase transfers in thin layers, this involves methods such as:TEM, SEM, XRD (composite morphology), diffraction of neutrons and x–ray radiation, light dispersion (as well as silicates, organosilicates and transient metal oxides); measurement of photoluminescence, thermoluminiscence and optical absorption of pure and spectroscoptically active ions (Cr3+, Mn4+, Fe3+ etc.) of charged thin layers and thin layer structures BaxSr1–xTiO3 and other perovscite type materials.

3. The development of simulation programs for the study of transport properties in semiconductor heterostructures.

- *Department of Physical Electronics* (P. Fiala, A. Fojtík, M. Kálal, A. Jančárek)

The Department of Physical Electronics covers teaching and research in quantum nanostructures and nanotechnologies.

It participates in teaching in this field at other institutions and universities as well.The Department has its own nanostructure and nanotechnology research laboratory (www.nanolab.cz).It actively works with a number of premier academic and scientific institutions in the Czech Republic and abroad (e.g. the CAESAR nanotechnology institute and TU Bonn (Germany), University of Rennes (France), the Delft Technical University (the Netherlands), the Hahn–Meitner Institut Berlin (Germany) and others), where the founders of this field, Czech and foreign, and their successors have built nanotechnology centres and guarantee continuity in the most advanced research trends in the field.

The main plan is:

1. The study and preparation of structures and their mutual manipulation, through which physical properties can be controlled and then used for optical and optoelectronic applications.Molecular lithography is used for *periodic assemblies* in combination with other methods, such as (alternatively) ion implantation, steaming, sputtering, electrolytic methods, iontophoresis and sedimentation.

2. The study and preparation of metal nanostructures for the design of environmental protection detectors and catalytic applications.Chemical preparation processes in a limited space using molecular lithograph structures of organic layers, micellar systems, the use of growth stabilisers and chemical "ablation," i.e. by dissolving in dual component organic systems, are used *to control particle size*.Specifically metal (Ni, Ag, Au and other suitable ones), semiconductor (Si, CdS and other suitable ones) and dielectric nanostructures are studied and prepared.

3. Metal magnetic and other special semiconductor nanostructures for biological and medical applications.

In connection with its new Physics of Nanostructures focus the Department introduced and organises teaching in the following subjects:

particle nanostructures, nanochemistry, nanophysics, nanoelectronics, semiconductor nanostructures, nanoscopy and nanocharacterisation.

A programme for teaching on the undergraduate and master’s level in the field has been prepared and is being introduced.

- *Department of Materials* (J. Siegl)

Work in nanomaterials can be divided into two main groups:

1. Study of the connections between microstructural parameters and mechanical properties of various types of construction materials (preparation of materials with ultra–fine grains, hardened alloys, study of solid solution disintegration in a model alloy, the use of methods of transmission electron microscopy with atomic resolution and auto–emission ion microscopy with tomographic atomic probe).

2. Study of the first stages of fatigue crack growth in connection with characteristic structural parameters of monitored construction materials in the field of nanostructures.

- *Department of Nuclear Chemistry* (V. Múčka)

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project AS CR KAN401220801 – "The preparation of nanostructures and nanomaterials of targeted controlled dimensions," 1/2008–12/2012; Principal investigator: prof. Ing. Pavel Fiala, CSc.

- Project MEYS, KONTAKT programme, ME 933 – "Special nanostructures – manufacture, study of their basic physical properties and practical implementations," 5/2007–12/2009; Principal investigator: as.prof. Ing. Milan Kálal, CSc.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project GA CR GAP208/10/0941 – "Engineering of surface–modified optical processes of molecules and semi–conductor quantum dots using plasmon resonances in metal nanoparticle assemblies," 2010–2014; Principal investigator: prof. RNDr. Blanka Vlčková, CSc., Charles University in Prague/Faculty of Science, Co–principal investigator for FNSPE CTU: RNDr.Martin Michl, Ph.D.

- Project GA CR GA102/09/1037 – "Metallic nanolayers for semiconductor sensor and detector structures," 2009–2011; Principal investigator: RNDr.Olga Procházková, CSc.,Institute of Photonics and Electronics AS CR, Co–principal investigator for FNSPE CTU: Ing.Kateřina Piksová

- Project GA CR GA106/07/0805 – "Surface layers of important technical materials – a complex structural analysis of th gradient of properties after mechanical finishing," 1/2007–12/2009; Principal investigator: Ing.Marian Čerňanský, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for FNSPE CTU: as.prof. Ing. Nikolaj Ganev, CSc.

- Project GA CR GA202/07/0818 – "Silicon nanophotonics – from individual nanocrystals to photonic structures," 1/2007–12/2009; Principal investigator: as.prof. RNDr. Jan Valenta, CSc., Institute of Physics AS CR, Co–principal investigator for FNSPE CTU: prof. Ing. Pavel Fiala, CSc.

- Project GA AS CR IAA100100718 – "Metal–dielectric nanostructures for optics," 1/2007–12/2009; Principal investigator: Dr. Ing. Jiří Bulíř, Dr., Institute of Physics AS CR, Prague, Co–principal investigator for FNSPE CTU: prof. Ing. Pavel Fiala, CSc.

- Project AS CR KAN300100802 – “Nanocomposite, ceramic and thin film scintillators,” 1/2008–12/2011; Principal investigator: Ing.Martin Nikl, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for FNSPE CTU: as.prof. Ing. Viliam Múčka, CSc.

- Project AS CR IAA100100718 – “Metal–dielectric nanostructures for optics," 2007–2009; Principal investigator: Dr. Ing. Jiří Bulíř, Dr.,Institute of Physics AS CR, Co–principal investigator for FNSPE CTU: prof. Ing. Pavel Fiala, CSc.

Other projects

- Project MIT FR–TI3/245 – “Research and development of technologies and systems of RAO treatment in connection with new nuclear sources,” 2011–2014; Principal investigator: Ing.Radek Trtílek, Institute of Nuclear Research Řež a.s., Co–principal investigator for FNSPE CTU: Ing.Mojmír Němec, Ph.D.

- Project MIT FR–TI1/356 – “A compact nanosecond eye–safe laser,” 2009–2012; Principal investigator: Ing. Karel Nejezchleb – CRYTUR spol. s r.o., Co–principal investigator for FNSPE CTU: prof. Ing. Helena Jelínková, DrSc.

- Project MIT FT–TA3/112 – “X–ray multilayer mirror replication technology,” 4/2006–12/2009; Principal investigator: as.prof. Ing. Ladislav Pína, DrSc., REFLEX s.r.o., Prague, Co–principal investigator for FNSPE CTU: Ing.Alexandr Jančárek, CSc

- Project 7FP EU SME type, SME thematic priority, project name:AXIS – “Advanced X–ray source based on field emitting Carbon Nanotubes cold cathode,” 2008–2011; 9 partner from 5 countries, project budget:MEUR 1.43, Coordinator: Caterina E. Ghio, Consiglio Nazionale Delle Ricerche, Italy, FNSPE CTU was a partner in the project.

Experts/field

- prof. Ing. Pavel Fiala, CSc.– laser and optic technologies, diffractive optics and applications with targeted physical properties.Identification and modelling of nanoparticle properties.

- as.prof. Ing. Nikolaj Ganev, CSc.– X–ray diffraction, material research

- as.prof. Ing. Milan Kálal, CSc.– interaction of laser rays with plasma and its diagnostics, high–performance lasers, complex interferometry

- prof. Ing. Viliam Múčka, DrSc.– physical chemistry, radiation chemistry

- Ing. Jan Siegl, CSc.– mechanical properties of construction materials, failure processes, SEM, plasma applied layers

- prof. Ing. Stanislav Vratislav, CSc.– neutron diffraction, material research

3.2.3.5 Faculty of Biomedical Engineering (FBME CTU)

Sítná 3105, 272 01 Kladno

www.fbmi.cvut.cz

A brief description of the Faculty

The Faculty of Biomedical Engineering (FBME) is the youngest faculty of the Czech Technical University in Prague.It was established in 2005 through the transformation of the Institute for Biomedical Engineering.The Faculty's history dates back to 1996, when the Centre for Biomedical Engineering (CBME) was founded at CTU to coordinate research and teaching activities in biomedical engineering.At the present time the Faculty has four departments and a joint biomedical engineering institution operated by FBME and 1st LF CU.

Focus of research and development

Research activity developed gradually from 2005–2011 in connection primarily with the implementation of sections of research proposal MSM6800770012 – "**Transdisciplinary research in biomedical engineering II**," and its section "Engineering problems of biology and medicine."The coordinator of plan implementation at FBME was prof. Ing. Peter Kneppo, DrSc.The research proposal was implemented at FME CTU and its coordinate–principal investigator was prof. Ing. Svatava Konvičková, CSc.Research activities in bionanotechnology were carried out at the Department of Natural Sciences (J. Kuba, M. Vrbová and M. Jelínek).The topic of thin layer nanocrystalline and nanocomposite thin biocompatible layers is being developed at the joint institution of 1st LF CU and FBME CTU in Prague's Albertov.

In 2011 a total of 11 programme research projects were implemented at the Faculty.One of them is **the BIKOS project – Infrastructure for biomedical engineering**, ED4.1.00/04.0193, supported by the Research and Development Operational Programme in the amount of CZK 50 million. From 2011–2013 the building of nine new laboratories equipped with state–of–the–art equipment for biomedical research is planned.At the Faculty's building at náměstí Sítná 3105 in Kladno new useable space with an area of 759 m^2 will be created, where an integral laboratory complex of current modern methods and biomedical engineering techniques will be constructed.

Projects implemented in nanotechnologies

a) *Projects implemented by the Faculty:*

- Project Ministry of Health NT12156 – "Scaffolds for osteochondral regeneration based on core/shell nanofibres with controlled drug release," 2011–2015; Principal investigators: as.prof. RNDr. Evžen Amler, CSc., Mgr. Eva Filová, Ph.D., as.prof. MUDr. Milan Handl, Ph.D., prof. MUDr. Leoš Navrátil, CSc. and prof. MUDr. Jozef Rosina, Ph.D.

- Project MEYS LD11078 – "Real time nanophotonic imaging in cells using nanodiamond particles," 2011–2013; Principal investigator: prof. RNDr. Miloš Nesládek, CSc., HDR

b) *Projects on whose implementation the Faculty is cooperating:*

- Project AS CR KAN300100702 – "The creation and characterisation of nanostructures with X–ray lasers," 1/2007–12/2011; Principal investigator: Ing.Bedřich Rus, Dr., Institute of Physics AS CR, Prague, Co–principal investigators for FBME CTU: Dr. Ing. Jaroslav Kuba, Ph.D., prof. Ing. Miroslava Vrbová, CSc., Ing. Přemysl Fitl and others also worked on project implementation for FBME.

Experts/field

- as.prof. Ing. Miroslav Jelínek, DrSc.– nanomaterials, nanolayers, nanocomposites
- as.prof. Ing.Anton Fojtík, CSc.– nanostructures and nanotechnologies, their engineering and mutual manipulation
- 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

3.2.3.6 Faculty of Transportation Sciences (FTS CTU)

Konviktská 20, 110 00 Prague 1

www.fd.cvut.cz

A brief description of the Faculty

The Faculty of Transportation Sciences was created in 1952. It provides education in undergraduate and master's level study programmes focused on transportation and telecommunication.

Focus of research and development

- Development of methods of system analysis, algorithms and statistics for transportation and communicaiton
- Automatic systems in transportation, diagnostics of transportation systems and processes
- Models of transportation and controlled transportation processes

Research in nanotechnologies

Work on the project described below:

- Project GA CR GPP108/10/P446 – "Multifunctional nanostructured carbon coatings for tribological applications," 2010–2012; Principal investigator: Ing.Tomáš Vítů, Ph.D.

3.2.3.7 Institute of Experimental and Applied Physics (IEAP)

Horská 3a/22, 128 00 Prague 2

www.utef.cvut.cz

A brief description of the Faculty

The Institute was established 1May 2002. The focus of its activities is experimental and applied physics of the microworld.

Focus of research and development

- Astroparticle&Nonaccelerared Physics
- ATLAS v LHC
- Subatomic Physics
- Radiation imaging
- R&D semiconductor detectors
- Applied Spectrometry

Experts/field

- RNDr. Michael Solar, CSc.– physics of semiconductors, nanostandardisation, Chairman of the “Nanotechnology" Czech Technical Standardisation Committee TNK 144, Czech representative in CEN/TC 352 “Nanotechnology”

3.2.4 BRNO UNIVERSITY OF TECHNOLOGY (BUT)

Antonínská 548/1, 601 90 Brno, ID: 00216305

www.vutbr.cz

The Brno University of Technology is the oldest university in Brno. Its beginnings date back to the mid–19th century, to the year 1849, when a German–Czech technical school was founded in Brno. The Czech University of Technology in Brno was opened in November 1899. At the present time BUT is the only technical university in Brno, covering the full range of technical sciences as well as a number of disciplines in the arts. It has 24,500 students.BUT is comprised of 8 faculties.Research in nanotechnology is carried out to a varied extent at the following faculties:

- The Faculty of Electrical Engineering and Communication – FEEC
- Faculty of Chemistry – FCH
- Faculty of Civil Engineering – FCE
- Faculty of Mechanical Engineering – FME

Since 2011 BUT has been involved in the building of the **CEITEC – Central European Institute of Technology–** ascientific research centre (European Centre of Excellence project ED1.1.00/02.0068); an additional six Brno universities and research institutions are taking part in its building. This is a project with an overall budget of CZK 5.246 billion, scheduled

from 2011–2015 (more information – www.ceitec.cz). BUT is the guarantor of material sciences at CEITEC. Within the framework of BUT the CEITEC BUT institute of higher learning was created in 2011. It oversees two of the seven research programmes – Advanced Nanotechnologies and Microtechnologies and Advanced Materials.

3.2.4.1 The Faculty of Electrical Engineering and Communication (FEEC BUT)

Technická 3058/10, 616 00 Brno

www.feec.vutbr.cz

A brief description of the Faculty

Teaching of the first disciplines in electrical engineering already started at BUT in 1905. In 1959 a separate Energy Faculty was created, which was then transformed to become the Faculty of Electrical Engineering.In 1993 the Faculty's structure was changed and the Faculty was renamed the Faculty of Electrical Engineering and Informatics (FEI).The Faculty of Electrical Engineering and Informatics was the third largest faculty of BUT's seven faculties at the time, following the separation of the Technology Faculty and Faculty of Management to set up the new Tomas Bata University, Zlín at the beginning of 2000.In 2001 preparations were begun at FEI BUT for the establishment of the Faculty of Information Technologies (FIT) and the transformation of the core Faculty of Electrical Engineering and Informatics to the Faculty of Electrical Engineering and Communication (FEEC).Both faculties have been operating independently since 1 January 2002.

FEEC BUT focuses on teaching and research in electrical engineering and communication technologies.This primarily involves microelectronic systems, electronic communication systems and technologies, the optimal use of electrical energy, automation of technological and manufacturing processes, information and control systems, applied cybernetics etc.In 2004 a single–semester course in Nanotechnology was introduced for students in the first year of the master's programme in Microelectronics and Telecommunications and Information Techniques.In 2007 a four–year doctoral programme in Physical Electronics and Nanotechnologies was accredited at the Institute of Physics for students in both full–time and combined programmes.The Faculty's activities are divided among 14 institutes, which in some cases are also divided by laboratory.

Focus of research and development

From 2005–2010 four research proposals were implemented at FEEC BUT, one of which was focused to a certain extent on nanotechnology.

Research proposalMSM0021630503 – "**New trends in microelectronic systems and nanotechnologies (MIKROSYN)**," 1/2005–12/2010; Principal investigator: prof. Ing. Radimír Vrba, CSc.; total costs for the entire period of the project equalled CZK 134.700 million, CZK 118.740 million of which was from the state budget. For nomenclature – area 2a, the nanotechnology research share equalled 50%.

The research proposal emphasized the issue of mature microelectronic circuits, microsystems and structures on chips.All the problem areas of the research proposal are oriented towards new, promising prepared micro– and nanosystems and technologies.The basic and applied research proposal is directed at five research areas:

1. Theory, design and diagnostics of low–voltage, low–volt integrated circuits in submicron technologies;
2. Integrated circuit modelling and simulation;
3. Microsystems and nanosystems;
4. Advanced technologies for microelectronics and nanoelectronics;
5. Modern diagnostics of materials and parts.

The research proposal goals in individual fields consisted of achieving original results in the research of new microelectronic systems, progressive methods of their solution and optimisation, in applied research of new micro– and nanotechnologies for the preparation of new electronics structures and new generation semiconductive parts.

Since 2010 a **Centre of Sensor, Information and Communications Systems** (SIX) http://www.six.feec.vutbr.cz has been under development at the Faculty as part of the CZ2.1.00/03/0072 project. This is a joint initiative of the Department of Radioelectronics, Department of Telecommunication, Department of Microelectronics and the Department of Physics of the Faculty of Electrical Engineering and Communication at BUT. The time for implementation is 2010–2013; project budget: CZK 292.23 million, Principal investigator and Centre director: prof. Dr. Ing. Zbyněk Raida.

Focus of the Centre:research on communication and information systems and their components to be operated in emerging bandwidths.This involves in particular:research of the base–band layer of communication systems:(sub) millimetre wave broadcasting, radiation, amplification, filtration and mixing; research of the system layer of communication systems:mobile systems, optical systems, satellite systems and digital TV systems; research of convergent information and communication technologies; research of scanning, processing and representation of communication signals (acoustic signals, video signals, text information and their multimedia connection); research in sensing and detection of chemical and biological substances and physical values using microsensors, with nanotechnology in sensory parts and transmitted by communication channels.

Another one of the Faculty's centre of applied research is the **Centre for Research and Utilization of Renewable Energy**, www.cvvoze.cz, project CZ.1.05/2.1.00/01.0014, time for implementation is 2010–2013, and project budget:CZK 260.16 million, Principal investigator and Centre director: prof. RNDr. Vladimír Aubrecht, CSc.

Focus of the Centre:Research, development and utilisation of renewable energy sources, including issues in electrochemistry, electromechanics, electrotechnology, electric power, electric drives, mobile robots and industrial electronics.The goals include the introduction of top–level basic and applied research in the promising area of renewable energy sources, including applications.

A total 124 programme research projects were implemented at the Faculty in 2011.

Research in nanotechnologies

Nanotechnology research is carried out at the following Faculty institutes:

Activities at the Laboratory of Optical Nanometrology have been in development under the leadership of prof. RNDr. Pavel Tománek at the **Department of Physics** for several years.The laboratory was initially involved in contactless, non–destructive research in the

surfaces of materials with lateral super resolution using optical scanning tunnel microscopy in reflective and permeable modes.Today the potential has been increased through the combination of AFM and STM.The main goals are topography, local spectroscopy and fluorescence of semiconductive surfaces and interfaces and the study of local defects.Workers:P. Tománek, L. Grmela, L. Holcman, R. Macků, P. Škarvada, D. Dallaeva.

Since 2003 the Laboratory of Microsensors and Nanotechnologies (LabSensNano www.umel.feec.vutbr.cz/labsensnano) has been developing under the direction of as.prof.Ing. Jaromír Hubálek, Ph.D., where research workers study applications of nanomaterials in chemical sensors and biosensors for the detection of heavy metals, biologically interesting substances, specific conductivity and gases.In the thin layers field they also focus on research in techniques for MEMS and NEMS creation.Members of the laboratory:J. Hubálek, A. Mozalev, J. Prášek, J. Drbohlavová, J. Chomoucká, R. Hrdý, J. Pekárek, J. Bušinová, D. Solovei and others.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

Projects of GA CR

- Project GA CR GAP102/11/1068 – "Nano–electro–bio–tools for biochemical and molecular–biological studies of eukaryotic cells (NanoBioTECell)," 2011–2015; Principal investigator: prof. Ing. Ivo Provazník, Ph.D., Co–principal investigator: as.prof. Ing. René Kizek, Ph.D. – Mendel University, Brno/Faculty of Agronomy

- Project GA CR GP102/11/1379 – "New intelligent submicron structures and systems for modern microsensors," 2011–2013; Principal investigator: prof. Ing. Radimír Vrba, CSc.

- Project GA CR GPP102/10/P618 – "Synthesis of quantum dots in planar form and their functionalisation for optical protein and DNA detection," 2010–2012; Principal investigator: Ing. Jana Drbohlavová, Ph.D.

- Project GA CR GA102/08/1474 – "Local optical and electrical characterization of optoelectronic structures with nanometric resolution," 1/2008–12/2010; Principal investigator: prof. RNDr. Pavel Tománek, CSc.

- Project GA CR GAP102/11/0995 – "Electron transport, noise and Schottky diagnostics and autoemission cathodes," 1/2008–12/2010; Principal investigator: as.prof. Ing. Lubomír Grmela, CSc.

- Project GA CR GA102/08/1546 – "Miniaturised intelligent systems and nanostructured electrodes for chemical, biological and pharmaceutical applications (NANIMEL)," 1/2008–12/2010; Principal investigator: as.prof. Ing. Jaromír Hubálek, Ph.D.

- Project GA CR GP102/09/P640 – "Characterisation of carbon nanotubes for electrochemical sensors' electrodes," 2009–2010; Principal investigator: Ing. Jan Prášek, Ph.D.

Other projects

- Project MEYS LH11060 – "Study of local electronic and optical characteristics of solar cells," 2011–2014; Principal investigator: prof. RNDr. Pavel Tománek, CSc.

- Project MEYS 7H11096 – “Nanoelectronics for Electric Vehicle Intelligent Failsafe PowerTrain (MOTORBRAIN),” 2011–2014; Principal investigator: as.prof. Ing. Pavel Václavek, Ph.D.

- Project MEYS 7H10021 – “Nanoelectronics for Mobile Ambient Assisted Living (AAL) Systems,” 2010–2013; Principal investigator: prof. Ing. Radimír Vrba, CSc.

- Project MEYS 7H09009 – “Nanoelectronics for an Energy Efficient Electrical Car,” 2009–2012; Principal investigator: prof. Ing. Radimír Vrba, CSc.

- Project MEYS EE2.3.09.0224 – “Building research teams and the development of university education of research professionals for micro– and nanotechnologies (NANOTEAM),” 2009–2013; Principal investigator: as.prof. Ing. Jaromír Hubálek, Ph.D

- Project MEYS EE2.4.12.0019 – “A partner network for cooperation among universities, research institutes and industry for microelectronic and nanotechnology development,” 2009–2013; Principal investigator: Pavel Šteffan

- Project MEYS EE2.3.09.0214 – “Incubator of research teams in physical electronics and nanotechnology,” 2009–2012; Principal investigator: Ing.Petr Sadovský, Ph.D.

- Project AS CR 1QS201710508 – “Impedimetric chemical microsensors with a nanomachined surface of electrodes,” 2005–2009; Principal investigator: as.prof. Ing. Jaromír Hubálek, Ph.D.

- Project AS CR KAN208130801 – “New designs and use of nanobiosensors and nanosensors in medicine (NANOSEMED),” 2008–2012; Principal investigator: as.prof. Ing. Jaromír Hubálek, Ph.D.

- Project TA CR TA01010088 – “Development and innovation of new nanomaterial for targeted modification of vascular grafts (NANOCEVA),” 2011–2015; Principal investigators: prof. Ing. Ivo Provazník, Ph.D., Ing.Radim Hrdý, as.prof. Ing. Jaromír Hubálek, Ph.D, Ing. Denisa Maděránková, Ing.Jan Prášek, Ph.D., Bc. Jiří Sedláček, Ing. Helena Škutková, Bc. Jaromír Žák, Co–principal investigators: RNDr.Věra Žižková, Výzkumný ústav pletařský, a.s., as.prof. Ing. René Kizek, Ph.D., RNDr. Vojtěch Adam, Ph.D., Mgr. Natalia Cernei, Ing. Dalibor Húska, Ing. Soňa Křížková, Ph.D., Ing. Petr Majzlík, Ph.D. and Mgr. Markéta Ryvolová, Ph.D., Mendel University, Brno/Faculty of Agronomy

- Project SoMoPro SIGA722 – “Synthesis of Self–Organized, Templated and Surface–Supported Metal and Metal–Oxide Nanostructures for Being Used in Advanced Micro– and Nanodevices (AnoNaS),” 2011–2013; Principal investigators: as.prof. Ing. Jaromír Hubálek, Ph.D., Dr. Alexander Mozalev

b) *Projects on whose implementation the Faculty is cooperating:*

- Project GA CR GA102/09/1601 – “Intelligent micro– and nanostructures for microsensors realised using nanotechnologies," 2009–2012; Principal investigator: prof. Ing. Miroslav Husák, CSc., Czech Technical University, Prague/Faculty of Electrical Engineering, Co–principal investigator for FEEC BUT: prof. Ing. Radimír Vrba, CSc.

- Project GA CR GAP205/10/1374 – “Plasmachemical processes for synthesis of carbon nanotubes and study of their functional properties,” 2010–2014; Principal investigator:

as.prof. Mgr. Lenka Zajíčková, Ph.D., Masaryk University, Brno/Faculty of Sciences, Co–principal investigator for FEEC BUT: as.prof. Ing. Jaromír Hubálek, Ph.D.

- Project GA CR GA102/06/1624 – "Micro– and nano sensor structures and systems with embedded intelligence (MINASES)," 1/2006–12/2008; Principal investigator: prof. Ing. Miroslav Husák, CSc., CTU, Prague/Faculty of Electrical Engineering, Co–principal investigator for FEEC BUT: prof. Ing. Radimír Vrba, CSc.

- Project MIT FT–TA3/027 – "Multifunctional composites of exceptional properties on an inorganic nanocomponent base," 2006–2010; Principal investigator: Ing.Miroslav Svoboda – Výzkumný ústav stavebních hmot a.s., Co–principal investigator for FEEC BUT: prof. Ing. Radimír Vrba, CSc.

Experts/field

- as.prof. Ing. Jaromír Hubálek, Ph.D. – self–assembling nanostructures, nanoporous membranes, metal nanowires and nanotubes, chemical microsensors and nanosensors, MEMS and NEMS

- prof. RNDr. Pavel Tománek, CSc.– optic nanometrology, studies of local optical and electrical properties of materials with nanostructures

- prof. Ing. Miroslav Vrba, CSc.– microelectronics

3.2.4.2 Faculty of Chemistry (FCH BUT)

Purkyňova 118, 612 00 Brno

www.fch.vutbr.cz

A brief description of the Faculty

The Faculty of Chemistry at BUT has been active since 1992, building on the long–standing tradition of higher education in chemistry in Brno, initiated by the founding of the chemistry department of the Czech Technical University in November 1911, interrupted in 1951 by the transformation of this school to the Military Technical Academy.In addition to teaching, activities in scientific research comprise an integral part of the mission of FCH BUT.Specifically, activities in this realm are depend on the professional focus of four (since 2010 five) of the Faculty's departments.

The Institute of Physical and Applied Chemistry focuses primarily on physical chemistry of (nano)colloid and macromolecular systems, organic electronics and photonics, photochemistry, plasma chemistry and physics and computer applications in chemistry, chemical technology and physics.Nanotechnology is used intensely for researching new materials and designing new organic semiconductor elements and equipment in areas such as organic photovoltaics and other carrier systems for medical, cosmetic and agrochemical applications.At **the Institute of Materials Chemistry** scientific activity is focused on the study of chemistry, technology and the properties of silicate, metal and polymer and composite materials with direct use of the knowledge gained in technology of their manufacture and processing according to the required material applications.The professional scientific research activities of the **Institute of Chemistry and Technology of Environmental Protection** are focused on chemistry and technology of the protection and treatment of water, and the protection of soil and air quality.At the Institute work is also

conducted on problems of special industrial toxicology and ecotoxicology, as well as problems of removal and recycling of waste.The **Institute of Food Science and Biotechnology** researches problems in biology, theoretical and experimental biochemistry, microbiology, bioengineering and the technology of food production.Research in nanotechnology was identified at the Institute of Physical and Applied Chemistry (M. Pekař and M. Weiter), the Institute of Materials Chemistry (V. Čech and J. Jančář), and the Institute of Food Science and Biotechnology (I. Márová).A new Faculty institute is also being created: the **Centre of Material Research**.

Focus of research and development

From 2005–2011 one research proposal was implemented which was focused to a certain extent on nanotechnology and in whose implementation all the FCH institutes were involved.

Research proposalMSM0021630501– "**Multifunctional heterogeneous materials on a synthetic polymer and biopolymer base**," 1/2005–12/2009; Principal investigator: prof. RNDr. Josef Jančář, CSc.; total costs for the entire period of the project equalled CZK 134.700 million, CZK 118.740 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 20%.

The research proposal was oriented towards the investigation of advanced methods of preparing and characterising heterogeneous materials, in particular polymer mixtures, nanostructures and composites, and also towards the investigation of low–dimensional structures such as ultra thin layers/multilayers.The solution of this assignment called for the design of new and the modification of already existing methods characterising structures on different dimensional scales and creating a theoretical interpretation of phenomena witnesses on the basis of processing the information acquired.The subject of activities was research of the preparation of functional heterogeneous polymer materials, quantification of relations among structure, properties and functions and finding control methods for their life span on the molecular or supramolecular level.The main goal was the preparation of advanced heterogeneous polymer materials whose structure and properties are controlled by methods of preparation and quantification of relations between structure and properties which make possible the use of modelling in the design of new materials.

Since 2010 a **Materials ResearchCentre** (www.materials–research.cz) has been built at the Faculty. The project was implemented under the Operational Programme Research and Development for Innovation, project number CZ.1.05/2.1.00/01.0012, project budget:CZK 232.7 million, implementation: 2010–2013, goal: to enhance cooperation between university research and the application sphere in the form of contractual research and joint research projects and to accelerate the transfer of knowledge and technology into practical application; research is focused on inorganic materials, transport systems and sensors; head of the project and Centre director:prof. Ing. Miloslav Pekař, CSc.

In 2011 a total 26 programme research projects were implemented at the Faculty.

Research focused on nanotechnologies

Through the Faculty of Chemistry, the **Institute of Physical and Applied Chemistry** (head: prof. Ing. Miloslav Pekař, CSc.) BUT is involved in the medicine pharmaceutical cluster *Nanomedic* (www.nanomedic.cz).The Cluster brings together companies and academic institutions with a common interest in the further development of medical nanobiotechnologies.The Cluster works on several specific research projects, which include nanosystems for targeted distribution of active substances (such as drugs) or for regenerative

medicine.The Institute is involved in implementation of the project MIT FI–IM4/205 – "Nanotechnology in medicine – tissue support for connective tissue reconstruction," project MIT FR–TI1/151 – "New wound dressings based on nano– and micro–carriers" and in the action – COST D43 "Colloid and Interface Science for Nanotechnology".At the Cluster's initiative a new interdisciplinary study programme focused on medical nanobiotechnology is being developed at the Institute.The Institute's activities are further focused on the study of the properties of organic materials suitable for molecular electronics.These issues are addressed as part of the "*Molecular nanosystems and nanocomponents: electric transport properties*" project (Principal investigator: as.prof.Ing. Martin Weiter, Ph.D.) in the "Nanotechnologies and Society" programme.The study focuses in particular on spin processes on a molecular level, especially on photoinduced spin, electrical conductivity and photoluminescence. From 2009–2011 a project of the 7FP in nanotechnology was also implemented. The project had the name DEPHOTEX "*Development of Photovoltaic Textiles based on Novel Fibres*" and was focused on the development of photovoltaic textiles made using commercially available materials and commercial industrial technologies or technologies, which could be upscalable.Fifteen partners participated in the implementation; they were primarily SME or technology companies and centres such as FIAT (Centro Ricerche Fiat).

Institute employees involved in nanotechnology research are: M. Pekař, M. Weiter, O. Zmeškal, M. Vala, M. Klučáková, P. Sedláček, M. Chytil and F. Mravec.

Activity in nanotechnologies at the **Institute of Materials Chemistry** (head: prof. RNDr. Josef Jančář, CSc.) are focused on the preparation, characterisation, computer modelling and application of polymer nanocomposites.The preparation of these includes both synthesis of $Mg(OH)_2$, hydroxyapatite and $CaCO_3$ base nano–fillers as well as the use of different processes of melt–mixing or dissolving polymers with nano–fillers with supplemental ultrasound.Modern measuring and characterisation methods together with computer and theoretical physical models are used to investigate the relationship between polymer nanocomposite structure and properties.A large quantity of the results achieved is starting to find use in applications such as in–tumescent and self–cleaning paints, low–abrasive paints, drug carriers, tissue engineering and dentistry.

Institute scientists involved in nanotechnology research are: J. Jančář, V. Čech, P. Poláček, J. Žídek, L. Vojtová and R. Bálková.

Work in nanobiotechnology is carried out at the **Institute of Food Science and Technology** (head: as.prof.Ing. Jiřina Omelková, CSc.).This includes work such as the isolation and characterisation of plant and bacterial enzymes which can be used in industry (pectinase, glucanase, protease, lipase); the ability for immobilisation and use in enzyme reactors.In proteomics this includes the use of microbial express systems for production of metabolites, raw materials for foods and components on laboratory scale where pilot–project treatment is possible.

The scientist involved in nanotechnology research is Ivana Márová.

The **Centre of Material Research** is a newly created Faculty institute, where research in nanobiotechnology, nanocolloid, carrier systems, organic electronics and photonics is concentrated.Institute scientists involved in nanotechnology research are: M. Pekař, M. Weiter, O. Zmeškal, I. Márová, S. Obruča, M. Vala, M. Klučáková, P. Sedláček, M. Chytil, F. Mravec, J. Krajčovič and J. David.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project AS CR KAN401770651 – "Molecular nanosystems and nanoparticles: electronic transport properties," 7/2006–12/2010; Principal investigator: as.prof. Ing. Martin Weiter, Ph.D.
- Project AS CR IAA401770601 – "Molecular–scale electron processes in materials suitable for organic photosensitive components," 2006–2009, Principal investigator: Ing.Martin Weiter, PhD., Co–principal investigator: Ing.Martin Weiter, PhD., Institute of Macromolecular Chemistry AS CR.
- Project MEYS OC08004 – "Associative colloids of hyaluronan–tenside, hyaluronan–amino acid for nanomedical applications," 2008–2011; Principal investigator: prof. Ing. Miloslav Pekař, CSc.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project 7FP EU SME type, NMP thematic priority, project name: DEPHOTEX – "Development of Photovoltaic Textiles based on novel fibres," 2008–2011; 14 partners from 7 countries, project budget:MEUR 4.21, Coordinator: Carmen Margeli, Fundación Privada CETEMMSA (Spain), FCH BUT was a partner in the project.
- Project AS CR KAN101120701 – "Nanocomposite layers and nanoparticles created in low pressure plasma for surface modification," 1/2007–12/2011; Principal investigator: prof. RNDr. Hynek Biederman, DrSc., Charles University, Prague/MFF, Co–researcher for FCH BUT: prof. RNDr. Vladimír Čech, Ph.D.
- Project MEYS 2B06130 – "Synthesis of new biomaterials in combination with stem cells in the treatment of diseases affecting human tissue derived from the mesoderm: cartilage, bone, ligaments and meniscus," 7/2006–12/2011; Principal investigator: prof. MVDr.Alois Nečas, Ph.D., Veterinary and Pharmaceutical University Brno/Faculty of Veterinary Medicine, Co–principal investigator for FCH BUT: prof. RNDr. Josef Jančář, CSc.
- Project MIT FR–TI1/151 – "New wound dressings based on nano– and micro–carriers," 2009–2012; Principal investigator: Ing.Michal Zavadil, Ph.D., CPN a.s., Co–principal investigator for FCH BUT: as.prof. Ing. Ladislav Burgert
- Project MIT FI–IM4/205 – "Nanotechnology in medicine – tissue support for connective tissue reconstruction," 3/2007–9/2010; Principal investigator: Ing.Kateřina Knotková, Ph.D., CPN spol. s r.o., Dolní Dobrouč, Co–principal investigator for FCH BUT: prof. Ing. Miloslav Pekař, CSc.
- Project MIT FT–TA3/055 – "Smart polymer coatings containing nanoparticles," 3/2006–12/2009; Principal investigator: Ing.Jiří Zelenka, CSc., SYNPO, a. s., Pardubice, Co–principal investigator for FCH BUT: prof. RNDr. Josef Jančář, CSc.

Experts/field

- Ing. Radka Bálková, Ph.D. – morphology and structural analysis of polymers and composites, thermal analysis

- prof. RNDr. Vladimír Čech, Ph.D. – thin layers, plasma nanotechnology, layered nanocomposites, surface treatment reinforcement for polymer composites, material interfaces, composite interphases
- Ing. Pavel Diviš, Ph.D. – elemental and special analysis using AAS, AFS, ICPAES and ICP–MS methods, sensory food analysis
- Ing. Martin Chytil, Ph.D. – rheology, biopolymer and polymer (nano)colloids
- prof. RNDr. Josef Jančář, CSc.– composites, nanocomposites, synthetic polymers and biopolymers, deformative behaviour and morphology of polymers
- as.prof. Ing. Martina Klučáková, Ph.D. – humin (nano)colloids, transport processes (diffusion)
- as.prof. RNDr. Ivana Márová, CSc.– biochemistry, (nano)biotechnology, biocompatible carrier systems, biodegradable polymers
- Ing. Filip Mravec, Ph.D. – fluorescence spectroscopy for nanotechnological applications, biopolymers and polymer (nano)colloids
- prof. Ing. Miloslav Pekař, CSc.– physical chemistry of (nano)colloid and macromolecular systems, polysaccharides, humin materials
- Ing. Petr Poláček, Ph.D. – fibre and hybrid composites, adhesion technology
- Ing. Petr Sedláček, Ph.D. – humin (nano)colloids, transport processes (diffusion)
- Ing. Martin Vala, Ph.D. – study of optoelectronic properties of organic semiconducting materials
- as.prof. Ing. Martin Weiter, Ph.D. – study of optoelectronic properties of organic semiconducting materials, applications of materials in organic electronics and photonics
- Mgr. Jan Žídek, Ph.D. – computer modelling, reinforced polymer composites, material interfaces, composite interphases

3.2.4.3 Faculty of Civil Engineering (FCE BUT)

Veveří 331/95, 602 00 Brno

www.fce.vutbr.cz

A brief description of the Faculty

The history of the Faculty of Civil Engineering BUT is closely connected with the history of the Brno University of Technology. The Czech Technical University was founded by Emperor Franz Joseph I in 1899 and civil engineering was its first field of study. In 1951 the Technical University was closed and the Military Technical Academy was established in its place. At the same time, however, in 1951 a University of Civil Engineering was founded in Brno and in 1956 BUT was revived. In 1961 the form which it maintains to this day was established.FCE BUT is divided organisationally into 22 institutes.

Focus of research and development

From 2005–2011 two research proposals were implemented at FCE BUT; they, however, were not focused on the use of nanotechnology or nanomaterials in construction. In 2011 a total 93 programme research projects were implemented at the Faculty.

Since 2011 an applied research centre, **AdMaS– Advanced Materials, Structures and Technologies**, http://www.admas.vutbr.cz/, has been built as part of the ED2.1.00/03.0097 project, scheduled from 2011–2014 with a budget of CZK 817.903 million, Centre director: prof. RNDr. Ing. Petr Štěpánek, CSc.,FEng.

The Centre is focused on the development of scientific knowledge and formulation of basic technical and technological principles and approaches oriented towards the integration of theory, analysis and method of designing building materials, structural building and other systems, as well as on technologies for diagnostics in construction and impacts affecting structures, design of structures and technologies used in the management of towns and municipalities.

The Centre's main goals:

- The development of new building materials, or the innovation of existing ones using new raw material bases and/or secondary raw materials while increasing their useful quality and the durability of construction materials in buildings and reduction of energy costs and their production,
- The development of new diagnostic methods for assessing construction materials, buildings or structures and the impacts acting on structures,
- The development of new technologies in removing and treating wastewater, treatment and distribution of drinking water, waste management, the development of new approaches for the use of energy from wastewater, waste and solids created during wastewater treatment,
- The creation of geodetic, photogrammetric and metrological support for building activities and research – testing practical applications of terrain and laboratory measurements, evaluation and development of methodologies in geotechnical research methods and diagnostics of basic building conditions,
- Measuring temperature and microclimate properties of buildings and parts of structures – the development of reliable, durable and autoadaptive buildings according to Performance Based Design and/or Life Cycle Design; optimisation.

Projects implemented in nanotechnologies

- Project GA CR GAP205/10/2259 – "The impact of nanoparticles on chain mobility and polyolefin nanocomposite crystallisation kinetics," 2010–2012; Principal investigator: prof. RNDr. Josef Jančář, CSc.
- Project MIT FT–TA3/027 – "Multifunctional composites of exceptional properties on an inorganic nanocomponent base," 2006–2010; Principal investigator: Ing.Miroslav Svoboda – Výzkumný ústav stavebních hmot a.s., Co–principal investigator for FCE BUT: prof. Ing. Drahomír Novák, DrSc.

Experts/field

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

3.2.4.4 Faculty of Mechanical Engineering (FME BUT)

Technická 2, 616 69 Brno

www.fme.vutbr.cz

A brief description of the Faculty

The Faculty is a renowned institution in science and research.Besides traditional machining fields which have a constructional and technological character, movements in applied sciences and disciplines such as applied mechanics, precision mechanics and optics, quality management, engineering informatics, material engineering etc. are also intensely developed here.The Faculty is divided into 14 institutes which carry out teaching and research activities.Some of the institutes are further divided into departments.

Focus of research and development

From 2005–2010 three research proposals were implemented at FME BUT, one of which was fully focused on nanotechnology.

Research proposalMSM0021630508– "**Inorganic nanomaterials and nanostructures: fabrication, analysis, properties**," 1/2005–12/2010; Principal investigator: prof. RNDr. Jaroslav Cihlář, CSc.; total costs for the entire period of the project equalled CZK 120.873 million, CZK 106.554 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 100%.

The research proposal was oriented towards the creation and examination of nanoparticle and nanostructured materials, in particular inorganic non–metal materials and their composites with metals and polymers, and also on the creation and examination of low–dimensional structures, such as nanowires and nanodots. The subject of the research proposal is the description of physical and chemical interactions in nanoparticle and nanostructural systems and the acquisition of new knowledge about the unique properties which can be derived from these relations, in particular in multiple phase ones, from the perspective of the behaviour of nanomaterials and nanostructures, their surfaces and interfaces.

At FME BUT two research centres were also established, one of which was fully focused on nanotechnology research:

- Project MEYS, "Basic Research Centre" programme, LC06040 – "**Structures for nanophotonics and nanoelectronics**," 3/2006–12/2011; Principal investigator: prof. RNDr. Tomáš Šikola, CSc. Research in nanotechnologies was carried out at the Institute

of Physical Engineering (T. Šikola, J. Pokluda, P. Šandera, M. Ohlídal, P. Bábor and M. Černý), the Institute of Material Science and Engineering (J. Cihlář, J. Švejcar, M. Trunec and K. Maca) and to a less extent at the Institute of Design (M. Hartl and I. Křupka) and the Institute of Metrology and Testing (L. Bumbálek).

Work at the **Institute of Physical Engineering** is focused on the creation of nanostructures using SPM for nanoelectronics and plasmonics, the preparation and characterisation of ultra–thin layers, multilayers and 1D–0D nanostructures using PVD. Further microstructure analysis using optical microscopy (BF, DF, DIC, polarisation microscopy), co–focal microscopy and LCIM are carried out at the Institute. The development of photoluminescence/reflex optical microscopy and spectroscopy takes place.

Work at the **Institute of Material Science and Engineering**/Department of ceramics:inorganic nanoparticle synthesis in unconventional conditions (hydrothermal synthesis, synthesis in ultrasound and microwave fields); the preparation of nanostructured coatings; the preparation of nanostructured bulk ceramics; the study of nanoparticle surface properties; the study of microstructures and properties of nanostructured coatings and objects. In the field of structural and phase analysis, TEM, STEM, SEM, X–ray and other types of structural analysis are conducted.

At the **Institute of Design** one of the research topics is also the study of very thin lubricating films, with thicknesses of a micrometer to a nanometer.

At the **Institute of Metrology and Testing** measurement with nanometric precision is carried out.

Since 2009 construction on an applied research centre –**NETME Centre (New Technologies for Mechanical Engineering**) www.netme.cz, has been underway. This is project ED0002 01/01; total costs: CZK 663 million, project implementation: 2009–2013. Its recipient is Brno University of Technology/Faculty of Machine Engineering. The NETME Centre is divided into 5 divisions: power, processes and environmental engineering (PPE), aircraft and automobile techniques (AAT), mechatronics (M), virtual machine design and testing (VMDT) and advanced metallic materials (AMM). The principal investigator of the project is prof. Ing. Petr Stehlík, CSc., the executive director is Ing.Peregrina Štípová. This Centre will also be partially dedicated to research and design of nanomaterials and nanotechnologies.

In 2011 a total 131 programme research projects were implemented at the FME BUT.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

COST programme research projects

- Project MEYS OC09040 – "Rheologic behaviour of polymer melts and solutions containing nanoparticle fillers," 2009–2011; Principal investigator: as.prof. Ing. Martin Trunec, Dr.
- Project MEYS OC 180 Action COST D–41 – "Heterogeneous catalysts for oxidation of organic substances founded on composite perovscite oxides," 1/2007–12/2010; Principal investigator: prof. RNDr. Jaroslav Cihlář, CSc.
- Project MEYS OC 102 Action COST 539 – "Processing of electroceramics from nanopowders," 2006–2009; Principal investigator: as.prof. RNDr. Karel Maca, Dr.

- Project MEYS OC09015 – “Processing of electroceramics from nanopowders–II,” 2009; Principal investigator: as.prof. RNDr. Karel Maca, Dr.

- Project MEYS OC 105 Action COST 540 – “Photocatalytic ceramic nanomaterials and layers for the photochemical breakdown of water and polar substances,” 3/2006–12/2009; Principal investigator: prof. RNDr. Jaroslav Cihlář, CSc.

- Project MEYS OC 148 – “Dual–layer analysis of distribution of charge under a nanoindenter stylus,” 3/2006–12/2009; Principal investigator: as.prof. Mgr. Miroslav Černý, Ph.D.

Other projects

- Project MEYS LC06040 – “Structures for nanophotonics and nanoelectronics,” 2006–2011; Principal investigator: prof. RNDr. Tomáš Šikola, CSc., Co–principal investigator: RNDr. Fejfar, CSc.– Institute of Physics AS CR

- Project GA CR GA106/09/1524 – “First principles study of the mechanical properties of ideal metallic fibre nanocomposites,” 2009–2011; Principal investigator: as.prof. Mgr. Miroslav Černý, Ph.D.

- Project GA CR GP202/07/P486 – “Depth profiling of 2D nanostructures using SIMS, TOF–LEIS and XPS methods combined with ion beam sputtering,” 1/2007–12/2009; Principal investigator: Ing. Petr Bábor, Ph.D.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project MIT FR TI2/736 – “Modular scanning electron microscope,” 2010–2014; Principal investigator: Ing.Jaroslav Jiruše, PhD., TESCAN, a.s., Co–principal investigator for FME BUT: prof. RNDr. Tomáš Šikola, CSc.

- Project AS CR KAN400100701 – “Functional hybrid nanosystems of semiconductors and metals with organic materials (FUNS),” 1/2007–12/2011;Principal investigator: RNDr.Bohuslav Rezek, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for FME BUT: prof. RNDr. Tomáš Šikola, CSc.

- Project GA AS CR IAA1010413 – “Nanoscience and nantechnology with scanning probe microscopes: from atomic processes to material properties,” 1/2004–12/2008; Principal investigator: Ing.Vladimír Cháb, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for FME BUT: prof. RNDr. Tomáš Šikola, CSc.

- Project GA CR GEFON/06/E001 – “Spin–dependent transport and electron correlation in nanostructures,” 1/2006–12/2009; Principal investigator: Ing.Vít Novák, Institute of Physics AS CR, Co–principal investigator for FME BUT: prof. RNDr. Tomáš Šikola, CSc.

c) *Cooperation on international projects:*

- Project 7FP EU – thematic priority FP7–REGPOT–2007–3, project name:RP DEMATEN – “Reinforcement of research potential of the Department of Materials Engineering in the field of processing and characterization of nanostructured materials,” 2008–2011; 6 partners from 5 countries, Coordinator: Vladimir Srdič, University of Novi Sad, Serbia; FME BUT was a partner in the project.

- Project 7FP EU – Marie Curie Actions, FP7–PEOPLE–2007–1–1–ITN – "Factory of European young nanotechnologists mastering applications of nanostructures (FEYNMAN)," 2008–2010; Co–principal investigator: prof. RNDr. Tomáš Šikola, CSc.
- Project 7FP 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; Co–principal investigator: as.prof. RNDr. Karel Maca, Dr.

Experts/field

- as.prof. Ing. Leoš Bumbálek, Ph.D. – surface texture assessment, assement of surface layer impact on the functional properties of components, nanometrology
- prof. RNDr. Jaroslav Cihlář, CSc.– synthesis of ceramic oxide material nanoparticles, nanoceramic layers and bulk materials, catalytic electrochemical and coordination systems
- prof. Ing. Martin Hartl, Ph.D. – optical methods for the study of thin liquid films, very thin (nanometrical) lubricating films, lubricating films under high contact pressures
- as.prof. RNDr. Karel Maca, Dr.– high–temperature processes in advanced ceramic materials, nanoceramic material technology, high–temperature interaction of melted alloys with ceramic materials
- prof. RNDr. Jaroslav Pokluda, CSc.– mechanical properties of materials, physics and micromechanics of deformation and fracture
- prof. RNDr. Pavel Šandera, CSc.– limit states of materials, computer modelling and simulations, ab initio calculations of mechanical properties of solid states
- prof. RNDr. Tomáš Šikola, CSc.– ultra–thin layers, ion and molecular beam technologies, ion beam etching of micro– and nanostructures, nanostructure creation using SPM methods, development and applications of methods for in situ and ex situ analysis of surfaces, thin layers and nanostructures (UHV STM/AFM, TOF–LEIS, XPS, SIMS, ellipsometry/reflectometry, LEED/AES)
- prof. Ing. Jiří Švejcar, CSc.– structural analytics (TEM, AFM, SPM etc.)
- as.prof. Ing. Martin Trunec, Dr.– technologies and properties of advanced ceramic materials and nanoceramics

3.2.5 INSTITUTE OF CHEMICAL TECHNOLOGY, PRAGUE (ICT)

Technická 5, 166 28 Prague 6 – Dejvice, ID: 60461373

www.vscht.cz

The Institute of Chemical Technology, Prague was founded in 1952. It is the largest educational institution of its kind in Central and Eastern Europe. It builds on a more than 170–year old tradition of technical chemical teaching in Bohemia.Research and development in all fields of chemistry are conducted.ICT has four faculties. Nanotechnology research is

carried out at the Faculty of Chemical Technology, the Faculty of Chemical Engineering and the Faculty of Food and Biochemical Technology.

3.2.5.1 Faculty of Chemical Technology (FCHT ICT)

Technická 5, 166 07 Prague 6 – Dejvice

www.vscht.cz

A brief description of the Faculty

The Faculty of Chemical Technology was created in 1969 through the merger of the Faculty of Inorganic Technology and the Faculty of Organic Technology, which together with the Faculty of Food Technology were the three founding faculties of the independent Institute of Chemical Technology, Prague. FCHT follows two basic movements in basic and applied research, specifically inorganic and organic technologies and materials. The Faculty is divided into 10 departments and 2 laboratories. Nanomaterials have been offered as a field of study since the 2011/2012 academic year.

Focus of research and development

From 2005–2011 two research proposals were implemented at FCHT ICT, one of which was focused to a certain extent on nanotechnology.

Research proposalMSM6046137302– "**Preparation and research of functional materials and material technologies using micro– and nanoscopic methods**," 1/2005–12/2009; Principal investigator: as.prof.Ing. Aleš Helebrant, CSc.; total costs for the entire period of the project equalled CZK 154.418 million, CZK 139.650 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 50%.

The basic problem addressed by the research proposal was study of the relationships between material preparation conditions and their composition, structure and properties to enable the targeted preparation and development of new types of materials with defined properties and to improve their functional properties and application utilisation.In terms of application the research proposal includes three main areas:1) materials for technical applications, 2) materials for human health and 3) materials and environmental protection. Research, pursuant to European and global trends, is moving more into the field of nanomaterials and nano– and microscopic layers. The goals of individual partial areas can be generalised and divided into groups which cut across individual areas of the research proposal:

- Discovering and generalising the relations between composition, structure and preparation conditions of special materials and substances with chemical, pharmacological, physical and physicochemical properties selected in advance, the development of chemical methodologies,
- Preparation of modifications of surfaces and secondary surface layers on materials and transfer of these into technical practice,
- Optimisation of technological process, applied research in new techniques and technologies using computer simulations,

- Clarification of physicochemical processes taking place with the contact of materials and the environment and proposals for methods to hamper corrosion and material degradation,
- Modelling structures of materials and processes during their preparation on a microscopic and nanoscopic level, development of analytical methods enabling their verification.

In 2011 a total 73 programme research projects were implemented at the FCHT ICT.

Research in nanotechnologies is performed at almost all the Faculty's departments. These are:

- Department of Inorganic Chemistry (D. Sedmidubský, O. Smrčková, D. Sýkorová)
- Department of Inorganic Technology (B. Bernauer, J. Krýsa)
- Department of Metal Materials and Corrosion Engineering (D. Vojtěch, J. Šerák)
- Department of Glass and Ceramics (A. Helebrant, J. Matoušek, V. Hulínský)
- Department of Solid State Chemistry (F. Kovanda, B. Doušová)
- Department of Organic Technology (P. Kačer, J. Pašek)
- Department of Polymers (J. Roda, J. Brožek)
- Department of Solid State Engineering (V. Švorčík, P. Slepička, J. Leitner, I. Hüttel, V. Myslík)

Employees working on research in nanotechnologies and nanomaterials are mentioned in parentheses.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

Projects of GA CR

- Project GA CR P108/11/P337 – "Preparation and characterisation of Au nanostructures," 2011–2013; Principal investigator: Ing. Jakub Siegel, Ph.D.
- Project GA CR GPP108/11/P840 – "Study of the preparation and properties of micro– and nano scale structured polymer surfaces," 2011–2013; Principal investigator: Mgr. Oleksiy Lyutakov, PhD.
- Project GA CR GP106/09/P046 – "Sputter–coated and grafted Au nanostructures on polymer," 2009–2011; Principal investigator: Ing. Petr Slepička, Ph.D.
- Project GA CR GA106/09/1378 – "Micro– and nanofibres from biodegradable polymers," 2009–2012; Principal investigator: as.prof. Ing. Jiří Brožek, CSc., Co–principal investigators: RNDr. Čeněk Novotný, Ph.D., Institute of Microbiology AS CR, Ing. Lenka Martinová, CSc., Technical University in Liberec/Faculty of Textile Engineering
- Project GA CR GA106/07/1149 – "Bioactive and photocatalytic sol–gel nanolayers," 1/2007–12/2009; Principal investigator: prof. Ing. Josef Matoušek, DrSc.

- Project GA AS CR IAA401250701 – "Modified aluminosilicates as effective nanosorbents of arsenic, antimony and selenium oxoanions: mechanisms and kinetics of reactions on solid phase surfaces," 1/2007–1/2009; Principal investigator: Ing. Barbora Doušová, CSc.

- Project GA AS CR – IAA401250703 – "Porous ceramics, ceramic composites and nanoceramics," 1/2007–12/2009; Principal investigator: as.prof. Dr. Willi Pabst

Other projects

- Project MEYS ME08086 – "Photochemical reactions in complex environments: theoretical study," 2008–2012; Principal investigator: RNDr. Petr Slavíček, Ph.D.

- Project MEYS MEB020825 – "New types nanocomposites for photodegradation of pollutants," 2008–2009; Principal investigator: as.prof. Dr. Ing. Josef Krýsa

- Project AS CR IAAX08240901 – "New inorganic–organic hybrid nanomaterials," 2009–2013; Principal investigator: prof. Ing. Pavel Lhoták, CSc., Co–principal investigators:Ing.Milena Špírková, CSc., Institute of Macromolecular Chemistry AS CR, Ing. Stanislav Šabata, Institute of Chemical Processes AS CR, and as.prof. Ing. Petr Duchek, CSc., University of West Bohemia in Pilsen/Faculty of Mechanical Engineering

- Project AS CR KAN208240651 – "Study of interactions of biological of macromolecules and nanolayers with a view to research of polymer microfluid biosensors and therapeutic nanoparticles," 2006–2010; Principal investigator: as.prof. Ing. Pavel Hasal, CSc., Co–principal investigator: RNDr. Pavel Branny, CSc., Apronex s.r.o.

b) *<u>Projects on whose implementation the Faculty is cooperating:</u>*

TIP programme research projects

- Project MIT FR–TI1/456 – "Development and implementation of tools for additively modulating the soil and water bioremediation process," 2009–2013; Principal investigator: Mgr. Zdeněk Kozlíček, MikroChem LKT, spol. s r.o., Co–principal investigator for FCHT ICT: prof. RNDr. Vladimír Jirků, DrSc.

- Project MIT FR–TI1/302 – "Engineered stone and its functional surface treatments," 2009–2012; Principal investigator: Jiří Ludvík, Technistone, a.s., Co–principal invesigator for FCHT ICT: Ing.Libor Mastný, CSc.

- Project MIT FR–TI1/454 – "Nanocatalysts for removal of harmful substances from exhaust gases," 2009–2012; Principal investigator: Dr.Jan Macák, ELMARCO s.r.o., Co–principal investigator for FCHT ICT: as.prof. Ing. Karel Ciahotný, CSc.

"Nanotechnology for Society" programme research projects

- Project AS CR KAN300100801 – "Multifunctional bulk metallic materials with nanocrystalline and ultra–fine grain structure," 1/2008–12/2012; Principal investigator: prof. Ing. Pavel Lejček, DrSc., Institute of Physics AS CR, Prague, Co–principal investigator for FCHT ICT: as.prof. Dr. Ing. Dalibor Vojtěch

- Project AS CR KAN100500651 – "The preparation and study of the properties of organic–inorganic nanocomposite materials prepared by *in situ* emulsion polymerisation," 7/2006–12/2009; Principal investigator: Ing. Zdeňka Sedláková, CSc.,

Institute of Macromolecular Chemistry AS CR, Prague, Co–principal investigator for FCHT ICT: Ing. František Kovanda, CSc.

- Project AS CR KAN400720701 – "Hierarchic nanosystems for microelectronics," 1/2007–12/2009; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals AS CR, Prague, Co–principal investigator for FCHT ICT: as.prof. Ing. Petr Klusoň, Dr.

Other projects

- Project GA CR P204/11/0723 – "Multifunctional self–assembling materials on a nano–level," 2011–2014; Principal investigator: RNDr.Vladimíra Novotná, CSc., Institute of Physics AS CR, Co–principal investigatorfor FCHT ICT: prof. Ing. Jiří Svoboda, CSc.

- Project GA CR 104/08/0435 – "Smart structure mesoporous TiO_2 layers with antibacterial and switchable wetting properties," 1/2008–12/2010; Principal investigator: Ing.Jiří Rathouský, CSc., J. Heyrovský Institute of Physical Chemistry AS CR, Prague, Co–principal investigator for FCHT ICT: as.prof. Dr. Ing. Josef Krýsa

- Project GA CR GA104/07/1400 – "Deposition of oxide catalysts for oxidation of VOC onto preformed supports and their modification using nanoparticles of noble metals," 1/2007–12/2009; Principal investigator: Ing. Květa Jiráková, CSc., Institute of Chemical Process Fundamentals AS CR, Prague, Co–principal investigator for FCHT ICT: Ing. František Kovanda, CSc.

- Project MEYS, Basic Research Centre programme, LC06041 – "The preparation, modification and analysis of materials using energy beams," 3/2006–12/2011; Principal investigator: as.prof. Ing. Vladimír Hnatowicz, DrSc., Nuclear Physics Institute AS CR, Husinec, Řež, Co–principal investigator for FCHT ICT: prof. Ing. Václav Švorčík, DrSc.

- Project MEYS, Research Centre programme, 1M0577 – "A research centre for nano surface engineering," 1/2005–12/2011; Principal investigator: Ing. František Peterka, Ph.D., ATG s.r.o, Prague, Co–principal investigator for FCHT ICT: as.prof. Dr. Ing. Josef Krýsa

- Project MIT FT–TA4/025 "Next generation nanomaterials and their industrial applications," 3/2007–12/2010; Principal investigator: Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, Co–principal investigator for FCHT ICT: as.prof. Dr. Ing. Josef Krýsa

- Project MIT 2A–2TP1/136 – "The use of nanotechnologies for the surface treatment of ropes," 6/2007–5/2010; Principal investigator: Ing. Libor Ganzer, LANEX a.s., Co–principal investigator for FCHT ICT: prof. RNDr. Petr Špatenka, CSc.

c) *<u>Projects involving international cooperation:</u>*

- Project 7FP EU Small type, NMP thematic priority, project name: DoubleNanoMem – "Nanocomposite and nanostructured polymeric membranes for gas and vapour separations," 2009–2012; 10 partners from 6 countries, project budget: EUR 4.16 million, Coordinator: Maria Annunziata Liberti, Consiglio Nazionale Delle Ricerche (Italy), FCHT ICT is a partner in the project.

- Project 7FP EU JTI type, JTI thematic priority, project name: DEMMEA – "Understanding the degradation mechanisms of membrane–electrode–assembly for high

temperature PEMFCs and optimisation of the individual components," 2010–2012; 8 partners from 5 countries, project budget: EUR 3.1 million, Coordinator: Stylianos Neophytides, Advanced Energy Technologies (Greece), FCHT ICT is a partner in the project.

- Project MEYS ME09114 – "Collaboration in Energy and Nanoscience:USA and Europe," 2009, Principal investigator: RNDr.Zdeněk Havlas, DrSc., Institute of Organic Chemistry and Biochemistry AS CR, Co–principal investigator for FCHT ICT: as.prof. Ing. Jaroslav Kvíčala, CSc.

Results in nanotechnologies/cooperation

– Protective metal alloy coatings

– Creation and modification of models for composite material property calculation

– Materials for tissue engineering

– Leucite–based dental composites

– Mixed transient metal oxide catalysts

– Consolidants of artistic stone objects

Experts/field

- as.prof. Ing. Bohumil Bernauer, CSc.– chemical technology, reactor engineering, membrane reactors and processes, process modelling
- as.prof. Ing. Václav Hulínský, CSc.– electron microscopy and microanalysis of inorganic materials (glass, ceramics), TEM, SEM, nanoporous membranes
- as.prof. Ing. Ivan Hüttel, DrSc.– technology of the preparation of passive and active integrated optics elements and structures (semiconductor lasers, optical waveguides, optical sensors)
- as.prof. Ing. František Kovanda, CSc.– monocrystals, crystal cultivation technology, nanocomposite materials
- as.prof. Dr. Ing. Josef Krýsa – photocatalysis, electrochemical and material engineering
- prof. Ing. Jindřich Leitner, DrSc.– thermodynamic properties of mixed oxides, group III–nitrides for applications in electronics and optoelectronics
- prof. Ing. Josef Matoušek, DrSc.– glass chemistry and technology, bioactive nanolayers
- as.prof. Ing. Vladimír Myslík, CSc.– laser technologies for modification and transfer of inorganic and organic substances, preparation of thin layers sensitive to reduction and oxidation atmospheres, study of chemical and electrophysical properties of deposited layers, preparation of chemical conductive sensors and their testing
- prof. Ing. Josef Pašek, DrSc.– organic technologies, zeolite catalysis
- prof. Ing. David Sedmidubský, Dr.– spintronics
- Ing. Jan Šerák, Ph.D. – nanocrystalline materials, plasma nitriding of steel for tools, optimisation and management of aluminium alloys, issues of intermetallic phases in alumium alloys

- prof. Ing. Václav Švorčík, DrSc.– biocompatibility of modified polymers, thin metal films
- as.prof. Dr. Ing. Dalibor Vojtěch – nanocrystalline metals and their alloys, nanocrystalline surface layers, thin Al, Mg, Ti alloys, metal composite materials

3.2.5.2 Faculty of Chemical Engineering (FCE TCI)

Technická 5, 166 07 Prague 6 – Dejvice

www.vscht.cz

A brief description of the Faculty

The Faculty of Chemical Engineering was founded as an independent faculty of TCI Prague in 1960, under the name the Faculty of Automatisation and Economics (FAE). The Faculty is made up of four basic professional departments (processes and apparatuses, chemical and food industry economics and management, mathematics and physics). In 1969 the Faculty was renamed the Faculty of Chemical Engineering (FCE). The Faculty is comprised of seven institutes.

Focus of research and development

Of the two research proposals conducted at the Faculty from 2005–2011, the research proposal MSM6046137307 "**Physicochemical methods of analysis and characterisation of chemical systems and biosystems**," 1/2005–12/2009; contained the most topics from nanotechnology. Principal investigator: prof. Ing. Karel Volka, CSc., For nomenclature – area 5c, the nanotechnology research share equalled 30%

The research activity focused on the acquisition of new or higher–quality physicochemical data characterizing chemical and biological systems with the goal of describing or predicting their thermodynamic properties and phase behaviour, clarifying their chemical composition or structure, designing systems with defined analytic or other utility properties and designing new analytical methods.Research was focused on several areas, the following relate to nanotechnology:

- Phase balances, fluid phase balances in technologically important systems, theoretical, pseudoexperimental and experimental studies of balance and metastable phase transitions in macroscopic and nanostructured systems.
- Processes in phase interfaces and in membranes, on the interphase between two fluid bulk phases and between the solid and fluid phase, long–term biotoxic radionuclide sorption on natural sorbents, the transport of gas mixtures and vapours using polymer membranes, interactions on nanoparticle and film surfaces.

In research FCE has a general focus on process engineering, molecular engineering, bioengineering, analytical and physical chemistry, process management, measurement and control technologies. In 2011 a total of 43 grant research projects were implemented at the Faculty.

In nanotechnologies it is oriented primarily towards researching the preparation and characterisation of analytical, diagnostic and therapeutic nanoparticles, further on researching the preparation and characterisation of nanostructured surfaces and polymer materials.

Research in nanotechnologies

Nanotechnology research is carried out at the following departments:

- Department of Analytical Chemistry (V. Král and B. Dolenský)
- Department of Chemical Engineering (P. Hasal, M. Přibyl, J. Kosek, D. Šnita, J. Lindner and P. Kočí)

The names of scientists working on research in nanotechnologies and nanomaterials are given in parentheses.

The molecular recognition in analytical chemistry group at the **Department of Analytical Chemistry** works on the preparation and characterisation of nanoparticles, modifications of nanoparticles using selective receptors, the preparation of metal–boron nanocluster nanoparticles, the preparation of porphyrin nanoparticles for use in medicine, ceramic nanoparticles with photosensors and functionalisation of dendrimers.

The microsystem laboratory at the **Department of Chemical Engineering** studies transport phenomena in nanostructured systems and conducts theoretical and experimental analyses of chemical and biological processes which can be implemented on a nanoscale. The preparation of structured nanolayers of biologically active molecules and the nanostructures of polymer materials are studied. Atom force microscopy (AFM) is used in the study.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project MEYS 7E09076 – "Nanocomposite and Nanostructured Polymeric Membranes for Gas and Vapour Separations," 2009–2012; Principal investigator: Ing.Karel Friess, Ph.D.
- Project MEYS MEB061108 – "The development of chitosan based biomedical polymers with antibacterial properties," 2011–2012; Principal investigator: as.prof. Ing. František Štěpánek, Ph.D.
- Project GA CR GA203/09/0675 – "The use of gold nanoparticles in capillary electrophoresis and capillary electrochromatography," 2009–2011; Principal investigator: Dr. RNDr. David Sýkora, Co–principal investigators: RNDr. Václav Kašička, CSc., Institute of Organic Chemistry and Biochemistry AS CR, and as.prof. Ing. Ivan Mikšík, DrSc., Physiological Institute AS CR
- Project GA CR GA203/08/0217 – "Measurement of vapour pressure of metal organic and related precursors for use in nanostructure production," 2008–2010; Principal investigator: prof. Ing. Vlastimil Růžička, CSc., Co–principal investigator: as.prof. Ing. Eduard Hulicius, CSc., Institute of Physics AS CR
- Project GA CR GAP106/10/1568 – "Optimisation of transport and catalytic properties of porous materials on the micro– and nano–scale using 3D digital reconstruction," 2010–2013; Principal investigator: Ing.Petr Kočí, Ph.D.
- Project GA CR GA104/09/1810 – "The mechanism gas–liquid mass transfer.The effects of diffusivity and solid micro– and nanoparticles," 2009–2011; Principal investigator: Ing. Michal Kordač, Ph.D.

- Project GA CR GA104/07/1127 – “Mathematical modelling and experimental study of the evolution of the mesoscopic structure of polymer materials,” 1/2007–12/2009; Principal investigator: Ing. Juraj Kosek, Dr.

- Project GA CR GA203/08/1445 – “Functional molecular tweezers on bis Trögers bases,” 1/2008–12/2010; Principal investigator: Ing. Bohumil Dolenský, Ph.D.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project GA CR GAP108/11/1298 – “Detection layers based on composites of organocomplexes and nanoparticles for chemical sensors,” 2011–2014; Principal investigator: Ing. Jiří Bulíř, Ph.D., Institute of Physics AS CR, Co–principal investigator for FCE: as.prof. Ing. Martin Vrňata, Dr.

- Project GA CR GA203/09/0422 – “The study of photochemical processes in free nanoparticles with atmospheric and biophysical relevance,” 2009–2013; Principal investigator: Mgr. Michal Fárník, Ph.D., J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for FCE: as.prof. RNDr. Petr Slavíček, Ph.D.

- Project MIT FR–TI3/521 – “Technology of the preparation of new magnetic nanoparticles for diagnostics and therapy in oncology,” 2011–2015; Principal investigator: Ing. Jiří Zelenka, CSc., SYNPO, a.s., Co–principal investigator for FCE: prof. RNDr. Vladimír Král, DrSc.

- Project MIT FR–TI1/548 – “Pilot project for manufacturing of nanoparticles of oxides and mixed oxides of Zr, Ti, Al, Li and Mn,” 2009–2012; Principal investigator: prof. Ing. Bohuslav Doležal, CSc., Co–principal investigator for FCE: Ing.Vladimír Ždímal, CSc.

- Project AS CR KAN200100801 – "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and drug delivery," 1/2008–12/2012; Principal investigator – prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics AS CR, Prague, Co–principal investigator for FCE: prof. RNDr. Vladimír Král, DrSc.

- Project AS CR KAN208240651 – “Study of interactions of biological macromolecules and nanolayers with a view to research of polymer microfluid biosensors and therapeutic nanoparticles,” 7/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for FCE: as.prof. Ing. Pavel Hasal, CSc. The task of FCE was the study of the interactions of biological macromolecules and nanolayers with a focus on polymer microfluid biosensors and therapeutic nanoparticles.

Experts/field

- as.prof. Ing. Pavel Hasal, CSc.– nanostructured microfluid and polymer systems

- Ing.Juraj Kosek, Ph.D. – characterisation and modelling of nanostructured materials

- prof. RNDr. Vladimír Král, CSc.– molecular recognition

- as.prof. Ing. Dalimil Šnita, CSc.– production and characterisation of nanostructured materials and systems

3.2.5.3 Faculty of Food and Biochemical Technology (FFBT ICT)

Technická 5, 166 07 Prague 6 – Dejvice

www.vscht.cz

A brief description of the Faculty

The Faculty of Food Technology was established in 1952 as one of the three faculties of the independent Institute of Chemical Technology, Prague. The Faculty has had the name it uses to this day since 1969.

Focus of research and development

Research and development at the Faculty is carried out at seven departments:

- Department of Fermentation Chemistry and Bioengineering
- Department of Biochemistry and Microbiology
- Department of Carbohydrate Chemistry and Technology
- Department of Dairy and Fat Technology
- Department of Food Chemistry and Analysis
- Department of Food Preservation and Meat Technology
- Department of Chemistry of Natural Compounds

In 2011 a total of 90 programme research projects were implemented at the Faculty.

Projects implemented in nanotechnologies

a) *Projects involving international cooperation:*

- Project 7FP EU Small type, KBBE+NMP thematic priority, project name: NANOLYSE – "Nanoparticles in Food: Analytical methods for detection and characterisation," 2010–2012; 10 partners from 8 countries, project budget: EUR 4.05 million, Coordinator: Jelte Zeilstra, Stichting Dienst Landbouwkundig Onderzoek, Netherlands, FBBT ICT is a partner in the project; Principal investigator: prof.Ing.Jana Hajšlová, CSc. The project was also supported from national sources as part of the MEYS 7E10038 project.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project MEYS 2B08062 – "Genetic and physiological manipulation with bacterial degraders of aromatic pollutants and their application," 2008–2011; Principal investigator: Ing. Miroslav Pátek, CSc., Institute of Microbiology AS CR, Co–principal investigator for FBBT ICT: prof. RNDr. Vladimír Jirků, DrSc.

- Project GA CR GAP304/10/1951 – "Nanoliposomes for the development of recombinant vaccines and targeted immunotherapies," 2010–2013; Principal investigator: RNDr. Jaroslav Turánek, CSc., Research Institute of Veterinary Medicine, Co–principal investigator for FBBT ICT: prof. RNDr. Pavel Drašar, DSc.

Experts/field

- prof. Ing. Zdeněk Bubník, CSc.– food processes

- prof. Ing. Jana Čopíková,CSc.– analysis of saccharides and polysaccharides
- as.prof. Ing. Ladislav Čurda, CSc.– dairy chemistry and technology
- prof. Ing. Vladimír Filip, CSc.– chemistry and technology of fats, detergents and cosmetics
- as.prof. Ing. Marie Hrušková, CSc.– cereal technology and rheology laboratory

3.2.6 UNIVERSITY OF WEST BOHEMIA IN PILSEN (UWB)

Univerzitní 8, 306 14 Pilsen, ID: 49777513

www.zcu.cz

The University of West Bohemia in Pilsen (UWB) was established 28 September 1991. It merged the already existing University of Mechanical Engineering and Electrical Engineering and the Pedagogical Faculty in Pilsen. The University of Mechanical Engineering and Electrical Engineering had been founded in 1949 as part of the Czech Technical University in Prague. In 1960 it was divided into two faculties – mechanical and electrical engineering.Two new faculties – applied sciences and economics were created in 1990. At the present time UWB has seven faculties. It is the only institution of higher learning in the West Bohemia region to prepare experts in the fields of: mechanical engineering, electrical engineering, informatics, applied mathematics, physics and mechanics, economics, education, philosophy, philology, social and cultural anthropology, archaeology, law and public administration. Research is also carried out in the above fields to the extent of the university's capabilities. Nanotechnology research is carried out to a limited degree at the Faculty of Applied Science and the Faculty of Mechanical Engineering.

3.2.6.1 Faculty of Applied Science (FAS UWB)

Univerzitní 22, 306 14 Pilsen

www.fav.zcu.cz

A brief description of the Faculty

The Faculty of Applied Science UWB was founded in 1990. It is an engineering–natural science faculty. Scientific research activities are carried out in informatics and computer science, mathematics, cybernetics, physics and mechanics. The Faculty is divided into five departments. The Department of Physics (head: J. Vlček) and to a limited extent the Department of Mechanics (head: V. Laš) are engaged in nanotechnologies.

Focus of research and development

From 2005–2011 three research proposals were implemented at FAS UWB, two of which were focused to a certain extent on nanotechnology.

Research proposalMSM4977751302 – "**Processes in discharge plasma and new thin layer materials with unique properties**," 1/2005–12/2010; Principal investigator: prof. RNDr. Jaroslav Vlček, CSc.; total costs for the entire period of the project equalled CZK 76.379 million, CZK 67.330 million of which was from the state budget. For nomenclature – area 6b, the nanotechnology research share equalled 20%.

The research proposal focused on the solution of basic problems in discharge plasma physics, plasma chemistry, surface physics and engineering, thin layer physics, solid state physics, electrical engineering and vacuum technology in connection with the use of thin layer materials with unique physical and functional properties. These materials were prepared in particular using unconventional processes in discharge plasma of various types, primarily magnetron or microwave discharge. Attention was devoted primarily to modelling and diagnostics of imbalanced discharge plasma, study of the processes of layer growth and surface modification, design and research of new plasma sources for thin layer deposition and surface modification, characterization of surfaces created and also the study of thermomechanical processes in materials. Research activity was focused principally on new nanostructured thin layer materials, new thin layer materials on ternary and quaternary systems of carbon, silicon, boron, nitrogen and other materials.

Research proposalMSM4977751303 – "**Prediction of failures of heterogeneous materials and components of mechanical and biomechanical systems**," 1/2005–12/2011; Principal investigator: prof. Ing. Vladimír Zeman, DrSc.; total costs for the entire period of the project equalled CZK 62.846 million, CZK 60.346 million of which was from the state budget. For nomenclature – area 6b, the nanotechnological research share equalled 5%.

The research proposal was focused on investigating processes of the breakdown of heterogeneous materials and selected components of mechanical and biomechanical systems.The breakdown processes were examined comprehensively using analytical, numerical and experimental methods from macroscopy to microscopy to achieve their connection in the calculation model. Reasons for breakdown were sought on macroscopic scales with the goal of minimizing the risk of the occurrence of failures. The subject of the research proposal was the investigation of a structure breakdown under dynamic loads, live organism tissue damage by breakdown of cohesiveness on a cellular level, according to macro loading or chemical and physiological processes and of dynamic properties of selected complex mechanical systems.

Research in nanotechnologies

The study of nanostructured materials (layers) has been one of the main fields of the **Department of Physics** for almost 20 years.Research in the technology of layer preparation (magnetron sputtering, unconventional plasma processes) as well as research in the properties of such layers are carried out. The goal of work is the practical application of results achieved. The main researchers are: J. Musil, J. Vlček and P. Zeman.

At the **Department of Mechanics** in the Microstructure Mechanics Division Ing. Olga Bláhová, Ph.D. is involved in the mechanical properties of micro– and nanolayers.

In 2011 a total 62 programme research projects were implemented at the FAS UWB.These include the project ED1.1.00/02.0090 N**TIS – "New technologies for the information society**" in the framework of which a modern European excellence research centre should be built from 2011–2014 at a cost of CZK 822 million (from structural funds of the Operational Programme Research and Development for Innovation). The research focus of the centre is oriented towards cybernetics and informatics, and concentrates on intelligent decision–making, automatic control, speech synthesis, clever design and biomechanical models, that is on the key disciplines for modern cybernetic, information, communication and mechatronic technology development. The other direction focuses on material research, in which nanostructured thin layer materials on a plasma technology base development is highlighted. A new building for centre offices and laboratories with a total useful area of 12,269 m^2

should be built as part of the project. In the final phase it is planned that approximately 180 research and specialised employees will work in the centre, 70 of these positions will be newly created jobs. Another goal of the project is the creation of a network of cooperating research institutions abroad and in the Czech Republic.The partner's project is the Research Institute of Geodesy, Topograhy and Cartography.

Another major investment project which the Faculty is involved in is the project ED.4.1.00/04.0192 –**CTPVV**, in the framework of which a new educational centre building for the further development of the Faculty of Applied Science at UWB, Pilsen, is to be built and equipped, primarily for the doctoral and connected master's study programmes at FAS. The centre is to be built from 2011–2014 at a cost of CZK 377.2 million (from the structural funds of the Operational Programme Research and Development for Innovation).

Projects implemented in nanotechnologies

- Project 7FP EU Large type, NMP thematic priority, project name:N2P – "Flexible production technologies and equipment based on atmospheric pressure plasma processing for 3D nano structured surfaces," 2008–2012; 22 partners from 8 countries, project budget:EUR 10.47 million, Coordinator: Walter Krause, Fraunhofer–Gesselshaft zur Foerderung Der Angewandten Forschung e.v., Germany, FAS UWB is a partner in the project, Principal investigator for FAS UWB: prof. Ing. Jindřich Musil, DrSc. The project was also supported from national sources as part of the MEYS 7E09039 project.

- Project MIT 2A–1TP1/037 – "Nuclear power plant safety in the event of LOCA–type emergencies," 2006–2011; Principal investigator: Ing.Olga Bláhová, Ph.D., FAS UWB, Co–principal investigator: Ing. Karel Kloc, CSc., UJP Praha a.s.

- Project GA CR GAP108/11/0853 – "Nanostructures with transition metals: Towards ab–initio material design," 2011–2015; Principal investigator: RNDr. Ondřej Šipr, CSc., Institute of Physics AS CR, Co–principal investigator for FAS UWB: Ing. Robert Cimrman, Ph.D.

Experts/field

- Ing. Olga Bláhová, Ph.D. – mechanical properties of micro– and nanolayers, nanoindentation

- prof. Ing. Jindřich Musil, DrSc.– nanostructured and nanocomposite layers, PVD, CVD sputtering methods, technology for the preparation of layers with controlled grain dimension in the scope of 1–10 nm

- prof. RNDr. Jaroslav Vlček, CSc.– plasma physics, plasma chemistry, thin layer physics and solid state physics

- Ing. Petr Zeman, Ph.D. – nanocrystallisation from a solid state

3.2.6.2 Faculty of Mechanical Engineering (FME UWB)

Univerzitní 22, 306 14 Pilsen

www.fst.zcu.cz

A brief description of the Faculty

The Faculty of Mechanical Engineering UWB in Pilsen is one of the oldest faculties at the Pilsen universities.Its beginnings reach back to 1949. The basic mechanical engineering disciplines are taught here, and research and development activities in them also take place. In 2011 the Faculty was divided into five field departments, two research centres and the Regional Institute of Technology (RIT).

Focus of research and development

From 2005–2011 research at FME was focused on the solution of a number of problems in mechanical engineering, particularly as part of MEYS projects in the "Research Centres" programme.

- 1M0507 – "Research of Production Engineering Techniques and Technologies," 1/2005–12/2011; Principal investigator–Coordinator: prof. Ing. Jaromír Houša, DrSc.
- 1M0519 – "Research Centre of Rail Vehicles," 1/2005–12/2011; Principal investigator–Coordinator: as.prof. Ing. Petr Heller, CSc.
- 1M06032 – "Research Centre of Forming Technology – FORTECH," 3/2006–12/2011; Principal investigator–Coordinator: prof. Dr. Ing. Bohuslav MašekThe issues resolved at this centre have a certain connection with nanotechnology (the creation of ultra–fine grain structure using extreme plastic deformation).

In 2011 a total 30 programme research projects were implemented at the Faculty.These included Project **ED2.1.00/03.0093 – Regional Institute of Technology – RIT**. Within its framework a regional research centre is to be built at the Faculty from 2011–2014 at a cost of CZK 455.5 million. The centre is to be involved in calculation and experimental support of designing modern vehicle structures and manufacturing machines and equipment as well as on research, development and optimisation of machining production technologies.

Research in nanotechnologies

To a limited extent this is carried out in the Faculty at the **Department of Materials and Mechanical Metallurgy** (head: prof. Ing. Václav Mentl, CSc.). The department's scientific research activities are focused on the structure of metal and non–metal materials, their mechanical properties and heat processing, formability of difficult–to–form materials, including the numerical simulation of forging and heat processing, special welding methods, unconventional methods for casting and engineering of thin layers and surfaces. The evaluation of the mechanical properties of thin layers and nanostructured materials using the nanoindentation method is connected with nanotechnology research, as well as research of bulk materials containing nanoscale structured phases. Research in biodegradable nanocomposites and inorganic–organic hybrid systems is a chapter in its own right. The following researchers are involved in nanotechnology research: J. Zrník, A. Kříž, O. Bláhová, P. Duchek and I. Štěpánek.

At the **Department of Machine Design** (head: as.prof. Ing. V. Lašová, Ph.D.) research in the application of unconventional methods in the design of machines focused on the use of composite matrices modified using nanoparticles takes place.

Projects implemented in nanotechnologies

- Project GA CR GA101/08/0299 – "Research of smart composite elements of manufacturing machines from ultra high modulated fibres and matrices modified using nanoparticles," 2008–2011; Principal investigator: as.prof. Ing. Václava Lašová, Ph.D., FME UWB, Co–principal investigator: Ing.Ondřej Uher, Ph.D., Compo Tech PLUS, spol s r.o., prof. Ing. Milan Růžička, CSc.,CTU in Prague/Faculty of Machine Engineering
- Project AS CR IAAX08240901 – "New inorganic–organic hybrid nanomaterials," 2009–2013; Principal investigator: prof. Ing. Pavel Lhoták, CSc., ICT, Co–principal investigator for FME UWB: as.prof. Ing. Petr Duchek, CSc.
- Project MIT FR–TI1/566 – "Research and development of high value–added nanocomposite biologically degradable materials," 2009–2013; Principal investigator: Ing. Eva Slavíková, LYCKEBY AMYLEX, a.s., Co–principal investigator for FME UWB: as.prof. Ing. Petr Duchek, CSc.

Experts/field

- as.prof. Olga Bláhová, Ph.D. – mechanical properties of micro– and nanolayers, properties of materials in micro– and nano–volumes, nanoindentation
- as.prof. Ing. Petr Duchek, CSc.– the preparation of inorganic–organic hybrid materials with a clay component, nanocomposite biodegradable materials based on natural substances
- as.prof. Dr. Ing. Antonín Kříž – thin wear–resistant layers, their analysis (tribology, microhardness, structure, adhesive–cohesive properties) and industrial applications
- RNDr. Ivo Štěpánek – thin layer deposition optimisation particularly using PVD technologies, properties and behaviour (particularly mechanical) of thin layer systems – substrate and in sites on the surface of materials in micron and submicron to nanometric areas, particularly nanoindentation measuring, nanoindentation
- prof. Ing. Jozef Zrník, CSc.– metal forming by severe plastic deformation (ECAP), metal alloys

3.2.7 TECHNICAL UNIVERSITY OF LIBEREC (TUL)

Studentská 2, 461 17 Liberec, ID: 46747885

www.tul.cz

The Technical University of Liberec is a successor to the Mechanical Engineering University, which was founded in 1953 and offered studies at a single faculty – the Faculty of Mechanical Engineering. In 1960 the establisment of the Faculty of Textile Engineering followed. The Mechanical Engineering University thereby became unique in the training of university–educated professionals for the textile industry, which it retains in Liberec to this

day. From 1990–1995 an additional four faculties (pedagogical, economic, architecture and the faculty of mechatronics) were added to the original two (mechanical engineering and textile). In 2004 the Institute of Healthcare Studies was added as a separate unit at TUL.In this way the spectrum of study programmes offered was significantly increased. The Technical University in Liberec has gradually been transformed from a solely technically oriented institute of higher education to a renowned university, which connects technical education and education in the humanities and natural sciences. Nanotechnology research is carried out at the following faculties:

- Faculty of Mechanical Engineering
- Faculty of Textile Engineering
- Faculty of Education
- Faculty of Mechatronics and Interdisciplinary Engineering Studies

In 2009 at TUL the **Institute for Nanomaterials, Advanced Technologies and Innovation** (www.cxi.tul.cz) was created. It is implementing the Centre for Nanomaterials, Advanced Technologies and Innovation project.Total costs: CZK 910 million, Project implementation: 2009–2013. The project connects technical laboratories from TUL and their cooperation with important entities from the application sphere. The Centre focuses on material research and competitive mechanical engineering with an emphasis on the practical applicability of results from R&D.

The goal of the project is to expand the existing research and development infrastructure and equip it with top level research equipment so as to ensure at TUL long–term sustainable growth in material research, including research in nanomaterials and competitive mechanical engineering.

The Centre's management team:

- as.prof. Ing. Petr Tůma, CSc.– Director of the Institute
- prof. Ing. Jaroslav Beran, CSc.– head of the research programme in competitive mechanical engineering
- prof. Ing. Petr Louda, CSc.– head of the research programme in material research

3.2.7.1 Faculty of Mechanical Engineering (FME TUL)

Studentská 2, 461 17 Liberec

www.fs.tul.cz

A brief description of the Faculty

The Faculty of Mechanical Engineering is the oldest faculty at the Technical University of Liberec. It provides university education in undergraduate, master's and doctoral study programmes. Teaching and scientific research activities are carried out in the fields of mechanical engineering technology, applied mechanics, machine and equipment design, manufacturing systems and processes and automatic control systems in mechanical engineering. The strategic directions of science, research and development are material engineering, competitive machines, equipment and mobile resources, progressive technological and manufacturing processes, and energy accumulation and transfer. The

Faculty has 11 departments and the necessary laboratory facilities which enable it to implement complex research and development projects. It works extensively with businesses in industry, through which it realises the transfer of research results into practical applications.

Focus of research and development in nanotechnology

Research and development at FME TUL is concentrated in several thematic units in nanotechnology:

Research in nano surface engineering (prof. Ing. Petr Louda, CSc, prof. RNDr. Petr Špatenka, CSc., Ing.Aleš Kolouch, Ph.D.**)**.

- Development of machine mechanisms for nanofibre manufacture, in particular from polymer melts and inorganic nanofibres.Research in 3D nanofabrics and manufacturing equipment. (prof. Ing. Ladislav Ševčík, CSc. and Ing.Martin Konečný, Ph.D.)
- Research and development of equipment producing nanofibre and nanofibre layers for medical and special applications (prof. Ing. Jaroslav Beran, CSc.)
- Development of nanofilters for protective masks and equipment for manufacture of these filters (prof. Ing. Jaroslav Beran, CSc., prof. Ing. Ladislav Ševčík, CSc., as.prof. Ing. Martin Bílek, Ph.D. and prof. Dr. Ing. Petr Lenfeld)
- Research and development of nanocomposites, use of clay nanoplates (montmorillonite) as filler for synthetic matrices for improving useful properties, ultrasound assessment of the weldability of such nanocomposites. (prof. Dr. Ing. Petr Lenfeld)
- The use of carbon nanotubes for practical applications. (prof. Dr. Ing. Petr Lenfeld)
- The use of nanomaterials in energy generation facilities (enthalpic heat exchanger) and use of nanofluids for intensification of heat transfer. (as.prof. Ing. Václav Dvořák, Ph.D., as.prof. Ing. Tomáš Vít, Ph.D.)
- Micromanipulator development for nanofibre manufacturing by tensile extrusion (Ing.Michal Moučka, Ph.D.)

Projects implemented in nanotechnologies

a) *Projects implemented by the Faculty:*

- Project TA CR TA01010946 – "Research in the useful properties and possibilities for application of polymer materials with natural fillers and nanofillers based on synthetic and PLA matrices," 2011–2013; Principal investigator: Dr. Ing. Petr Lenfeld, Co–principal investigator: Ing. Zdeněk Severa, Ph.D., Magna Exteriors & Interiors (Bohemia) s.r.o.
- Project Ministry of Interior VG20122014078 – "Applied research of new generation protective masks with nanofilters to improve protection of persons from the structural, technological and material perspective," 2012–2014; Principal investigator: prof. Dr. Ing. Petr Lenfeld
- Project MEYS ME10145 – "Modification of nanofibre materials by plasma technologies for biological applications," 2010–2012; Principal investigator: prof. Ing. Petr Louda,

CSc., Co–principal investigator: RNDr. Evžen Amler, CSc.Charles University in Prague/2nd Faculty of Medicine

b) *Projects on whose implementation the Faculty is cooperating:*

- Project MIT FR–TI3/845 – "Technology for manufacturing inorganic nanofibres," 2011–2014; Principal investigator: Ing. Jan Čmelík, ELMARCO, Co–principal investigator for FME TUL: prof. Ing. Ladislav Ševčík, CSc.

- Project MIT FR–TI3/373 – "Research and development of new sub–ledeburite steel tools for wood working with improved efficiency," 2011–2014; Principal investigator: Ing. Jiří Krejčík, CSc., SVÚM a.s., Co–principal investigator for FME TUL: prof. Ing. Petr Louda, CSc.

- Project MIT FR–TI1/103 – "Research of technologies for application of sandwich–type coating with nanostructures oriented for press tools using the PA CVD method," 2009–2013; Principal investigator: Ing Slavomír Hořejš, CSc.,VÚHŽ a.s., Co–principal investigator for FME TUL: prof. Ing. Petr Louda, CSc.

- Project MIT FR–TI3/451 – "Productive technologies for production of nanofibres," 2009–2012; Principal investigator: Ing. Jan Čmelík, ELMARCO, Co–principal investigator for FME TUL: prof. Ing. Ladislav Ševčík, CSc.

- Project MIT 2A–3TP1/120 – "Equipment for nanofibre preparation from polymer melts," 4/2008–12/2011; Principal investigator: Ing.Jan Čmelík, ELMARCO, Co–principal investigator for FME TUL: prof. Ing. Ladislav Ševčík, CSc.

- Project MIT 2A–1TP1/113 – "Design of special textile machines for manufacturing nanofibres," 11/2006–12/2009; Principal investigator: Ing. Jan Čmelík, ELMARCO, Co–principal investigator for FME TUL: prof. Ing. Ladislav Ševčík, CSc.

- Project TA CR Alfa TA 01020313 – "Enthalpic heat air–air exchanger development," 2011–2014; Principal investigator: C2W s.r.o., Co–principal investigator: FME TUL

- Project MEYS, Operational Programme Research and Development for Innovation, ED0005/01/01 – "Centre for Nanomaterials, Advanced Technologies and Innovation," 2009–2013; Principal investigator: as.prof. Ing. Petr Tůma, CSc., TUL, Co–principal investigator: FME TUL

- Project MEYS EE2.3.09.0109 – "Communication skill development in science using the NANO model pilot project," 2009–2012; Principal investigator: Petra Rydalová, TUL, Co–principal investigator: FME TUL

- Project MEYS, Research Centre Programme, 1M0577 – "A research centre for nano surface engineering," 1/2005–12/2011; Principal investigator: Ing.František Peterka, Ph.D., ATG s.r.o., Prague, Co–principal investigator for FME TUL: Ing.Aleš Kolouch, Ph.D.

- Project GA CR GAP108/10/1296 – "Development and characterisation of active hybrid fabrics with integrated micron diameter NiTi fibres with a nano grain structure," 2010–2012, Principal investigator: Ing. Luděk Heller, Ph.D., Institute of Physics AS CR, Co–principal investigator for FME TUL: prof.Ing.Bohdana Marvalová, CSc.

- "Innovation and development of nanomaterial studies at the Technical University in Liberec," Principal Investigator: prof.Šedlbauer, TUL, Co–principal investigator for FME TUL: prof. Ing. Petr Louda, CSc.
- "Education and contact centre for industrial nanotechnological surface treatments," Recipient: Masaryk University, Brno/Faculty of Sciences, Co–principal investigator for FME TUL: prof. RNDr. Petr Špatenka, CSc.
- Project MIT OPPI –"NANOPROGRESS Cluster Project," Co–principal investigator for FME TUL: prof. Ing. Jaroslav Beran, CSc.

Experts/field

- prof. Ing. Jaroslav Beran, CSc.– design of machines and equipment for nanofibre and nanofibre layer manufacturing
- as.prof. Ing. Václav Dvořák, Ph.D.– nanomaterial application in energy generation facilities
- Ing. Aleš Kolouch, Ph.D. – surface engineering
- prof. Dr. Ing. Petr Lenfeld – nanocomposite manufacturing technologies
- prof. Ing. Petr Louda, CSc.– plasma technologies, thin layer properties
- prof. Ing. Ladislav Ševčík, CSc – design of machines and equipment for nanofibre manufacturing
- prof. RNDr. Petr Špatenka, CSc.– plasma technologies, deposition of biocompatible layers

3.2.7.2 Faculty of Textile Engineering (FT TUL)

Studentská 2, 461 17 Liberec

www.ft.tul.cz

A brief description of the Faculty

FTE TUL was created in 1960 under the influence of the textile industry tradition in the region. At the present time it provides teaching and research of comprehensive issues in fabrics. The Faculty has eight departments. Researchers at the Department of Nonwovens are engaged in nanotechnologies.

Focus of research and development

From 2005–2011 research and development at FT TUL took place within the framework of two research centres – "Textile II" and the "Centre for Quality and Reliability" – and several grant projects focused for the most part on nanotechnology – research and manufacture of nanofibres and nanofabrics.

Nanotechnology research is carried out at the **Department of Nonwovens** (head: prof. RNDr. David Lukáš, CSc., researchers: O. Jirsák, J. Hrůza, K. Kalinová), and to a less extent at the **Department of Textile Materials** (head: Ing.Jakub Wiener, Ph.D.).

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project MEYS MEB041008 – "Manufacturing composite nanofibres and their use as composite system reinforcements," 2010–2011; Principal investigator: as.prof. Ing. Lenka Martinová, CSc.

- Project MEYS MEB040704 – "The study of nanofibrous materials and their use for carbonisation and composite material preparation," 1/2008–12/2008; Principal investigator: prof. RNDr. David Lukáš, CSc.

- Project GA CR GP106/07/P044 – "Transport and absorption of sound in nanofibre assemblies," 1/2007–12/2009; Principal investigator: Ing. Klára Kalinová, Ph.D.

b) *Projects on whose implementation the Faculty is cooperating:*

Projects of GA CR

- Project GA CR 106/09/1378 – "Micro– and nanofibres from biodegradable polymers," 2009–2012; Principal investigator: as.prof. Ing. Jiří Brožek, CSc., FCHT ICT, Co–principal investigator for FT TUL: Ing. Lenka Martinová, CSc.

- Project GA AS CR IAA500390702 – "Scaffolds from nanofibre materials with inbuilt liposomes," 1/2007–12/2011; Principal investigator: as.prof. RNDr. Evžen Amler, CSc., Institute of Experimental Medicine AS CR, Prague, Co–principal investigator for FT TUL: prof. RNDr. David Lukáš, CSc.

- Project GA CR GA203/08/0831 – "Nanotissues producing singlet oxygen," 1/2007–12/2010; Principal investigator: RNDr. Jiří Mosinger, Ph.D., Charles University in Prague/Faculty of Science, Co–principal investigator for FT TUL: prof. RNDr. Oldřich Jirsák, CSc.

- Project of GA CR GA304/07/1129 – "Polarised cultures of hepatocytes and mesenchymal cells on nanofibre layers in the experimental bioreactor," 1/2007–12/2009; Principal investigator: prof. MUDr. Miroslav Ryska, CSc., Charles University in Prague/2nd LF, Co–principal investigator for FT TUL: prof. RNDr. Oldřich Jirsák, CSc.

Other projects

- Project AS CR IAA500390702 – "Scaffolds from nanofibre materials with inbuilt liposomes," 2007–2011; Principal investigator: as.prof. RNDr. Evžen Amler, CSc.,Institute of Experimental Medicine AS CR, Prague, Co–principal investigator for FT TUL: prof. RNDr. David Lukáš, CSc

- Project AS CR KAN101630651 – "Preparation of nano–films and nano–coatings on fabrics using plasma surface treatment at atmospheric pressure," 7/2006–12/2010; Principal investigator: prof. RNDr. Mirko Černák, CSc., Masaryk University in Brno/Faculty of Sciences, Co–principal investigator for FT TUL: as.prof. Ing. Jakub Wiener, Ph.D.

- Project MIT FT–TA5/007 – "Advanced research in nanomaterials for fabrics," 3/2008–11/2010; Principal investigator: Ing.Antonín Mlčoch, České technologické centrum pro anorganické pigmenty a.s., Přerov, Co–principal investigator for FT TUL: as.prof. Ing. Jakub Wiener, Ph.D.

Experts/field

- Ing. Jakub Hrůza – fibrous filter, filtration properties of fibrous materials
- prof. RNDr. Oldřich Jirsák, CSc.– nonwoven fabrics, technical fabrics, fibres, nanofibres
- prof. RNDr. David Lukáš, CSc.– material engineering of nonwoven fabrics, fabrics for healthcare
- as.prof. Ing. Jakub Wiener, Ph.D. – dyeing – theoretical and practical aspects, optical behaviour of textile systems

3.2.7.3 Faculty of Science, Humanities and Education (FE TUL)

Studentská 2, 461 17 Liberec

www.fs.tul.cz

A brief description of the Faculty

The tradition of teacher training in Liberec extends back more than 200 years. Teachers were systematically prepared here for their careers starting in 1779 at "preparands." On 16 September 1892 the first year of the Teaching Institute was ceremoniously initiated at Keil Hill. In 1990 the tradition of teacher training was renewed in Liberec when the Faculty of Education was opened as part of the Technical University in Liberec (originally the Mechanical Engineering University).

Focus of research and development

Research in sol–gel base sensors at nanometric sizes is conducted at the Department of Chemistry under as.prof.Ing. P. Exnar, CSc. This research involves cooperation on international research projects.

Projects implemented in nanotechnologies

- Project MEYS EUREKA programme OE 222 (E!3653 SENSIT) – "Sensor systems for smart fabrics," 3/2006–12/2010; Principal investigator: Ing.Pavol Ozaňák, TESLA BLATNÁ, a.s., Co–principal investigator for FE TUL: as.prof. Ing. Petr Exnar, CSc., FE TUL developed sensor layers for indication of moisture and hazardous gases and measured the properties of sensors with these layers.
- Cooperation on Project 6FP EU NAPOLYDE – "Nano–Structured Polymer Deposition Processes for Mass Production of Innovative Systems for Energy Production & Control and for Smart Devices," Coordinator: Patrick Chequet, Recherche e Développement du Groupe Cockerill Sambre, Liege, Belgium, FE TUL organised development of substrates and manufacture of sensors through the company ELCERAM a.s., Co–principal investigator for FE TUL: as.prof. Ing. Petr Exnar, CSc.

Expert/field

- as.prof. Ing. Petr Exnar, CSc. sensor systems using nanolayers

3.2.7.4 Faculty of Mechatronics and Interdisciplinary Engineering Studies (FM TUL)

Studentská 2, 461 17 Liberec

A brief description of the Faculty

The Faculty of Mechatronics and Interdisciplinary Studies was created in 1995 as a faculty focused primarily on fields combining technical disciplines (electronics, control, measurement) with informatics and natural sciences (mathematical modelling). FM TUL is divided into 4 departments.

Focus of research and development

Scientific and creative activities at the Faculty are focused on basic and applied research. The key areas of the Faculty's interest are: electrical engineering, electronics, control technologies, measurement technologies, information technologies, artificial intelligence, mechatronics, mathematical modelling processes, natural science engineering. In 2011 a total 72 programme research projects were implemented at FM TUL.

Research in nanotechnology is focused on researching elementary nano–iron and its use in water treatment; researching the surface functionalisation abilities of nanofibres and their use as filters, catalysts or carriers of biological materials; risks and toxicity of nanomaterials. The University also prepares students for practical work in nanomaterials, and since 2008 has offered the specialised field of nanomaterials. Nanotechnology research is carried out at the Department of New Technologies and Applied Informatics (head: prof. Dr. Ing. Jiří Maryška).

Projects implemented in nanotechnologies

- Project MIT FR–TI3/622 – "Development and use of diffuse reactive barriers based on micro–Fe and nano–Fe for remediation," 2011–2014; Principal investigator: RNDr. Jaroslav Hrabal, MEGA, a.s., Co–principal investigator for FM TUL: as.prof. Dr. Ing. Miroslav Černík, CSc.

- Project TA CR TA01021792 – "Development of combined nano–bio technology for remediation up chromium contamination," 2011–2014; Principal investigator: RNDr.Jan Němeček, ENACON s.r.o., Co–principal investigator for FM TUL: as.prof. Dr. Ing. Miroslav Černík, CSc.

- Project TA CR TA01021304 – "Application of electrical field for remediation of sites contaminated by organic pollutants," 2011–2013; Principal investigator: RNDr. Jaroslav Hrabal – MEGA, a.s., Co–principal investigators for FM TUL: as.prof. Dr. Ing. Miroslav Černík, CSc. and Ing.Jaroslav Nosek, Ph.D.

- Project TA CR TA01020348 – "Reversible storage of energy in the rock massif," 2011–2014; Principal investigators: Mgr. Michal Vaněček, Mgr. Jana Michálková, RNDr. Dagmar Trpkošová, ISATech, s.r.o., Co–principal investigator for FM TUL: as.prof.Ing.Miroslav Černík, CSc.

- Project MEYS – "Research centres" programme 1M0554 "Advanced remedial technologies and processes (ARTEC)," 1/2005–12/2011; Principal investigator: prof. Dr.

Ing. Jiří Maryška, FM TUL.The use of elementary nano–iron for in situ remediation was researched.

- Project MEYS 2B08062 – "Genetic and physiological manipulation with bacterial aromatic pollutant degraders and their application," 2008–2011; Principal investigator: Ing. Miroslav Pátek, CSc., Institute of Microbiology AS CR, Co–principal investigator for FM TUL: as.prof. Dr. Ing. Miroslav Černík, CSc.
- Project 7FP EU Small type, ENV+NMP thematic priority, project name: NAMETECH – "Development of intensified water treatment concepts by integrating nano– and membrane technologies," 2009–2012; 11 partners from 8 countries, project budget: EUR 2.87 million, Coordinator: Inge Genné, Vlaamse Instelling Voor Technologisch Onderzoek N.V.(Belgium), FM TUL is a partner of the project.

Expert/field

- as.prof. Dr. Ing. Miroslav Černík, CSc.– the use of nano–iron and surface–treated nanofibres in water treatment, clean–up technologies

3.2.8 JAN EVANGELISTA PURKYNĚ UNIVERSITY IN ÚSTÍ NAD LABEM (UJEP)

Hoření 13, 400 96 Ústí nad Labem, ID: 44555601

www.ujep.cz

The University was opened in September 1991. At the present time the University has seven faculties, research and development in nanotechnologies were identified only at the Faculty of Science.

3.2.8.1 Faculty of Sciences (FS UJEP)

České mládeže 8, 400 96 Ústí nad Labem

www.sci.ujep.cz

A brief description of the Faculty

The Faculty of Science was established 4 November 2005. It was created through the transformation of the Institute of Science UJEP. Its mission is teaching and developing knowledge in the natural sciences. Most attention is devoted to plasma physics, plasma chemistry, physics of thin layers, computer physics, computer methods, biotechnology, microbiology and biology of plants and animals, applied geography, environmental geography of synthesizing physical–geographical and social–geographical landscape aspects, organic chemistry, modelling, calculations in chemistry, instrumental analytical chemistry methods, computer simulation and numerical analysis of compressible flow problems, radiobiological process in live cells and self–assembled imaging. The Faculty has six departments (biology, physics, geography, chemistry, informatics and mathematics). Nanomaterials will be offered as a field of study starting in the 2012/2013 academic year.

Focus of research and development

Research and Development at the Faculty of Science was focused primarily on solving problems inside of one basic research centre (LC60041– "The preparation, modification and characterisation of energy beam materials") and three projects of the "Nanotechnology for Society" programme. In addition 13 programme research projects were implemented at the Faculty in 2011. Nanotechnology research is performed at the Department of Physics (researchers with a focus on nanotechnology research: S. Novák, J. Pavlík, J. Lörinčík and M. Švec) and at the Department of Biology (the researcher with a focus on nanotechnology research is J. Malý).

Projects implemented in nanotechnologies

- Project MEYS OC10053 – "Dendrimers in biomedical applications," 2010–2012; Principal investigator: as.prof. Ing. Martin Lísal, DrSc., FS UJEP

- Project MEYS Basic Research Centre Programme LC60041 "The preparation, modification and characterisation of energy beam materials," 3/2006–12/2010; Principal investigator: as.prof. Ing. Vladimír Hnatowicz, DrSc., Nuclear Physics Institute AS CR, Husinec, Řež, Co–principal investigator for FS UJEP: as.prof. RNDr. Jaroslav Pavlík, CSc.

- Project GA CR GA203/06/0006 – "Synthesis and study of chiral supramolecular synthons (SSCSS)," 2006–2008; Principal investigator: prof. RNDr. Pavel Drašar, CSc., ICT, Co–principal investigator for FS UJEP: Mgr. Huong Thi Thu Nguyen, Ph.D.

- Project AS CR "Nanotechnologies for Society" programme KAN101120701 – "Nanocomposite layers and nanoparticles created in low pressure plasma for surface modification," 1/2007–12/2011; Principal investigator: prof. RNDr. Hynek Biederman, DrSc., Charles University in Prague/MFF, Co–researcher for FS UJEP: as.prof. RNDr. Stanislav Novák, Ph.D.

- Project AS CR, "Nanotechnology for Society" programme, KAN200520702 – "Nano immunosensors for cytokine detection," 1/2007–12/2011; Principal investigator: Ing. Petr Šebo, CSc., Biotechnology Institute AS CR, Prague, Co–principal investigator for FS UJEP: Mgr. Jan Malý, Ph.D.

- Project AS CR, "Nanotechnology for Society" programme, KAN400720409 – "Hierarchical nanosystems for microelectronics," 1/2007–12/2011; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Processes AS CR, Prague, Co–principal investigator for FS UJEP: as.prof. RNDr. Jaroslav Pavlík, CSc.

Experts/field

- prof. RNDr. Pavla Čapková, DrSc.– Department of Physics – structural characterisations of nanomaterials using a combination of molecular modelling, X–ray diffraction and IR spectroscopy

- Mgr. Jan Malý, Ph.D. – photosynthetic biosensor development for herbicide detection, research of new procedures for biological component immobilisation on the surface of electrodes, creation and research of properties of self–assembly monolayers of natural and recombinant proteins and research in the use of new atomic–strength microscopy techniques (AFM, STM) for biological material study

- as.prof. RNDr. Stanislav Novák, CSc.– computer modelling, morphology of thin layers, composites, nanocomposites, plasma chemistry
- as.prof. RNDr. Jaroslav Pavlík, CSc.– plasma physics, plasma chemistry, physics of thin layers (plasmatic oxidation of Al), preparation of physical measurement and experiment management using PC, probe and optical plasma diagnostics
- RNDr. Martin Švec, Ph.D. – computer modelling (nanocomposite materials, interactions of particles with solid surfaces)

3.2.9 UNIVERSITY OF PARDUBICE (UPA)

Studentská 95, 532 10 Pardubice, ID: 00216275

www.upce.cz

The University of Pardubice was founded as the Chemical College in Pardubice in 1950. In 1953 it was transformed to become the College of Chemical Technology in Pardubice. The school's structure changed after 1990. It went from being a single–faculty school with a focus on chemistry to an institute providing university–style higher education. Since 1994 it has been called the University of Pardubice. The University of Pardubice has seven faculties.

Nanotechnology research is carried out at the Faculty of Chemical Technology.

3.2.9.1 Faculty of Chemical Technology (FChT UPa)

Studentská 573, 532 10 Pardubice

www.uni–pardubice.cz/fcht

A brief description of the Faculty

The Faculty of Chemical Technology at the University of Pardubice is a faculty with a tradition extending back for more than sixty years. During the period of its existence it has developed into an important centre of research in chemistry and technical chemistry, material engineering, chemical technology, construction chemistry as well as biological and biological–chemical fields, pharmacological chemistry, managerial and management processes. The Faculty is divided into 7 departments and 5 institutes. Several joint institutions with other entities are connected with the Faculty, including the Joint Laboratory of Solid State Chemistry of the Institute of Macromolecular Chemistry AS CR and the University of Pardubice (SLChPL), the Joint Laboratory of NMR Spectroscopy of the Research Institute for Organic Synthesis a.s., Pardubice–Rybitví and the University of Pardubice (SLNMR), Joint Laboratory of Analysis and Evaluation of Polymers SYNPO, a.s., Pardubice and the University of Pardubice (SLAP) and others.

Focus of research and development

The Faculty's scientific activity is focused on both basic as well as applied research, depending on practical needs. In basic research this involves in particular the implementation of research proposals, research centre activities, the implementation of projects in the framework of domestic and international grant competitions and agencies.

Research and development in nanotechnologies

Nanotechnology research is carried out at the following institutions:

- Institute of Applied Physics and Mathematics
- Institute of Organic Chemistry and Technology
- Department of Graphic Arts and Photophysics
- Institute of Environmental and Chemical Engineering

The topic of activities at the **Institute of Applied Physics and Mathematics** in nanotechnologies is the characterisation of nanostructure composites using spectroscopic ellipsometry. The main researchers are Mgr.Jan Mistrík, Ph.D. and RNDr.Petr Janíček.

Research in nanotechnology performed at the **Institute of Organic Chemistry and Technology** takes place primarily in the field of nanomedicine and is related to targeted polymer conjugates for antibiotic and anti–inflammatory drugs designed for medical applications. Specific research activities are comprised of synthesis and characterisation of reactive organic compounds and functionalised polymer systems designed for the targeted transport of selected drugs. Drugs are capable of being released from a polymer nanocomposite carrier (such as polypseudorotaxans: cyclodextrin–poly(ethylene glycol)) under defined conditions (pH, presence of specific enzymes). A significant portion of research is the characterisation of prepared systems using physicochemical methods (such asNMR, GPC, HPLC, powder–X–ray and STM–microscopy). The main researchers are prof. Ing. Miloš Sedlák, DrSc., Ing.Pavel Drabina, Ph.D., Ing.Aleš Imramovský, Ph.D. and Ing.Eliška Bílková.

Research and development in printing techniques is focused on:

- The preparation of thin functional layers using printing techniques for printed electronics, smart packaging and smart fabrics,
- The development of formulations for a variety of printing techniques based on chemical specialties for functional layer preparation (conductive, semiconductive, luminescent, thermochromic, electrochromic etc.),
- The development of printing formulations for printing on rigid (ceramics, glass) and flexible (polymer sheets, papers, synthetic papers etc.)
- The preparation of multilayered electronic elements using printing techniques (sensor elements, electroluminescent panels, solar panels, organic transistors etc.),
- The characterisation of functional layers using a wide spectrum of instrumental methods (spectroscopic methods, photoacoustic spectroscopy, optical and electron microscopy, AFM, X–ray diffraction analysis, image analysis, electrical value measurement, sensor characteristics, stability tests of sensor characteristics, light resistance, rheological measurement, surface charge and free surface energy measurement etc.).

The main researchers are Ing.Tomáš Syrový, Ph.D., prof. RNDr. Marie Kaplanová, CSc., Ing. Lucie Syrová, Ing. Nikola Peřinka, Ing. Markéta Držková, Ph.D. and Ing. Ondřej Panák.

Pressure membrane process research is focused on acquiring knowledge in the use of membrane separation in the treatment and removal of wastewater which is a burden on the

environment (including methods for the removal of released water contaminated by substances such as heavy metals, solvents etc.), treatment of process and drinking water (removal of inorganic salts and impurities for application and environmental reasons) and during biotechnological processes, which use processes such as those combining solid phase sorption with nanofiltration.

Further at the Institute of Environmental and Chemical Engineering testing of reproduction toxicity of nanomaterials on aquatic organisms is tested, in particular characterisation of nanomaterials before conception by ecotoxicity tests and studies of nanomaterial behaviour in liquid cultivation media. The parameters monitored include in particular speed and degree of nanoparticle agglomeration depending on liquid media parameters and the design of environmentally relevant conditions for the cultivation of biological models respecting nanomaterial behaviour in individual environment types.

Projects implemented in nanomaterials and nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project GA CR GAP204/11/0832 – "The fabrication of optical elements based on micro– and nanostructuring of chalcogenide layers," 2010–2014; Principal investigator: prof. Ing. Miroslav Vlček, CSc.
- Project GA CR GAP106/11/0058 – "Phosgene derivatives for nanotechnologies," 2011–2013; Principal investigator: prof. Ing. Miloš Sedlák, DrSc.
- Project GA CR GAP106/10/0196 – "Advanced nanostructured vanadium–based catalysts for oxidative dehydrogenation reactions," 2010–2015; Principal investigator: as.prof. Ing. Roman Bulánek, Ph.D., Co–principal investigator: Ing. Jana Mayerová, Ph.D., J. Heyrovský Institute of Physical Chemistry AS CR
- Project TA CR ALFA programme TA01020730 – "Separation of hydrocarbons from waters and their quality control," 2011–2013; Principal investigator: prof. Ing. Petr Mikulášek, CSc., Co–principal investigator: ASIO, s.r.o.
- Project MIT FR–TI1/436 – "The use of nanofibre membranes for controlled release of active compounds," 2009–2012; Principal investigator: Mgr. Marcela Slováková, Ph.D.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project TA CR, Centres of Competence programme, TE01020022 – "Flexible printed microelectronics using organic and hybrid materials, FLEXPRINT," 2012–2015 (2019); Principal investigator: Centre for Chemistry Ltd., Pardubice, Co–principal investigator Department of Graphic Arts and Photophysics at FChT UPa
- Project MIT FR–TI3/288 – "Research in methods of determining nanomaterial effects on reproduction of aquatic organisms," 2011–2013; Principal investigator: Ing.Petra Plodíková, Research Institute for Organic Synthesis a.s., Pardubice, Co–principal investigator for FChT UPa: Ing. Miloslav Pouzar, Ph.D.
- Project MIT FR–TI1/144 – "Multicomponent electronic systems based on organic compounds," 2009–2013; Principal investigator: Ing. Lubomír Kubáč, Centre for Organic Chemistry Ltd., Pardubice, Co–principal investigator for FChT UPa: prof. RNDr. Marie Kaplanová, CSc.

- Project MIT FR–TI3/176 – “Paints with long–term antimicrobial effects for indoor and outdoor applications based on nanomaterials and other new additives,” 2011–2013; Principal investigator: Ing. Libuše Hochmannová, Ph.D., Co–principal investigator for FChT UPa: as.prof. Ing. Jarmila Vytřasová, CSc.
- Project MIT FR–TI1/151 – “New wound dressings based on nano– and micro–carriers,” 2009–2012; Principal investigator: Ing.Michal Zavadil, Ph.D., CPN a.s., Co–principal investigator for FChT UPa: as.prof. Ing. Ladislav Burgert, CSc.
- Project AS CR KAN200100801 – "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and drug delivery," 2008–2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics AS CR, Prague, Co–principal investigator for FChT UPa: Mgr. Jan Mistrík, Ph.D.

Results in nanotechnologies/cooperation

Publication activities, utility models, patents such as Patent No. 302856– Polysaccharide derivate preparation method, Authors: Velebný V., Hrdina R., Šuláková R., Mlčochová P., Holas T., Krčmář M.

Experts/field

- Membrane separation–prof. Ing. Petr Mikulášek, CSc., as.prof. Ing. Jiří Cakl, CSc., Ing. Petr Doleček, CSc., Ing. Hana Jiránková, Dr. and Ing. Bedřich Šiška, CSc.
- Optics and magnetic–optical nanostructures–Mgr. Jan Mistrík, Ph.D.
- Optical, transport, magnetic and thermal properties of nanostructures–RNDr.Petr Janíček
- Synthesis and characterisation of reactive organic compounds and functionalised polymers designed for nanotransport systems of drugs or as templates for nanocomposite materials–prof. Ing. Miloš Sedlák, DrSc., Ing. Pavel Drabina, Ph.D., Ing. Aleš Imramovský, Ph.D. and Ing. Eliška Bílková
- Printing technique development–prof. RNDr. Marie Kaplanová, CSc., Ing.Tomáš Syrový, Ph.D., Ing.Markéta Držková, Ph.D., Ing.Lucie Syrová, Ing.Nikola Peřinka, Ing.Ondřej Panák

3.2.10 MINING UNIVERSITY – TECHNICAL UNIVERSITY OF OSTRAVA (TUO)

17. listopadu 15, 708 33 Ostrava–Poruba, ID: 61989100

www.vsb.cz

The Mining University – Technical University of Ostrava continues the tradition of the training centre – The Mining Academy and Mining University in the town of Příbram. In 1945 the educational activities were moved to Ostrava and at the beginning of the 1950s its division into individual faculties started.Since 1989 the Technical University Ostrava has been transformed into a modern technical university. Scientific and research activities are developed in metallurgy, material engineering, mechanical engineering, electrical engineering and electronics, information technologies, mining and geology, construction,

economics and other fields. TUO has seven faculties. Besides the universities faculties, the university also has institutes, university–wide institutions and task–oriented facilities. Nanotechnology research is carried out at the Faculty of Metallurgy and Material Engineering, the Faculty of Mechanical Engineering, at the Faculty of Mining and Geology's Institute of Physics, the Faculty of Safety Engineering and in particular at the Nanotechnology Centre.

3.2.10.1 Faculty of Metallurgy and Material Engineering (FMME TUO)

17. listopadu 15, 708 33 Ostrava–Poruba

www.fmmi.vsb.cz

A brief description of the Faculty

The Faculty of Metallurgy and Material Engineering, which has used the name since 1991, developed from the Faculty of Metallurgy, which was created in 1951 after TUO was divided into faculties and which has historical roots in the Příbram and previous era. The Faculty of Metallurgy and Material Engineering is the only Czech university institute specialising in material engineering taken as a whole, from production to use. The Faculty is divided into 13 departments, some of which are further divided into institutes. Implementation of projects with nanotechnology elements was found at the Department of Material Forming and the Department of Material Engineering.

Focus of research and development

From 2005–2011 research at FMME was focused primarily on the implementation of two research proposals, one of which was focused partially on nanotechnologies, particularly on the issue of the use of severe plastic deformation (SPD) for the creation of ultra–fine grain structured metallic materials.

Research proposalMSM6198910013– "**Processes of preparation and properties of highly pure and structural defined special materials**," 1/2005–12/2011; Principal investigator: prof. Ing. Miroslav Kursa, CSc.; total costs for the entire period of the project equalled CZK 85.342 million, CZK 78.040 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 10%.

The research proposal was oriented towards the comprehensive solution of issues in preparation processes, studies of properties and degradation of highly pure and structurally defined special materials. An integral part of the preparation processes of selected materials was also the diagnostics of any defects, microstructures, processes separation, determination of chemical composition, physical metallurgical parameters and mechanical properties. The results of these evaluations and their correct interpretation with respect to material preparation was ensured by feedback for the subsequent optimisation process of the crystallisation of individual types of materials. The implementation of the plan was focused on the study of the processes on the melt/crystal phase interface, a description of events from a physicochemical, thermodynamic and kinetic perspective of material structure creation etc.

The above research of the creation of ultra–fine structures of metallic materials (Fe, Mg) through severe plastic deformation was performed by researchers at the Department of Material Forming (M. Greger, R. Kocich and B. Kuřetová) and the Department of Material

Engineering (V. Vodárek and L. Čížek) in cooperation with the Department of Mechanical Technology at the Faculty of Mechanical Engineering (S. Rusz).

In 2011 a total of 54 programme research projects were implemented at the Faculty.One of them was the Project **ED0040/01/01 – Regional Material Technological Research Centre**. From 2010–2013 in its framework and at a cost of CZK 680.1 million (from structural funds of the Operational Programme Research and Development for Innovation) laboratories are to be built and teams formed to develop, prepare, research and optimise advanced materials and the technologies for their preparation for the application sphere. RMTRC activity should be focused on the preparation of very pure materials, special alloys, biomedical materials, the development of materials for high–temperature applications and power generation, the preparation of materials using progressive powder metallurgy technologies (magnetic materials, friction materials, composite materials etc.), the preparation of nanocrystalline materials on a non–iron metal base, their alloys and steel prepared by severe plastic deformation, research in the development in the liquid phase taking place in reactors having an impact on the utility properties of materials, physical and mathematical modelling of material forming processes including forging and the application of knowledge acquired in research and development in the technology of forming components for nuclear power plant equipment.

Projects implemented in nanotechnologies

- Project GA CR GAP107/11/1918 – "Research of zinc and cadmium sulphide nanoparticles deposited on phyllosilicates for photocatalytic reduction of carbon dioxide," 2011–2013; Principal investigator: as.prof. Ing. Petr Praus, Ph.D., FMME TUO, Co–principal investigator: RNDr. Miroslav Pospíšil, Ph.D., Charles University in Prague/Faculty of Mathematics and Physics

- Project GA CR GA106/09/1598 – "Research of properties of nanostructured titanium for dental implants and its production," 2009–2011; Principal investigator: as.prof. Ing. Miroslav Greger, CSc., FMME TUO

- Project GA CR GP104/08/P274 – "Study of the properties and use of clay materials after intercalation by inorganic and organic cations," 2008–2010; Principal investigator: Jiří Pavlovský, Ph.D., FMME TUO

- Project GA CR GA205/08/0869 – "Clay materials as host matrices for functional nanostructures," 2008–2010; Principal investigator: prof. RNDr. Pavla Čapková, DrSc., FMME TUO, Co–principal investigators: RNDr. Miroslav Pospíšil, Ph.D., Charles University in Prague/Faculty of Mathematics and Physics, prof. RNDr. Miroslav Mašláň, CSc., Palacký University, Olomouc/Faculty of Science

- Project GA CR GA106/07/1436 – "Friction materials based on polymers containing metals and their environmental impact," 2007–2009; Principal investigator: prof. Ing. Václav Roubíček, CSc., FMME TUO, Co–principal investigators: Ing. Pavel Moravec, CSc., Institute of Chemical Processes AS CR, and as.prof. RNDr. Kateřina Malachová, CSc.University of Ostrava/Faculty of Science

Experts/field

- as.prof. Ing. Miroslav Greger, CSc.– forming metal by severe plastic deformation
- prof. Ing. Vlastimil Vodárek, CSc.– electron microscopy

3.2.10.2 Faculty of Mechanical Engineering (FME TUO)

17. listopadu 15, 708 33 Ostrava–Poruba

www.fs.vsb.cz

A brief description of the Faculty

The Faculty of Mechanical Engineering (formerly known as the Faculty of Mining Mechanical Engineering) was created in 1951 by the merger of the Mechanical Engineering University in Ostrava, located in Brušperk, with the Mining University in Ostrava. The educational and scientific research activities of FME TUO are oriented primarily towards machine design, robotics and manufacturing processes, manufacturing technology innovation, materials and their properties, and machine and process control. The Faculty is divided into 11 departments, one institute, two laboratories and one centre. Nanotechnology research is conducted at the Department of Mechanical Technology (S. Rusz) and the Laboratory of Bulk Materials (J. Zegzulka).

Focus of research and development

In 2011 research at FME TUO was focused on the implementation of 24 programme research projects. Research with nanotechnology characteristics was found at the **Department of Mechanical Technology** and the **Institute of Forming**. Here as.prof.Ing. Stanislav Rusz, CSc. has been extensively involved in researching technologies of severe plastic deformation with the goal of achieving ultra–fine grain structures of formed metals. The ECAP method is used in particular. At the Laboratory of Bulk Materials experts (J. Zegzulka and A. Slíva) are involved in solving problems of nanoparticle storage, modification of the surface of corn starch microparticles using SiO2 hydrophobic nanoparticles with the goal of changing their interactive properties and measuring the geometric and mechanical–physical properties of nanoparticles etc.

Projects implemented in nanotechnologies

- Project MEYS ME08083 – "A comprehensive system of short–term and long–term anti–corrosion protection for steel products," 2008–2012; Principal investigator: as.prof. Ing. Jitka Podjuklová, CSc., FME TUO
- Project GA CR GA101/08/1110 – "The development of new technology with a high degree of deformation for the production of ultra–fine grain materials," 1/2008–12/2010; Principal investigator: prof. Ing. Stanislav Rusz, CSc., FME TUO
- Project MIT 2A–1TP1/124 – "Research of the impact of severe deformation conditions on submicrostructure metals and testing methods for diagnostics of their technological properties," 11/2006–3/2011; Principal investigator: Karel Malaník, CSc., VÚHŽ a.s., Dobrá, Co–principal investigator for FME TUO: prof. Ing. Stanislav Rusz, CSc.

Experts/field

- as.prof. Ing. Jitka Podjuklová, CSc. – nanocoating and corrosion protection of materials
- prof. Ing. Stanislav Rusz, CSc.– mechanical forming, superplasticity, powder material formability, unconventional forming methods, the development of new manufacturing technologies for ultra–fine grain material production, mathematical modelling of unconventional forming technologies
- as.prof. Ing. Aleš Slíva, Ph.D. – nanoparticle behaviours, micro– and nano interparticle bonds, surface modification of microparticles using nanoparticles for improving flow properties in transport, handling and storage systems
- prof. Ing. Jiří Zegzulka, CSc.– operations and processes with particular masses, preparation, transport and storage of micro– and nanopowders, design of technologies, machines and processes

3.2.10.3 Faculty of Mining and Geology (FMG TUO)

17. listopadu 15, 708 33 Ostrava–Poruba

www.hgf.vsb.cz

A brief description of the Faculty

The history of the Faculty of Mining and Geography reaches back to 1716, when the oldest mining school was founded in the town of Jáchymov. During the course of the centuries the form and length of instruction was changed, as were the location of teaching institution and even the organisational form of mining education. The last major change in location consisted of moving the Mining University to Ostrava in 1945, after which the school was divided into faculties. The present–day Faculty of Mining and Geology was created in 1959 through the combination of the separate Mining Faculty and the Geological Faculty. FMG is divided into seven institutes, of which the **Institute of Physics**, which organises teaching of physics and related subjects at the six technical faculties of TUO is focused on nanotechnology research (in one of its divisions).

Focus of research and development

In 2011 research at FMG TUO was focused on the implementation of 26 programme research projects. The largest of these is the primarily investment project ED2.1.00/03/0082 – "**Institute of clean technologies for mining and utilization of raw materials for energy use"**, implemented as part of the Operational Programme Research and Development for Innovation.From 2011–2014 a unique centre (the only one in the Czech Republic) is to be built at a cost of CZK 294.5 million. The centre will be devoted to research in mining and the use of power–generating raw materials and other uses of the geological environment in assuring sustainable development and the requirement for maximum raw material self–sufficiency. The Faculty is building the centre in partnership with the Institute of Geonics AS CR.

Research in nanotechnologies is carried out at the Faculty at the Institute of Physics in the Department of Nanostructure Physics. Magnetic optical phenomena in magnetic nanostructures are studied here theoretically and experimentally under the guidance of prof. Ing. Jaromír Pištora, CSc. Research is connected with the practical use of magnetic

nanostructures in magnetic and magnetic–optical information record, in magnetic field sensors and in spin electronic elements. The implementation of projects is carried out in cooperation with MFF CI and several foreign institutions.

Projects implemented in nanotechnologies

- Project MEYS MEB051021 – "Measurement and analysis of surface topography created by progressive technologies and cold rolling from the perspective of classic materials and nanomaterials and their mechanism of creation," 2010–2011; Principal investigator: as.prof. Ing. Jan Valíček, Ph.D., FMG TUO
- Project MEYS MEB021039 – "Theoretical and experimental study of new integrated non–reciprocal magnetoplasmonic nanostructures," 2010–2011; Principal investigator: as.prof. Mgr. Kamil Postava, Dr., FMG TUO
- Project GA CR GAP205/11/2137 – "Magnetophotonic interactions in realistic nanostructures," 2011–2013; Principal investigator: prof. Ing. Jaromír Pištora, CSc., FMG TUO, Co–principal investigator: prof. Ing. Štefan Višňovský, DrSc.,Charles University in Prague/Faculty of Mathematics and Physics
- Project GA CR GA106/08/1092 – "The preparation of nanocomposite materials in flow with extreme dynamics," 2008–2010; Principal investigator: as.prof. Dr. RNDr. Jiří Luňáček, FMG TUO
- Project GA CR GA202/06/0531 – "Reflection and waveguide effects in magnetic nanostructures," 1/2006–12/2008, Principal investigator: prof. Ing. Štefan Višňovský, DrSc., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for FMG TUO: prof. Ing. Jaromír Pištora, CSc.
- Project AS CR, "Nanotechnology for Society" programme, KAN400100653 – "Self–organized magnetic nanostructures," 7/2006–12/2010, Principal investigator– Ing.Ján Lančok, Ph.D., Institute of Physics AS CR, Prague, Co–principal investigator for FMG TUO: as.prof. Mgr. Kamil Postava, Dr.

Experts/field

- Mgr. Karla Barčová, Ph.D. – Mössbauer effect
- as.prof. RNDr. Petr Hlubina, CSc.– fibre optics, interferometry
- as.prof. RNDr. Jiří Luňáček, Dr.– metallic structures
- prof. Ing. Jaromír Pištora, CSc.– magnetic optics, nanostructures, optics of planar structures
- as.prof. Mgr. Kamil Postava, Dr.– magnetic optics, ellipsometry

3.2.10.4 Faculty of Safety Engineering (FSE TUO)

17. listopadu 15, 708 33 Ostrava–Poruba

www.fbi.vsb.cz

A brief description of the Faculty

The Faculty of Safety Engineering is the youngest faculty of the Technical University of Ostrava. Its inception on 1 August 2002 was a reaction to the growing demand in the field for the preparation of university–educated experts in the field of safety engineering and related scientific and research activity.

Focus of research and development

The Faculty's scientific research focus covers the extensive field of safety engineering, in particular: fire protection, industry safety, work safety and processes, technical safety of persons and property, and protection of the population. In 2011 the Faculty implemented 12 programme research projects.

Projects implemented in nanotechnologies

- Project TA CR TA01010552 – "The use of membranes with nanopores to reduce the health risks of VOCs from small water sources," 2011–2013; Principal investigators: Ing.Lubomír Kříž, Ph.D., Ing.Marek Čáslavský, Ph.D. – Vodní zdroje Chrudim, spol. s. r.o., Co–principal investigators for FSE TUO: prof. RNDr. Pavel Danihelka, CSc., Ing.Pavel Dobeš and Ing.Jana Suchánková, Ph.D.

Experts/field

- prof. RNDr. Pavel Danihelka, CSc.– nanotechnologies and health risks

3.2.10.5 Nanotechnology Centre (CNT TUO)

17. listopadu 15, 708 33 Ostrava–Poruba

www.cnt.vsb.cz

A brief description of the Centre

- The Nanotechnology Centre (CNT) was established 1 February 2007 as a successor of the Institute of Material Chemistry (IMACH) pursuant to the approval of the new TUO statute by the Ministry of Education, Youth and Sports on 28 December 2006. The establishment of the Nanotechnology Centre reflects among other things the accreditation and introduction of the new Nanotechnology study at TUO starting in the 2007/2008 academic year. CNT organises a significant portion of instruction in this programme as well as instruction for other TUO faculties. The Centre, under the leadership of prof. J. Pištora, is divided into five departments:

- Department of Nanotechnology and Nanomaterials Structure (M. Valášková, K. Čech Barabaszová, G. Simha Martynková and S. Holešová)

- Department of Materials Testing and Environmental Risk of Nanoparticle (V. Tomášek)

- Department of Inorganic Analysis (J. Seidlerová)
- Department of Organic Analysis and Catalytic Processes (Z. Lacný and D. Plachá)
- Department of Bionanotechnology (J. Kukutschová, V. Matějka, G. Kratošová, J. Tokarský and K. Mamulová Kutláková)

Focus of research and development

From 2005–2011 one research proposal completely focused on nanotechnology was implemented at CNT TUO and at other institutions at the university.

Research proposal MSM6198910016– "**Synthesis, structure and properties of nanomaterials based on intercalated sheet silicates and ferromagnetics**," 1/2005–12/2011; Principal investigator: prof. Ing. Jaromír Pištora, CSc.; total costs for the entire period of the project equalled CZK 83.389 million, CZK 73.511 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 100%.

The research proposal was oriented toward the preparation and characterisation of modified phyllosilicates which are created through intercalated–prepared precursor delamination and which will then be used for polymer–layered silicate nanocomposite preparation. Direct delamination techniques (such as mechanical micronisation, microwave procedure) and mixing are tested. Other nanomaterials with photofunctional, luminescent, sorption and catalytic properties (with planned use as photofunctional units, sorbents for immobilisation of contaminants from gases or water) and catalytic effects (with the goal of use for selective nitrogen oxide reduction) were prepared through intercalation of organic molecules and polycations into phyllosilicate interlayers. Another promising method of nanoparticle preparation is turning out to be preparation using live organisms, known as bioreduction, in particular of metals under standard laboratory conditions by using various organisms such as green algae or bryophyte. Special attention was paid to analysis of the structural makeup of modified phyllosilicates. Further the mechanical–physical and geometric properties of modified phyllosilicate nanoparticles studied were also tested. Findings were also used in the application of the model of ideal loose material on plate structures.

Research in nanotechnology was focused on nanomaterials on a base of intercalated and surface–modified host structures, primarily layered silicates and hydrotalcites.These host structures were intercalated or surface modified with either organic molecules (organic dyes, organic ammonium surfactants), organic–metal complexes or nanoparticles of metals and their oxides. The use of nanomaterials prepared in this manner was directed at organic pollutant catalysis, photocatalysis, sorption and degradation, nitrogen oxide breakdown, photofunctional and anti–bacterial materials. The research proposal also included methodology of silicate nanoparticle preparation by a combination of mechanical and physicochemical procedures for nanocomposites as frictional and structural materials and protective coatings. Computer design allowing structure modelling, e.g. of new drug forms, was also used for nanomaterial structure research.

The plan also included studies of the role of phyllosilicates as friction composite components and further the testing, characterisation and development of friction composites for passenger vehicle brake pads oriented towards the development of environmentally friendly materials. Friction process products, i.e. wear particles including nanometric particles, were also examined in terms of chemical and phase composition, as well as their effects on living organisms. Special attention was devoted to toxicity and environmental and health risks of

nanoparticles and chemical analysis of various types of tissues and body fluids in terms of nano– and micro–metric metal particles in connection with diagnosis, lifestyle and environmental quality. Experimental equipment: X–ray diffraction and X–ray spectroscopy, atom absorption and emission spectroscopy, IR spectroscopy, Raman microspectroscopy, gas, liquid and ion chromatography, AFM microscopy, electron microscopy and microanalysis of EDAX, and jet mill – Sturtevant microniser. Molecular modelling methods using Materials Studio software were also used for nanomaterial design.

Besides the research proposal, in 2011 in total five programme research projects (presented below) were implemented at the Centre.

Research in nanotechnology at CNT is focused on the following areas:

- Preparation and characterisation of layered silicates and hydrotalcites intercalated by organic molecules,
- Preparation and characterisation of nanoparticles of metals, their oxides and sulphides anchored on silicate matrix surfaces, nanocomposite coatings on silicate matrices,
- Preparation of metal nanoparticles using bionanotechnology, their characterisation and study of their applications,
- Preparation and characterisation of silicate nanoparticles using a combination of mechanical and physicochemical procedures for nanocomposite materials,
- Analysis and characterisation of wear particles created during friction processes,
- Study of toxicity of nanomaterials also created as by–products of human activity and of the health risks presented by nanoparticles,
- Optical and magnetic properties of nanostructures.

Projects implemented in nanotechnologies

- Project GA CR GAP108/11/1057 – “Synthesis, structure and properties of conductive polymer/phyllosilicate nanocomposites,” 2011–2013; Principal investigator: prof. RNDr. Pavla Čapková, DrSc., CNT TUO, Co–principal investigator: as.prof. RNDr. Jaroslav Burda, CSc.,Charles University in Prague/Faculty of Mathematics and Physics
- Project GA CR GAP210/11/2215 – “Study and evaluation of vermiculite structures modified in the role of nanofillers and substrates,” 2011–2013; Principal investigator: RNDr. Marta Valášková, DSc.
- Project GA CR P205/11/2137 – “Magnetophotonic interactions in realistic nanostructures,” 2011–2013; Principal investigator: prof. Ing. Jaromír Pištora, CSc.,CNT TUO, Co–principal investigator: prof. Ing. Štefan Višňovský, DrSc.,Charles University in Prague/Faculty of Mathematics and Physics
- Project MEYS OP VK CZ.1.07/2.3.00/20.0074 – “Nanobase – the basis for international cooperation," 2011–2014; Principal investigator: prof. Ing. Jaromír Pištora, CSc., CNT TUO

- Project MEYS KONTAKT ME 10121 – "The development of friction composites for environmentally friendly brake friction materials," 2010–2012; Principal investigator: Ing. V. Matějka, Ph.D., CNT TUO

- Project MEYS ME08040 – "The significance of clay materials and their impact on the friction mechanism in friction composites for the automobile industry," 1/2008–12/2009; Principal investigator: Ing. Gražyna Simha Martynková, Ph.D., CNT TUO

- Project MIT FT–TA4/025 – "Next generation nanomaterials and their industrial applications," 3/2007–12/2010; Principal investigator: Ing.Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, Co–principal investigator for CNT TUO: prof. RNDr. Pavla Čapková, DrSc.

Results in nanotechnologies/cooperation

In 2011 a total 22 scholarly articles were published for CNT in periodicals with an impact factor, 19 articles were published in reviewed non–impact periodicals, 11 reviewed articles in international journals kept in an internationally renowned database, and one chapter in a book (Springer publishers). Two patents, 3 utility models, 2 functional designs and 1 certified method were submitted to the Industrial Property Office.

Academic partners in the Czech Republic

- Institute of Geonics AS CR Ostrava– Cooperation on rock characterisation, phase analysis of kidney stones, phase analysis of metallurgical slag

- Institute of Inorganic Chemistry AS CR, Řež – Cooperation on the characterisation of clay–dust sediments

- University of Ostrava/Faculty of Science/Department of Physical Geography and Ecology – Cooperation on the study of the chronology of sedimentation of flood silts of the Olše River

- University of Ostrava/Faculty of Science/Department of Biology and Ecology – Cooperation on the evaluation of the effects of nanomaterials and friction composites on biosystems and the biosynthesis of nanomaterials using living organisms, in biomimetics and electron microscopy of biological structures

- University of Ostrava/Faculty of Medicine: Nanopathology

- Teaching Hospital in Ostrava/Institute of Pathology, Ear, Nose, and Throat Clinic – Nanopathology, Department of Traumatology – development of external fixators, Clinic of Oral, Maxillary and Facial Surgery – developed nanomaterial testing

- The National Institute for Nuclear, Chemical and Biological Protection – hydrolytic degradation of warfare agents, antimicrobial properties of bionanocomposites

- Institute of Nanobiology and Structural Biology CVGZ AS CR – composite magnetisation

- Charles University in Prague/Faculty of Science/Department of Botany – nanomaterial biosynthesis, cultivation of brown algae with siliceous cell walls for bionanocomposite

preparation; Faculty of Mathematics and Physics/Department of Chemical Physics and Optics – computer modelling

- VÚHŽ Dobrá Frýdek–Místek – issues of metallurgical waste
- Tomas Bata University Zlín – nanocomposite materials as polymer fillers
- Public Health Institute, Ostrava – Development of methods for asbestos identification in emissions and in construction materials using electron microscopy and X–ray microanalysis, testing antimicrobial properties of developed nanomaterials
- Research Institute of Veterinary Medicine AS CR Brno – development of nanomaterials as feed additives for farm animals
- České technologické centrum pro anorganické pigmenty, Přerov
- Charles University in Prague/Faculty of Mathematics and Physics/Institute of Physics – Magnet optics and nanomagnetism

Foreign partners (selected)

- TU Bergakademie Freiberg, Germany – nanomaterial structure solutions
- Southern Illinois University, Carbondale, USA – development and characterisation of friction composites
- Beijing University of Chemical Technology, People's Republic of China – development and characterisation of friction composites
- Slovak Academy of Sciences, Bratislava – characterisation of biological structures and biosynthesized nanoparticles using electron microscopy methods
- Bene–fit GMbH, Germany – SiO_2/TiO_2 photoactive nanocomposite preparation
- McGill University Health Centre, Montreal, Canada – nanopathology, nanomaterial testing on tissue cultures
- Dalhousie University, Hallifax, Canada – cooperation in nanomagnetism and nanophotonics

Experts/field

- Ing. Karla Čech Barabaszová, Ph.D. – preparation and characterisation of defined nanoparticles, nanostructured ceramics and nanocomposites, structural and morphological characterisation methods (atomic force microscopy)
- Ing. Gabriela Kratošová, Ph.D. – preparation methods of nanomaterials on a metal base using living organisms
- as.prof. Mgr. Jana Kukutschová, Ph.D. – friction composite characterisation and its environmental impact, infrared and Raman spectroscopy for composite material and metal particle characterisation in biological materials (tissue and body fluids)

- as.prof. Ing. Gražyna Simha Martynková, Ph.D. – nanocomposite material and nanostructured carbon material preparation technologies, X–ray diffraction analysis and modelling and simulation of nanostructured materials
- Ing. Vlastimil Matějka, Ph.D. – the use of atomic force microscopy in the study of the nanostructure of materials, development, and characterisation of friction composites, development and characterisation of photocatalytic nanomaterials
- prof. Ing. Jaromír Pištora, CSc.– Optics and magnetic–optical nanostructures
- as.prof. Ing. Daniela Plachá, Ph.D., and Ing.Zdeněk Lacný – the use of gas and liquid chromatography methods for analysis of organic substances and evaluation of sorption and catalytic properties
- prof.Ing.Jana Seidlerová, CSc.– the use of atom emission methods and absorption spectrometry for material chemical composition analysis
- Ing. Jonáš Tokarský, Ph.D. – computer design of clay materials, drug forms and developed nanomaterial structures
- as.prof. Ing. Vladimír Tomášek, CSc.– the use of electron microscopy and X–ray spectrometry in the study of the nanostructure of materials
- RNDr. Marta Valášková, DSc., Mgr.Kateřina Mamulová Kutláková, Ph.D. – intercalated phyllosilicates preparation technology and their X–ray diffraction analysis

3.2.11 PALACKÝ UNIVERSITY IN OLOMOUC (UPOL)

Křížkovského 8, 771 47 Olomouc, ID: 61989592

www.upol.cz

Palacký University in Olomouc was founded in 1946 as a successor to the activities of the former Theological Faculty. UPOL has eight faculties: Sts. Cyril and Methodius Faculty of Theology, Faculty of Medicine and Dentistry, Philosophical Faculty, Faculty of Science, Faculty of Education, Faculty of Physical Culture, the Faculty of Law and the Faculty of Health Sciences. Nanotechnology research is performed at the Faculty of Science and to a lesser extent at the Faculty of Medicine and Dentistry.

3.2.11.1 Faculty of Science (FS UPOL)

Tř.Svobody 26, 771 46 Olomouc

www.upol.cz/fakulty/prf

A brief description of the Faculty

In 1953 the University of Education was established, with Faculties of Natural Science and Social Science. At the present time the Faculty of Science provides university education in mathematics, physics, chemistry, biology, geography and ecology. It also conducts scientific research in these disciplines. The Faculty is divided into 6 fields (mathematics, physics, chemistry, biology, geology and earth sciences and faculty equipment) which are further divided into departments and laboratories. Nanotechnology research is performed at the

Department of Experimental Physics, Department of Inorganic Chemistry, the Department of Physical Chemistry, Department of Optics and the Joint Laboratory of Optics of Palacký University and the Institute of the Czech Academy of Sciences.

Focus of research and development

From 2005–2011 six research proposals were implemented at FS UPOL, one of which was focused to a certain extent on nanotechnology.

Research proposalMSM6198959218– "**Complex compounds and oxides of transition metals with a use in bioapplications and nanotechnology**," 1/2005–12/2011; Principal investigator: prof. RNDr. Zdeněk Trávníček, Ph.D.; total costs for the entire period of the project equalled CZK 146.769 million, CZK 128.989 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 60%.

The research proposal was occupied with the synthesis of complex compounds of transition metals, oxides of transition metals and elementary metals with properties suitable for bioapplications (cancerostatics) and nanotechnology (catalysis, biomagnetic separation, nanopigments). Research activity was composed of three basic steps and progressively includes synthesis of complex compounds and nanomaterials, their complex physicochemical characterisation and practical testing in selected nanotechnology and bioapplication areas. Partial tasks of the research activities include study of the mechanism of selected reaction in solutions and the solid phase or study of the impact of surface treatments and interparticle interactions on nanoparticle magnetic properties.

In 2011 a total 109 programme research projects were implemented at the Faculty, most of them were focused on nanotechnologies and nanomaterials.

Research in nanotechnologies and nanomaterials

From 2005–2011 research activity at the Department of Experimental Physics was focused on implementation of the project MEYS 1M0512 – "**Research Centre of Powdered Nanomaterials**," www.nanocentrum.upol.cz, Principal investigator: prof. RNDr. Miroslav Mašláň, CSc.Researchers from the Department of Inorganic Chemistry and the Department of Physical Chemistry also worked at the Centre.These are primarily: 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.

At the Centre primarily amorphous and nanocrystalline oxides of transition metals and ferromagnetic spinel structures including ferrites (Ni, Co, Mn, Zn, Cu) were synthesized in the form of nanoparticles by thermally induced reactions in the solid phase. These thermic syntheses, which may be controlled through reaction conditions and precursor properties, were targeted to achieve suitable combinations of dimension, morphological, surface, structure, magnetic and other properties (catalytic, sorption, optical) of nanoparticles enabling their use in nanopigments, the preparation of standards for microscopic techniques, in sorption–purification processes, biomagnetic separation (detoxication processes, dialysis), in ferrofluid technologies, magnetic cooling and catalysis. The use of a wide selection of precursors is presumed, including complexes of transition metals and organic acid salts, whose structural properties and low conversion temperature allow the preparation of nanopowders with a narrow size distribution, large surface area and desirable magnetic properties (superparamagnetism, ferrimagnetism). Through solid phase and solution reduction elementary metal (Fe, Ag) nanoparticles are synthesised with the use of iron oxides

and complex compounds of silver as precursors.Nanoparticles were tested in terms of the application of their antibacterial, sorption, catalytic and magnetic properties.

At the Department of Experimental Physics work is also done on the development of analytical methods used in nanotechnology research (Mössbauer spectroscopy – development of modern automatic measuring methods and systems and their application on the analysis of substance structures, microscopy scanning using a probe and surface analysis on a submicroscopic level) – M. Mašláň, R. Kubínek and M. Vůjtek.

At the **Department of Inorganic Chemistry** synthesis is performed of complex compounds with applications in a variety of industry branches, such as high–pressure lubricants, flotation agents, antioxidant agents, insecticides or as precursors for nanoparticle preparation (Z. Trávníček).

At the **Department of Physical Chemistry** synthesis is performed of iron oxide nanoparticles by thermally induced reactions in the solid phase, including preparation of rare structured forms of amorphous Fe_2O_3, ß–Fe_2O_3, and ε–Fe_2O_3 with defined properties (K. Zbořil, L. Kvítek, R. Orucek and A. Panáček). At the Joint Laboratory of Optics of Palacký University and the Institute of the Czech Academy of Science one of the directions of research conducted at the **"Optical structures, detection systems and related technology for low–photon applications"** research centre was in the period 2005–2011 the preparation and application of nanostructured layers of diamonds and other super hard layers with low internal tension for optical applications (M. Habrovský). At the Department of Optics certain aspects of nanometrology are examined in the framework of the "Modern Optics Centre" research centre (J. Fiurášek).

The most ambitious nanotechnology project which is in the faculty implemented in this period(2010–2014) is the project MEYS ED2.1.00/03.0058 – "**RCAPTM** –**Regional centre of advanced technologies and materials,**" supported by the Research and Development for Inovation Operational Programme; www.rcptm.com; Principal investigator and general director of the Centre: prof. RNDr. Radek Zbořil, Ph.D. Project with budget of CZK 737 million, CZK 545 million of which is a grant from the EU and the budget of the Czech Republic. The project includes the construction of a new building in Olomouc–Holice and outfitting the facility with unique equipment at a cost of CZK 250 million.

The Centre is occupied with nanomaterial, chemical and optical research with expected outputs in medicine and environmental applications. The Centre is focused on six research programmes:

1. Nanocrystalline oxides of transition metals in environmental, medical, catalytic and optical applications
2. Carbon nanostructures, biomacromolecules and hybrid systems – synthesis, modeling of interaction and applications
3. Biologically-active compounds and molecular magnets on the basis of complexes of transition metals in interaction with nanocrystalline magnetic carriers
4. Advanced optical and photonic technologies
5. Advanced materials on the basis of nanoparticles of metals and metal hybrids with extraordinary reduction, antibacterial, sorption and catalytic properties
6. Nanometric systems and nanotechnologies in new analytic approaches

Within the RCATM, a series of laboratories will be established (partly on the basis of existing infrastructure). The most important laboratories include, for example, the technological laboratory for solid-state syntheses of nanoparticles of metals, oxides of transition metals and oxides of iron in a high valence state, applicable in the field of water purification, production of magnetic elements, catalytic and biomedical applications; the laboratory of advanced optical technologies, usable for surface modification of optical elements intended for building of the international „North Observatory“ as a part of „The Pierre Auger Observatory – North“ project in Colorado, USA; the laboratory of advanced microscopy techniques, being a unique background for analysis of nanomaterials and biomacromolecules by means of microscopic techniques (cryoHRTEM, TEM, AFM, SEM); the laboratory of magnetic characterization of nanomaterials including a complex background for analysis of materials in external magnetic fields (PPMS, SQUID, NMR, Mössbauer spectroscopy).

A total about 100 of research employees focused on applied or industrial research is planned to be involved in the Centre. In order to reach this goal, the research is closely connected with the PhD., Master and Bachelor study programs available at the Faculty of Science of the Palacky University, namely Applied Physics, Material, Physical, Analytical, Organic and Inorganic Chemistry.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project MEYS Research and Development for Inovation Operational Programme ED2.1.00/03.0058 – “Regional centre of advanced technologies and materials," (RCAPTM),2010–2014**;** Principal investigator and general director of the Centre: prof. RNDr. Radek Zbořil, Ph.D. (more information above)
- Project MEYS, “Research Centres” programme, 1M0512 – “Research Centre of Powdered Nanomaterials,” 1/2005–12/2011; Principal investigator: prof. RNDr. Miroslav Mašláň, CSc.
- Project MEYS, “Research Centres” programme, 1M06002 – “Optical structures, detection systems and related technologies for low–photon number applications,” 2006–2011; Principal investigator: prof. RNDr. Miroslav Hrabovský, DrSc.
- Project MEYS, “Basic Research Centre" programme, LC06007 – “Centre Modern Optics,” 3/2006–12/2011; Principal investigator: as.prof. Mgr. Jaromír Fiurášek, Ph.D.
- Project MEYS EE2.3.09.0051 – “Advanced education in research and application of nanomaterials,” 2009–2012; Principal investigator: as.prof. RNDr. Michal Otyepka, Ph.D.
- Project GA CR GAP207/11/0841 – “Functionalised magnetic carriers based on iron oxide nanoparticles with bonded biologically active or magnetically interesting compounds,” 2011–2014; Principal investigator: prof. RNDr. Zdeněk Trávníček, Ph.D.
- Project GA CR GPP108/11/P657 – “The preparation and characterisation of new composite materials containing amino acids, iron oxide nanoparticles and silver or gold nanoparticles,” 2011–2013; Principal investigator: RNDr. Karolína Šišková, Ph.D.

- Project GA CR GPP208/11/P463 – “Mechanisms of iron nanoparticle reactions with selected pollutants," 2011–2013; Principal investigator: Mgr. František Karlický, Ph.D.

- Project GA CR GAP304/10/1316 – “In vitro and in vivo determination of antimicrobial activity and toxicity of silver nanoparticles and nanocomposites and materials based on silver nanoparticles,” 2010–2013; Principal investigator: RNDr. Aleš Panáček, Ph.D.

- Project GA CR GAP208/10/1742 – “Molecules on the surfaces of carbon nanostructures,” 2010–2013; Principal investigator: RNDr. Petr Jurečka, Ph.D.

- Project AS CR, “Nanotechnology for Society” programme, KAN115600801 – “New technologies of the preparation and use of iron oxide–based nanoparticles for environmental, industrial and medical applications,” 1/2008–12/2012; Principal investigator: prof. RNDr. Radek Zbořil, Ph.D.

- Project AS CR, “Nanotechnology for Society” programme, KAN301370701 – “Nanostructued macroscopic systems – technology for their preparation and characterisation,” 1/2007–12/2011; Principal investigator: prof. RNDr. Miroslav Hrabovský, DrSc.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project GA CR GAP108/11/1350 – “Effects of cores and boundaries of nanograins on structural and physical properties of ball milled and mechanically alloyed iron–based materials,” 2011–2014; Principal investigator: Ing. Yvonna Jirásková, CSc.,Institute of Physics of Materials AS CR, Co–principal investigator for FS UPOL: Mgr. Dalibor Jančík, Ph.D.

- Project GA CR GA106/08/1440 – “Iron and iron oxide nanoparticles for magnetic separation processes,” 1/2008–12/2011; Principal investigator: Ing.Oldřich Schneeweiss, DrSc., Institute of Physics of Materials AS CR, Brno, Co–principal investigator for FS UPOL: prof. RNDr. Miroslav Mašláň, CSc.

- Project GA CR GA205/08/0869 – “Clay minerals as host matrices for functional nanostructures,” 2008–2010; Principal investigator: prof. RNDr. Pavla Čapková, DrSc.,Mining University – Technical University of Ostrava, Co–principal investigator for FS UPOL: prof. RNDr. Miroslav Mašláň, CSc.

- Project MIT FR–TI3/622 – “Development and use of diffuse reactive barriers based on microFe and nanoFe for remediation,” 2011–2014; Principal investigator: RNDr.Jaroslav Hrabal, MEGA a.s., Co–principal investigator for FS UPOL: prof. RNDr. Radek Zbořil, Ph.D.

- Project MIT FR–TI3/196– “Advanced technologies for sanitary and toxicological treatment of release from wastewater plants,” 2011–2014; Principal investigator: Ing.Karel Plotěný, ASIO, spol s r.o., RNDr. Co–principal investigator for FS UPOL: RNDr. Jana Soukupová, Ph.D.

- Project MIT FR–TI3/808 – “Medicine in motion,” 2011–2012; Principal investigator: MUDr. Barbara Kubešová, Národní tkáňové centrum a. s., Co–principal investigator for FS UPOL: as.prof. RNDr. Jan Hlaváč, CSc.

- Project MIT FR–TI2/205 – “Research and development of medical devices based on nanomaterials," 2010–2013; Principal investigator: RNDr.Jiří Oborný – NanoTrade s.r.o, Co–principal investigator for FS UPOL: prof. RNDr. Jitka Ulrichová, CSc.

- Project AS CR, “Nanotechnology for Society" programme, KAN101630651 – “Preparation of nano–films and nano–coatings on fabrics using plasma surface treatment at atmospheric pressure,” 7/2006–12/2010; Principal investigator: prof. RNDr. Mirko Černák, CSc., Masaryk University in Brno/Faculty of Sciences, Co–principal investigator for FS UPOL: prof. RNDr. Miroslav Mašláň, CSc.

Experts/field

- prof. RNDr. Miroslav Hrabovský, DrSc.– wave optics, holography

- as.prof. RNDr. Roman Kubínek, CSc.– atomic force microscopy (AFM), nanoparticles (ferrous oxide)

- as.prof. RNDr.Libor Kvítek, CSc.– electrochemistry of organic metallic and coordination compounds, the preparation and characteristics of inorganic colloids (Ag, TiO_2)

- prof. RNDr. Miroslav Mašláň, CSc.– Mössbauer spectroscopy, magnetic nanoparticle synthesis

- prof. RNDr. Zdeněk Trávníček, Ph.D. – new coordination substance synthesis

- prof. RNDr. Radek Zbořil, Ph.D. – magnetic nanoparticle synthesis, structured, magnetic and morphological characterisation of nanoparticles

3.2.11.2 Faculty of Medicine and Dentistry (LF UPOL)

Tř.Svobody 8, 771 46 Olomouc

www.upol.cz/fakulty/lf

A brief description of the Faculty

The Faculty of Medicine and Dentistry was established in 1946 as one of the faculties of the revived Palacký University in Olomouc.It is divided into 24 clinics, 17 institutes and other institutions (laboratories etc.). The Faculty is joined together with a teaching hospital.Research and use of nanotechnology was identified to a lesser degree at the Institute of Microbiology, the Institute of Immunology and the Institute of Pharmacology.

Focus of research and development

From 2005–2011 two research proposals were implemented at LF UPOL, one of which was focused to a certain extent on nanotechnology and nanomedicine.

Research proposalMSM6198959223– “**New options for diagnostics and immunomodulation in infectious diseases and immunopathological states**,” 1/2007–12/2011; Principal investigator: prof. MUDr. Evžen Weigl, CSc.; total costs for the entire period of the project equalled CZK 101.678 million, CZK 101.678 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 10%.

The research proposal focused on the following areas:

– Induction of specific systemic immunity answers such as systemic infection prevention (Lyme disease, HIV–1 infection) and topical skin infections (trichphytosis).Induction of specific mucosal immunity as a prevention of mucosally localised infections (vaginal candidiasis) and infections transmitted through mucous membranes (HIV–1 infection).

– The testing of fusion DNA vaccines for modulation of antigen specific immune answers for targeted induction of humoral or cellular answers as prevention of infectious diseases, as well as inflammatory and allergic conditions.

– New options in diagnostics of pathogenic bacteria, virulence factors and resistance to antimicrobials.The elaboration and testing of options for new methods of quick pathogenic microorganism detection using physical chemistry methods based on interactions of organised metal nanoparticle layers with these pathogens, or their specific parts.

– Prevention of the inception and spread of bacterial resistance in humans and animals.

At the Institute of Microbiology as part of the research proposal described above options for the use of metal nanoparticles for the fast detection of pathogenic microorganisms were investigated (M. Kolář).

At the Institute of Immunology researchers participated in research in new nanovaccines against AIDS as part of an international project (M. Raška).

The Institute of Pharmacology participated in implementation of the “Nanotechnology for Society” programme (P. Anzenbacher).

In 2011 a total 71 programme research projects were implemented at the Faculty, some of them were of nanotechnology character.

Projects implemented in nanotechnologies

- Project ED0030/01/01 – "**BIOMEDREG – Biomedicine for regional development and human resources**," total cost: CZK 884 mil., project implementation: 2010 – 2013. Recipient:Palacký University, Olomouc/Faculty of Medicine and Dentistry, Co–investigator:Institute of Chemical Technology, Prague.The goal of the project is the establishment of the Institute of Molecular and Translational Medicine, and the technological infrastructure and platform for molecularly oriented basic and translation biomedical research, focused specifically on studying the mechanisms of the inception and treatment of tumourous and infectious diseases, the creation of a national platform for chemical biology and the development of drugs and identification of new targets, biomarkers and diagnostic approaches aimed at individualised therapy.Preclinical development will build on the research, and in certain instances the phase of early proof–of–concept type clinical tests.Project director: as.prof. MUDr. Marián Hajdúch, PhD., Palacký University, Olomouc/Faculty of Medicine and Dentistry/Instituteof Molecular and Translational Medicine, Project managers: Mgr. Miroslav Dvořák and Ing. Mgr. Arnošt Rybář, UPOL/Faculty of Medicine and Dentistry.

Projects on whose implementation the Faculty is cooperating:

- Project Ministry of Health NR9076 – “Genomic profiling in predicting the response to chemotherapy for patients with locally advanced colorectal carcinomas,” 2006–2010; Principal investigator: prof. MUDr. Rostislav Vyzula, CSc.,Masaryk Memorial Cancer

Institute, Brno, Co–principal investigator for LF UPOL: as.prof. MUDr. Marián Hajdúch, Ph.D.

- Project GA CR GAP304/10/1951 – "Nanoliposomes for the development of recombinant vaccines and targeted immunotherapies," 2010–2013; Principal investigator: RNDr. Jaroslav Turánek, CSc., Research Institute of Veterinary Medicine, Co–principal investigator for LF UPOL MUDr. Mgr. Milan Raška, Ph.D.
- Project AS CR KAN200200651 – "Nanoparticulate and supramolecular systems for targeted drug delivery," 6/2007–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for LF UPOL: prof. MUDr. Pavel Azenbacher, DrSc.
- Project 6FP STREP, project name: "MUNANO VAC –Mucosal Nano Vaccine Candidate for HIV," 1/2007–12/2009, 8 participants. The use of PLA nanoparticles as drug carriers was investigated. Principal investigator for LF UPOL: MUDr. Mgr. Milan Raška, CSc.

Experts/field

- prof. RNDr. P. Anzenbacher, DrSc.– drug metabolism – enzymes of drug metabolism, differences in metabolism among species, drug interactions
- as.prof. MUDr. Marián Hajdúch, Ph.D. – genomics
- prof. MUDr. Milan Kolář, Ph.D. – microbiology, microbe resistance
- MUDr. Mgr. Milan Raška, CSc.– immunology
- prof. MUDr. Evžen Weigl, CSc.– immunology

3.2.12 TOMAS BATA UNIVERSITY IN ZLÍN (TBU)

Mostní 5139, 760 01 Zlín, ID: 70883521

www.utb.cz

TBU is an educational and scientific–research institution. With 11,000 students it ranks among the medium–sized universities in the Czech Republic. The university was established on 1 January 2001 through the transformation of two faculties of Brno University of Technology. TBU has five faculties (technological, management and economics, multimedia communications, applied informatics and study in the humanities) and a University Institute, which takes care of both project activities and research activities in the following fields polymer materials, technology and products with a special emphasis on polymer application in healthcare and materials and technology in the food industry with a focus on food supplements.

Nanotechnology research is carried out at the Faculty of Technology.

3.2.12.1 Faculty of Technology (FT TBU)

Náměstí T. G. Masaryka 275, 762 72 Zlín

www.ft.utb.cz

A brief description of the Faculty

The Faculty of Technology in Zlín, with its core field of study in Technology of Leather, Plastics and Rubber, was established on 15 April 1969 as part of the Brno University of Technology. In 2001 it was one of the founding faculties of TBU. Scientific–research activity at FT TBU is derived from its long–standing tradition and also reflects developing trends, including the engineering fields of chemical, chemical–technological, environmental, material, management, aumation, information, safety, manufacturing procedural and mechanical fields and the related fields. Scientific disciplines are focused primarily on polymer material chemistry and technology, industrial process control and manufacturing economics, and further on information technology application in industrial manufacturing control. FT TBU is divided into seven departments and one centre. Nanotechnology research is carried out at the Polymer Centre (head: prof. Ing. Petr Sáha, CSc.), the Department of Polymer Engineering (head: Ing.Roman Čermák, Ph.D.) and the Institute of Physics and Materials Engineering (head: prof. Ing. Lubomír Lapčík, Ph.D.).

Focus of research and development

From 2005–2011 one research proposal which was partially focused on nanotechnology was implemented at FT TBU.

Research proposalMSM7088352101– "**Multifunctional composite systems based on natural and synthetic polymers**," 1/2005–12/2011; Principal investigator: prof. Ing. Petr Sáha, CSc.; total costs for the entire period of the project equalled CZK 240.898 million, CZK 204.253 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 70%.

The research proposal was oriented toward the acquisition of new knowledge in natural and synthetic macromolecular composite systems, with an emphasis on the transfer of this knowledge into the applied research sphere. Selected multifunctional polymer composites with integral biocomponents, optical, magnetic and electronic functions, containing nanostructures, gel systems or additives, were investigated in terms of their preparation, properties and processing. The output was new basic knowledge in the monitored areas and in particular then the design of innovations for products and manufacturing procedures, including the complete design of control systems. It is expected that the results achieved will find use in the plastics, food and automobile industries. Significant benefits are also expected in healthcare materials and packaging.

In 2011 a total of 18 grant projects were implemented at the Faculty. One of the largest one is the investment project ED4.1.00/04.0139 – "**Laboratory Centre of the Faculty of Technology**," implemented as part of the Operational Programme Research and Development for Innovation. From 2011–2013 a new laboratory building for teaching connected with research and development in the connected master's and doctoral study programmes at the Faculty. The laboratory should cost CZK 448.3 million. Its operations and facilities will be connected with the existing building, which will enable the concentration of all teaching and scientific–research capacities of the Faculty into a single organic whole.

Research in nanotechnologies in individual departments

Polymer Centre:

The centre's activities in nanotechnology are focused on both systems of functional nanoparticles in biocompatible, biodegradable, or a naturally–occurring polymer matrix for use in medicine and in packaging equipment, and polymer materials with optical, magnetic and electrical functions, which contain targeted modified **nano– or nanostructured** fillers, are further researched. Issues in the preparation and properties of layered and mesoporous intercalated nanofillers are also studied. In the field of purely polymer nanosystems issues of electron resistors for nanoprinting technology are worked on.

Department of Polymer Engineering:

The Department of Polymer Engineering has been involved for a long time in studies of treatments of **nanofillers** on an organophilic clay base, particularly montomorillonite and vermiculite, focusing on their use in various polymer matrices. Experimental work is also supplemented with the theoretical solution of mathematical computer modelling predicting the arrangement and position of organophilic agents in clay strata and in connection with agent concentration. In addition studies are conducted on the conditions of mixing these treated and commercial nanofillers for a polymer matrix and the impact of these conditions and types of nanofillers on the properties of prepared polymer **nanocomposites**. It is expected that they will find use in a number of fields.

Department of Physics and Materials Engineering:

The Department's activities are focused on modification of surface properties of **nanofillers** for applications in polymers, gel systems, PUR foams, paints and thin surface layers. The Department has sufficient personnel and the materials and technology needed to study and characterise shape, charge and zeta potential of **nanoparticles**, their synthesis and modification. The Department was included in international cooperation in the field in the form of EU research projects in the framework of the 5FP, 6FP, 7FP (SUPERWAFER, NENAMAT, MICRONANO, SCRATCH, AeroNet, EnerPlast) programmes, and within the Czech Republic with a number of domestic and foreign companies. The Department is further actively engaged in EASN (Garching, Germany) activities, where prof. Ing. L. Kapřík, Ph.D. is working in the Innovative Concepts and Scenarios – Pioneering Nanomaterials for Aerospace Applications group, and in the ELKIN (NL) and ICCE (USA) international advisory committees.In the field of education study in material engineering at FS TBU is also focused on the field of nanomaterials.

Projects implemented in nanotechnologies

a) *Projects whose recipient is the Faculty:*

- Project ED2.1.00/03.0111 – "**Centre of Polymer Systems**," 2011–2014; Principal investigator: prof. Ing. Petr Sáha, CSc., budget: CZK 754 million. This is primarily an investment project in the Operational Programme Research and Development for Innovation, which involves the building of a regional research centre focused on the plastics and rubber industry. The construction part of the project includes the construction of a new CPS building close to the other TBU buildings in Zlín with an estimated capacity of 112 researchers and its outfitting with modern equipment. The scientific part is conceived as 2 mutually connected research programmes linked to polymer processes, bioactive polymers and polymer composites.

- Project MEYS MEB090801 – "Development and characterization of polymeric nanocomposites," 2008–2009; Principal investigator: prof. Ing. Petr Sáha, CSc.

- Project GA CR GAP108/10/1325 – "Applied rheology for progressive polymer technologies," 2010–2014; Principal investigator: prof. Ing. Martin Zatloukal, Ph.D.

- Projekt GA CR GA202/09/1206 – "Nanocrystalline heterogeneous photovoltaic solar cells," 2009–2011; Principal investigator: prof. Ing. František Schauer, DrSc., Co–principal investigators: RNDr. Jan Rohovec, Ph.D., Institute of Geology AS CR andas.prof. RNDr. Jana Toušková, CSc.Charles University in Prague/Faculty of Mathematics and Physics

b) *Projects on whose implementation the Faculty is cooperating:*

- Project AS CR, "Nanotechnology for Society" programme, KAN100400701 – "Hybrid nanocomposite materials," 1/2007–12/2011; Principal investigator: prof. Ing. Jiří Čejka, DrSc., J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for FS TBU: Ing.Dagmar Měřínská, Ph.D.

- Project GA AS CR IAA100100622 – "Conjugated silicate polymers for resistors in nanotechnology," 1/2006–12/2009; Principal investigator: RNDr. Josef Zemek, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for FS TBU: prof. Ing. Pavek Schauer, DrSc.

- Project MIT FI–IM3/085 –"Polyolefin based nanocomposites with extraordinary utility properties," 3/2006–12/2009; Principal investigator: Ing.Ivan Dobáš, CSc., SYNPO, a. s., Pardubice, Co–principal investigator for FS TBU: Ing.Dagmar Měřínská, Ph.D.

Experts/field

- MSc. Qilin Cheng – Nanostructured material synthesis, mesoporous intercalates

- Ing. Alena Kalendová, Ph.D. – Study of polymer/clay type nanocomposite materials with a focus on polyvinylchloride and polyolefin

- as.prof. Mgr. Natalia Kazantseva, Ph.D. – electrical properties of nanocomposites, electromagnetic shielding, applications in medicine, metamaterials

- Ing. Ivo Kuřitka, Ph.D. – structured characterisation, spectroscopy, polysilanes for nanoresistors

- as.prof. Ing. Jiří Maláč, CSc.– options for the use of clay nanofillers in caoutchouc mixtures and their impact on rubber properties for various purposes

- Ing. Dagmar Měřínská, Ph.D. – polymer structure and morphology, intercalation and cointercalation treatment of clay materials, composite and nanocomposite material technology, study of nanocomposite properties, PO/clay nanocomposites

- as.prof. Dr. Ing. Vladimír Pavlínek – rheology and electrorheology of nanoparticle and nanocomposite suspensions

- as.prof. MSc. Nabanita Saha, Ph.D. – biodegradation, microbiology

- prof. Ing. Petr Sáha, CSc.– polymer processes, rheology and electrorheology, unstable polymer melt and blend flows, physical aging of polymers
- Ing.Vladimír Sedlařík, Ph.D. – biodegradable and biocompatible materials, nanocomposites containing silver and ZnO nanoparticles
- prof. Ing. František Schauer, DrSc.– vacuum and plasma deposition of amorphous and nanocrystalline inorganic and organic semiconductors, characterisation of deposition conditions using electric methods, mass–based methods and optical spectroscopy, transport, optical and photoelectric properties of amorphous inorganic and organic semiconductors with the main emphasis on electron spectroscopy, in particular on tunnel electron spectroscopy
- Ing. Petr Slobodian, Ph.D. – carbon nanotubes, nanocomposite, thermal analysis
- as.prof. Ing. Jarmila Vilčáková, Ph.D. – electrical properties of nanocomposites, conductivity, di–electric spectroscopy
- Mgr.He Ying, Ph.D. – hybrid nanosystems and nanocomposites,elastomer nanocomposites

3.2.13 UNIVERSITY OF SOUTH BOHEMIA IN ČESKÉ BUDĚJOVICE (USB)

Branišovská 31, 370 05 České Budějovice, ID: 60076658

www.jcu.cz

The University of South Bohemia, founded in 1991, performs teaching and research primarily in the fields of biology, agriculture and fishing. The University is divided into seven faculties (Faculty of Economy, Faculty of Philosophy, Pedagogical Faculty, Faculty of Science, Faculty of Fisheries and Protection of Water, Faculty of Theology, Faculty of Health and Social Studies and the Faculty of Agriculture). Research in nanobiotechnology was identified at the Faculty of Science, the Faculty of Agriculture and at the Institute of Physical Biology in Nové Hrady.

3.2.13.1 Faculty of Science (FS USB)

Branišovská 31, 370 05 České Budějovice

www.prf.jcu.cz

A brief description of the Faculty

The Faculty of Science of USB was created from the USB Faculty of Biology in 2007. Study programmes in chemistry, physics, mathematics and information studies were added to its specialised study programmes, focused heavily on topics in biology. The Faculty is divided into 9 departments and 3 institutes.

From 2011–2014 a building housing a laboratory, classrooms, preparation rooms and lecture halls with usable floorspace of 4750 m^2 will be built at a cost of CZK 362.9 million. It is part of the investment project from the Operational Fund for Research and Development for Innovation ED4.1.00/04.0155 – **Development of FS USB**. The goal is to ensure suitable

conditions for development and diversification of teaching and research activities at the Faculty.

Focus of research and development

From 2005–2011 one research proposal was implemented at FS USB. It was not, however, focused on nanotechnologies. In 2011 a total 53 programme research projects were implemented at the Faculty, some of them were of nanotechnology character.

Nanotechnology research is carried out in cooperation with the Department of Chemistry and Biochemistry and the Department of Physics and Biophysics of FS USB.

Projects implemented in nanotechnologies

a) *Projects implemented by the Faculty:*

- Project GA CR, Centres of Excellence, P501/12/G055 – "Photosynthesis Research Centre," 2012–2018; Principal investigator: prof. RNDr. František Vácha, Ph.D.
- Project MEYS ME09062 – "Computer modelling study of the structure and dynamics of mineral surfaces and biomembranes and their interactions with organic and inorganic ligands," 2009–2012; Principal investigator: Mgr. Milan Předota, Ph.D.

b) *Projects on whose implementation the Faculty is cooperating:*

- Project GA CR GAP205/11/0386 – "Advanced experimental research of discharge plasma sources applied for deposition of nanostructured thin films," 2011–2013; Principal investigator: prof. RNDr. Milan Tichý, DrSc.,Charles University in Prague/MFF, Co–principal investigator for FS USB: RNDr. Vítězslav Straňák, Ph.D.
- Project GA CR GA203/08/0094 – "Computer modelling of structural, dynamic and transport properties of liquids on a nanoscale," 1/2008–12/2011; Principal investigator: Mgr.Milan Předota, Ph.D.
- Project AS CR, "Nanotechnology for Society" programme, KAN200100801 – "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and drug delivery," 1/2008–12/2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics AS CR, Prague, Co–principal investigator for FS USB: RNDr. Jaroslav Turánek, CSc.

Experts/field

- Mgr. David Kaftan, Ph.D. – AFM, structural biology
- prof. RNDr. Tomáš Polívka, Ph.D. – kinetic absorption spectroscopy, artificial photosynthesis
- RNDr. Vítězslav Straňák, Ph.D. – plasma physics, thin layers
- prof. RNDr. František Vácha, Ph.D. – biochemistry, structural biology, spectroscopy, photosynthesis, spectroscopy and single molecule detection

3.2.13.2 Institute of Physical Biology (IPB USB)

Zámek 136, 373 33 Nové Hrady

www.ufb.jcu.cz

A brief description of the Institute

The Institute of Physical Biology, located in the town of Nové Hrady, joined the University of South Bohemia in 2002. The main activities of UPH are basic research of natural systems using physical, mathematical, biological, chemical and other exact methods. Together with the faculties of USB the Institute also provides instruction in the subjects which the University entrusts to it, including the applicable habilitation proceedings. The Institute is divided into three departments (structures and functions of proteins, ecophysiology of autotrophic microorganisms and biotechnology) which are further divided into laboratories. IPB USB created several joint laboratories with the Institute of Systems Biology and Ecology AS CR, part of which is located in the same building.

On 31.12.2011, the Institute of Physical Biology (IPB) was terminated as individual part of the University of South Bohemia in České Budějovice. Part of the IPB has formed a new scientific unit, the School of Complex Systems that is now part of the Faculty of Fishery and Water Protection, while another part was transferred to the Faculty of Science.

Focus of research and development

From 2005–2011 one research proposal which was partially focused on nanotechnology was implemented at IPB USB.

Research proposalMSM6007665808– "**Physical biology – new approaches in biological research**," 1/2005 – 12/2011; Principal investigator: prof. RNDr. František Vácha, Ph.D., total costs for the entire period of the project equalled CZK 146.818 million, CZK 129.423 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 10%.

The goal of the project was the use of exact physical, chemical and mathematical methods in the study of biology on a level from the entire organism to cellular biology, molecular biology all the way to protein biochemistry and individual biologically active molecules. The subject was the study of the relationships between protein structure and function, molecular ecophysiology of photosynthesis, photosynthetic biotechnology and production of biologically active substances, applied photobiology and imaging techniques and equipment development. The goal was contributing to clarification of basic processes, molecular principles and regulation of energy exchange in an organism from individual proteins to the level of the whole organism.

The goal of research at the Institute of Physical Biology USB is the study of:

- Biology of systems – study of the function of living organisms and their communities on different levels, and their regulation and adaptation to external conditions takes place. For this purpose randomly and purposefully mutated organisms are used. Part of this research activity also includes the development of new measuring techniques and mathematical methods for processing results and the development of biotechnology.
- Structures and functions of key proteins in cells – all methods available are used to determine the structure and function of proteins and other biologically significant

molecules. Part of these activities also includes molecule modelling calculation methods including ab initio calculations.

In 2011, an additional 14 programme research projects were implemented at the Institute, some of which included elements of nanotechnology.

Research in nanotechnologies

Research with the character of nanobiotechnology is carred out at the Laboratory of Nanobiology (D. Kaftan). This laboratory is part of the Department of Protein Structure and Function and is a joint laboratory between the IPB USB and the Institute of Systems Biology and Ecology AS CR. Since key reactions in cells are catalysed by enzymes and molecular tools with sizes ranging from 1 to 100 nm, whose in situ and in vivo study requires their precise localisation in time and space as well as the characterisation of forces which stabilise protein complexes and receptors – ligand pairs – which participate in the reaction, the laboratory is involved in imaging surface structures and physicochemical properties of isolated proteins and proteins in the native membrane environment in an immobilised state and during physiological processes with the goal of describing organisations of organels, sub–cellular structures and membrane proteins in living cells under physiological conditions in relation to internal and external biotic and abiotic factors. The goal is to simultaneously analyse functions and localisation of protein complexes using a combination of confocal microscopy and high definition imaging and detection on a molecular level through AFM.

Projects implemented in nanotechnologies

- Project GA CR GAP208/10/1678 – "Fotophysics and photochemistry of self assembled nanostructures," 2010–2012; Principal investigator: RNDr. Pavel Kubát, CSc., J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for IPB USB: as.prof. RNDr. Tomáš Polívka, Ph.D.

- Project GA CR GA202/07/0818 – "Silicon nanophotonics – from single nanocrystals to photonic structures," 2007–2009; Principal investigator: as.prof. RNDr. Jan Valenta, Ph.D., Charles University in Prague/MFF, Co–principal investigator for IPB USB: prof. RNDr. František Vácha, Ph.D.

Experts/field

- Mgr. David Kaftan, Ph.D. – absorption and emission spectroscopy, fluorescent and confocal microscopy, scan probe microscopy – imaging, dynamic force spectroscopy, isolation of soluble and membrane proteins, development and application of new imaging and non–imaging spectroscopic methods

- prof. RNDr. Tomáš Polívka, Ph.D. – methods of molecular spectroscopy with very high time resolution (to femtoseconds), transfer of exciters and electrons and carotenoid function in antenna systems of photosynthesizing organisms

- prof. RNDr. František Vácha, Ph.D. – biochemistry, structural biology, spectroscopy, photosynthesis, single molecule spectroscopy, single molecule detection

3.2.13.3 Faculty of Agriculture (FA USB)

Studentská 13, 370 05 České Budějovice, ID: 60076658

www.zf.jcu.cz

A brief description of the Faculty

The Faculty of Agriculture of USB was founded in 1960. In 1991 it became one of the two founding faculties at the inception of the University of South Bohemia. Besides traditional agriculture fields, the present day Faculty of Agriculture is also focused on applied natural science – agroecology, quality of raw materials for foods, biology of special interest organisms etc. From 2011–2014 a three–story building housing a laboratory, classrooms, preparation rooms and lecture halls with a useable floorspace of 4800 m^2 will be built at a cost of CZK 295 million. It is part of the investment project from the Operational Fund for Research and Development for Innovation ED4.1.00/04.0155 – **Development of Faculty of Agriculture and Faculty of Fisheries & Protection of Waters USB**. The goal is ensure suitable conditions for development and diversification of teaching and research activities at the Faculty.

Focus of research and development

Research is focused primarily on agroecology and improving the quality of raw materials for the food industry. In 2011 a total of 40 programme research projects were implemented at the Faculty, one of which concerns nanotechnology.

Project implemented in nanotechnologies

- Project Ministry of Agriculture QH92195 – "The use of selected nanotechnologies for the design and verification of the best available techniques (BAT) in agricultural activities," 2009–2011; Principal Investigator: Ing.Antonín Jelínek, CSc., Research Institute of Agricultural Engineering, Co–principal investigator for FA USB: prof. Ing. Miloslav Šoch, CSc.

3.2.14 UNIVERSITY OF VETERINARY AND PHARMACEUTICAL SCIENCES BRNO (UVPS)

Palackého 1/3, 612 42 Brno, ID: 62157124

www.vfu.cz

The University of Veterinary and Pharmaceutical Sciences was established 1 January 1995 when the Veterinary and Pharmaceutical University changed its name. The University of Veterinary and Pharmaceutical Sciences has three faculties: Faculty of Veterinary Medicine, Faculty of Pharmacy and Faculty of Veterinary Hygiene and Ecology. Nanotechnology research is carried out to a limited degree at the Faculty of Veterinary Medicine and the Faculty of Pharmacy.

3.2.14.1 Faculty of Veterinary Medicine (FVM)

Palackého 1/3, 612 42 Brno

http://fvl.vfu.cz

A brief description of the Faculty

The Faculty of Veterinary Medicine (FVM) builds on the tradition of the Veterinary University which was founded in December 1918. It is the only university of its kind in the Czech Republic. Four sections comprise the specialised organisational units of FVM – the Section of Morphology and Physiology, Section of Pathobiology, Section of Small Animals Diseases and the Section of Large Animals Diseases. Sections are further divided into individual departments and clinics. A total of six departments, four clinics and two clinical laboratories ensure the teaching of the study programme and research of the Faculty of Veterinary Medicine in integration with the further departments of the other faculties. A diagnostic, teaching and research centre of infectious diseases of animals at UVPS Brno: **the Centre of Diagnostics of Zoonosis**, which will be created from 2012–2013 at a cost of CZK 106 million by the reconstruction of one building at the Faculty with an area of 2,296 m^2 and the building of new capacity with an area of 424 m^2, and modernized laboratories and rooms for instruction. The centre is part of the investment project from the Operational Programme Research and Development for Innovation, ED4.1.00/04.0156.

Focus of research and development

From 2005–2011 research at FVM focused primarily on the implementation of one research proposal. No focus on nanotechnology was found in connection with it. In 2011, a total of 24 grant agency projects were implemented at the Faculty. Research using nanotechnology was carried out at the Department of Surgery and Orthopaedics at the Dog and Cat Clinic, located in the Section of Small Animals Diseases (A. Nečas).

Projects implemented in nanotechnologies

- Project MEYS 2B06130 – "Synthesis of new biomaterials in combination with stem cells in the treatment of diseases affecting human tissue derived from the mesoderm:cartilage, bone, ligament and meniscus," 7/2006–6/2011; Principal investigator: prof. MVDr. Alois Nečas, Ph.D., MBA

- Project AS CR, "Nanotechnology for Society" programme, KAN200520703 – "The use of ultrasound in nanomedicine," 1/2007–12/2011; Principal investigator: as.prof. Ing. Jiří Neužil, CSc., Biotechnology Institute AS CR, Prague, one of the co–investigators was FVM UVPS Brno

Results in nanotechnologies/cooperation

Project NPV II 2B01630 is an example of unique interdisciplinary cooperation and connection of fitting teams of experts from the fields of material development, tissue engineering and experimental surgery from veterinary medicine and humane medicine. The results achieved in transplantation surgery of newly developed composite biomaterials and nanofibres in combination with stem cells are beneficial for the anticipated launch of clinical trials before their potential clinical use, as grafts for irreversibly damaged tissues in the human locomotor system.

Experts/field

- prof. MVDr. Alois Nečas, Ph.D., MBA – orthopaedics of small animals, arthroscopy and veterinary neurosurgery

3.2.14.2 Faculty of Pharmacy UVPS Brno

Palackého 1/3, 612 42 Brno

http://faf.vfu.cz

A brief description of the Faculty

The Faculty is part of the University of Veterinary and Pharmaceutical Sciences Brno. Its main mission is the provision of university education in pharmacy in master's and doctoral study programmes and the conducting of research in pharmacy and related sciences.

The Faculty has five departments and operates a faculty pharmacy.

Focus of research and development

Research activity is oriented towards the acquisition, preparation, pharmacological and biochemical evaluation of natural and synthetic substance with biological activity and the preparation and evaluation of the quality of modern drug forms.In 2011, a total 6 programme research projects were implemented at the Faculty, one of which concerns nanotechnology.

Projects implemented in nanotechnologies

- Project GA CR GAP304/11/2246 – "Targeted drug transport across biological membranes," 2011–2014; Principal investigator: as.prof. PharmDr. Josef Jampílek, Ph.D.

3.2.15 MENDEL UNIVERSITY OF AGRICULTURE AND FORESTRY IN BRNO (MUAF)

Zemědělská 1, 613 00 Brno, ID: 62156489

www.mendelu.cz

Mendel University of Agriculture and Forestry in Brno (MUAF) is the oldest university providing instruction of agriculture and foresty in the Czech Republic. It was established in 1919 as the University of Agriculture in Brno and existed under this name until 1994. MUAF is comprised of five faculties and one university institute. The Faculty of Agronomy, the Faculty of Forestry and Wood Technology, the Faculty of Business and Administration, the Faculty of Regional Development and International Studies and the Institute of Lifelong Learning (university institute) are located in Brno, and the Faculty of Horticulture is in the town of Lednice.

Cooperation in projects focused on nanotechnology was found at the Faculty of Agronomy.

3.2.15.1 Faculty of Agronomy (FA)

Zemědělská 1, 613 00 Brno

www.af.mendelu.cz

A brief description of the Faculty

Together with the Faculty of Forestry and Wood Technology the Faculty of Agronomy counts as the oldest component of Mendel University of Agriculture and Forestry in Brno. Over the years new study majors and specialisations were developed at the Faculty of Agronomy. Phytotechnics and zootechnics are in existence to this day, while gardening and horticulture have separated from the Faculty and become part of the separate Faculty of Horticulture. The irrigation and drainage major has been closed. Specialisations in animal breeding and feeds have been introduced at the Faculty of Agronomy. The fishery specialisation has a long–standing tradition and is the only original specialisation still in existence at the Faculty. The Faculty is divided into 15 departments.

From 2011–2013 two multiple–story university pavilions focused on research and teaching in biotechnology are to be built at a cost of CZK 619.3 million as part of the investment project from the Operational Programme Research and Technology for Innovation ED4.1.00/04.0135**– Teaching and research capacity for biotechnology fields and infrastructure expansion**.

Focus of research and development

From 2005–2011 research at FA focused primarily on the implementation of one research proposal. No focus on nanotechnology was found in connection with it. In 2011 a total of 75 programme research projects were implemented at the Faculty. The most ambitious of these is European Centres of Excellence project ED1.1.00/02.0068 –**CEITEC–Central European Institute of Technology** (www.ceitec.cz), in which the Faculty is involved as one of the partners. The person responsible for the project at the Faculty is prof. MVDr. Jiří Rubeš, CSc.

Research in nanotechnologies

Work on implementation of the projects described below:

- Project TA CR TA01010088 – "NANOCEVA – Development and innovation of new nanomaterials for targeted modification of vascular grafts," 2011–2015; Principal investigators: prof. Ing. Ivo Provazník, Ph.D., Ing. Radim Hrdý, as.prof. Ing. Jaromír Hubálek, Ph.D, Ing. Denisa Maděránková, Ing. Jan Prášek, Ph.D., Bc. Jiří Sedláček, Ing. Helena Škutková and Bc. Jaromír Žák, Brno University of Technology/Faculty of Electrical Engineering and Communication, Co–principal investigator for FA MUAF: as.prof. Ing. René Kizek, Ph.D.

- Project TA CR TA01010356 – "Suitable materials for nanotechnological applications in the purification and treatment of water and air," 2011–2014; Principal investigators: Ing. Karel Plotěný, Ing. Marek Holba, Ph.D., ASIO, spol. s r.o., Co–principal investigators for FA MUAF: Ing. Libor Kalhotka, Ph.D., prof. Ing. Jaroslav Buchar, Dr.Sc., as.prof. Ing. Michal Černý, CSc., Mgr. Marie Konečná and Ing. Jaroslav Lev

- Project GA CR GAP102/11/1068 – "Nano–electro–bio–tools for biochemical and molecular–biological studies of eukaryotic cells (NanoBioTECell)," 2011–2015; Principal investigator: prof. Ing. Ivo Provazník, Ph.D., Brno University of

Technology/Faculty of Electrical Engineering and Communication, Co–principal investigator for FA MUAF: as.prof. Ing. René Kizek, Ph.D.

- Project GA CR GD204/09/H002 – "Plant developmental biology and genetics," 2009–2012; Principal investigator: prof. RNDr. Boris Vyskot, DrSc., Biophysical Institute AS CR, Co–principal investigator for FA MUAF: prof. RNDr. Ladislav Havel, CSc.
- Project GA CR GA102/08/1546 – "Miniaturised intelligent systems and nanostructured electrodes for chemical, biological and pharmaceutical applications (NANIMEL)," 1/2008–12/2012; Principal investigator: as.prof. Ing. Jaromír Hubálek, Ph.D.Brno University of Technology/Faculty of Electrical Engineering and Communication, Co–principal investigator for FA MUAF: as.prof. Ing. René Kizek, Ph.D.
- Project GA CR GAP503/10/0975 – "Nanostructured imprinted polymers as highly selective sorbents for the determination of endocrine disrupting compounds," 2010–2012; Principal investigator: Mgr. David Matějíček, Ph.D., FA MUAF, Co–principal investigator Mgr. Jan Přibyl, Ph.D., Masaryk University in Brno/Faculty of Sciences
- Project AS CR KAN208130801 – "New designs and use of nanobiosensors and nanosensors in medicine (NANOSEMED)," 01/2008–12/2012; Principal investigator: as.prof. Ing. Jaromír Hubálek, Ph.D., Brno University of Technology/Faculty of Electrical Engineering and Communication, Co–principal investigator for FA MUAF: as.prof. Ing. René Kizek, Ph.D.

Experts/field

- prof. RNDr. Ladislav Havel, CSc.– PCR optimisation for gene detection, plant biology
- as.prof. Ing. René Kizek, Ph.D. – the use of electrochemical methods in proteomics and genomics

3.2.16 UNIVERSITY OF OSTRAVA

Dvořákova 7, 173 10 Ostrava, ID: 61988987

www.osu.cz

The University of Ostrava was founded on 28 September 1991. The foundations for its creation were established in 1953. Then the Higher School of Education was opened in the town of Opava.Its mission was to train teachers for middle school level of primary schools.The University of Ostrava organically built on this tradition in the humanities. At the present time the University of Ostrava is comprised of Faculty of Social Studies, Faculty of Fine Arts, Faculty of Arts, Faculty of Medicine, Faculty of Education and Faculty of Science.It offers undergraduate study programmes, connected master's, master's and doctoral study programmes and lifelong learning programmes.

The university has two scientific institutes. The Institute for Research and Application of Fuzzy Modelling (http://ifm.osu.cz) focuses on the development of special mathematical methods. The European Research Institute for Social Work (http://evis.osu.cz) focuses on the development of practical knowledge and skills of managers and social workers.Cooperation in projects focused on nanotechnology was found at the Faculty of Science.

3.2.16.1 Faculty of Science (FS UO)

Dvořákova 7, 173 10 Ostrava

www.osu.cz

A brief description of the Faculty

The Faculty of Science at the University of Ostrava came into existence 1 October 1991. The Faculty trains students in undergraduate, master's and doctoral study programmes.

Focus of research and development

Main directions of research and development:

- Biophysics, biochemistry and ecophysiology of photosynthesis
- Biomonitoring of the toxic and genotoxic effects of environmental contaminants
- Differential geometry and global analysis

In 2011 a total 21 research and development projects were implemented at the Faculty. One of these is the project ED2.1.00/03.0100 – **Institute of Environmental Technology**. The Faculty is a partner in this project (the main recipient is the Mining University – Technical University Ostrava). From 2011–2013 a research pavilion is to be built, laboratories equipped and research teams created which will prepare, develop, study and optimise advanced methods and technologies of the of use waste for energy including the removal of products and environmental assessment of the impact of these technologies. The project should cost CZK 270.56 million (from structural funds).

Research in nanotechnologies

Work on implementation of the project described below:

- Project GA CR GA106/07/1436 – "Friction materials based on polymers containing metals and their environmental impact," 2007–2009; Principal investigator: prof. Ing. Václav Roubíček, CSc., Mining University – Technical University Ostrava/Faculty of Metallurgy and Material Engineering, Co–principal investigator for FS UO: Ing. Pavel Moravec, CSc.,

3.2.17 UNIVERSITY OF DEFENCE

Kounicova 156/65, 602 00 Brno–Veveří, ID: 60162694

www.vojenskaskola.cz/skola/uo

The University of Defence was established 1 September 2004. It is comprised of three faculties: Faculty of Economics and Management – Brno, Faculty of Military Technology – Brno and Faculty of Military Health Sciences – Hradec Králové.

Cooperation in projects focused on nanotechnology was found at the Faculty of Military Health Sciences Hradec Králové.

3.2.17.1 Faculty of Military Health Sciences Hradec Králové (FMHS HK)

Třebešská 1575, 500 01 Hradec Králové

www.vojenskaskola.cz

A brief description of the Faculty

The Faculty of Military Health Sciences provides for the teaching and preparation of students in a three–year undergraduate Medical First Responder study programme, a six–year master's programme in Military General Medicine and a five–year master's study programme in Military Dentistry and Military Pharmacy. FMHS has accredited doctoral study programmes in Epidemiology, Infectious Biology, Medical Microbiology, Toxicology, Military Hygiene, Military Surgery, Military Radiobiology and Military Internal Medicine. In these medical fields it prepares highly trained professionals in full–time and combined forms of study.

Focus of research and development

In 2011 a total of 45 programme research projects were implemented at the Faculty, 18 of which were projects in military research, 4 research proposals, 6 foreign projects, 1 project financed by the Ministry of Industry and Trade, 6 projects financed by the Grant Agency of the Czech Republic, 5 projects financed by the Ministry of Education, Youth and Sports and 5 projects financed by the Internal grant agency of the Ministry of Health. One of the projects implemented was connected with nanotechnology.

Research in nanotechnologies

Work on implementation of the project described below:

- Project Ministry of Defence OVUOFVZ200807 – "PROTEIN – Biosensors for determining of nerve agents and yperites using recombinant proteins and nanotechnologies," 2008–2011; Principal investigators: RNDr.Miroslav Pohanka, Ph.D., prof. MUDr. Jiří Kassa, CSc., as.prof. Ing. Kamil Kuča, Ph.D., as.prof. Kamil Musílek, Ph.D. and PharmDr. Jana Žďárová–Karasová, Ph.D.

3.2.18 CZECH UNIVERSITY OF LIFE SCIENCES IN PRAGUE (CULS)

Kamýcká 129, 165 21 Prague 6 – Suchdol, ID: 60460709

www.czu.cz

The history of the school dates back to the establishment of the Agriculture Department at the Czech Technical University (CTU) in 1906. The independent University of Agriculture in Prague was established 8 July 1952.

3.2.18.1 Faculty of the Environment (FE)

www.fzp.czu.cz

A brief description of the Faculty

The Faculty of the Environment was established 1 July 2007, when the Faculty of Forestry and the Environment split into two entities: The Faculty of Forestry, Wildlife and Wood Sciences and the Faculty of Environmental Science. The Faculty is divided into 6 departments (Department of Applied Geoinformatics and Spatial Planning, Department of Environmental Geosciences, Department of Ecology, Department of Applied Ecology, Department of Land Use and Improvement, Department of Water Resources and Environmental Modelling) which cover the entire field of education and science at the Faculty.

Focus of research and development in biological diversity:

- Protection of biological diversity, improving retention and water accumulation in the landscape
- Renewal of extra–productive landscape functions
- Environmental relations and their changes on the level of the landscape, communities and species
- Protection and management of selected sites, care for protected landscapes
- For the care of protected landscapes, grant programmes etc.
- The use of alternative energy sources
- Research projects for commercial use focused on research and the use of alternative energy sources

Research in nanotechnology

Work on implementation of the project described below:

- Project TA CR TA01010552 – "The use of membranes with nanopores to reduce the health risks of VOCs from small water sources," 2011–2013; Principal investigators: Ing.Lubomír Kříž, Ph.D. and Ing. Marek Čáslavský, Ph.D., Vodní zdroje Chrudim, spol. s. r.o., Co–principal investigator for FE CULS: prof. Ing. Zdeňka Wittlingerová, CSc.

3.2.18.2 Institute of Tropics and Subtropics (ITS)

www.its.czu.cz

A brief description of the Institute

The Institute of Tropics and Subtropics was formerly known as the Institute of Tropical and Subtropical Agriculture (ITSA). Within the Czech University of Life Sciences in Prague (CULS) it has the position of a specialised institute on the level of a faculty for the preparation of Czech and foreign specialists in undergraduate, master's level and doctoral level studies.

Focus of research and development

The Institute is involved in scientific–research activities and implementation of projects in developing countries, primarily in priority countries for Czech development cooperation. In 2011, a total 5 programme research projects were implemented at the Faculty, one of which concerned nanotechnology.

Research in nanotechnology

Work on implementation of the project described below:

- Project Ministry of Agriculture QH92195 – "The use of selected nanotechnology for the design and verification of the best available techniques (BAT) in agricultural activities," 2009–2011; Principal Investigator: Ing. Antonín Jelínek, CSc., Research Institute of Agricultural Technology, Co–principal investigator for CULS: MVDr. Josef Holejšovský, Ph.D.

3.2.18.3 Faculty of Agrobiology, Food and Natural Resources (FAFNR)

www.af.czu.cz

A brief description of the Faculty

In 1952 the Faculty of Agronomy was instituted as one of the faculties of the newly founded independent University of Agriculture.Since that time it has fulfilled its role as the main workplace for the education and preparation of experts in agriculture, not only for work in the field, but also for research institutes and government organs. In 2005 it was renamed the Faculty of Agrobiology, Food and Natural Resources in connection with the expansion of its activities.

Focus of research and development

Agrobiology, food and natural resources.In 2011 a total of 69 grant projects were implemented at the Faculty, one of which concerned nanotechnology.

Research in nanotechnology

Work on implementation of the project described below:

- Project MEYS 2B06053 – "New methods for the characterisation and identification of probiotic bacteria strains suitable for functional foods," 2006–2011; Principal investigator: as.prof. Ing Bohuslav Rittich, CSc., Masaryk University in Brno/Faculty of Sciences, Co–principal investigator for FAFNR CULS: prof. Ing. Vojtěch Rada, CSc.

Experts/field

- prof. Ing. Vojtěch Rada, CSc.– practical and food microbiology

3.3 CONTRIBUTORY ORGANISATIONS OF GOVERNMENT MINISTRIES

3.3.1 INSTITUTE FOR CLINICAL AND EXPERIMENTAL MEDICINE (IK+EM)

Vídeňská 9, 140 21 Prague 4, ID: 00023001

www.ikem.cz

A brief description of the Institute

The Institute for Clinical and Experimental Medicine was created in 1971 through the integration of six formerly independent research institutes – the Institute of Clinical and Experimental Surgery, the Institute for Diseases of Blood Circulation, the Institute for Human Nutrition Research, the Research Institute of Experimental Therapy, the Research Institute for Radioisotope Use in Medicine and the Research Institute for Electronics and Modelling in Medicine. Their integration created the largest scientific research institute with three specialised centres – the Cardiology Centre, the Transplant Centre and the Diabetes Centre. At the present time IK+EM is a contributory organisation directly managed by the Ministry of Health. It is comprised of 3 specialised centres, 8 clinics, 15 specialised departments, work stations and laboratories, and it has 1450 employees.

Focus of research and development

In 2011, a total 82 programme research projects were implemented at the Institute, six of which concerned nanotechnology. **In the field of nanotechnology** research is focused on the application of nanoparticles in molecular imaging. These methods are investigated by the Magnetic Resonance Spectroscopy Unit (M. Hájek). The Unit is part of the Radiodiagnostic and Interventional Radiology Department. Within the framework of IK+EM the MR Spectroscopy (MRS) Unit works on molecular imaging projects with the Diabetes Clinic (F. Saudek) and with the Institute for Experimental Medicine AS CR in the Cell Transplant and Tissue Repair Centre, as well as with other partners.

Projects implemented in nanotechnologies

a) *Projects whose recipient is IK+EM:*

- Project GA AS CR 2B06175 – "Quantification of insulin producing tissue by magnetic resonance," 7/2006–6/2011; Principal investigator: as.prof. MUDr. František Saudek, DrSc.

b) *Projects on whose implementation the Institute is cooperating:*

- Project MIT FR–TI3/521 – "Technology of new magnetic nanoparticles for diagnostics and treatment in oncology," 2011–2015; Principal investigator: Ing. Jiří Zelenka, CSc., SYNPO, a.s., Co–principal investigator for IK+EM:Mgr. Vít Herynek, PhD.
- Project GA CR GA203/09/1242 – "Surface modification of magnetic nanoparticle surfaces for cell labelling and in vivo and in vitro diagnostics," 2009–2011; Principal investigator: Ing. Daniel Horák, CSc., Institute of Macromolecular Chemistry AS CR, Co–principal investigator for IK+EM: Mgr. Vít Herynek

- Project MEYS, “Research centres” programme, 1M0538 – “Centre of Cell Therapy and Tissue Repair,” 1/2005–12/2011; Principal investigator: prof. MUDr. Eva Syková, DrSc., Institute of Experimental Medicine AS CR, Prague, Co–principal investigator for IK+EM: Ing. Milan Hájek, DrSc.

- Project AS CR, “Nanotechnologies for Society” programme, KAN201110651 – “Combined contrast agents for molecular MR imaging,” 7/2006–12/2010, Principal investigator: prof. RNDr. Ivan Lukeš, CSc., Charles University in Prague/Faculty of Science, Co–principal investigator for IK+EM: Ing. Milan Hájek, DrSc.

c) *Projects involving international cooperation:*

- Cooperation on Project – 6FP EU DiMI/512146 “Diagnostic Molecular Imaging:A Network of Excellence for Identification of New Molecular Imaging Markers for Diagnostic Purposes," 4/2005–3/2010; Project coordinator: prof. Andreas Jacobs, University of Cologne, Germany.The excellence network is comprised of 45 institutions. The principal investigator in the Czech Republic is prof. MUDr. Eva Syková, DrSc., Institute of Experimental Medicine AS CR, Ing. M. Hájek, DrSc. and his group contributed for IK+EM.

Experts/field

- Mgr. Monika Dezortová – molecular imaging – clinical MR spectroscopy and relaxometry

- Ing. Milan Hájek, DrSc.– molecular imaging – study of live tissue using MR imaging and MR spectroscopy

- Mgr. Vít Herynek, Ph.D. – molecular imaging – MR spectroscopy and relaxometry

3.3.2 INSTITUTE OF HEMATOLOGY AND BLOOD TRANSFUSION (IHBT)

U nemocnice 1, 128 20 Prague 2, ID: 00023736

www.uhkt.cz

A brief description of the Institute

The Institute of Haematology and Blood Transfusion is a contributory organisation directly organised by the Ministry of Health of the Czech Republic. It was founded 1 January 1952 together with a number of other ministry research institutes run by the Ministry of Health.The Institute brings together therapeutic hematologic care, diagnostic and research laboratories and transfusion facilities. At the Institute highly specialised therapeutic care, research facilities, premium transfusion expert facilities and special counselling and educational activities are integrated as a unit. The most important parts of the Institute are its three divisions: the Clinical Division, the Transfusion Department and the Research Division.

Focus of research and development

From 2005–2011 one Ministry of Health research proposal was implemented at IHBT which also contained elements of nanotechnology research.

Research proposal MZ0UHKT2005 – "**The role of molecular biological examinations in clarifying pathogenesis and in diagnosis of haematopoietic disorders and the use of haematopoietic cells in the treatment of haematopoietic disease**," 1/2005–12/2011; Principal investigator: MUDr.Jaroslav Čermák, CSc.; total costs for the entire period of project implementation equalled CZK 279.063 million, CZK 177.063 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 5%.

The subject of implementation was the use of molecular biological examination for clarification of pathogenesis and for diagnostics and treatment of haematopoieticdisorders; observation of the significance of changes in genome structure and function for diagnosis, prognosis and treatment of congenital and acquired haematopoieticdisease; observation of the significance of activation of individual coagulation system components in malignant haematopoieticdisease; clarification of the molecular basis of rare erythrocyte phenotypes and certain congenital erythropoeitic disorders; the use of haematopoietic stem cells in the treatment and disease of haematopoietic and other tissues; handling of stem haematopoieticcells for cell therapy; the observation of the role of transplantation of haematopoieticcells in the treatment of malignant and non–malignant haematopoieticdisease; monitoring the safety of mobilisation and separation of donors of haematopoieticcells acquired from peripheral blood and the monitoring of genetic factors influencing the success of haematopoieticcell transplantation.

In 2011, a total of 31 programme research projects were implemented at the Institute. Research projects implemented at the Institute focus on the development of new diagnostic and therapeutic methods and the acquisition of new knowledge, particularly in physiology of blood and haematopoiesis, and biology of tumour cells and the tumour process.

Research which to a certain extent falls by its nature into the fields of **nanobiotechnology and nanomedicine** was identified in the Transfusion Department's Division of Cellular Therapy (head: P. Kobylka) and at the Research Division's Department of Biochemistry (head J. E. Dyr), the Department of Cellular Biochemistry (head: I. Kalousek) and the Department of Cell Physiology (head: L. Doležalová).

Projects implemented in nanotechnologies

- Project Ministry of Health (MH) NT11541 – "Development of vaccines against cancer stem cell markers," 2010–2013; Principal investigators: RNDr. Michal Šmahel, Ph.D., Mgr. Martina Dušková, Mgr. Ingrid Poláková

- Project AS CR, "Nanotechnology for Society" programme, KAN200670701 – "Surface plasmon resonance biosensors and protein arrays for medical diagnostics," 1/2007–12/2011; Principal investigator: Ing. Jiří Homola, CSc., Institute of Photonics and Electronics AS CR, Prague, Co–principal investigator for IHBT: prof. Ing. Jan Evangelista Dyr, DrSc.

- Project MEYS, "Research Centres" programme, 538 "Centre for Cell Therapy and Tissue Repair," 1/2005–12/2011; Principal investigator: prof. MUDr. Eva Syková, DrSc., Institute of Experimental Medicine AS CR, Prague, Co–principal investigator for IHBT: MUDr. Petr Kobylka, CSc.

Experts/field

- prof. Ing. Jan Evangelista Dyr, DrSc.– biochemistry, molecular genetics, biomolecular sensors
- RNDr. Ivan Kalousek, CSc.– study of the interactions of proteins controlling ribosome synthesis with products of oncogenes and tumour suppressor proteins
- prof. MUDr. Pavel Klener, DrSc.– haematology, oncology

3.3.3 MASARYK MEMORIAL CANCER INSTITUTE IN BRNO (MMCI)

Žlutý kopec 7, 656 53 Brno, ID: 00209805

www.mou.cz

A brief description of the Institute

Masaryk Memorial Cancer Institute is a contributory organisation directly organised by the Ministry of Health of the Czech Republic. MMCI is a full service cancer centre with 230 beds. Treatment is provided, and also research in all aspects of oncological disease is conducted. MMCI is divided into two clinics, 13 specialised departments, a Clinical Psychology Division and other support facilities.

Focus of research and development

From 2005–2011 one Ministry of Health research proposal was implemented at MMCI which also contained elements of nanotechnology research.

Research project MZ0MOU2005 – "**Functional diagnostics of malignant tumours,"** 1/2005–12/2011; Principal investigator: prof. MUDr. Pavel Klener, DrSc., total costs for the entire period of the project equalled CZK 279.063 million, CZK 177.063 million of which was from the state budget. For nomenclature – area 3, the nanotechnology research share equalled 15 %.

The topic of the plan was the development and implementation of a new concept of integrated functional diagnostics of solid malignant tumours, based on a spectrum of applied molecular–biological, cytodiagnostic, histocultural and imaging methods, which should effectively supplement tumour diagnostics that to date have been purely morphological, by adding new parameters corresponding to individual tumour properties at the beginning and during the course of anti–tumour treatment. The goal is to improve the therapeutic results through better targeted and individualised therapy. The research proposal contains elements of bionanotechnology research.

In 2011, a total 22 programme research projects were implemented at the Institute. The largest of these was the primarily investment project ED2.1.00/03.0101 – **Regional Centre for Applied Molecular Oncology**, financed from the Operational Programme Research and Development for Innovation. From 2011–2014 there should be created at a cost of CZK 299.5 million a centre for research of new biomarkers with significance for diagnosis, imaging methods, disease monitoring, prognosis and treatment of tumourous disease. The

centre is to be equipped with state of the art equipment and a multi–disciplinary group of Czech and foreign researches and medical specialists should work in it.

At the Institute **research in bionanotechnology** is carried out in more than one department, in particular at the Department of Oncological and Experimental Pathology (at the Molecular and Experimental Oncology Laboratory, head: Vojtěšek) and at the Department of Laboratory Medicine (head: D. Valík).

Projects implemented in nanotechnologies

- Project Ministry of Health NR9076 – "Gene expression profiling in predicting treatment response to chemotherapy for patients with locally advanced colorectal carcinomas," 2006–2010; Principal investigator: prof. MUDr. Rostislav Vyzula, CSc., Co–principal investigators: prof. MUDr. Jiří Hoch, CSc., Motol University Hospital, and as.prof. MUDr. Marián Hajdúch, Ph.D., Palacký University in Olomouc/Faculty of Medicine and Dentistry
- Project GA CR GA203/08/1680 – "Nanotechnology in functional diagnostics of apoptotic and tumour cells," 1/2008–12/2011; Principal investigator: Ing. Karel Klepárník, Ph.D., Department of Analytical Chemistry AS CR, Brno, Co–principal investigator for MMCI: MUDr. Dalibor Valík, Ph.D.
- Project GA CR GA301/07/0490 – "Protein and DNA–modified electrodes. New tools for biomedicine," 1/2007–12/2009; Principal investigator: prof. RNDr. Emil Paleček, DrSc., Biophysical Institute AS CR, Prague, Co–principal investigator for MMCI: RNDr. Bořivoj Vojtěšek, DrSc.

Experts/field

- MUDr. Dalibor Valík, Ph.D. – tumour markers
- RNDr. Bořivoj Vojtěšek, DrSc.– tumour biology research
- as.prof. MUDr. Rostislav Vyzula, CSc.– positron emission tomography

3.3.4 INSITITUTE OF ENDOCRIONOLOGY (IE)

Národní 8, 116 94 Prague 1, ID: 00023761

www.endo.cz

A brief description of the Institute

The Institute of Endocrinology in Prague is an independent contributory organisation directly managed by the Ministry of Health. It was founded in 1956. The basic mission of the Institute is highly specialised preventive, diagnostic, therapeutic and scientific–research activity in the field of endocrinology, the metabolic disorders related to it and the fields which supplement endocrinology. The Institute is divided into nine specialised departments.

Focus of research and development

In research the Institute uses methods from molecular genetics, biochemistry, immunology and oncology of hormonally dependent tissues, including in silico analysis, in particular:

- Microanalysis of nucleic acids using capillary electrophoresis with laser induced fluorescence techniques (sequencing, fragment analysis) and RealTime PCR techniques from different biological materials
- Proteomic techniques, including computer–assisted modelling of peptide or protein structures and their interactions
- Determination of nano– and pico–concentrations of steroid hormones using mass spectrometry
- Determination of nano–concentrations of hormones, protein hormones, biofactors and antigens using radio and immunoanalysis techniques, including multiplex analysis
- Development of separation and analytical chromatographic methods for micro– and nano–analysis
- In vivo microdialysis in fatty tissue .

In 2011, a total 19 programme research projects were implemented at the Institute.

Projects implemented in nanotechnologies

- Project MH NT/12336–4/2011 „Chromogranin, metanephrines and thyroid factors in differential diagnostics of neuroendocrine tumour with a focus on medullary carcinomas of the thyroid gland and pheochromocytoma", 2011–2014; Principal investigator: as.prof. Ing. Radovan Bílek,CSc.,Co–investigator: as.prof. Tomáš Zelinka, General University Hospital in Prague
- Project MH NT/13369–4„The impact of selected endocrine disruptors on human spermatogenesis", 2012–2015; Principal investigator: Mgr. Jana Kubátová, Co–investigator: as. prof. MUDr. Jiří Heráček, University Hospital Královské Vinohrady, Prague
- Project MH NT/13543–4„A study of the common pathogenic factors of Alzheimer's disease and diabetes mellitus type 2", 2012–2015; Principal investigator: RNDr. Markéta Vaňková, Ph.D., Co–investigators: MUDr. Robert Rusina, Ph.D., Thomayer University Hospital, Prague, and as.prof. MUDr. Iva Holmerová, Ph.D., Charles University in Prague/Faculty of Humanitary Studies
- Project MH NT/13544–4„The role of genetic variability in diabetes mellitus type 2 and gestational diabetes", 2012–2015; Principal investigator: RNDr. Daniela Vejražková, Ph.D., Co–investigator: MUDr. Hana Krejčová, Ph.D., General University Hospital in Prague
- Project MH NT/13890–4„The role of neuroactive steroids in etiopathogenesis of affective and mood disorders", 2012–2015; Principal investigator: prof. MUDr. Luboslav Stárka, DrSc., Co–investigator: RNDr. Daniela Řípová, CSc., Psychyatric Centre, Prague
- Project MH NT/13901–4„Study of genetic changes in thyroid gland tumours", 2012–2015; Principal investigator: RNDr. Běla Bendlová, CSc., Co–investigator: as.prof. MUDr. Petr Vlček, CSc., University Hospital in Motol, Prague

Experts/field

- as.prof. RNDr. Běla Bendlová, CSc. – molecular genetics, nucleic acid analysis
- as.prof. Ing. Radovan Bílek, CSc. – protein modelling, chromatographic techniques
- Ing. Martin Hill, DrSc. – mass spectrometry of steroid hormones, development of separation methods

3.3.5 PRAGUE PSYCHIATRIC CENTRE (PPC)

Ústavní 91, 181 03 Prague 8 – Bohnice, ID: 00023752

www.pcp.lf3.cuni.cz

A brief description of the Centre

The Prague Psychiatric Centre is located on the premises of the Bohnice psychiatric hospital. In 1961 the Psychiatric Research Institute was founded here. In 1990 the activities of the Psychiatric Centre were combined with teaching of psychiatry at the 3rd LF CU.PPC is divided into a Clinical Division, 4 specialised laboratories and the Centre of Neuropsychiatric Studies (Ministry of Education, Youth and Sports project). In addition to numerous other medical–research activities, PPC provides a base for research in the field of normal and pathological aging (Alzheimer's Disease Centre), within which several projects using nanotechnologies have been and are being implemented.

Focus of research and development

From 2005–2011 PPC coordinated activities of research centre 1M0557 and oversaw the implementation of research proposal of the Ministry of Health MZ0PCP2005 – "**Determination of the causes of psychiatric morbidity and increasing the effectiveness of preventive and therapeutic approaches in care of the mental health of inhabitants of the Czech Republic from 2005–2011**," 1/2005–12/2011; Principal investigator: prof. MUDr. Cyril Höschl, DrSc.; total costs equalled CZK 176.2 million. For nomenclature – area 3, the nanotechnology share of research equalled 3%.

The goals of project implementation were: the detection, prevention and remedy of risk factors which threaten individuals' mental health and study of etiopathogenesis, diagnostics and therapy of serious mental health disorders, which according to the World Bank and WHO are globally among the ten main reasons for disability (schizophrenia, depression, bipolar disorder, addiction and obsessive–compulsive disorder). To this research in dementia is being added, in which a marked increase in prevalence has been noted and which presents an enormous socioeconomic burden on society.

In 2011, a total 24 programme research projects were implemented at the Centre. The biggest one was the project ED2.1.00/03.0078 –**National Institute of Mental Health**, financed from the Operational Programme Research and Development for Innovation. From 2011–2015 there should be created at a cost of CZK 971 million a modern and clinically oriented research center, which will become a reference center for mental health in the Czech Republic by providing expert services in the field of epidemiology of mental disorders. Principal co-ordinator of the project is prof. MUDr. Cyril Höschl, DrSc.

Projects implemented in nanotechnologies

- Project MH NT/13890–4 „The role of neuroactive steroids in etiopathogenesis of affective and mood disorders", 2012–2015; Principal investigator: prof. MUDr. Luboslav Stárka, DrSc., Co–principal investigator for PPC: RNDr. Daniela Řípová, CSc., Psychyatric Centre, Prague

- Project AS CR, "Nanotechnology for Society" programme, KAN200520701 – "Nano–PCR – an ultrasensitive test for the detection of specific proteins in body fluids," 1/2007–12/2011; Principal investigator: RNDr.Petr Dráber, DrSc., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for PPC: RNDr. Daniela Řípová, CSc.The task of PPC as the Co–principal investigator was to collect data on the normal aging population and ELISA examination of three key proteins in Alzheimer's disease diagnostics.

- Project MEYS, "Research Centres" programme, 1M0557 – "Centre for neuropsychiatric studies," 1/2005–12/2011; Principal investigator: prof. MUDr. Cyril Höschl, DrSc. As part of the implementation of the project the effects of a static magnetic pole on high affinity choline transport in synaptosomes prepared from the right and left hippocampus of Wistar rats were tested. Part of the synaptosomes was incubated before the actual exposition using superparamagnetic nanoparticles covered with dextran. After internalisation of nanoparticles in synaptosomes there is a chain of reactions, which are oriented by an external static magnetic field and which regulate through the cytoskeleton membrane proteins including the choline transporter.

Experts/field

- MUDr. Aleš Bartoš, Ph.D. – neurology, biological markers, immunochemistry of neuropsychiatric diseases

- Ing. Zdena Krištofiková, Ph.D. – normal and pathological aging, neurochemistry and pathophysiology of Alzheimer's Disease, choline transport

- RNDr. Daniela Řípová, CSc.– neurochemistry, pathophysiology of neuropsychiatric diseases, biological markers

3.3.6 RESEARCH INSTITUTE OF VETERINARY MEDICINE, BRNO (RIVM)

Hudcova 70, 621 00 Brno, ID: 0027162

www.vri.cz

A brief description of the Institute

The Veterinary Research Institute was founded in 1955. Its organizer is the Ministry of Agriculture of the Czech Republic. The Institute is the only professional research institute in the Czech Republic which is focused on research in veterinary medicine with a significant share of applied research. Its focus, however, also covers the broad field of pre–clinical disciplines in veterinary medicine which cross over into human medicine, environmental science and other fields (the field of infectious and non–infectious diseases, hygiene and food

safety and ecotoxicology). The Institute is divided into seven departments, which are further divided into laboratories.

Focus of research and development

Research covers the extensive field of veterinary medicine. Research activities in nanotechnology are focused on the use of biodegradable nanoparticles for the development of vaccines and systems for targeting drugs, the production of bound biomaterials (antibodies, aptamers and receptors) for biomaterial immobilisation for chips and nanoextraction.

In the Immunology Department the activity of the Immunopharmacology and Immunotoxicology Group (head: J. Turánek), which is focused on the preparation and development of targeted microbubbles and liposomes for therapy of tumours and vaccine design, is developed. The laboratory has equipment for nanoparticle preparation and characterisation – ultrasound, high pressure homogenisation and microfluidisation, characterisation of nano– and microparticles using static and dynamic light diffraction, gel permeation chromatography and electrophoretic methods, differential nanocalorimetry scanning and electron microscopy. The in vitro and in vivo biological effect is investigated using fluorescent and confocal microscopy on tissue cultures and histological sections. Tumour and immunisation models are introduced.

The Analytical Biotechnology Department (head: M. Fránek) is focused on the development and production of monoclonal antibodies for biomarker detection and disease detection using biosensors and on the development of micro– and nanotechnologies (such as micro–immunoextraction) for bioanalytical methods.

In 2011, a total 44 programme research projects were implemented at the Institute. Two projects from the Operational Programme Research and Development for Innovation have key significance.

- ED0006/01/01 – "**Centre for applied microbiology and immunology in veterinary medicine (AdmireVet)**."The principal investigator at RVIM is prof. MVDr. Ivo Pavlík, CSc. The project, implemented from 2009–2013 with a budget of CZK 416.59 million, is focused on the reconstruction of Pavilion III at the RVIM campus, the reconstruction of two experimental stables and supplementing of the equipment of laboratories and training of researchers at renowned workplaces in the Czech Republic and abroad. The research activity of the centre is focused on the use of molecular biology tools to acquire new knowledge in the fields of immunology, virology and bacteriology. This knowledge will be used among other things for the preparation of vaccines.

- ED1.1.00/02.0068 – "**CEITEC – Central European Institute of Technology**" (2011–2015), Project budget: CZK 5.246 billion (www.ceitec.cz). The principal investigator of the European Centre of Excellence project is Masaryk University in Brno. RVIM is a partner in the project. The principal investigator for RVIM is prof. MVDr. Jiří Rubeš, CSc.Top–level research is to be carried out at the Centre and advanced graduate and post–doctoral instruction is to be provided. The state of the art technology installed there should enable the synergistic study of objects from living and non–living nature at all levels of complexity which is available at the present time, starting from individual atoms to molecules, molecular groupings and cells to whole organisms.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute:*

- Project GA CR GAP304/10/1951 – "Nanoliposomes for the development of recombinant vaccines and targeted immunotherapies," 2010–2013; Principal investigator: RNDr.Jaroslav Turánek, CSc., Co–investigators: RNDr. Miroslav Ledvina, CSc., Institute of Macromolecular Chemistry AS CR, RNDr. Zbyněk Pientka, CSc., Institute of Macromolecular Chemistry AS CR, as.prof. Ing. Irena Kratochvílová, Ph.D., Institute of Physics AS CR, MUDr. Mgr. Milan Raška, Ph.D., Palacký UniversityOlomouc/Faculty of Medicine and Dentistry, and prof. RNDr. Pavel Drašar, DrSc., ICT/Faculty of Food and Biochemical Technology

b) *Projects on which the Institute cooperates:*

- Project AS CR, "Nanotechnology for Society" programme, KAN200380801 – "Immunonanotechnologies for hormone diagnostics," 1/2008–12/2012; Principal investigator: prof. Ing. Miroslav Strnad, DrSc., Institute of Experimental Botany, České Budějovice, Co–principal investigator for RIVM: Dr. Milan Fránek, DrSc.

- Project AS CR, "Nanotechnology for Society" programme, KAN200520703 – "The use of ultrasound in nanomedicine," 1/2007–12/2011; Principal investigator: as.prof. Ing. Jiří Neužil, CSc., Biotechnology Institute AS CR, Prague, Co–principal investigator for RIVM: RNDr. Jaroslav Turánek, CSc.

Experts/field

- Dr. Milan Fránek, DrSc.– analytical biotechnology

- RNDr. Jaroslav Turánek, CSc.– vaccinology and immunotherapy, preparation of functionalised microbubbles, design of liposomes for development of vaccines and targeted therapeutics

3.3.7 NATIONAL INSTITUTE OF PUBLIC HEALTH (NLPH)

Šrobárova 48, 100 42 Prague 10, ID: 75010330

www.szu.cz

A brief description of the Institute

The National Institute of Public Health is a contributory organisation of the Ministry of Health of the Czech Republic. It organises the preparation of materials for the national health policy, undertakes activities for health protection and support, for securing methodological and reference activities in public health protection, monitors and undertakes research in the relationship between living conditions and health, organises international cooperation, checks the quality of services provided for public health protection, performs graduate instruction in the medical fields of health protection and support and takes care of public health education. The Institute is divided into five centres, which are further organised into professional groups.

Focus of research and development

Nanotechnology research was identified at the Centre for Epidemiology and Microbiology, where MUDr. Marta Havelková, CSc. worked on a project in the "Nanotechnology for Society" programme and in the Centre for Occupational Health, where a working team is occupied with nanomaterials and nanotechnologies, in particular from the perspective of their impact on human health in the event of professional or environmental exposure.

Projects implemented in nanotechnologies

Projects on whose implementation the Institute is cooperating

- Project TA CR TA01010552 – "The use of membranes with nanopores to reduce the health risks of VOCs from small water sources," 2011–2013, Principal investigators: Ing. Lubomír Kříž, Ph.D., Ing. Marek Čáslavský, Ph.D. – Vodní zdroje Chrudim, spol. s r.o., Co–investigators for NIPH: MUDr. Magdalena Zimová, CSc. and Ing. Ladislava Matějů
- Project AS CR, "Nanotechnology for Society" programme, KAN200520702 – "Nano immunosensors for cytokine detection," 1/2007–12/2011; Principal investigator: Ing. Petr Šebo, CSc., Biotechnology Institute AS CR, Prague, Co–principal investigator for NIPH: MUDr. Marta Havelková, CSc.

Experts/field

- MUDr. Marta Havelková, CSc.– molecular epidemiology
- MUDr. Miroslava Hornychová, CSc., head of the expert group for chemical safety
- RNDr. Jaroslav Mráz, CSc., researcher in the expert group for evaluation of chemical substance exposure at work

3.3.8 CZECH METROLOGY INSTITUTE (CMI)

Okružní 31, 638 00 Brno, ID: 00177016

www.cmi.cz

A brief description of the Institute

The Czech Metrology Institute is a contributory organisation established in 1993 under the direction of the Ministry of Industry and Trade. It fulfils functions which belong in the sphere of activity of state administration in metrology in accordance with Act No. 505/1999 Coll. CMI organises services in all the basic areas of metrology: fundamental metrology (preservation of state etalons, calibration of etalons and measuring gauges) and legal metrology (type–approval of measuring gauges, initial and subsequent verification of measuring gauges, state metrology supervision). CMI is responsible for a set of tasks in technical development, the nature of which ranges from applied research to the execution of specific technical tasks. CMI's activities are organised by divisions directly managed by the general director, 10 regional inspectorates, two specialised offices – the Laboratories of Fundamental Metrology and the Inspectorate for Ionizing Radiation – and 4 associated laboratories in different institutions.

Focus of research and development

In nanotechnology CMI focuses primarily on the measurement of lengths and dimensions in micrometers to nanometers, determination of surface topography (using SPM methods), 3D shape of objects (coordinate machines), local measurement of other physical values (electrical, thermal, magnetic, mechanical and optical properties) and the conducting of research of new measurement methods in all these areas.

Activities related to nanotechnologies are performed in particular in the Department of Technical Length (V. Zelený), the Department of Quantum Length Metrology and Lasers (P. Balling), the Laboratory of Fundamental Metrology in Prague and the Department of Nanometrology in Brno (P. Klapetek). In 2011a total 16 programme research projects were implemented at CMI.

Projects implemented in nanotechnologies

- Project AS CR KAN311610701 – "Nanometrology using scanning probe microscopy," 1/2007–12/2011; Principal investigator: Mgr. Petr Klapetek, Ph.D.
- Project GA CR GA202/07/1669 – "Deposition of thermomechanically stable nanostructured diamond–like thin layers in dual–frequency capacitive discharges," 1/2007–12/2011; Principal investigator: RNDr. Vilma Buršíková, Ph.D., Masaryk University in Brno/Faculty of Sciences, Co–principal investigator for CMI: Mgr. Petr Klapetek, Ph.D.
- Project MIT FR–TI1/241 – "Components for nanometric diagnostics of length fluctuations, deviations in shape and surface faults," 2009–2013; Principal investigator: Ing. Jan Kůr, MESING, spol. s r.o., Co–principal investigator for CMI: Mgr. Petr Klapetek, Ph.D.
- Project MIT FR–TI1/168 – "High efficient coloured solar panels for architectural applications," 2009–2012; Principal investigator: Ing. A. Poruba, Ph.D., Solartec s.r.o., Co–principal investigator for CMI: Mgr. Petr Klapetek, Ph.D.
- Project MIT FT–TA3/055 – "Smart polymer surface coatings containing nanoparticles," 3/2006–12/2009; Primary investigator: Ing. Jan Kůr, MESING, spol. s r.o., Brno, Co–principal investigator for CMI: Mgr. Petr Balling

Results of research in nanotechnologies/cooperation

Cooperation with foreign metrological institutes (PTB, NPL, INRIM, BIPM, METAS, etc.) and other institutes devoted to issues of measurement in the field of nanotechnologies (University of Bristol, DTU, TU Ilmenau, and University of Zaragoza), publications in specialised periodicals and the development of new techniques.

Experts/field

- RNDr. Petr Balling, Ph.D. – interferometry, lasers
- Mgr. Petr Klapetek, Ph.D. – scanning probe microscopy and related methods
- as.prof. Ing. Vít Zelený, CSc.– measurement of lengths, coordinate machines

3.3.9 TEXTILE TESTING INSTITUTE (TTI)

Václavská 6, 658 41 Brno, ID: 0013251

www.tzu.cz

A brief description of the Institute

The government enterprise performs several hundred accredited tests according to many national and international standards. TTI is also a certification authority for product certification (textile toys, geotextiles and work clothes) and systems (ISO 9001, ISO 14 001, ISO 13 485, OHSAS 18 001 and HACCP). In 2011 a total 2 programme research projects were implemented at the Institute, one of which concerned nanotechnology.

Number of employees: 27 (2010)

Annual turnover: CZK 52 million (2010)

Activity in nanotechnologies

Options for incorporating nanoparticle materials (in particular ferrous oxide and colloid silver) into/on textiles and their impact on textile properties with consideration for the potential use of the composites created were investigated as part of the two projects defined below:

- Project AS CR, "Nanotechnology for Society" programme, KAN101630651 – "Creation of nano–layers and nano–coatings on fabrics using plasma surface treatments at atmospheric pressure," 1/2006–12/2010; Principal investigator: prof. RNDr. Mirko Černák, CSc., Masaryk University in Brno/Faculty of Sciences, Co–principal investigator for TTI: Ing. Petr Benešovský, Ph.D. The task for TTI was the incorporation of nanoparticle materials into/on fabrics, testing and contact with manufacturers.
- Project MEYS, "Research Centres" programme, 1M0512 – "Research Centre of Powdered Nanomaterials," 1/2005–12/2011, Principal investigator: prof. RNDr. Miroslav Mašláň, CSc., Palacký University in Olomouc/Faculty of Sciences, Co–principal investigator for TTI: RNDr. Pavel Malčík. The task of TTI was research in the manner of using plasma in developing fabrics with added properties, contact with manufacturers and fabric testing.

Results of research in nanotechnologies/cooperation

- Finished products: NS AcousticWebTM – sound–absorbent material with outstanding sound absorption at lower frequencies, NS AntimicrobWebTM – filtration material with antimicrobial effects
- Cooperation with MIT (Massachusetts Institute of Technology, USA), NCRC (Nonwovens Cooperative Research Centre, USA), with the BASF concern, Germany

Experts/field

- Mgr. Petr Benešovský, Ph.D. – general textile treatments, antibacterial treatments
- Ing. Petr Nasadil – textile analysis (mass spectrometry, atomic spectroscopy etc.)

3.3.10 OCCUPATIONAL SAFETY RESEARCH INSTITUTE (VÚBP)

Jeruzalémská 9, 116 52 Prague 1, ID: 00025950

www.vubp.cz

A brief description of the Institute

The Occupational Safety Research Institute is a public research institute founded by the Ministry of Labour and Social Affairs of the Czech Republic. It conducts scientific research in the field of occupational safety and health and performs tasks which are derived from the conventions of the International Labour Organization, from valid legal regulations in occupational safety and health, from the requirements of the Council of the European Union and the European Commission, the European Agency for Safety and Health at Work, Eurostat and the needs of the organiser and work inspection. It also fulfils the function of an analytical and conceptual office in the field of occupational health and safety.

Number of employees: 45 (2012)

Focus of research and development

Scientific research, verification and application of methods and means in prevention of risks threatening the health and life of people, the environment and wealth, following from work activities and improving the work comfort and quality of working life. VÚBP is also involved in operational research, in other words, monitoring the state and development of occupational work and safety by keeping data and statistics in the field. In 2011 a total 6 programme research projects were implemented at the Institute.

Projects implemented in nanotechnologies

- Project Ministry of Labour and Social Affairs HC213/11 “Analysis of nanoparticle contamination of the air at the workplace and determination of the effectiveness of personal protective equipment in protecting the respiratory system against the effects of nanoparticles at the workplace", 2011; Principal investigator: RNDr. Mgr. Petr Skřehot

3.3.11 FOOD RESEARCH INSTITUTE PRAGUE (FRIP)

Radiová 7, Prague 15, 102 31, ID: 00027022

www.vupp.cz

A brief description of the Institute

The Institute was established in 1958. The institute implements tasks of basic, cross–discipline and applied research in chemistry, biochemistry and technology of foods, nutrition and food engineering and technology. In addition to these activities, it also carries out business activities, comprised of filling orders, providing services, and performing advisory and consulting activities. In 2011a total 18 programme research projects were implemented at the Institute.

Projects implemented in nanotechnologies

- Project 7FP EU Network type, KBBE thematic priority, project name: HIGHTECH EUROPE – “European network for integrating novel technologies for food processing,”

2009–2013; 22 partners from 10 countries, project budget: MEUR 7.04, Coordinator: Heinz Volker, Deutsches Institut für Lebensmitteltechnik (Germany); FRIP is a partner in the project.The project was also supported from national sources as part of the MEYS 7E09115 grant.

- Project MIT FR–TI3/496 – "Development of production technology and application forms of glutathione with high bioavailability for the suppression of oxidative stress (radiation, chemotherapy)," 2011–2014; Principal investigator: MUDr. Róbert Hromádka – C2P, s.r.o., Co–principal investigator for FRIP: Ing. Miloš Beran

3.3.12 VOP CZ, s.p.

Olomoucká 1841/175, 785 01 Šternberk, ID: 000 00 493

www.vop.cz

A brief description of the Institute

VOP CZ, s.p. is a government enterprise which conducts its activities in the field of defence equipment, engineering production, testing and research and development. Its offices are located in the towns of Šternberk, Nový Jičín, Slavičín, Vyškov and Brno. In Šternberk and Nový Jičín the company is involved primarily in repairs of defence equipment and engineering production. The Slavičín site specialises in the development and production of weapons and ammunition and related services. In Vyškov there are specialised ground force test sites and an associated research and development centre. The Brno site specialises in research and development of electronic warfare, camouflage, military chemistry, NBC defence and material engineering.

Number of employees: 1.400 (2012)

Focus of research and development

The main research and development areas are military chemistry, material engineering, electronic warfare and camouflaging. In research examples of state–of–the–art facilities include the unique "Stone Cottage" worksite, where testing of hazardous chemical or highly toxic substances in an open space are tested under polygon conditions.

Projects implemented in nanotechnologies

- Project Ministry of Defence OVVTUPV201003 CARRIER "Research of the possible uses of composite materials in special applications – light antenna carriers," 2010–2012; Principal investigators:Ing. Pavel Höfer, Ing. Pavel Berka, Ing. Roman Chládek, Dagmar Kvaková, Ing. Milan Pernický, Ing. Marian Tlčik and Tomáš Věrný

- Project Ministry of Defence OVVTUO2008001 "NANOBIO – Nanotechnology for immunosensor–based detection of bioaerosols," 2008–2011; Principal investigators: Ing. Eva Kupská, Ing. Jana Dvořáková, RNDr. Vladimír Obšel, CSc., as.prof. RNDr. Petr Skládal, CSc. and Mgr. Martin Štěpán

- Project Ministry of Defence OSVTUO2009001 "NANOMATERIALS – Research in the possible applications of nanotechnology and nanomaterials in chemical protection," 2009–2011; Principal investigator: RNDr. Vladimír Obšel, CSc.

3.3.13 RESEARCH INSTITUTE OF AGRICULTURAL ENGINEERING

Drnovská 507, Prague 6, 161 00

www.vuzt.cz

A brief description of the Institute

The Research Institute of Agricultural Engineering is organised by the Ministry of Agriculture. It conducts basic and applied research and development in agricultural machinery and technology, power generation and construction and related fields. In 2011 a total 21 programme research projects were implemented at the Institute.

Projects implemented in nanotechnologies

- Project Ministry of Agriculture QH92195 – "Use of selected nanotechnology for the design and verification of the best available techniques (BAT) in agricultural activities," 2009–2011; Principal Investigator: Ing.Antonín Jelínek, CSc, Research Institute of Agricultural Engineering, Co–investigators: Ing. Jan Dolejš, CSc., Institute of Animal Science, Ing. Jiří Zelenka, ZD Krásná Hora nad Vltavou, a.s., prof. Ing. Miloslav Šoch, CSc., University of South Bohemia, České Budějovice/Faculty of Agriculture and MVDr. Josef Holejšovský, Ph.D. – Czech University of Life Sciences in Prague/Institute of Tropics and Subtropics

3.3.14 INSTITUTE OF ANIMAL SCIENCE (IAS)

Přátelství 815, Prague 22, 10400, ID: 00027014

www.vuzv.cz

A brief description of the Institute

The Institute of Animal Science was established by the Ministry of Agriculture of the Czech Republic (MA). Since it was founded in 1951 it has been active in the field of zootechnical research, in the biological and biotechnological foundations of animal production. It has been authorised by the Ministry of Agriculture to represent the Czech Republic in the European Federation of Animal Science (EAAP) and works with the UN FAO in the programme for the use and protection of genetic resources of farm animals.

Focus of research and development

Basic and applied research in animal genetics and breeding, reproduction, nutrition, quality of animal products, ethology, farming technology, herd management and production economics. In 2011, a total 30 programme research projects were implemented at the Institute.

Research in nanotechnologies

Work on the implementation of the following task:

- Project Ministry of Agriculture QH92195 – "The use of selected nanotechnology for the design and verification of the best available techniques (BAT) in agricultural activities," 2009–2011; Principal Investigator: Ing. Antonín Jelínek, CSc.,Research Institute of Agricultural Engineering, Co–principal investigator for IAS: Ing. Jan Dolejš, CSc.

3.3.15 CZECH GEOLOGICAL SERVICE (CGS)

Klárov 131/3, Prague 1 118 21, ID: 00025798

www.geology.cz

A brief description

The Czech Geological Service is a contributory organisation acting as the ministry research institute of the Ministry of the Environment of the Czech Republic. CGS (originally called the Czech Geological Institute) collects and processes data on the geological composition of state–owned land and gives it to the administrative authorities for political, economic and environmental decision–making. It is the only institution whose mission is systematic research of the geological composition encompassing the entire Czech Republic – oriented basic research, applied geological research and the creation of basic geological maps of the Czech Republic, derived from purpose–oriented maps of the territory. Geological mapping is the basic tool for this research.

Focus of research and development

Research, use and protection of natural mineral resources with a view to the preservation of the environmental balance of the natural environment and human activity. In 2011, a total 49 programme research projects were implemented by CGS.

Research in nanotechnologies

Work on the implementation of the following projects:

- Project TA CR TA01020348 – “Reversible energy storage in the rock massif,” 2011–2014; Principal investigators: Mgr. Michal Vaněček, Mgr. Jana Michálková, RNDr. Dagmar Trpkošová – ISATech, s.r.o., Co–investigators for CGS: as.prof. Mgr. Jan Franěk, Ph.D., RNDr Josef Klomínský, CSc. and Mgr. Jiří Konopásek, Ph.D.
- Project GA CR GAP210/10/0841 – "Biostratigraphic and paleoenvironmental nanofossil correlation across the late cretaceous in the Bohemian massif and the Western Carpathians,” 2010–2012; Principal investigator: RNDr. Lilian Švábenická, CSc.

3.3.16 NATIONAL INSTITUTE FOR NUCLEAR, CHEMICAL AND BIOLOGICAL PROTECTION

Kamenná 71, Milín 262 31, ID: 70565813

www.sujchbo.cz

A brief description of the Institute

The institute was established by the National Office for Nuclear Safety for the purpose of research and development in protection against chemical, biological and radioactive substances and assuring technical support of supervisory and inspection activities performed by this Office in radiation protection and in the control of the ban on chemical and biological weapons in accordance with valid Czech legislation.

Focus of research and development

The Institute is included in safety research of the Ministry of the Interior of the Czech Republic with the goal of ensuring protection of people, property and critical infrastructure against the effects of chemical, biological and radioactive substance. The offices are further involved in several foreign projects (European Commission and other parties) engaged in similar issues. At the Institute one project is currently being implemented which is focused on the use of nanomaterials. The second project touches marginally on this issue in one of its chapters.

Research in nanotechnologies

Work on the implementation of the following projects:

- Project Ministry of the Interior CR VG20102014049 – "Research in the possible applications of new materials (with a focus on nanomaterials) and advanced technologies for the protection of people against exposure to CBRN materials, with an emphasis on critical infrastructure," 2010–2014; Principal investigator: Ing. Jiří Slabotinský, CSc., Co–principal investigator: prof. RNDr. David Lukáš, CSc.,Technical University in Liberec
- Project Ministry of the Interior CR VF20112015013 – "Research of modern methods of detection and identification of hazardous chemical, biological, radioactive and nuclear (CBRN) substances and materials, methods of hazard reduction and decontamination; research of modern methods for protection of persons and elements of critical infrastructure," 2011–2015; Project manager: RNDr. Josef Břínek, Ph.D.

3.4 PRIVATE SECTOR RESEARCH INSTITUTIONS

3.4.1 COMTES FHT a.s.

Průmyslová 995, 334 41 Dobřany, ID: 26316919

www.comtesfht.cz

A brief description

Comtes FHT a.s. is a research and development organisation focused on applied research in metallic materials.It is equipped with a forming and heat treatment laboratory, a metallographic laboratory (light and electron microscopy), a physical simulation laboratory, a mechanical testing site, and physical property and numerical simulation technology laboratories.

Number of employees: 57

Annual turnover: CZK 72.98 million (2011)

Activity in nanotechnologies

The main subject of activity is research in forming ultra–fine submicroscopic and nanostructured materials by the application of severe plastic deformation, the study of deformation mechanisms and the study of structure using electron–microscopic analysis.

Research activities from 2004–2010 was focused primarily on implementation of MEYS research proposal MSM2631691901 – "**Metallic materials with submicron and nanometre structures prepared using severe plastic deformation methods**," 1/2004–12/2010; Principal investigator: prof. Ing. Jozef Zrník, CSc.; total costs for the entire period of implementation CZK 59.552 million,CZK 56.490 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 100%.

The research proposal was involved in the creation of ultra–fine submicroscopic and nanostructured materials through severe plastic deformation (ECAP, ARB and HPT methods), concurrently with controlled thermal exposure on selected materials. Primarily steel and aluminium alloys, and in the past two years titanium as well, have been chosen for the experimental programme. As part of the project different types of deformation techniques accompanied by different thermal regimes are applied. Detailed analyses were performed of both the microstructure and the properties of the processed materials. The most important goals of the plan were: theoretical knowledge of the mechanisms of grain refinement all the way to its nanostructured form, determination of physical limitations in terms of grain refinement and structure stability, and acquisition of the mechanical properties of materials.

In 2011, a total 23 programme research projects were implemented at the COMTES FHT, three of which (partially) concerned nanotechnology.

Projects implemented in nanotechnologies

- Project MSM ED2.1.00/03.0077 – "**West–Bohemian Centre of Materials and Metallurgy**," 2011–2014; budget: CZK 349,484 million, Principal investigator: Ing. Libor Kraus. The goal of this structural fund supported project is to build in Dobřany a regional centre for the research of new metallic materials and technologies for their

manufacture and use in industry with state–of–the–art laboratories and an experienced research team with advanced professional skills. As part of the project a metallurgical hall equipped with a four high rolling mill with accessories is to be built and the laboratory building enlarged. The subject of the two implemented research programmes will be thermomechanical modern steel processing and research and development of metallic materials for special applications.

- Project MIT FR–TI1/415 – "Research and development of nanostructured materials for medicinal applications," 2009–2012; Principal investigator: Ing. Michal Zemko, Ph.D.
- Project MEYS 1M06032 – "Research Centre of Forming Technology – FORTECH," 3/2006–12/2011; Principal investigator: prof. Dr. Ing. Bohuslav Mašek, University of West Bohemia in Pilsen, Co–principal investigator for COMTES FHT: Dr. Ing. Zbyšek Nový

Results in nanotechnologies/cooperation

The following were delivered to external clients:

- ECAP equipment for cold–extrusion of circular cross–section samples
- ECAP equipment for extrusion of square cross–section samples in a temperature range of –40 – 500°C with possible counterpressure
- HPT equipment for deformation of 20 mm diameter samples in a temperature range of RT – 500°C
- Development of methods for testing small samples and samples with nanostructure
- Numerical simulation using SPD technology

The following were built for internal use:

- Several units of ECAP equipment for extruding varied dimension samples at room temperature with possible counterpressure and without it
- CGP equipment for repeated deformation of whole sheets
- ASF equipment for repeated deforming of the surface layer of sheets
- Tools for Conform equipment for continuous extrusion

Experts/field

- as.prof. Ing. Ján Džugan, Ph.D. – fragility fracture behaviour of materials, testing of small samples
- Ing. Libor Kraus – chairman of the board of directors, material engineering
- Dr. Ing. Zbyšek Nový – director of research and development, thermomechanical metal processing
- Ing. Michal Zemko, Ph.D. – numerical simulation
- prof. Ing. Jozef Zrník, CSc.– metal forming by severe plastic deformation, metal alloys, material engineering

3.4.2 ČESKÉ TECHNOLOGICKÉ CENTRUM PRO ANORGANICKÉ PIGMENTY A.S (The Czech Technological Centre for Inorganic Pigments)

Nábřeží Dr. E. Beneše 24, 751 62 Přerov, ID: 26834839

www.ctcap.cz

A brief description

The Centre is a subsidiary of PRECHEZA a.s. It was created in 2004 and is involved in the development of technology for the production of titanium whites, new types of titanium whites and ferric pigments, as well as in the development of suitable application methods and applications in the production of paints, plastics, fibres, construction materials, in cosmetics and in catalysts. The Centre's activities also include technical assistance in the transfer of technology to China. In 2011 3 programme research projects were implemented at the Centre.

Number of employees: 35

Annual turnover: CZK 29.46 million (2010)

Activity in nanotechnologies

Development of technologies for the preparation of various forms of nano TiO_2 and their application in manufacture of paints, building materials, plastics, in cosmetics and in catalysts.

Projects implemented in nanotechnologies

- Project MIT FT–TA4/025 – "Next generation nanomaterials and their industrial applications," 3/2007–12/2010; Principal investigator: Ing. Pavel Hynčica
- Project MIT FT–TA5/007 – "Advanced research of nanomaterials for textiles," 3/2008–11/2010; Principal investigator: Ing. Antonín Mlčoch
- Project MIT FT–TA3/009 – "Research and development of new high performance coloured pigments for paints, plastics and building materials," 1/2006–12/2008; Principal investigator: Ing. Václav Kokaisl
- Projec MEYS, "Research Centre" programme, 1M0577 – "Research Centre for Nano Surface Engineering – NANOPIN," 1/2005–12/2011; Principal investigator: Ing.František Peterka, Ph.D., ATG s.r.o., Prague, Co–principal investigator for the Centre: Ing. Antonín Mlčoch, CSc.
- Company project – Non–pigment applications of TiO_2, 2006–2009;

Experts/field

- Ing. Pavel Hynčica – research
- Ing. Pavel Kovář – research

3.4.3 CZECH NANOTECHNOLOGY CLUSTER, ASSOCIATION (CNC)

Mozartova 178/12, 779 00 Olomouc, ID: 27776816

www.nanoklastr.cz

A brief description

The Cluster's goal is to build in the Olomouc Region an association of closely–cooperating suppliers of nanoproducts, companies using nanotechnology in their own products and research and educational institutions in this field. This involves a centre for the support and use of nanotechnologies, specifically in the field of information and technology transfer, consulting, education, research and development, promotion and networking. The Cluster brings together eight Czech entities, mainly small and medium enterprises, working in the use and promotion of nanotechnology.

Activity in nanotechnologies

Projects implemented:

- Education and promotion in nanotechnology (dissemination of knowledge in the field of nanotechnology,
- Preparation for the resolution of issues in nanotechnology and nanomaterials with support from the Cooperation programme for members, cooperating partners and the greater public, exchange of experience and knowledge with foreign institutions, organisations and clusters, active presentation of project results etc.)

Responsible persons

- prof. RNDr. Miroslav Mašláň, CSc.– chairman of the cluster
- RNDr. Jiří Oborný – cluster secretary

3.4.4 INSTITUTE OF MICROELECTRONIC APPLICATIONS INC. (IMA INC.)

Na Valentince 1003/1, Prague 5, 150 00, ID: 45277397

www.ima.cz

A brief description

IMA Inc. was created in 1992. It focuses on the development of systems using identification and biometric technology. It is a supplier of identification systems for companies, as well as for public and government administrations. In 2011 the Institute implemented 8 programme research projects.

Number of employees: 66

Annual turnover: CZK 106.78 million (2010)

Activity in nanotechnologies

Development of applications of the newest technologies using nanoelectronics; work on the implementation of the following projects:

- Project MEYS 7H11101 – "Nanoelectronics for Electric Vehicle Intelligent Failsafe Drive Train," 2011–2014; Principal investigator: Ing. Jiří Havlík
- Project MEYS 7H10020 – "Nanoelectronics for Mobile Ambient Assisted Living (AAL) Systems," 2010–2013; Primary investigator: Ing. Tomáš Trpišovský, CSc.
- Project MEYS 7H09009 – "Nanoelectronics for an Energy Efficient Electrical Car," 2009–2012; Primary investigator: Ing. Jiří Havlík

Responsible persons

- Ing. Jiří Bárta – executive officer
- Ing. Jiří Havlík – nanoelectronic applications
- Ing. Tomáš Trpišovský– executive officer

3.4.5 MOLECULAR CYBERNETIS, s.r.o.

Strážovská 65/7, 150 00 Prague 5, ID: 49621386

A brief description

Research and development focused on nanomaterial synthesis and properties. In 2011, the company implemented two programme research projects, both of which concerned nanotechnology.

Activity in nanotechnologies

Nanomaterial research and development for micro– and nanoelectronics; work on the implementation of the following projects:

- Project MIT FT–TA4/126 "Research of semiconductive nanotubes for implementation of cold–emission components," 1/2007–12/2010; Researcher:Ing. Stanislav Štarman, Ph.D., Co–principal investigator for MOLECULAR CYBERNETIS: RNDr. Zdeněk Kváča
- Project MIT 2A–1TP1/092 – "Research of the preparation of layered piezoelectric nanoforms for implementation of high–temperature ultrasound transducers," 7/2006–12/2011; Principal investigator: Ing. Stanislav Štarman, Ph.D., Co–principal investigator for MOLECULAR CYBERNETIS: RNDr. Zdeněk Kváča
- Project MIT 2A–2TP1/147 – "Research and semiconductive nanotubes for implementation of photoelectronic components," 5/2007–12/2011; Principal investigator: Ing. Stanislav Štarman, Ph.D., Co–principal investigator for MOLECULAR CYBERNETIS: RNDr. Zdeněk Kváča

Responsible persons

- RNDr. Zdeněk Kváča – director

3.4.6 NANOMEDIC, A.S.

Dolní Dobrouč 401, 561 02 Dolní Dobrouč, ID: 27502881

www.nanomedic.cz

A brief description

The Nanomedic cluster brings together 16 companies and 6 universities and research institutes which cooperate closely in the following research and development fields: medical products for wound healing, tissue grafts, medical products for targeted drug distribution, products for gene therapy.

Activity in nanotechnologies

1. Research and development of new medical products:
   - External dressings for wounds and burns based on biologically active materials prepared using nanotechnology
   - Internal dressings for wounds, tissue separation materials and internal, temporary patches based on polymers prepared using nanotechnology
   - Materials and kits for tissue engineering and gene therapy
   - Carriers of different drugs for targeted distribution based on nanoparticles, liposomes etc.

2. The development of new technologies allowing the industrial production of the medical products described above

3. The development of new analytical and testing procedures for testing and control of the medical products described above

Projects implemented in nanotechnologies

Nanotechnology projects include the following research projects implemented within the cluster and financed from its members' resources:
   - The development of nanofibres on a base of native or chemically modified biopolymers or their mixtures with additional biodegradable substances
   - The development of two–dimensional textiles containing structurally simple or derived nanofibres or bioactive nanolayers
   - The development of nanofibres based on native or chemically modified biopolymers or their mixtures with other biodegradable substances
   - The development of biologically active bandages
   - The development of scaffolds for cartilage replacement
   - The development of carriers for targeted drug distribution based on biopolymer marked liposomes
   - The development of carriers for targeted drug distribution based on biopolymers with a micelle–like structure
   - Polysaccharides as carriers for gene therapy

Results of research and development in nanotechnology

- Patent application for a new type of biological bandages submitted by one member of the cluster
- Patent application for a special procedure for nanofibre preparation on a base of native and chemically
- Modified polysaccharides submitted by one member of the cluster

Responsible persons/experts

- 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
- as.prof. RNDr. Jiří Kanta, CSc.– Charles University Hradec Králové/Faculty of Medicine; healing of wounds
- Mgr. Lukáš Kubala, Ph.D., – Biophysical Institute AS CR, Brno; molecular biology, prof. PharmDr. Ing. Milan Lázníček, CSc.– Charles University Hradec Králové, Pharmaceutical Faculty, biodistribution and pharmacokinetics
- Ing. Jan Marek, CSc.,– INOTEX spol. s r.o., Dvůr Králové; textiles
- prof. MUDr. Luboš Sobotka, CSc.– Hradec Králové University Hospital; healing of wounds
- prof. Ing. Miloslav Pekař, CSc.– Technical University Brno/Faculty of Chemistry/Institute of Physical and Applied Chemistry; physical chemistry of biopolymers
- as.prof. RNDr. Vladimír Velebný, CSc.– Contipro Biotech, s.r.o., Dolní Dobrouč; tissue engineering

3.4.7 NANOPROGRES, Z.S.P.O.

Nová 306, 530 09 Pardubice, ID: 72070382

www.nanoprogres.cz

A brief description

The goal of the Cluster, which has been active since 2011, is to develop and prepare technological procedures, products and services for “core–sheath” nanofibres for applications in biomedicine and to commercialise these products in the medium–time frame.

The Cluster is planning to focus on:

- Development in nanofibres and load bearing textiles in particular for biomedicine.
- Research and development in clinical and experimental medicine.
- The application of research results (patents, utility models) and their transfer into the practical sphere.

The Cluster's centres of operation are located in the towns of Brno, Česká Třebová, Chrudim, Liberec, Pelhřimov and Most.The Cluster has 19 members, primarily small and medium enterprises, as well as the Technical University in Liberec and Czech Technical University/Faculty of Biomedical Engineering.

Activity in nanotechnologies

Applied research of the following products:

- **Nanofibre structures**– nanofibre structures from various types of polymer materials for experimental purposes, nanofibre structures made from core–sheath (coaxial) polymer materials functionalised by different gradually released additives depending on the desired target effect, core–sheath (coaxial) nanofibre structures functionalised by additives supporting cell structure cultivation and in vitro tissues, and the preparation of artificial tissues
- **Products based on nanofibres for applications in healthcare**– skin dressings with functionalised coaxial nanostructures, functionalised nanoscreens for surgical applications, 3D nanofibre coverings
- **Products based on nanofibres and nanoparticles for applications in industry, cosmetics and the food industry**– coaxial fibres with added substances based on therapeutic materials, disinfecting additives, growth factors, vitamins, protective substances etc.
- **Others**– packaging material and sterilisation procedures for preservation, transport and storage of functionalised nanofibre structures

Responsible persons/experts

- Ing. Karel Havlíček, Ph.D., MBA – chairman of the board of directors
- Ing. Bořivoj Frýbert – chairman of the management committee
- as.prof. RNDr. Evžen Amler, CSc.– head of the expert council and expert guarantor
- Ing. Jozef Lörincz – head of the expert council and expert guarantor
- prof. RNDr. David Lukáš, CSc.– head of the expert council and expert guarantor
- MVDr. Andriy Lytvynets, Ph.D. – head of the expert council and expert guarantor

3.4.8 NÁRODNÍ TKÁŇOVÉ CENTRUM A.S (National Tissue Centre – NTC)

Palachovo náměstí 726/2 Brno–Starý Lískovec 625 00, ID: 28338766

www.natic.cz

Number of employees: 40 (2011)

Annual turnover: CZK 5.22 million (2011)

A brief description

The National Tissue Centre Ltd. (NTC) was established in 2009. The majority shareholder of the National Tissue Centre is the government, under the representation of the Ministry of Health of the Czech Republic (51% of shares), and the rest of the shares belong to PrimeCell, a private company. NTC holds a leading position in modern therapy and bioimplantology (advanced therapies) in the Czech Republic. NTC is an innovative company focused on the development and production of medical products for modern therapy (ATMP = Advanced Therapies Medical Products) and the preparation of tissues and cells in the good manufacturing practice system. Currently the company's key product on the market is a cartilage graft produced from a patient's own cells which are located on carriers. The product is called NTC chondrograftTM. In addition, NTC is developing a new type of treatment using stem cells and unique medical materials based on micro– and nanotechnology.

NTC is divided into four divisions – the Modern Therapy Department, the Material Engineering Department, the Tissue Graft Department and the Cell Graft Department.Interdisciplinary cooperation of individual units enables the development of new human–cell based products and new materials. The company supplies its products to more than 70 medical facilities in the Czech Republic, the European Union and around the world.

Activity in nanotechnologies

The company develops and produces a wide spectrum of nanomaterials using the "electrospinning" process. It uses a unique technology of industrial nanofibre production from organic polymers in manufacturing its products. Materials are tested in vitro and in the scope of pre–clinical evaluation. In this area NTC cooperates with research institutions (2nd and 3rd Faculties of Medicine of Charles University in Prague, Palacký University Olomouc etc.) and with private companies (Elmarco s.r.o., PrimeCell a.s. etc.).

In 2011 the Centre implemented three programme research projects, two of which concerned nanotechnology.

Projects implemented in nanotechnologies

- Project TA CR TA01010964 – "Osteograft," 2011–2013; Principal investigators: MUDr. Barbara Kubešová, Jana Komárková, RNDr. Eva Matějková and Mgr. Lucie Štrajtová, Ph.D., Co–principal investigators: as.prof. MUDr. Martin Krbec, CSc., MUDr. Filip Fridrich, MUDr. Jiří Záhora, Charles University in Prague/3rd Faculty of Medicine
- Project MIT FR–TI3/808 – "Medicine in motion," 2011–2012; Principal investigator: MUDr. Barbara Kubešová, Co–principal investigator: as.prof. Ing. Lukáš Jebavý, CSc.,CB Bio, s.r.o., as.prof. RNDr. Jan Hlaváč, CSc., Palacký University Olomouc/Faculty of Science

Results in nanotechnologies/cooperation

The company developed or took part in the development of new nanomaterials designed as 2D and 3D human cell carriers for medical applications.

Responsible persons

- RNDr. Eva Matějková – head of the Cell Graft Department, qualified person as drug manufacturer
- RNDr. Eva Matějková – head of the Cell Transplants Department
- Mgr. Ján Karkoška – head of the Tissue Graft Department
- MUDr. Barbara Kubešová – head physician, executive director, chairwoman of the board of directors
- Mgr. Lucie Štrajtová – head of the Modern Therapy Department
- Ing. Lukáš Zubal – head of the Material Engineering Department

3.4.9 POLYMER INSTITUTE BRNO, SPOL. S.R.O.

Tkalcovská 36/2, 656 49 Brno, ID: 60711990

www.polymer.cz

A brief description

The Polymer Institute Brno, spol. s. r.o. is a contract research organisation (until 1994 known as the Research Institute of Macromolecular Chemistry Brno) specialised in applied polymer research. Its majority owner is Unipetrol RPA, s.r.o. (part of Unipetrol a.s.). Besides research and development activities, the Institute has its own small–volume production facilities (e.g. production of stabilisation concentrates, custom production of colour concentrates etc.). In 2011 the Institute implemented 13 programme research projects, three of which concerned nanotechnology.

Number of employees: 90 (2011)

Annual turnover: CZK 280.35 million (2011)

Activity in nanotechnologies

Development of modified polymers; work on the implementation of the projects defined below:

- Project MIT FR–TI1/345 – "Multilayer plastic pipes with microfillers, nanofillers, reinforcements, foamed and nucleated and with other additives," 2009–2012; Principal investigator: RNDr. Ladislav Pospíšil, CSc.,Co–investigator: Ing. Vladimír Pelíšek, Ph.D., Pipelife Czech, s.r.o.
- Project MIT FR–TI1/272 – "Modification of impact polypropylene morphology with the aim of improving its properties," 2009–2013; Principal investigator: RNDr. Zdeněk Buráň, CSc., Co–principal investigator: Dr. Ing. Juraj Kosek, Institute of Chemical Technology, Prague/Faculty of Chemical Engineering
- Project MIT FR–TI1/208 – "Research and development of in–situ polypropylene nanocomposites," 2009–2012; Principal investigator: Dr. Ing. Miroslav Skoumal

Responsible persons

- Ing. Ludmila Borčická – executive director
- Ing. Artur Paździor – executive officer
- Ing. Zdeněk Salajka, CSc. – executive officer

3.4.10 SIGMA VÝZKUMNÝ A VÝVOJOVÝ ÚSTAV, S.R.O. (Sigma research and development institute)

Jana Sigmunda 79, 783 50 Lutín, ID: 25355015

www.sigmagroup.cz

A brief description

Since 1996 the Sigma Research and Development Institute has been active within the holding company SIGMA GROUP a.s., a research–development, informational and standardisation facility whose goal is research in machine hydraulics and implementation of scientific and development trends in the manufacture of pumping equipment.

Number of employees: 58 (2010)

Annual turnover: CZK 51.71 million (2010)

Activity in nanotechnologies

Research in the application of polymer nanofibres in protective filters. In 2011 a total 9 programme research projects were implemented at the Institute, one of which concerns nanotechnology; work on the implementation of the project defined below:

- Project TA CR TA01010584 – "New filtration materials based on nanofibre structures," 2011–2014; Principal investigator: Ing. Josef Novák, Ph.D. – Technical University of Liberec, Co–principal investigators for SIGMA VVÚ: Ing. Jiří Šoukal, CSc., Ing. Jiří Langer and Ing. Oldřich Ludvík

Responsible person

- Ing. Jiří Šoukal, CSc. – executive officer

3.4.11 SPUR A.S.

Tř. T. Bati 299, 764 22 Zlín, ID: 46900098

www.spur.cz

A brief description

The Company was created in 1992 through the privatisation of the Research Institute of Rubber and Plastic Technology – the successor to the Zlín Chemical Institute founded in 1934 at the Baťa company. The main manufacturing activities are extrusion of plastic piping systems, plates and profiles from PET, PE, PP, PS, ABS and PVC plastics; extrusion of light

insulation tubes and belts from PE and PP plastics (distributed under the trade name TUBEX®); the manufacture of RETROX® retroflective materials and the preparation of BARKOLEN® dye concentrates and additives.

Number of employees: 187

Annual turnover: CZK 634.92 million (2010)

Activity in nanotechnologies

- Preparation of sheets made of polymer nanofibres using the electrospinning process
- Research and development in nanotechnology focused on the preparation of nanofibres in a high–voltage electrical field, primarily from polyurethane (PU) and polyurethane–urea (PUU) solutions.
- Development of technology for manufacturing non–woven forms and verification of its possible use for filtration, separation membranes, water–resistant and breathable clothing materials, nanocomposites etc. In 2011 SPUR implemented five programme research projects, all of which involved nanotechnology.

Projects implemented in nanotechnologies

a) *Projects implemented by the Company:*

- Project MIT FR–TI3/370 – "New dermatological agents based on polymer carriers containing nanostructures modified by cyclodextrins," 2011–2014; Principal investigator: Ing. David Petráš
- Project MIT FR–TI1/007 – "Research and development of product conception of thick–walled expanded boards by physical foaming using a polymer melt accumulator and additivation and composite masterbatches," 2009–2013; Principal investigator: Ing. Tomáš Dudák
- Project MIT FR–TI1/053 – "Research and development of nanofibre filter materials and their application in filters for protective respiratory face masks," 2009–2013; Principal investigator: Ing. Dušan Kimmer, CSc.
- Project MIT 2A–1TP1/068 – "Synthesis of optimised polymer solutions for nanofibre preparation, nanofibre production and application of non–woven forms from nanofibres," 10/2006–9/2011; Principal investigator: Ing. Dušan Kimmer, CSc.

b) *Projects for which the Company is the co–investigator:*

- Project TA CR TA01010356 "Suitable materials for nanotechnological applications in the purification and treatment of water and air," 2011–2014: Principal investigators: Ing. Karel Plotěný and Ing. Marek Holba, Ph.D., ASIO, spol. s r.o., Co–principal investigators for SPUR: Ing. Dušan Kimmer, CSc. and Ing. Ivo Vincent, CSc.
- Project, EUREKA programme, E!3778 MANGO "Managing Contamination by Fibrous Product Systems," 1/2007–12/2009; Coordinator – principal investigator: VTT – Technical Research Centre of Finland, 10 participants, SPUR was a co–investigator.

Experts/field

- Ing. Dušan Kimmer, CSc.– PU synthesis, application technologies, reactions to polymers
- Ing. Lenka Lovecká, Ph.D. – informatics, PU technologies
- Ing. David Petráš – polymer carriers
- Ing. Zdeněk Šenkeřík – application technologies
- Ing. Miroslav Tomášek – PU synthesis

3.4.12 SVÚM A.S.

Areál VÚ, Podnikatelská 565, Prague 9 – Běchovice, ID: 25797000

www.svum.cz

A brief description

SVÚM a.s. is a successor to the State Research Institute of Material, which was founded in 1949. It is active in the following fields: research–development and experimental activities; consultation; material tests in accredited laboratories according to CSN standards, ISO/IEC Standard 17025 (from the CIA, certificate also from GE Aircraft Engines – USA); Certification and inspection centre of the CISS welding process, accredited according to CNS, EN ISO/IEC 17020:2005 standard, license no. 4050; research and development connected with specialised manufacture in surface treatment, manufacture of METALOPLAST® self–lubricating bearing foils and products from PTFE and high performance permanent magnets.

Number of employees: 60

Annual turnover: CZK 55 million (2011)

Focus of research and development

From 2004–2010 research and development were focused mainly on the implementation of one research proposal.Research proposal MSM2579700001 – "**Research of damage mechanisms and influence of quantification of defects on the useful life of components used in heavy duty working conditions**,"1/2004–12/2010; Principal investigator: Ing. Ivo Černý, Ph.D.; total costs for the entire period of implementation CZK 66.488 million,CZK 61.470 million of which was from the state budget. For nomenclature – area 1, the nanotechnology research share equalled 10%.

The subject of research activity in the plan was research of the mechanisms, threshold and growth conditions of cracks on defects characteristic for structural materials and components of machines, machinery and energy equipment and piping systems in variable temperature conditions and in environments with variable corrosion activity, with a special focus on specific complicated mechanisms under static, fatigue and creep loading and in high–temperature corrosive environments. One of the ten areas investigated focused on research of polymer/clay nanocomposite properties. In nanotechnology the Institute further cooperates on the solution of problems concerning nanostructured coatings.

In 2011 SVÚM implemented 18 programme research projects, 7 of which concerned nanotechnology.

Projects implemented in nanotechnologies

- Project 7FP EU Large type, NMP thematic priority, project name: PARTICOAT – "New multipurpose coating systems based on novel particle technology for extreme environments at high temperatures," 2008–2012; 14 partners from 7 countries, project budget: EUR 6.9 million, Coordinator: Walter Krause, Fraunhofer–Gesellschaft zur Foerderung der Angewandten Forschung E.V.(Germany), SVÚM a.s. is a partner.

- Project MEYS OC09036 – "Study of the influence of microstructures on malleability and creep and toughness of thermoplastic nanocomposites with nanofillers," 2009–2012; Principal investigator: Ing. Jaroslav Hell, CSc.

- Project MEYS OC09037 – "Study of the influence of nanoparticle addition on the improvement of the tribologic properties of PTFE composite coatings," 2009–2012; Principal investigator: Ing. Vratislav Hlaváček, CSc.

- Project MEYS 1M06032 – "Research Centre of Forming Technology – FORTECH," 3/2006–12/2011; Principal investigator: prof. Dr. Ing. Bohuslav Mašek, University of West Bohemia in Pilsen/Faculty of Machine Engineering, Co–principal investigator for SVÚM: Ing. Ivo Černý, Ph.D.

- Project MIT FR–TI3/373 – "Research and development of new subledeburitic steels for wood working with improved performance," 2011–2014; Primary investigator: Ing. Jiří Krejčík, CSc., Co–investigators: Ing. Bohuslav Chmiel, Třinecké železárny a.s, Ing. Zdeněk Kolář, PILANA Knives s.r.o., prof. Ing. Petr Louda, CSc., Technical University in Liberec/Faculty of Mechanical Engineering

- Project MIT TI3/814 – "Laser surface processing optimisation machine parts for enhancing their useful qualities," 2011–2014; Principal investigator: Ing. Ivo Černý, Ph.D., cooperating organisations: MATEX PM, s.r.o. and CTU, Prague/Faculty of Nuclear Science and Physical Engineering

- Project MIT FR–TI1/225 – "Research in the durability of diffuse nano–coatings on an aluminium base against high–temperature corrosion under conditions in municipal waste incinerators and furnaces for burning biomass," 2009–2012; Principal investigator: Ing. Josef Cizner, CSc., Co–investigators: Ing. Jiří Tomeš,TERMIZO, a.s. and RNDr. Petr Sajdl, CSc., Institute of Chemical Technology, Prague/Faculty of Environmental Technology

- Project MIT FT–TA3/151 – "Research and development of the technology of surface layers of roller and slide bearings," 3/2006–12/2009; Principal investigator: Ing. Vladimír Vansa, ZKL, Výzkum a vývoj, a.s., Brno, Co–principal investigator for SVÚM a.s.: Ing. Jiří Krejčík, CSc..SVÚM's activities in this project were focused on the development of nanostructured coatings for slide bearings on a base of metal and non–metal nanopowders, such as Ni, SiC, C (in the form of graphite) with a suitable fill material.

Results in nanotechnologies/cooperation

- Patent no. 301085 – Driving magnetic drum
- Patent no. 300502 – Separator magnetic drum
- Utility model no. 22790 – Nanocomposite slippery coating
- Utility model no. 22791 – Joint bearing resistant to a dusty environment
- Utility model no. 20496 – Product for arrangement of axial alignment of testing equipment
- Utility model no. 20632 – Product for testing and research of fretting fatigue material failure
- Utility model no. 20592 – Magnetic roller for a non–ferrous metal separator
- Utility model no. 19951 – Tool steel with high malleability and wear resistance designed for work under heat
- Utility model no. 19950 – Tool steel with high malleability designed for work under heat
- Utility model no. 19949 – Tool steel with high wear resistance designed for work under heat
- Utility model no. 20300 – Tool steel with high depth of hardening and wear resistance designed for work under heat

Experts/field

- Ing. Josef Cizner, CSc.– nanocoatings, corrosion, high–temperature oxidation
- Ing. Ivo Černý, Ph.D. – fatigue properties of surfaces, metal composites
- Ing. Ivan Furbacher, CSc.– contact fatigue
- Ing. Jaroslav Hell, CSc.– material engineering of plastics and polymer composites
- Ing. Vratislav Hlaváček, CSc.– surface treatments, nanostructures
- Ing. Jiří Kadlec, CSc.– coating analysis, phase composition
- Ing. Jiří Krejčík, CSc.– tribology, surface treatments
- Ing. Jakub Mlnařík – nanocoatings, high–temperature corrosion
- Ing. Robert Válek, Ph.D. – material engineering of plastics and composites
- Ing.Tomáš Vlasák, Ph.D. – high–temperature materials, creep

3.4.13 SVÚOM, S.R.O.

U Měšťanského pivovaru 934/4 Prague 7, 170 00, ID: 25794787

www.svuom.cz

A brief description

SVÚOM s.r.o. is a contract research organisation involved in the solution of problems concerning corrosion, anti–corrosion protection and surface treatments. Its professional activities are connected with the State Research Institute for Material Protection (SVÚOM). In 2011 SVÚOM implemented 5 programme research projects, one of which concerned nanotechnology.

Annual turnover: CZK 10.26 million (2011)

Activity in nanotechnologies

Material resistance, nanocoating; collaboration on the implementation of the research project defined below:

- Project TA CR TA01010183 –"Effective anti–corrosive and special coatings with reduced zinc content for surface protection of construction materials," 2011–2014; Principal investigators: Ing. Libuše Hochmannová, Ph.D. and Ing. Jan Skoupil, CSc., SYNPO, a.s., Co–principal investigators for SVÚOM: Ing. Lubomír Mindoš, RNDr. Boleslav Eremiáš, CSc. and Ing. Hana Geiplová

3.4.14 SYNPO, A.S.

S. K. Neumanna 1316, 532 07 Pardubice, ID: 46504711

www.synpo.cz

A brief description

The contract research organisation SYNPO was established in 1952 as the Research Institute of Synthetic Resins and Varnishes. It specialises in applied research and development of polymers. Since 1992 SYNPO has been a joint stock company which is involved in the following:

- Contractual research, development and formulations in synthetic polymers, paints, composites, glues and polymers for applications in electronics
- Application development
- Development of processes in pilot operation and manufacturing facilities
- Special product manufacture in polymer chemistry
- Analysis and testing in accredited laboratories

In 2011, a total 17 programme research projects were implemented at the SYNPO, seven of which concerned nanotechnology.

Number of employees: 127

Annual turnover: CZK 95.43 million (2011)

Activity in nanotechnologies

- Preparation of organic, inorganic and hybrid nanoparticles specifically structured for concrete polymer systems.
- Characterisation of nanoparticles in terms of their size, chemical composition and surface properties, including testing method development.
- Study of the relationships between structure and size of nanoparticles and properties of materials containing these nanoparticles.

Projects implemented in nanotechnologies

- Project ESA FLPP 2.1 – “Liners material study,” 10/2010–5/2012; Principal investigator: Ing. Jiří Zelenka, CSc.
- Project ESA NMS Czech RepublicAO 6647 – "Epoxy core development"11/2011–5/2013; Principal investigator: Ing. Jiří Zelenka, CSc.
- Project TA CR TA01010183 – “Effective anti–corrosive and special coatings with reduced zinc content for surface protection of construction materials,” 2011–2014; Principal investigator: Ing. Libuše Hochmannová, Ph.D.
- Project MIT FR–TI3/521 – “Technology of the preparation of new magnetic nanoparticles for diagnostics and therapy in oncology,” 2011–2015; Principal investigator: Ing. Jiří Zelenka, CSc.
- Project MIT FR–TI3/176 – “Paints with long–term antimicrobial effects for indoor and outdoor applications based on nanomaterials and other new additives,” 2011–2013; Principal investigator: Ing. Libuše Hochmannová, Ph.D.
- Project MIT FR–TI1/376 – “New types of composites based on local raw materials for reinforcing building structures with an emphasis on improved fire resistance,” 2009–2012; Principal investigator: Ing. Kateřina Zetková
- Project MIT EA 4.2PT02/012 – "Czech Centre of Nanostructured Polymers and Polymers Based on Renewable Resources," 2008–2011 (investment project)
- Project MIT FT–TA4/064 – “Coatings that fulfil the new environmental requirements of the EU,” 2007–2010; Principal investigator: Ing. Libuše Hochmannová, Ph.D.
- Project MIT FR–TI1/078 – “The use of ultrasound for dispersion resins,” 2009–2010; Principal investigator: Ing. Jiří Novák, CSc.
- Project MIT 2A–2TP1/135 – “New polyfunctional hybrid polymers from renewable and recyclable raw materials with possible use of enzyme catalysts and nanoparticles," 7/2007–6/2011; Principal investigator: Ing. Tomáš Vlček, Ph.D.
- Project MIT FI–IM4/037 – “New modified epoxide compositions containing special additives for industrial casting and adhesive systems,” 2007–2010; Principal investigator: Ing. Miroslav Balcar, CSc.
- Project MIT FT–TA4/074 – “Caoutchouc nanocomposites with exceptional properties for rubber products with use primarily in the automobile and defence industry,” 3/2007–12/2010; Principal investigator: Ing. Jiří Zelenka, CSc.

- Project MIT FT–TA3/055 – “Smart polymer surface coatings containing nanoparticles,” 3/2006–12/2009; Primary investigator: Ing. Jiří Zelenka, CSc.
- Project MIT FI–IM3/085 – “Polyolefin based nanocomposites with extraordinary utility properties,” 3/2006–12/2009; Principal investigator: Ing. Ivan Dobáš, CSc.
- Project 6FP EU, MULTIHYBRIDS – “Innovative sensor–based processing technology of nanostructured multifunctional hybrids and composites,” 1/2007–12/2010; integrated project, 20 participants, SYNPO was a partner in the project.

Results in nanotechnologies/cooperation

During the implementation of the projects various types of nanostructured paint systems, adhesives, hybrid composites and rubbers for different applications (the automobile industry, construction, defence industry, electrotechnics, aeronautics industry and astronautics) were developed.

Cooperation was initiated with the following entities:

University and research institutes:

University of Pardubice/Faculty of Chemical Technology and the Faculty of Chemical Engineering; University of Chemical Technology/Faculty of Chemical Engineering, University of Technology Brno/Faculty of Civil Engineering; Institute of Physics AS CR; Institute of Clinical and Experimental Medicine; Institute of Experimental Medicine AS CR; SVÚOM s.r.o.

Manufacturing facilities:

Barvy a laky Teluria s.r.o., Stavební chemie Slaný, a.s., Color Spectrum a.s., Barvy a laky Hostivař a.s., and Betosan s. r. o.

Experts/field

- Ing. Ivan Dobáš, CSc.– technology synthesis and transfer, international project coordination
- prof. Ing. Štěpán Podzimek, CSc.– polymer and nanomaterial analysis
- Ing. Pavla Švíglerová, Ph.D. – polymer synthesis, preparation and analysis of nanocomposites
- Ing. Petr Vlasák, Ph.D. – study of paint films with nanoparticles
- Ing. Tomáš Vlček, Ph.D. – polymers based on renewable resources, international project coordination
- Ing. Jiří Zelenka, CSc.– nanomaterials, nanostructured polymer synthesis, nanoparticle preparation, study of relationships between structure and properties, material research
- Ing. Markéta Zelenková Myšková, Ph.D. – nanocomposite development, AFM
- Ing. Kateřina Zetková – nanomaterial–base paints, hybrid composites

3.4.15 TECHNOLOGY CENTRE AS CR (TC)

Ve Struhách 27, 160 00 Prague 6 – Bubeneč, ID: 60456540

www.tc.cz

A brief description

The Technology Centre AS CR is a non–profit interest association of legal entities – 5 institutes of the Academy of Science of the Czech Republic (specifically: the Institute of Physics AS CR, Institute of Microbiology AS CR, Institute of Chemical Process Fundamentals AS CR, Institute of Plasma Physics AS CR and the Institute of Molecular Genetics As CR) and the company Technology management s.r.o.. It is divided into the Department of EU Research Promotion, the Department of Strategic Studies, the Department of Business Support and Technology Transfer, the Economic–Administration Department and the Czech Liaison Office for Research and Development in Brussels (CZELO). It supports participation of the Czech Republic in the European Research Area, prepares analytical and conceptual studies for research and innovation, performs international technology transfers and supports the creation and development of small innovation companies.

Through its wide spectrum of informational activities the Technology Centre contributes to a greater level of Czech team participation in European research and development, particularly in framework programmes of the European Community for research and technological development.These activities are overseen in particular by the National Information Centre for European Research (NICER) project, financed by MEYS from the EUPRO programme and they are organised by a team of thematically focused national contact persons (NCP) for the FP. Its informational activities include specialised consultancy for Czech research institutions regarding preparation and management of international research projects; identification of partners for investigation consortia; organisation of conferences, seminars and trainings; operation of specialised websites; publication of electronic and printed informational materials (VADEMECUM compilation); publication of the ECHO magazine, specialising in issues of European research and development; monitoring and analysis of the Czech Republic's participation for use by the public administration.

Activity in nanotechnologies/nanomaterials

- Informational activity, consulting and monitoring in the NMP 7FP priority
- Informational activities and a part in preparing the Czech Republic's participation in the Horizont 2020 programme
- Creation of studies from various areas in nanotechnologies and their applications
- Support of international cooperation in nanoscience and nanotechnology
- Nanotechnology promotion
- Support of nanotechnology teaching

Projects implemented in nanotechnologies

- Project 7FP EU CSA type, NMP thematic priority, project name: NMP TeAm2 – "Improving the services of the NMP NCP Network through Trans–national Activities 2," 2012–2014; 15 partners from 15 countries,project budget:EUR 986,117, Coordinator:

Zinovia Papatheodorou, Foundation for Research and Technology Hellas (Greece), TC AS CR is a partner

- Project 7FP EU CSA type, NMP thematic priority, project name: NMP TeAm – "Improving the services of the NMP NCP Network through Trans–national Activities," 2009–2011; 15 partners from 15 countries, project budget: EUR 1.29 million, Coordinator: Zinovia Papatheodorou, Foundation for Research and Technology Hellas (Greece), TC AS CR was a partner
- Project 7FP EU CSA type, NMP thematic priority, project name: NANO observatory – "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," 2008–2012; 16 partners from 10 countries, project budget: EUR 5.14 million, Coordinator: Eleanor O'Rourke, Institute of Nanotechnology (Great Britain), TC AS CR is a partner
- Project 7FP EU CSA type, SIS thematic priority, project name: NANOCODE – "A multi–stakeholder dialogue providing inputs to implement the European Code of Conduct for Nanosciences & Nanotechnologies (N&N) research," 2010–2011; 10 partners from 10 countries, project budget: EUR 1.42 million, Coordinator: Guido Frigessi di Rarralma, Associazione Italiana Per La Ricerce Industriale– AIRI (Italy), Technology Centre AS CR was a partner
- Project 7FP EU CSA type, SIS thematic priority, project name: FramingNano "International Multi–stakeholder Dialogue Platform framing the Responsible Development of Nanosciences and Nanotechnologies (NS&T)," 2008–2010; 6 partners from 6 countries, project budget: EUR 743 thousand, Coordinator: Guido Frigessi di Rarralma, Associazione Italiana Per La Ricerce Industriale– AIRI (Italy), Technology Centre AS CR was a partner
- Project 7FP EU CSA type, NMP thematic priority, project name: ENF 2009 – "Organization of the Conference EURONANOFORUM 2009 "Nanotechnology for Sustainable Economy"," 2008–2009; project budget: EUR 786 thousand, Coordinator: Petra Perutková, Technology Centre AS CR TC

Partners of TC AS CR:

- Institute of Physics AS CR
- Faculty of Biomedical Engineering, CTU, Prague
- Faculty of Mechanical Engineering, BUT
- Faculty of Science, Palacký University, Olomouc
- Faculty of Mechanical Engineering, Technical University in Liberec
- The Czech Society for New Materials and Technologies

Experts

- as.prof. RNDr. Jitka Kubátová, CSc.– informational activities, consulting, coordination activities, promotion and international cooperation in nanotechnologies
- Ing. Gabriela Salejová, Ph.D. – national contact point for thematic priority Nanosciences, nanotechnologies, materials and new manufacturing technologies (NMP) 7FP EU, risk assessment of nanotechnologies in foods

3.4.16 VÝZKUMNÝ ÚSTAV ANORGANICKE CHEMIE, A.S. (Research institute of inorganic chemistry – VÚAnCh)

Revoluční 84, 400 01 Ústí nad Labem, ID: 62243136

www.vuanch.cz

A brief description

VÚAnCh, a.s. is the central research and development organisation of the Unipetrol industrial group.Research and development work are focused on chemistry, technology and raw materials use. Further authorised emission measurement, water and leaching discharge analysis, selected element determination in fertilisers, composts, soils, earth, sediments, sludge and similar materials, identification and analysis of unknown samples, waste analysis and evaluation, revision and removal of waste etc are performed.

In 2011 the Institute implemented 21 programme research and development projects. One of them is the Regional Centre project supported by EU structural funds ED2.1.00/03.0071 – **Unipetrol Centre of Research and Education** (**UniCRE**). This primarily investment project is scheduled for 2010–2014 and its budget equals CZK 592.437 million. UniCRE is focused on research in technologies of effective and environmentally acceptable uses of carbon–based energy raw materials for the production of clean automobile fuels, technologies for acquiring raw materials for the production of advanced polymer materials and the sustainable use of renewable resources and reduction of dangerous emissions.

Number of employees: 115 (2011)

Annual turnover: CZK 36.23 million (2011)

Activity in nanotechnologies/nanomaterials

Tricalcium–phosphate nanoparticle preparation for polymeration styrene suspension takes place, nanostructures on a base of zeolite and molecule networks designed for catalyst preparation are investigated, Al_20_3 nanoparticles are prepared for special ceramics manufacture and nanofiller preparation for plastics and rubbers on a base of intercalations of exfoliated clay materials is carried out.

Projects implemented in nanotechnologies

a) *Projects implemented by the Institute*

- Project MIT FT–TA5/005 – "Advanced types of zeolites and their applications," 2008–2010; Principal investigator: Ing. Věnceslava Tokarová, CSc., Co–investigators: Ing. Josef Konečný, Vakos XT, a.s. and prof. Ing. Jiří Čejka, DrSc., J. Heyrovský Institute of Physical Chemistry AS CR

- Project MIT FT–TA3/077 – "Groundwater remediation by means of permeable reactive barriers," 2006–2010; Principal investigator: Ing. Josef Kozler, CSc.The project was focused on the use of elementary nano–iron as the filler for a reactive groundwater wall for the removal of chlorinated hydrocarbons in contaminated groundwater.

- Project MIT FT–TA3/080 – "Synthesis of titanium silicates and their applications," 2006–2009; Principal investigator: Ing. Věnceslava Tokarová, CSc.

b) *Projects on whose implementation the Institute is cooperating/cooperated:*

- Project MIT FR–TI1/456 – "Development and implementation of tools additively modulating the soil and water bioremediation process," 2009–2013; Principal investigator: Mgr. Zdeněk Kozlíček, MikroChem LKT, spol. s r.o., Co–principal investigator for VÚAnCH: Ing. Josef Kozler, CSc.
- Project MIT FT–TA5/005 – "Progressive types of zeolites and their applications," 4/2008–12/2010; Principal investigator: Ing. Věnceslava Tokarová, CSc.
- Project AS CR, "Nanotechnology for Society" programme, KAN100400701 – "Hybrid nanocomposite materials," 1/2007–12/2011; Principal investigator: prof. Ing. Jiří Čejka, DrSc., J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for VÚAnCH: RNDr. Vojtěch Varga
- Project AS CR 1QS400400560 – "A joint laboratory of the J. Heyrovský Institute of Physical Chemistry and VÚAnCh for research and development of catalytic processes," 2005–2009; Principal investigator: prof. Ing. Jiří Čejka, DrSc.,J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for VÚAnCh: Dr. Ing. Věnceslava Tokarová

Experts/field

- Ing. Gabriela Šťávová – nanocatalysis
- Ing. Věnceslava Tokarová, CSc. – nanoceramics
- RNDr. Vojtěch Varga – nanocomposites

3.4.17 VÚHŽ A.S.

739 51 Dobrá 240 u Frýdku–Místku, ID: 27768953

www.vuhz.cz

A brief description

VÚHŽ Dobrá was created in 1992 from the government enterprise – the Research Institute of Iron Metallurgy (originally the Steel Research Institute). In 2007 the company Třinecké železárny, a. s. became the sole shareholder of VÚHŽ a.s. The company is oriented both towards small–series production as well as towards research and development. Production is focused primarily on exports of forged products (centrifugal casting, hot profile rolling), machined products (small–series machines and production lines, sound insulation and covers) and the manufacture of measurement, regulation and automated technology for industry. Research and development are focused primarily on new materials and technologies, testing, consulting and expertise.In 2011a total 7 programme research projects were implemented at VÚHŽ.

Number of employees: 307 (2011)

Annual turnover: CZK 566.60 million (2011)

Activity in nanotechnologies

Research in nanotechnology is carried out at the Laboratory and testing room division.It is focused on development in the field of manufacturing and qualitative evaluation of bulk materials with nanocrystalline structure manufactured using multiple severe plastic deformation.

R&D activities at VÚHŽ a.s., in cooperation with Technical University Ostrava/FME, are focused on the development of the new DRECE (Double Roll Equal Channel Extrusion) technology.

Research is also being expanded to include additional types of materials.As part of material properties and structural stability evaluation, R&D of new testing methods is performed, or the development of a new, comprehensive qualitative evaluation of technical materials manufactured using the above technology, or technical materials with a nanocrystalline structure in general is carried out.

Projects implemented in nanotechnologies

- Project MIT FR–TI1/103 – "Research of technologies for application of sandwich–type coating with nanostructures oriented for press tools using the PA CVD method," 2009–2013; Principal investigator: Ing Slavomír Hořejš, CSc., Co–principal investigators: prof. Ing. Petr Louda, CSc.,Technical University of Liberec/Faculty of Machine Engineering/Institute for Nanomaterials, Advanced Technologies and Innovation
- Project MIT 2A–1TP1/124 – "Research of the impact of severe deformation conditions on submicrostructure metals and testing methods for diagnostics of their technological properties," 2006–2011; Principal investigator: Ing. Karel Malaník, CSc.

Experts/field

- Ing. Milan Gottwald – material engineering, expertise
- Ing. Karel Malaník, CSc. – material testing, chemical phase analysis
- Ing. Vít Michenka – non–standard property testing
- prof. Ing. Stanislav Rusz, CSc. – new technology development (TUO)

3.4.18 VÚK PANENSKÉ BŘEŽANY, S.R.O.

Panenské Břežany 50, 250 70 Odolena Voda, ID: 25604716

www.vukpb.cz

A brief description

The company came into existence 1 January 1998 when the Research, Information and Testing division separated from the Innovative technological centre – VÚK, a.s., the successor to the Research Institute of Metals, s.p., s.p. VÚK, which was founded in 1946 as a research institute for non–ferrous metals in direct cooperation with foundries. The company performs applied research of new material types, including materials with nanometer phase sizes (precipitates), development, treatment and optimisation of metals and their

technological approaches for making products of non–ferrous alloys, including methods of preparing ultra–fine grain rolled materials using the ARB method (Accumulative Roll Bonding).

VÚK also performs mechanical property tests (static, impact and fatigue), metallographic analyses and chemical analyses. The company further operates a specialised information centre of non–ferrous metals, provides the services of a specialised library, technical consultation in non–ferrous metal standards, and the use and substitute of materials.

In 2011, a total 7 programme research projects were implemented at VÚK.

Activity in nanotechnologies

Primarily methods for the preparation of ultrafine grain aluminium based materials are developed, particularly from industrially produced alloys produced using the modern method of casting between rollers (AlFe1, 5Mn, AMg3, AlScZr, Al99.99).

Projects implemented in nanotechnologies

- Project MIT FR–TI2/702 – "Development of water stabilized plasma (WSP) torch based technology," 2010–2013; Principal investigator: Ing.Vladivoj Očenášek,CSc., Co–investigators: Ing. Petr Romaniak, CSc., Innovative Technology Centre VÚK a.s., Ing. Tomáš Chráska, PhD., Institute of Plasma Physics AS CR

- Project AS CR, "Nanotechnology for Society" programme, KAN300100801 – "Multifunctional bulk metallic materials with nanocrystalline and ultra–fine grain structure," 1/2008–12/2012; Principal investigator: prof. Ing. Pavel Lejček, DrSc., Institute of Physics AS CR, Prague, Co–principal investigator for VÚK: RNDr. Vladivoj Očenášek, CSc.

- Research proposal MEYS MSM2631691901 – "Metallic materials with submicron and nanometre structures prepared using severe plastic deformation methods," 1/2004–12/2010; Principal investigator–Coordinator: Ing. Jozef Zrník, CSc., COMTES FHT a.s., Dobřany, Co–principal investigator for VÚK: Ing. Vladivoj Očenášek, CSc. The task of VÚK was the research and development of severe plastic deformation methods using ARB and ECAP methods for the preparation of ultrafine grain materials from highly pure aluminium and AlMg, AlZnScZr, AlFeMn and AlMgScZr alloys.

- Project GA CR GA106/07/0303 – "The role of grain boundaries in high–temperature plastic deformation of fine–grain materials," 1/2007–12/2010; Principal investigator: as.prof. RNDr. Přemysl Málek, CSc., Charles University in Prague/MFF, Co–principal investigator for VÚK: RNDr. Margarita Slámová, CSc. VÚK was responsible for the preparation of ultra–fine grain materials using the ARB method and the study of microstructure and structure of grains using EBSD, EDS, WDS methods on FEG–SEM.

Experts/field

- Ing. Vladivoj Očenášek, CSc., – non–ferrous metals, physical metallurgy, statistical data processing methods

3.4.19 VÝZKUMNÝ ÚSTAV ORGANICKÝCH SYNTÉZ A.S. (Research Institute of Organic Syntheses – VUOS)

Rybitví no. 296, 533 54 Rybitví, ID: 60108975

www.vuos.com

A brief description

VUOS is one of the largest Czech companies involved in research and development in the field of organic chemistry and toxicology. Its history dates back to 1941, when research laboratories were established by the Society for Chemical and Metallurgical Manufacturing in a newly built factory in the town of Rybitví by Pardubice. Today VUOS is a 100% subsidiary of Synthesia, a.s. The Company's main activities are special chemical production, research and development, environmental service and process engineering. In 2011 a total 26 programme research projects were implemented at VUOS.

Number of employees: 212 (2011)

Turnover: CZK 251.89 million (2011)

Activity in nanotechnologies/nanomaterials

The Company conducts research and development of precursors (monomers for conductive polymers, colour modifiers) for electrochrome materials, research of organic and organic–metallic compounds for high–tech applications in electronics and for use in medicine, research in photocatalytic systems and nanosystems for micro electrotechnology.

Projects implemented in nanotechnologies

- Project MIT FR–TI3/288 – "Research in methods of determining nanomaterial effects on reproduction of aquatic organisms," 2011–2013; Principal investigator: Ing. Petra Plodíková, Co–principal investigator: Ing. Miloslav Pouzar, Ph.D., University of Pardubice/Faculty of Chemical Technology

- Project MIT FT–TA3/048 – "Nanomaterials and functional systems for electronic equipment based on DPP and CPP compounds," 1/2006–12/2008; Principal investigator: Ing. Martin Kaja

- Project MEYS 2B06104 – "Photosensitizers in dentistry," 7/2006–6/2010; Principal investigator: Ing. Marie Karásková

- Project 7FP EU Large type, NMP thematic priority, project name:INNOSHADE – "Innovative Switchable Shading Appliances based on Nanomaterials and Hybrid Electrochromic Device Configurations," 2008–2012; 19 partners from 10 countries, project budget: EUR 10.95 million, Coordinator: Walter Krause, Fraunhofer–Gesellschaft zur Foerderung der Angewandten Forschung E.V.(Germany), VUOS is a partner in the project.

- Project AS CR "Nanotechnology for Society" programme KAN400720701 – "Hierarchic nanosystems for microelectronics," 1/2007–12/2011; Principal investigator: Ing. Olga Šolcová, CSc., Institute of Chemical Process Fundamentals AS CR, Prague, co–researcher for VUOS: Ing. Jan Rakušan, CSc.At VUOS the project was focused on

the study of application of phtalocyanine derivatives on metal oxide nanoparticles and the use of composites in microelectronics.

Experts/field

- Ing. Lubomír Kubáč – synthesis, UV stabilisation
- Ing. Miroslav Nečas, CSc. – chemical synthesis, nanomaterials
- Ing. Jan Rakušan, CSc. – functional nanosystems
- Ing. Jan Vyňuchal – organic compounds for electronics

3.4.20 VÝZKUMNÝ ÚSTAV PLETAŘSKÝ, A.S. (VÚP)

Šujanovo náměstí 3 Brno–centre 60200, ID: 15546578

www.vup.cz

A brief description

The Institute was founded in 1949. It is one of the major global manufacturers of special implantable and non–implantable medical products.

Number of employees: 25

Annual turnover: CZK 28.19 million (2009)

Activity in nanotechnologies

Adipograft vascular prosthesis

Project implemented in nanotechnologies

Cooperation on implementation of the following project:

- Project TA CR TA01010088 – "Development and innovation of new nanomaterial for targeted modification of vascular grafts," 2011–2015; Principal investigators: prof. Ing. Ivo Provazník, Ph.D., Ing. Radim Hrdý, as.prof. Ing. Jaromír Hubálek, Ph.D, Ing. Denisa Maděránková, Ing. Jan Prášek, Ph.D., Bc. Jiří Sedláček, Ing. Helena Škutková, Bc. Jaromír Žák, Brno University of Technology/Faculty of Electrical Engineering and Communication, Co–principal investigator for VÚP: RNDr. Věra Žížková

3.4.21 VÝZKUMNÝ ÚSTAV TEXTILNÍCH STROJŮ – VÚTS A.S.

U Jezu (P.O. Box 92) 525/4 Liberec 46119, ID: 46709002

www.vuts.cz

A brief description

The Institute has its specialisation in research, development and manufacture of machines and equipment for the processing industry, primarily in machining, textile, graphic design, food, packaging and healthcare technology. VÚTS is further engaged in automation,

development, design and building of special single–purpose machines, manipulators, conveyors and testing equipment, particularly for automobile industry suppliers. VÚTS also is engaged in the series production of cams, step transmissions and pressure plate clutches. In 2011 the Institute implemented 20 programme research projects. One of them is the Regional Research Centre ED2.1.00/03.0096 – **Centre of Mechanical Engineering Research Development Liberec**. The goal of the project, with a budget of CZK 745.215 million, is to create from 2010–2012 a research centre, with state–of–the–art spatial resources, material equipment and personnel, focused on design of machines and equipment for the processing industry, particularly tools for machining, glass–making, jewellery–making, graphic design, installation, textile and single–purpose machines.

Number of employees: 154

Annual turnover: CZK 157.61 million

Activity in nanotechnologies

Cooperation on implementation of the following project:

- Project MIT FR–TI3/621 – "Nanofibre textile composites for special filtration," 2011–2014; Principal investigator: prof. Dr. Ing. Jiří Maryška, CSc., Technical University of Liberec, Co–principal investigator for VÚTS a.s., as.prof. Ing. Josef Dvořák, CSc.

3.4.22 ÚSTAV JADERNÉHO VÝZKUMU ŘEŽ A.S. (Nuclear Research Institute Řež - NRI)

250 68 Husinec – Řež 130, ID: 46356088

www.nri.cz

A brief description

The Institute was founded in 1955. In 1992 it was transformed into a joint stock company. It provides expertise and services to nuclear power plant providers in the Czech Republic and abroad, supports the Czech central government institutions in strategic power generation management and handling nuclear waste (Ministry of Industry and Trade), provides independent professional expertise for the National Office of Nuclear Safety, arranges for the development of use of ionizing equipment and radiation services for basic and applied research, the healthcare field and industry, provides research and services for radioactive waste removal, organises radio pharmaceutical manufacture, carries out instruction and training of expert and scientific workers and a number of other activities. In addition, NRI is also active in non–nuclear areas, such as classical power generation, the chemical industry and protection of the environment.

The following organisations are members of the NRI group (with NRI capital participation):

Ústav aplikované mechaniky Brno, s.r.o. (*Institute of Applied Mechanics*), ŠKODA VÝZKUM s.r.o, Pilsen (*ŠkodaResearch*), 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.

In 2011 a total 33 programme research projects were implemented at the Institute. The biggest one is SUSEN project. Since 2011 NRI has participated in the building of the **Centre**

of Excellence SUSEN – Sustainable Energy,www.cvrez.cz. The goal of the SUSEN project, with a budget of CZK 2.5 billion, is to build a new research centre in the field of nuclear power generation by 2015. Project manager is Ing.Jiří Richter. The majority (approximately two thirds) of this Centre will be located in the town of Řež by Prague, and a smaller part in Pilsen, at the Borská pole site. The project is being realised by the Centrum výzkumu Řež s.r.o. (100% owned by the Nuclear Research Institute Řež plc.), and the University of West Bohemia is a partner in the project.

It is anticipated that the Centre will be fully operable starting in 2016, and that it will provide jobs for 180 employees. Research activity will be focused on the management of the useful life of existing nuclear equipment while meeting all the requirements for reliable and safe operation, and on research in IVth generation nuclear power plants (GenIV). The SUSEN project is thematically divided into four research programmes: Technological experimental circuits, Structural and systemic diagnostics, The nuclear fuel cycle and Material research.

Number of employees: 929

Annual turnover: CZK 1,307.29 million (2010)

Activity in nanotechnologies

Cooperation on the implementation of the programme research projects described below.

- Project MIT FR–TI3/245 – "Research and development of technologies and systems of RAO treatment in connection with new atomic sources," 2011–2014; Principal investigator: Ing. Radek Trtílek, other project investigators: Mgr. Josef Süssmilch, CSc., CHEMCOMEX Praha, a.s., Ing. Mojmír Němec, Ph.D., CTU in Prague/Faculty of Nuclear Science and Physical Engineering

- Project MIT FR–TI1/397 – "Development and use of methodologies and resources needed for neutron irradiation of specimens at a nuclear research reactor," 2009–2012; Principal investigator: RNDr. Ladislav Viererbl, CSc.

- Project MIT FT–TA4/025 – "Next generation nanomaterials and their industrial applications," 2007–2010; Principal investigator: Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, Co–principal investigator for NRI: RNDr. Vladimír Balek, DrSc.

- Project MEYS, "Research Centres" programme, 1M0505–"Centre for Targeted Therapy," 2005–2011; Principal investigator: as.prof. MUDr. Vladimír Viklický, CSc.

- Project AS CR, "Nanotechnology for Society" programme, KAN100400702 – "Nanostructured materials for catalytic, electrocatalytic and sorption applications," 1/2007–12/2011; Principal investigator: prof. RNDr. Zdeněk Samec, DrSc., J. Heyrovsky Institute of Physical Chemistry AS CR, Prague, Co–principal investigator for NRI: Ing. Jiří Rais, CSc., DSc.

Experts/field

- RNDr. Vladimír Balek, DrSc. – nanocomposite diagnostics using diffuse and structure analysis
- Ing. Leo Kronrád, DrSc. – research of radiopharmaceuticals
- Ing. Jiří Rais, CSc., DSc. – separation methods in nuclear chemistry and processing of nuclear waste
- as.prof. MUDr. Vladimír Viklický, CSc. – cell engineering, biotechnological preparation

3.4.23 VÝZKUMNÝ ÚSTAV PIVOVARSKÝ A SLADAŘSKÝ, A.S., (Research Institute of Brewing and Malting)

Lípová 15, Prague 2 120 44, ID: 60193697

www.beerresearch.cz

A brief description

This is the only research institute in the Czech Republic which is specialised in issues in brewing and malting, including research and development of modern techniques and technologies. The Institute also verifies the properties of barley and hops varieties. It is the only institution which is authorised to recommend suitable varieties for the brewing of Czech beer (protected geographical mark according to EU directive). In 2011 the Institute implemented 12 programme research projects.

Number of employees: 64

Annual turnover: CZK 66.19 million (2010)

Activity in nanotechnologies

Cooperation on the project described below:

- Project TA CR TA01011363 – "Research and development of a sensory system for determining diacetyl content in beer," 2011–2013, Principal investigator: as.prof. RNDr. Juraj Dian, CSc.,Charles University in Prague/MFF, Co–principal investigators: RNDr. Miroslav Dienstbier, Research Institute of Brewing and Malting Ltd., Ing. Jiří Flégl, Centec automatika, spol. s. r.o.

3.4.24 VÝZKUMNÝ ÚSTAV STAVEBNÍH HMOT, A.S. (Research Institute of Building Materials -VUSTAH)

Hněvkovského 30/65 Brno–South 61700, ID: 26232511

www.vustah.cz

A brief description

VUSTAH is a Czech research organisation involved in applied research in building materials and related issues for more than 65 years. In 2011 a total 10 programme research projects were implemented at the Institute.

Number of employees: 93

Annual turnover: CZK 69.88 million (2011)

Activity in nanotechnologies

Implementation of the project described below:

- Project MIT FT–TA3/027 – "Multifunctional composites of exceptional properties on an inorganic nanocomponent base," 2006–2010; Principal investigator: Ing.Miroslav Svoboda, Co–principal investigators: Ing. Ludvík Lederer, DAKO Brno s.r.o., prof. Ing. Radimír Vrba, CSc., Brno University of Technology/Faculty of Electrical Engineering and Communication, prof. Ing. Drahomír Novák, DrSc., Brno University of Technology/Faculty of Civil Engineering

Responsible person

- Ing. Miroslav Svoboda, PhD.– managing director and member of the board of directors

3.4.25 ZKL — VÝZKUM A VÝVOJ, A.S.

Jedovnická 8/4039, 628 00 Brno–Líšeň, ID: 25558480

www.zkl.cz

A brief description

This research entity is a part of the bearing manufacturing concern ZKL. It builds on the activities of ZKL VUVL Brno, with a tradition reaching back more than 45 years. The Institute is involved in research and development of bearing manufacturing under the ZKL trademark (all types and sizes from 1.5 mm to ca 1.5 m). The company also carries out the function of the main design office for the concern.

Number of employees: 19

Annual turnover: CZK 14.83 million (2010)

Activity in nanotechnologies

Implementation of the project described below:

- Project MIT FT–TA3/151 "Research and development of the technology of surface layers of roller and slide bearing parts," 3/2006–12/2009; Principal investigator: Ing. Vladimír Vansa

Responsible persons

- Ing. Vladimír Zikmund – director
- Ing. Libor Procházka – head of Department of development

4. MANUFACTURING COMPANIES

4.1 LARGE COMPANIES (MORE THAN 250 EMPLOYEES)

4.1.1 BARVY A LAKY HOSTIVAŘ, A.S.

Průmyslová 1472/11, 102 19 Praha 15, I.D. 26765306

www.bal.cz

A brief description of the Company

The Company was founded in 2003. It is involved in research, development and manufacture of paints and coatings for metals, wood, concrete, walls, wall and façade paint, and it also manufactures thinners, special insulations and technical fluids.

Number of employees: 194

Annual turnover: CZK 1,037.95 million (2010)

Activity in nanotechnologies

Nanotechnology applications in paint and lacquer, participation on implementation the project described below:

- Project MIT, TANDEM programme, FT–TA4/064 – "Coatings that fulfil the new environmental requirements of the EU," 2007–2010; Principal investigator: Ing.Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, Co–principal investigator for BARVY A LAKY HOSTIVAŘ: Ing. Dariusz Jakubowicz

Responsible person

- Ing. Jaroslava Úředníčková – head of research and development

4.1.2 BARVY A LAKY TELURIA, S.R.O.

Skrchov 1, 67961 Letovice, I.D. 43420371

www.barvyteluria.cz

A brief description of the Company

The company is a manufacturer of interior and exterior paints, coatings and enamels for wood, primers and top–coat enamel paint for metal, penetrating and protective products or wood, adhesives for laying flooring, cork sheets, polystyrene, wallpaper and other materials. The company is part of BARVY A LAKY HOSTIVAŘ, a.s. The Company's development department is involved in particular in the development of suitable adhesives, fillers and additives for the preparation of façade paints, the preparation of façade paint samples and testing of the properties of facade paints.

Number of employees: 168

Annual turnover: CZK 459.79 million (2011)

Activity in nanotechnologies

Development of facade paints containing photocatalytic active titanium whites. Cooperation on implementation of the projects described below:

- Project MIT, TANDEM programme, FT–TA4/025 – "Next generation nanomaterials and their industrial applications," 3/2007–12/2010; Principal investigator: Ing. Pavel Hynčica, České technologické centrum pro anorganické pigmenty a.s., Přerov, Co–principal investigator for BARVY A LAKY TELURIA: Ing. Luboš Mrázek
- Project MIT, "Sustainable Prosperity" programme, FT–TA4/064 – "Coatings that fulfil the new environmental requirements of the EU," 7/2007–12/2010; Principal investigator: Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, Co–principal investigator for BARVY A LAKY TELURIA: Ing.Jaroslav Prudil

Responsible person

- Ing. Jakub Noll – director

4.1.3 BUZULUK A.S.

Buzulucká 108 Komárov 26762, I.D. 25056301

www.buzuluk.cz

A brief description of the Company

This is a machine engineering company which develops, designs and builds machines and equipment for the rubber industry and piston rings.

Number of employees: 710

Annual turnover: CZK 795 million (2011)

Activity in nanotechnologies

Work on the project described below:

- Project MIT FT–TA3/106 – "The creation of a know–how database for handling the design, technology and production of next generation piston rings,"2006–2008; Principal investigator: Ing. Petr Mašek, Co–principal investigators: Ing. Vladimír Volák, Ricardo Prague, s.r.o., prof. RNDr. Jaroslav Fiala, University of West Bohemia in Pilsen/Institute of Further Education

4.1.4 FEI CZECH REPUBLIC, S.R.O.

Podnikatelská 2956/6, 612 42 Brno, I.D. 46971629

www.feicompany.com

A brief description of the Company

The Company is a subsidiary of FEI Company from the USA. It is involved in the development and manufacture of electron microscopes.

Number of employees: 287

Annual turnover: CZK 2,613.86 million (2009)

Activity in nanotechnologies

The Brno plant is involved in the development and manufacture of electron microscopes and instruments with cross electron beams and ion beams (DualBeam™). The microscopes function with nanometric and subnanometric precision.

Projects implemented in nanotechnologies

- Project MEYS, EUREKA programme, OE08012 – "Contrast and detection in scanning electron microscopy," 2008–2010; Principal investigator: RNDr. Lubomír Tůma

Responsible person

- RNDr. Jiří Očadlík – executive officer

4.1.5 GEA HEAT EXCHANGERS, A.S.

Vesecká 1, Liberec 46312, I.D. 46708375

www.gealvz.cz

A brief description of the Company

The company established in May 2012 by the merger of two in the Czech Republic operating companies GEA LVZ, a.s. and GEA Klimatizace spol. s r.o. The new company is a part of the multi–national segment of the GEA Air Treatment Systems concern. On the Czech European market it organises the manufacture and sale of equipment for air heating, cooling, humidification, dehumidification, and filtration. It is further a manufacturer and supplier of systems for clean spaces.In its solutions for clients, the Company emphasises minimisation of energy consumption for the entire recommended life of the equipment.

Number of employees: 367

Annual turnover: CZK 1,186.42 million (2011)

Activity in nanotechnologies

Cooperation on implementation of the following projects:

- Project MIT FR–TI3/621 – "Nanofibre textile composites for special filtration," 2011–2014; Principal investigator: prof. Dr. Ing. Jiří Maryška, CSc.,Technical University of Liberec, Co–principal investigator for GEA: Ing. Dušan Kraus
- Project TA CR TA01011512 – "Nanofibre air filters with active agents for air conditioning and ventilation," 2011–2014; Principal investigator: Ing. Jakub Hrůza, Ph.D., Co–principal investigators for GEA: Ing. Dušan Kraus and Ing. Antonín Pros

Responsible person/experts

- Ing. Dušan Kraus – nanofiltration

4.1.6 GUMÁRNY ZUBŘÍ, A.S.

Hamerská 9, 756 54 Zubří, I.D. 00012122

www.guzu.cz

A brief description of the Company

The Company has been a traditional manufacturer of technical rubber since 1935. It is involved in the production and development of technical rubber, mainly for the automobile industry. Technical rubber is manufactured using injection moulding or extrusion technology. The manufacturing programme of Gumárny Zubří, a.s. further includes the manufacture of protective face masks and the processing of thermoplastic elastomers.

Number of employees: 716

Annual turnover: CZK 798.07 million (2010)

Activity in nanotechnologies

The development of caoutchouc nanocomposites suitable for rubber production; collaboration on the implementation of the project defined below:

- Project MIT, TANDEM programme, FT–TA4/074 – "Caoutchouc nanocomposites with exceptional properties for rubber products with use primarily in the automobile and defence industry," 2007–2010; Principal investigator: Ing. Jiří Zelenka, CSc., SYNPO, a. s., Pardubice, Co–principal investigator for Gumárny Zubří, a.s.: Ing. Aleš Maceček

Expert/field

- Ing. Aleš Maceček – preparation and evaluation of caoutchouc nanocomposites

4.1.7 HARFA PLUS S.R.O.

Poděbradská 195/7, 190 05 Praha 9, I.D. 45794316

www.balakryl.cz, www.barvytebas.cz

A brief description of the Company

The Company was founded in 1992 (as Barvy Tebas, spol. s r.o.) and in 2001 was renamed to BARVY TEBAS s.r.o. and in 2010 to HARFA PLUS s.r.o. It is one of the largest manufacturers of water–based paints in the Czech Republic. The Company's core product is BALAKRYL Uni Mat V 2045 universal acrylic paint.

Activity in nanotechnologies

The use of nanoparticles in paint and lacquer; collaboration on the implementation of the project defined below:

- Project MIT, TANDEM programme, FT–TA4/064 "Coatings that fulfil the new environmental requirements of the EU," 7/2007–12/2010; Principal investigator: Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, Co–principal investigator for BARVY TEBAS: Ing. Jaroslav Prachař

Responsible persons

- Ing. Tomáš Jelínek – general director
- Ing. Jaroslav Prachař – technical director

4.1.8 HEDVA A.S.

Na Stráni 572/6, 572 21 Moravská Třebová, former I.D. 28828291

www.hedva.cz

A brief description of the Company

Silk textile production comes from a long–standing tradition, dating back to 1868. In 1949 the mills involved in silk production in Bohemia and Moravia were concentrated into the national company, Hedva, which was transformed in 1993 into a private joint stock company.

Production is concentrated in two weaving mills. One is in Moravská Třebová, where smooth sheet fabrics are made, and another in Rýmařov, where jacquard fabrics, ties and other men's fashion accessories are made. The third mill in Šumperku is involved in the production of silk sewing and specialty threads. In 2008 HEDVA a.s. bought from the Belgian company BDT the "Cyr Gambier" trade name, under which it supplies fabrics for outdoor furniture upholstery, sunshades and baby carriages.

The company's product mainstay is technical fabrics for uses in sports, filtration, protective, military, haberdashery and reinforcement and for further use in the construction and automobile industries as well as in medicine and in ultra–clean facilities.

Number of employees: 347

Annual turnover: CZK 383 million (2009)

Activity in nanotechnologies

Lighter types of silk technical fabrics weigh less than 50 grams per 1 m^2 and are suitable as carriers for special–property nanolayers.They are useful where strength is required in addition to special nanofibre properties.

Nanotechnologies are used in the final treatments of silk fabrics which demand effectiveness, resilience, and durability of the properties bestowed by the treatment.In regular practice, higher demands are placed on the chemical composition of the product and the technological process used rather than on special equipment.

The most common nanotechnological treatments of silk fabrics are water resistant, stain–resistant, anti–static and fire–resistant. Here the general rule also applies that finer capillarity of the fibre used in the fabric yields a more effective application of final treatments applied by nanotechnological methods.

4.1.9 INTERPHARMA PRAHA, A.S.

Komořanská 955, 143 00 Prague 12 – Modřany, I.D. 44265409

www.interpharma–praha.cz

A brief description of the Company

Interpharma Praha, a.s. is a pharmaceutical company which was founded in 1932. It is involved in research, development and production of generic drugs, in particular diagnostics, antitumour and urological drugs and dermo–cosmetics. The Company is owned by INTERPHARMA WEST Inc., from the USA, which is registered in the British Virgin Islands.

Number of employees: 108

Annual turnover: CZK 187.65 million (2010)

Activity in nanotechnologies

Cooperation on implementation of the project described below:

- Project AS CR, "Nanotechnologies for Society" programme, KAN201110651 "Combined contrast agents for molecular MR imaging," 2006–2010; Principal investigator: prof. RNDr. Ivan Lukeš, CSc., Charles University in Prague/Faculty of Science, Co–principal investigator for Interpharma Praha: Ing. Ivan Hlaváček, CSc.

Responsible person

- Ing. Ivan Hlaváček, CSc.– member of the board of directors, research and development

4.1.10 LANEX A.S.

Hlučínská 1/96, 747 23 Bolatice, Opava, I.D. 28223209

www.lanex.cz

A brief description of the Company

Lanex a.s. manufactures technical textiles – composite ropes, including marine and mountain climbing ropes, as well as large–volume bags, flexitanks, straps, technical fibres etc.

Number of employees: 747

Annual turnover: CZK 950.94 million (2010)

Activity in nanotechnologies

Research in the use of nanotechnologies to improve the functional properties of ropes; implementation of the project described below:

- Project MIT, "Sustainable Prosperity" programme, 2A–2TP1/136 "The use of nanotechnologies for the surface treatment of ropes," 2007–2010; Principal investigator: Ing. Libor Ganzer. The goal of project implementation was to improve the hydrophilic properties of ropes and the resilience of textiles through the use of nanofibres.

Responsible persons

- Ing. Rudolf Gregořica – general director
- Ing. Libor Ganzer – technical development

4.1.11 LASSELSBERGER, S.R.O.

Adelova 2549/1, 320 00 Pilsen, I.D. 25238078

www.rako.cz

A brief description of the Company

The Company is the largest manufacturer of ceramic wall and floor tiles in the Czech Republic, and one of the largest European manufacturer of tiling materials. LASSELSBERGER, s.r.o. is continuing and developing the tradition of the Czech RAKO brand with a complete selection of interior ceramics.

Number of employees: 1 641

Annual turnover: CZK 4,015.18 million (2011)

Activity in nanotechnologies

The Company manufactures special treatments for standard interior ceramics with a surface layer of photoactive titanium oxide. This layer improves the cleanability of products and is notable for its antibacterial effect. The technology is owned by the Japanese TOTO. Lasselsberger manufactures the products on the basis of a purchased licence. The technology consists of applying and then using heat to affix a thin, transparent layer of nanoparticle titanium oxide and other inorganic components on the surfaces of ceramic materials. The layer improves the hygienic properties of the ceramic tiles thanks to the hydrophilic and antibacterial effect of the surface. Lasselsberger manufactures these products for its former owner – the German DSCB, which sells it under its HYDROTEC brand.

Responsible person

- Ing. Monika Zechovská –technological development

4.1.12 MAGNA EXTERIORS & INTERIORS (BOHEMIA), S.R.O.

Kubelíkova 604 Liberec 460 78, I.D 26195348

www.eu.magna.com

A brief description of the Company

The development, manufacture, completion and sale of technical high–demand plastic parts for the automobile industry in four plants located in Liberec (2 plants), Liban near Jičín and Nymburk. From the year 2009 the company (established in the year of 1946 as Plastimat and in 1996 renamed to Peguform Bohemia a.s.) is a part of the global industrial conglomerate Magna International Inc., Canada, operating in 25 countries. The Magna Exteriors & Interiors (Bohemia) is responsible also for the Russian plants of the Magna located in Kaluga, Nizhny Novgorod and St. Petersburg.

Number of employees: 1 652

Annual turnover: CZK 7,609.24 million (2010)

Activity in nanotechnologies

Cooperation on the project described below:

- Project TA CR TA01010946 – "Research in the useful properties and possibilities for application of polymer materials with natural fillers and nanofillers based on synthetic and PLA matrices," 2011–2013; Principal investigator: Dr. Ing. Petr Lenfeld, Technical University of Liberec/Faculty of Mechanical Engineering, Co–principal investigator for MAGNA: Ing. Zdeněk Severa, Ph.D**.**

4.1.13 MOMENTIVE SPECIALTY CHEMICALS A.S.

Tovární 2093, 356 01 Sokolov, I.D. 00011771

www.momentive.com

A brief description of the Company

Momentive Specialty Chemicals a.s. (formerly in turn Chemické závody Sokolov and Eastman Sokolov, RSM Chemacryl and Hexion Specialty Chemicals) is part of the multinational Momentive Specialty Chemical, Inc. group, headquartered in Columbus, Ohio, USA. The Company is involved in the production and processing of products in the acrylic chemistry field.Acrylic acid and four basic acrylic acid esters (methyl acrylate, ethyl acrylate, butyl acrylate and 2–ethylhexyl acrylate) comprise two thirds of the company's manufacturing portfolio. The rest is composed of polymers which in dispersion form find use primarily in the production of paints, glues and materials for construction. Acrylic acid is used primarily as superabsorbent polymers, detergent polymers, flocculants or copolymers.

Number of employees: 350

Annual turnover: CZK 3,986.90 million (2010)

Activity in nanotechnologies

The company is cooperating on the implementation of research projects as a potential implementer of results achieved in research.

Projects implemented in nanotechnologies

- Project MEYS, "Research Centre" programme, 1M0577 – "A research centre for nano surface engineering – NANOPIN," 1/2005–12/2010; Principal investigator: Ing. František Peterka, Ph.D., ATG s.r.o., Prague, Co–principal investigator for Momentive: Ing. Pavel Holub.The goal of activities at Hexion was finding commercially interesting products using photocatalytic phenomena of nanomaterials in products on a base of acrylate dispersions.

- Project AS CR, "Nanotechnology for Society" programme, KAN100500651 – "The preparation and study of the properties of organic–inorganic nanocomposite materials prepared by *in situ* emulsion polymerisation," 7/2006–12/2009; Principal investigator:

Ing. Zdeňka Sedláková, CSc., Institute of Macromolecular Chemistry AS CR, Prague, Co–principal investigator for Momentive: Ing. Jan Nájemník

Responsible person

- Ing. Pavel Holub – technician, EMEA dispersion

4.1.14 PEGAS NONWOVENS S.R.O.

Přímětická 86, 689 04 Znojmo, I.D. 25478478

www.pegas.cz

A brief description of the Company

Pegas Nonwovens s.r.o. was established in 1990 as a purely Czech–owned company. The Company is involved in the production of nonwoven textiles. Production was expanded in 2002, with the addition of bicomponent nonwoven textiles of a polypropylene and polyethylene base.

Number of employees: 380

Annual turnover: CZK 4,240.65 million (2011)

Activity in nanotechnologies

The use of nanotechnology in nonwoven textile production; implementation of the projects described below:

- Project MIT FR–TI3/340 – "Next generation of barrier spun melt type nonwoven textiles based on nanofibres," 2011–2014; Principal investigator: Ing. Zdeněk Mečl
- Project MIT 2A–3TP1/126 – "In–line plasma treatments and surface nano–plasma treatments of non–woven fabrics," 2008–2011; Principal investigator: Ing. Zdeněk Mečl

Responsible persons

- Ing. Miloš Bogdan – general director
- František Klaška, MBA – technical director
- Ing. Zdeněk Mečl – technical development

4.1.15 POLIČSKÉ STROJÍRNY A.S.

572 12 Polička, I.D. 46504851

www.pos.cz

A brief description of the Company

The Company is involved in the development, production, sales and service of pneumatically controlled door systems for vehicles, pneumatic systems for control and automation applications, technologies for measurement and pumping liquids, as well as the development,

production, sales, destruction and ecological liquidation of armaments, ammunition and explosives.

Number of employees: 333

Annual turnover: CZK 302 million (2010)

Activity in nanotechnologies

Work on the project described below:

- Project MIT FRTI1/278 – "Research and development of devices and technology of detonation–synthesised ultra dispersed diamond graphite," 2009–2012; Principal investigator: Ing.Jiří Tamele, Co–principal investigator: prof. RNDr. Jaroslav Fiala, University of West Bohemia in Pilsen/New Technologies Research Centre in the West–Bohemian Region

Responsible person

- Ing. Jaroslav Trávníček– chairman of the board of directors

4.1.16 RAVAK A.S.

Obecnická 285, 261 01 Příbram I, I.D.: 25612492

www.ravak.cz

A brief description of the Company

RAVAK a.s. was founded in 1991.It is the largest manufacturer of bath fixtures in the Czech Republic and in all of Central and Eastern Europe. The Company manufactures bathtubs, shower stalls and doors, bathtubs with hydromassage systems, bathroom sinks, bathroom furniture, faucet fixtures and other bath accessories such as radiators, light fixtures etc. The company is active in over fifty countries around the world.

Number of employees: 551 (2010)

Annual turnover: CZK 1,307.875 million (2010)

Activity in nanotechnologies

Use of nanomaterials in the production of bath fixtures.

Responsible person

- Jindřich Vařeka – chairman of the board of directors

4.1.17 SAFINA, A.S.

Vídeňská 104, 252 42 Vestec, I.D. 45147868

www.safina.cz

A brief description of the Company

SAFINA, a.s., which builds on traditions reaching back to 1860, was established in 1992. The Company has a leading position in the field of processing precious and non–ferrous metals not only in the Czech Republic, but also all around Europe. The Company has an extensive product portfolio, ranging from refinement of precious metals to a purity of 3N to 4N, from semi–finished products and products made of precious and other metals, pure chemical products containing precious metals for the pharmaceutical industry, chemical compounds and catalysts containing precious metals for recycling electrical waste from electrical equipment, electronics and the chemical industry.

Number of employees: 521

Turnover: CZK 6,742.72 million (2010)

Activity in nanotechnologies

Research in the use of nanotechnologies in technologies used by the company – nanolayers etc., work on the project described below:

- Project MIT FI–IM5/124 – "Coating technology research of new material nanolayers for energy–efficient, high output sensors, regulators and actuators," 2008–2010; Principal investigator: Ing. František Veselý

Responsible person

- Ing. Tomáš Plachý, CSc.– chairman of the board of directors

4.1.18 SAINT – GOBAIN ADVANCED CERAMICS, S.R.O.

Přepeřská 1302, 511 01 Turnov, I.D. 25763121

www.sgac–turnov.cz

A brief description of the Company

The Company is the largest manufacturer of ceramics for the Saint–Gobain concern in Central Europe.It was created in August 1999, when Saint–Gobain Céramiques Avanceés Desmarquest purchased all the activities related to ceramics (including research and development) from the Czech company Dias Turnov, s.r.o. The Company's activities are focused primarily on the production of ceramic disks for water faucet cylinders, the production of ceramic filters for molten metals for the foundry industry, the production of ceramic cutting inserts for metal machining and tools for steel tube forming, the production and installation of electroceramic parts.

Number of employees: 242

Annual turnover: CZK 242.80 million (2010)

Activity in nanotechnologies

Development and production of high–tech ceramic prototypes (materials include submicro– and nanometric powders and suspensions of Al_20_3, ZrO_2 etc.). The Company carries out freeze and spray–dry granulation of ceramic submicro– and nanopowders and suspensions. After semi–finished objects are produced by various technologies, at least a submicrometric grain size of this granulate is maintained by heat processes.

Projects implemented in nanotechnologies

- Project 7FP EU Large type, NMP thematic priority, project name:Clear–up – "Clean buildings along with resource efficiency enhancement using appropriate materials and technology," 2008–2012; 22 partners from 11 countries, Project budget: EUR 12.02 million, Coordinator: Udo Weimar, Eberhard–Karls–Universität Tuebingen (Germany), Saint–Gobain is a partner in the project.
- Project MIT, "Sustainable Prosperity" programme, 2A–1TP1/087 – "Research of "in situ" reinforced nanocomposite ceramic materials," 11/2006–12/2010; Principal investigator: Ing. Vladimír Šída, CSc.

Responsible persons

- Ing. Vladimír Šída, CSc.– ceramic technologies
- Ing. Miroslav Liška – materials research

4.1.19 SPOLEK PRO CHEMICKOU A HUTNÍ VÝROBU, A.S. (Spolchemie)

Revoluční 1930/86, 400 32 Ústí nad Labem, I.D. 00011789

www.spolchemie.cz

A brief description of the Company

The Company is involved in research, development, production and processing of chemical and biochemical products and in their sale. Spolchemie produces more than 500 types of products in the field of synthetic resins, basic and special inorganic compounds, such as sodium hydroxide and potassium hydroxide, chlorine, hydrochloric acid, hydrofluoric acid, sodium fluoride, potassium permanganate and synthetic corundum. Since 2005 Spolchemie's majority shareholder (holding 38% of shares) has been the Via Chem Group, which belongs to Euro Capital Alliance Ltd., registered in Toronto, Canada.

Number of employees: 838

Annual turnover: CZK 3,395.27 million (2009)

Activity in nanotechnologies

Cooperation on implementation of the projects described below:

- Project MIT, T.I.P. programme, FR–TI1/548 – "Pilot project for manufacturing of nanoparticles of oxides and mixed oxides of Zr, Ti, Al, Li and Mn," 2009–2012;

Principal investigator: prof. Ing. Bohuslav Doležal, CSc., Co–principal investigators: Ing. Josef Konečný, Vakos XT a.s, and Ing.Vladimír Ždímal, CSc.,ICT/Faculty of Chemical Engineering

- Project MIT, TANDEM programme, FT–TA4/064 – "Coatings that fulfil the new environmental requirements of the EU," 2007–2010; Principal investigator: Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, Co–principal investigator for Spolchemie: Ing.Jan Hyršl, CSc.

Responsible persons

- Ing. Hyršl, CSc.– research and development
- prof. Ing. Otakar Söhnel, DrSc. – director

4.1.20 SYNTHOS KRALUPY A.S.

O. Wichterleho 810, Kralupy nad Vltavou, I.D 28214790

www.kaucuk.cz

A brief description of the Company

The chemical company (until 2007 called Kaučuk, a.s., now part of the Polish company SYNTHOS S.A., Oswiecim) is specialised in the production of styrene–butadiene rubber for the rubber and shoe industry and the production of different types of polystyrenes.

Number of employees: 695

Annual turnover: CZK 14,931.02 million (2010)

Activity in nanotechnologies

Research and development directed at improving the useful properties of polystyrene and other company products; work on the project specified below:

- Project AS CR, "Nanotechnology for Society" programme, KAN100400701 – "Hybrid nanocomposite materials," 1/2007–12/2011, Principal investigator: prof. Ing. Jiří Čejka, DrSc., J. Heyrovský Institute of Physical Chemistry AS CR, Co–principal investigator for SYNTHOS Kralupy: Ing. Jiří Reiss, CSc.

Responsible person

- Ing. Jiří Reiss, CSc.– research and development

4.1.21 TŘINECKÉ ŽELEZÁRNY, A.S.

Průmyslová 1000 Třinec 73970, I.D. 18050646

www.trz.cz

A brief description of the Company

Třinecké železárny is a manufacturer of long rolled steel products. It was established in 1839. The Company produces more than one third of the steel made in the Czech Republic.

Number of employees: 5,897

Annual turnover: CZK 32,914.43 million (2010)

Activity in nanotechnologies

Research and development in the field of limiting the quantity of waste created and increasing the share of its use, the use of nanotechnologies for steel quality improvement; work on the project specified below:

- Project MIT FR–TI3/373 – "Research and development of new sub–ledeburite steel tools for wood working with improved efficiency," 2011–2014; Primary investigator: Ing. Jiří Krejčík, CSc. SVÚM a.s., Co–principal investigator Třinecké železárny a.s. Ing. Bohuslav Chmiel

Responsible person

- Ing. Henryk Huczala – technical director

4.1.22 ZENTIVA, A.S.

U kabelovny 130, 102 37 Prague 10 – Dolní Měcholupy, I.D. 49240030

www.zentiva.cz

A brief description of the Company

Zentiva, a.s. is a pharmaceutical company focused on the development, production and sale of modern, generic pharmaceutical products. This is one of the largest drug manufacturers in Central and Eastern Europe ant the third largest producer of generic pharmaceutical products. In the Central and Eastern Europe Zentiva operate four production plants (in Prague-Horní Měcholupy, Hlohovec in Slovakia, Romania and Turkey). The Company is a part of the Sanofi multinational pharmaceutical concern (from the year 2009) and is responsible for the generic business in the concern (from the year 2012). In the Czech Republic the company employs about 200 employees in development of pharma products.

Number of employees: 1,130

Annual turnover: CZK 7,780.09 million (2010)

Activity in nanotechnologies

Nanomedicine – the development of a targeted breast cancer drug together with the Institute of Molecular Genetics AS CR and the Institute of Microbiology AS CR and cooperation on implementation of the research projects described below:

- Project AS CR, “Nanotechnology for Society" programme, KAN200100801 – "Bioactive biocompatible surfaces and new nanostructured composites for applications in medicine and drug delivery," 1/2008–12/2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics AS CR, Prague, Co–principal investigator for Zentiva, a.s.: Ing. Jan Šotola, CSc.
- Project AS CR, “Nanotechnology for Society" programme, KAN200200651 “Nanoparticulate and supramolecular systems for targeted drug transport," 7/2006–12/2010; Principal investigator: prof. RNDr. Blanka Říhová, DrSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for Zentiva, a.s.: Ing. Jan Šotola, CSc.

Responsible person

- Saša Leskovšek – director of development

4.2 SMALL AND MEDIUM ENTERPRISES (UP TO 250 EMPLOYEES)

4.2.1 5 M S.R.O.

Na Záhonech 1177, 686 04 Kunovice, I.D. 46969250

www.5m.cz

A brief description of the Company

Development and production of composites and sandwich materials for special applications

Number of employees: 123

Annual turnover: CZK 152.195 million (2010)

Activity in nanotechnologies

Development and production of nanocomposites; cooperation on implementation of the project described below:

- 7FP EU project, SME type, SME Thematic Priority, Project name:NANOCORE – Development of a low FST and high mechanical performance nanocomposite foam core materials for ferries and cruise ship superstructures, 2011–2013; 6 partners from 4 countries, Project budget: EUR 1.24 million, Project Coordinator: Jaime Rudiez Ruiz, Plasticos Karey SA (Spain), 5M spol. s r.o. is a partner in the project.

Responsible person

- Ing. Antonín Zelinka – executive officer

4.2.2 ADVANCED MATERIALS JTJ, S.R.O.

Kamenné Žehrovice 23, 270 01, I.D. 26763842

www.advancedmaterials1.com

A brief description of the Company

The Company was formed in 2003, and focuses on the innovation, development, manufacture and use of nanomaterials.It specialises in nano–titanium dioxide, photo alkaline applications and 3D Li–ion batteries

Number of employees: 1

Annual turnover: CZK 2 million (2010)

Activity in nanotechnologies

Nanomaterials and their use.

Responsible person

- Ing. Jan Procházka PhD. – executive officer

4.2.3 AGRITEC, RESEARCH, BREEDING& SERVICES, S.R.O.

Zemědělská 2520/16, 787 01 Šumperk, I.D. 48392952

www.agritec.cz

A brief description of the Company

Agritech focuses on applied and basic research in agriculture, environmental protection and the food industry. These activities are integrated with plant breeding and reproduction, sale of seed stock, chemical formulas for plant protection, substrates, animal feed, biochemical services, chemical analysis, laboratory and field testing of formulas, additives and plant varieties.

Number of employees: 32

Annual turnover: CZK 15.30 million (2010)

Activity in nanotechnologies

Use of nanotechnology in agriculture; cooperation on implementation of the project described below:

- Project 7FP EU, SME type, NMP Thematic Priority, Project name: BIOAGROTEX – Development of innovative agrotextiles from renewable resources and with tailored biodegradability, 2008–2012; 17 partners from 7 countries, Project budget: EUR 4.37 million, Project Coordinator: Michele Adams, Centre Scientifique & Technique de L'industrie Textile Belge (Belgium), AGRITEC spol. s. r.o is a partner in the project.

Responsible person

- Ing. Miroslav Hochman – executive officer and company director

4.2.4 ARCADIS GEOTECHNIKA, A.S.

Geologická 4/988 Prague 5 152 00, I.D. 41192168

www.arcadisgt.cz

A brief description of the Company

Arcadis Geotechnika a.s. (formerly Building geology – Geotechnika, a.s.) is the oldest (80–year tradition) geotechnical consulting firm in the Czech Republic. Since 2002 it has been part of the ARCADIS international group. It is active in applied research in all areas of building and environmental geotechnology. The Company has its own facility for numeric modelling of geotechnical problems, a geomechanical laboratory and a field testing and monitoring facility.

Number of employees: 202

Annual turnover: CZK 367.29 million (2010)

Activity in nanotechnologies

Participation in the project described below:

- Project TA CR TA01020348 “Reversible storage of energy in the rock massif,” 2011–2014; Principal investigator: Mgr. Michal Vaněček, Mgr. Jana Michálková, RNDr. Dagmar Trpkošová – ISATech, s.r.o., Co–principal investigators for ARCADIS: Ing. Jiří Záruba, MBA, and Mgr. Karel Sosna

Responsible person

- Ing. Václav Hořejší – chairman of the board of directors

4.2.5 ASIO, SPOL. S.R.O.

83 Jiříkovice 66451, I.D. 48910848

www.asio.cz

A brief description of the Company

This is an engineering and supply company active in the area of wastewater treatment.It specialises in the treatment of municipal wastewater, especially from smaller sources, i.e. sources equivalent to five thousand inhabitants, treatment of wastewater containing light fluids and fat, treatment of industrial wastewater, including plastic and stainless steel equipment.

Number of employees: 47 (2009)

Annual turnover: CZK 198.94 million (2009)

Activity in nanotechnologies

Research and use of nanomaterials used for wastewater treatment; implementation of the projects described below:

- Project TA CRTA01010356 – “Proper materials for nanotechnological applications of air and water treatment,” 2011–2014; Principal investigators for ASIO: Ing. Karel Plotěný and Ing. Marek Holba, Ph.D., Co–principal investigators: the Centre for Organic Chemistry Ltd., SPUR a.s., the Institute of Botany AS CR, Mendel University in Brno/Faculty of Agronomy

- Project MIT FR–TI3/196 – “Advanced technologies for sanitary and toxicological treatment of release from wastewater plants,” 2011–2014; Principal investigator for ASIO: Ing. Karel Plotěný, Co–principal investigators: Ing. Roman Sládek, RAWAT consulting s.r.o., as.prof. Ing. Blahoslav Maršálek, CSc., Institute of Experimental Botany AS CR, RNDr. Jana Soukupová, Ph.D., Palacky University Olomouc/Faculty of Science

Responsible person

- Ing. Karel Plotěný – executive officer

4.2.6 ATG S.R.O. (ADVANCED TECHNOLOGY GROUP, spol. s r.o.)

Beranových 65, 199 02 Prague 9 – Letňany, I.D. 45314772

www.atg.cz

A brief description of the Company

A Czech engineering company, activities include training and certification of technical personnel (non–destructive technology – NDT, welding corrosion), inspection and supervision in accordance with ASME Code and conducting independent NDT testing supervision.It manufactures NDT equipment and supplies a complete range of equipment for all methods for NDT facilities. Its subsidiary, LA composite, s.r.o., focuses on the design, development and manufacture of composite and sandwich structures, mainly for aerospace applications and autoclave equipment. Part of the Company is also the Centre for TiO_2 photocatalytic applications.

Number of employees: 80

Activity in nanotechnologies

Activity in nanotechnologies is focused on coordinating the work of the Centre for TiO_2 photocatalytic applications, coordinating the events of the 540 COST programmes and completing programme research projects.

Projects implemented in nanotechnologies

- Project MEYS, Research Centres programme, 1M0577 – "Research centre for nano surface engineering – NANOPIN," 1/2005–12/2011; Principal investigator: Coordinator Ing. František Peterka, Ph.D.
- Project Ministry of Industry and Trade, TANDEM programme, FT–TA4/025 – "New generation nanomaterials and their industrial applications," 2007–2010;Principal investigator: Ing. Pavel Hynčica, Czech Technology Centre for Inorganic Pigments a.s., Přerov, Co–principal investigator for ATG Ing. František Peterka, Ph.D.
- Event of the COST 540 PHONASUM programme – "Photocatalytic technologies and innovative nano surface materials – critical issues," 2005–2010; ATG Coordinator: Ing. František Peterka, Ph.D.Twenty countries participated in the event.More information at: www.cost540.com.Specific research subjects included the synthesis of highly photovoltaic nanoparticles of titanium dioxide, including doped and mixture materials with spectral sensitivity extended into the visible spectrum and preparation of surfaces based on nanocrystalline titanium dioxide both from gas state, using plasma deposition technology and from solution using various chemical procedures, and the use of advanced methods using micelles as patterns for the creation of defined porous structure.

Responsible person

- Ing. František Peterka, Ph.D. – director of the Centre for TiO_2 photocatalytic applications

4.2.7 APRONEX S.R.O.

Nad Safinou II/365, Vestec, 252 42 Jesenice u Prahy, I.D. 27093123

www.apronex.com

A brief description of the Company

Apronex s.r.o. is a biotechnological company, a spin–off of the Institute of Molecular Genetics AS CR, formed in 2003. It produces biologically active recombinant proteins for various applications and conducts analyses of protein preparations.

Number of employees: 4

Annual turnover: CZK 4.19 million (2010)

Activity in nanotechnologies

Development of biotechnology production and testing of biologically active protein products.Research in the bio–nanotechnology area.

Projects implemented in nanotechnologies

- Project AS CR, "Nanotechnology for Society" programme, KAN200520701 – "Use of ultrasound in nanomedicine," 1/2007–12/2011; Principal investigator: as.prof. Ing. Jiří Neužil, CSc., Institute of Biotechnology AS CR, Prague, Co–principal investigator for Apronex: Ing. Jiří Špička
- Project AS CR, "Nanotechnology for Society" programme, KAN208240651 – "Study of interactions of biological macromolecules and nanolayers focused on research of polymer microfluidic biosensors and therapeutic nanoparticles," 7/2006–12/2010; Principal investigator: as.prof. Ing. Pavel Hasal, CSc., Institute of Chemical Technology, Prague, Co–principal investigator for Apronex: RNDr. Vladimír Kořínek, CSc.
- Project MEYS 1M0506 – "Centre of Molecular and Cellular Immunology," 1/2005–12/2009; Principal investigator: prof. RNDr. Václav Hořejší, CSc., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for Apronex: RNDr. Ladislav Anděra, CSc.

Responsible person

- RNDr. Ladislav Anděra, CSc. – executive officer

4.2.8 AQUATEST A.S.

Geologická 4, 152 00 Prague 5, I.D. 44794843

www.aquatest.cz

A brief description of the Company

Aquatest a.s. was formed by the transformation of the former hydro–geologic branch of the Building Geology Company. It provides consultation and engineering services in the area of

environmental protection and water management, with a special focus on rehabilitation and recycling technologies.

Number of employees: 239 (2011)

Annual turnover: CZK 433.64 million (2011)

Activity in nanotechnologies

Research and development of the use of nanomaterials in rehabilitation of contaminated underground, surface and industrial wastewater. Aquatest a.s. uses nano iron for the rehabilitation of chlorine ethene, polychlorinated biphenyl contamination and also hexavalent chromium and arsenic, on an experimental basis.

Specific focus in research and development:

- Application of elementary nano iron for rehabilitation of contaminated ground water in geologic environment
- Use of elementary nano iron in the fillers for permeable reactive surface treatment
- Research of nano iron production from underground mine water
- Use of elementary nano iron for the treatment of industrial wastewater

Projects implemented in nanotechnologies

- Project 7FP EU Small – ENV+ NMP Thematic Priority, Project name: NAMETECH – "Development of intensified water treatment concepts by integrating nano and membrane technologies," 2009–2012; 11 partners from 8 countries, Project budget: 2.87 EUR million, Project Coordinator: Inge Genné, Vlaamse Instelling Voor Technologisch Onderzoek N.V. (Belgium), AQUATEST a.s. is a partner in the project.
- Project 7FP EU – Theme environment, Integrated Project AQUAFIT4USE "Water in Industry, Fit–for–Use, sustainable water use in chemical, paper, textile and food industry," 2008–2011;AQUATEST a.s. is a partner in the project.The project focused on the use of nanoparticles of elementary iron purification of textile industry wastewater and on the development of the purification reactor.
- Project TA CR TA01021764 – "Modified biomass carriers for wastewater treatment," 2011–2014, Principal investigators: Ing. Libor Novák, Vladimír Janeček, Dr. Ing. Radovan Šorm, PRO–AQUA CZ, s.r.o., Co–principal investigators for AQUATEST: Ing. Tomáš Lederer, Ph.D. and Ing. Libor Polách
- Project MIT FR–TI1/456 – "Development and implementation of tools additively modulating soil and water bioremediation," 2009–2013, Principal investigator: Mgr. Zdeněk Kozlíček, MikroChem LKT, spol. s r.o., Co–principal investigator for AQUATEST: as.prof.Ing. Dr. Miroslav Černík, CSc.
- Project MIT, TANDEM programme, FT–TA3/077 – "Remediation of ground water with the use of permeable reactive barriers," 2006–2010, Principal investigator: Ing. Josef Kozler, CSc., the Inorganic Chemistry Research Institute a.s., Ústí nad Labem, Co–principal investigator for AQUATEST: as.prof. Dr. Ing. Miroslav Černík, CSc. The project focused on the use of elementary nano iron as fill for reactive underground barriers for removal of chlorinated carbohydrates in contaminated ground water.

- Project AS CR, “Nanotechnology for Society” programme, KAN108040651 – “Research of production and application of zero–valent iron nanoparticles for remediation of contaminated groundwater,” 2006–2008; Principal investigator: as.prof. Dr. Ing. Miroslav Černík, CSc., Technical University of Liberec/Faculty of Mechatronics and Interdisciplinary Engineering Studies, Co–principal investigator for AQUATEST: RNDr. Petr Kvapil, Ph.D. The goal of the research was the development and production of new types of nanomaterial based on surface–modified nanoparticles of iron with specific properties used in oxidation reducing reactions leading to the breakdown of specific groundwater contaminants into non–toxic or less toxic substances.

Results of research and development in nanotechnologies

Pilot application of the use of nano iron for water remediation; cooperation with the Technical Universityof Liberec, the Inorganic Chemistry Research Institute a.s., Ústí nad Labem and international cooperation with Golder Associates, (USA), TODA (Japan).

Responsible person/experts

- as.prof. Dr. Ing. Miroslav Černík, CSc. – division director – research and development specialised in nanoparticles of elementary iron for water remediation.
- RNDr. Petr Kvapil, Ph.D. – pilot application of nano iron in water remediation technology
- Ing. RNDr. Pavel Dusílek, Ph.D. – water remediation technology

4.2.9 BD SENSORS S.R.O.

Hradišťská 817, 687 08 Buchlovice u Uherského Hradiště, I.D. 49968416

www.bdsensors.cz

A brief description of the Company

BD SENSORS s.r.o. was founded in 1993; it manufactures electronic pressure measuring devices such as pressure gauges, water level gauges and related accessories.

Number of employees: 115 (2011)

Annual turnover: CZK 237 million (2011)

Activity in nanotechnologies

Applied research of fully intelligent pressure sensors using MEMS and related nano–structures, including researching innovative pressure sensing principles; work on implementation of the project defined below:

- Project MIT, “Sustainable Prosperity” programme, 2A–2TP1/143 – “Research of innovative MEMS structures usable for measuring pressure,” 2006–2011; Principal investigator: Ing. Karel Mareček

Responsible person

- Ing. Karel Mareček – executive officer

4.2.10 BIOMEDICA, SPOL. S.R.O.

Pekařská 8, 158 00 Prague 5, I.D. 44265859

www.bio–medica.eu

A brief description of the Company

The production of medicine, health aids, nutritional supplements and cosmetics with a special focus on the content of plant extracts, essential oils and vitamins.

Number of employees: 106 (2011)

Annual turnover: CZK 145.98 million (2011)

Activity in nanotechnologies

Development of technological processes for the production of lipid emulsions and their use as carriers of lipid–based medicine, work on implementation of the project defined below:

- Project MIT, "Sustainable Prosperity" programme, 2A–1TP1/015 – "New procedures of the lipid micro and nanodispersion systems formulation as the transport systems of pharmacological active substances," 2006–2011; Investigator: RNDr. Jan Mikeska, CSc.

Responsible person

- Ing. Jaroslav Říha – director

4.2.11 B.O.I.S.– FILTRY, SPOL. S.R.O.

Staňkova 103/18, Brno–Královo Pole 602 00, I.D. 44962592

www.bois–filtry.cz

A brief description of the Company

The company was founded in 1991 by experts focusing on nonwoven fabrics, filtration and protection against weapons of mass destruction. It focuses on the development and production of camouflage aids, breathable NBC protective clothing and specialised air filters.

Number of employees: 20 (2010)

Annual turnover: CZK 44.01 million (2010)

Activity in nanotechnologies

Work on the project described below:

- Project Ministry of Defence, OVBOIS2009001 – "VOJAN (Military Application of Nanotechnology) – Assessment of the possibility of using nanostructured materials on textile substrates as camouflage means," 2009–2012; Principal investigator: Mgr. Zuzana Studýnková, Ph.D.

Responsible person

- Ing. Miloslav Tieff, CSc. – executive officer

4.2.12 BioDevice Systems s.r.o.

Bulharská 996/20, 101 00 Prague 10, I.D. 27957667

www.biodevicesystems.cz

A brief description of the Company

Company established in 2007 with the aim to be active in research and application of computer modelling for the analysis of biological data in biomedicine (tissue engineering, cell and biomaterial interaction, morphological analysis of microobjects). BioDevice Systems s.r.o. specialises in the interaction of various types of experimental data and theoretical presuppositions in simulations (prognosis) of cell and tissue in vitro and in vivo development.

Number of employees: 1 (2010)

Projects implemented in nanotechnologies

- Project 7FP Large –NMP Thematic Priority, Project name: MAGISTER – Magnetic Scaffolds for in vivo Tissue Engineering, 2008–2012; 20 partners from 10 countries, Project budget: EUR 11.09 million, Coordinator: Valentin Dediu, Consiglio Nazionale Delle Ricerche (Italy), BioDevice Systems spol. s r.o. is a partner in the project.

Responsible person

- MUDr. Vitaly Goranov – executive officer

4.2.13 BVT TECHNOLOGIES, A.S.

Hudcova 78c, 612 00 Brno, I.D. 26234386

www.bvt.cz

A brief description of the Company

BVT Technologies, a.s. was founded in 1990 as a biosensor division of Krejci Engineering.It specialises in the development and manufacture of miniaturised TFP (thick film technology) electrochemical sensors and biosensor substrates.

Number of employees: 9 (2010)

Annual turnover: CZK 1.85 million (2010)

Activity in nanotechnologies

Development of custom electrochemical sensors and biosensors, creation of 3D structures with thick film technology, development of nanostructured electrodes.

Projects implemented in nanotechnologies

BVT Technologies a.s. conducts research and development of new sensors, electrodes and biosensors. It also participates in international research and development projects:

- Project 7FP EU–Marie Curie – project title: INFULOC – “Integrated and functional Lab–on–Chip,” 2009–2013; BVT Technologies is one of the participants in the project.

- Project 7FP EU –SME–2010–1 EU – project title: CLAMP – "Clinical Application of Metabolic Profiling," 2010–2012; Coordinator: Institute for Metabolic Research GmbH (Germany), BVT Technologies is one of the six participants in the project.

- Project 7FP EU – project title: BIOLISME – "Speedy system for sampling and detection of Listeria monocytogenes in agri–food and related European industries," 2009–2010; BVT Technologies is one of the participants in the project.

- Project AS CR, "Nanotechnology for Society" programme, KAN200520702 – "Nanoimmunosensors for cytokine detection," 1/2007–12/2011; Principal investigator: as.prof. Ing. Peter Šebo, CSc., Institute of Biotechnology AS CR, Prague, Co–principal investigator for BVT: RNDr. Jan Krejčí, Ph.D.

- Project MIT T.I.P., FR–TI1/118 – "New generation of electrochemical sensors and biosensors using thin modificated DLC layers," 2009–2013; Principal investigator: RNDr. Jan Krejčí, Ph.D., BVT Technologies, Co–principal investigator: Ing. Vilém Neděla, Ph.D., Institute of Biophysics AS CR

- Project MIT T.I.P., FR–TI1/076, "New electrochemical sensors for heavy metal detection," 2009–2011; Principal investigator: RNDr. Jan Krejčí, Ph.D., BVT Technologies

Results of research and development in nanotechnologies

- Patent Application – US11/913.086 – Functional nanostructured electrode as part of an electrochemical sensor, manufacturing method and a sensor containing this functional electrode, CZ 297082 patent – Parts with 3D structure prepared using thick film technology and its manufacturing method, patent is in the phase of European and US international application – PCT/CZ03/00031.

Responsible person

- RNDr. Jan Krejčí, Ph.D. – chairman of the board of directors

4.2.14 CB BIO, S.R.O.

Národních hrdinů 279 Praha–Dolní Počernice 19012, I.D. 27168204

www.cbbio.cz

A brief description of the Company

Research and development in the area of natural and technical sciences; participation in the project described below:

- Project MITFR–TI3/808 – "Medicine in Motion," 2011–2012; Principal investigator: MUDr. Barbara Kubešová, Národní tkáňové centrum a. s. (National Tissue Centre), Co–principal investigator for CB Bio: as.prof. Ing. Lukáš Jebavý, CSc.

Responsible person

- Ing. Lukáš Jebavý CSc. – executive officer

4.2.15 C2P, S.R.O.

Jungmannova 101 Chlumec nad Cidlinou 50351, I.D. 26003279

A brief description of the Company

Sales of drugs, medications, vitamins and nutritional supplements, the company operates the PharmacyAve Maria in Chlumec nad Cidlinou.

Annual turnover: CZK 17.65 million (2010)

Activity in nanotechnologies

Participation in the project described below:

- Project MIT FR–TI3/496 – "Development of production technology and application forms of glutathione with high biological usability in suppressing oxidation stress (irradiation, chemotherapy)," 2011–2014; Principal investigator: MUDr. Róbert Hromádka, Co–principal investigator: Ing. Miloš Beran, Research Institute of Food Industry Prague, prof. MUDr. Zdeněk Zadák, CSc., University Hospital, Hradec Králové

Responsible person

- MUDr. Róbert Hromádka – executive officer

4.2.16 CENTEC AUTOMATIKA, SPOL. S.R.O.

Pekařská 8/601, 155 00 Prague 5, I.D. 44848048

www.centec.cz

A brief description of the Company

The company specialises in measuring the physical properties of liquids and gases, such as density and speed of sound and also in calculating derived values such as concentration, solid substance content, etc. The company develops and manufactures systems for continuous and very precise mixing of liquids, gas dispensing, de–gassing systems, sterilisation and cooling of water for chemical, power generation industry and other general industry uses.

Number of employees: 26 (2011)

Annual turnover: CZK 70.16 million (2011)

Activity in nanotechnologies

Participation in the project described below:

- Project TA CR TA01011363 – "Research and development of a sensor system for determining the content of diacetyl in beer," 2011–2013, Principal investigator: as.prof. RNDr. Juraj Dian, CSc., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for Centec Automatika, spol. s r.o.: Juraj Lomen

Responsible person

- Ing. Stanislava Vaňková – executive officer

4.2.17 CENTRAL EUROPEAN BIOSYSTEMS S.R.O.

U Habrovky 247/11, 140 00 Prague 4, I.D. 27124762

www.cebiosys.com

A brief description of the Company

Central European Biosystems s.r.o. was founded in 2004. It is owned by Flexbio LLC, an American company headquartered in New York. It is active in applied biological research.

Number of employees: 7 (2010)

Annual turnover: CZK 18.07 million (2010)

Activity in nanotechnologies

Participation in the project described below:

- Project AS CR, "Nanotechnology for Society" programme, KAN200520704 – "New nanoparticles for ultrastructural diagnostics," 01/2007–12/2011 Principal investigator: as.prof. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics As CR, Prague, Co–principal investigator for Central European Biosystems: MUDr. Zdeněk Kleibl, Ph.D.

Responsible persons

- MUDr. Zdeněk Kleibl, Ph.D. – ultrastructural diagnostics
- Mgr. Mária Krivjanská – executive officer

4.2.18 CLEANTEX A.S.

Olomoucká 26, 796 01 Prostějov, I.D. 25302655

www.cleantex.cz

A brief description of the Company

Cleantex a.s. was founded in 1996 and it continues the long–lasting tradition of the Apparel Research Institute. It focuses on the research and production of special work clothes for clean spaces and antistatic or explosive environments. The Company makes fabric for repeated–use clothing. Cleantex is the only research facility active in this area in Eastern Europe and at the same time it is the largest manufacturer in this region.

Number of employees: 13

Annual turnover: CZK 14.34 million (2009)

Activity in nanotechnologies

Use of nanomaterials for work clothes; participation in the project described below:

- Project EUREKA E! 3778, MANGO Programme – "Managing Contamination by Fibrous Product Systems," 1/2007–1/2010; Coordinator and Principal investigator: VTT, Technical Research Centre of Finland, 10 participants, Cleantex was a project co–principal investigator.

Responsible persons

- Ing. Hana Kozlovská – director
- Ing. Václav Kozlovský – researcher

4.2.19 COMPO TECH PLUS, SPOL. S.R.O.

Družstevní 159, 342 01 Sušice II, I.D. 63507412

www.compotech.com

A brief description of the Company

Compo Tech PLUS, spol. s.r.o. was founded in 1995; it is active in the development and manufacturing of composite materials, specifically composite tubing from carbon and glass fibres. For their manufacturing it uses a unique, zero degree fibre winding process. The company makes tubing of custom length, diameter, wall thickness, shape and mechanical properties. Compo Tech developed and constructed its own fibre laying machines including the controlling software and system and accessory equipment. In 2011 the Company opened a newly built Research and Development Building in Sušice.

Annual turnover: CZK 59.90 million (2011)

Activity in nanotechnologies

Research and manufacturing of nanocomposite tubing from carbon and glass fibres; participation in the project described below:

- Project GA101/08/0299 – "Research of intelligent composite components of machine tools made of ultrahighmodulus fibers and nanoparticles modified matrix," 1/2008–12/2011; Principal investigator: as.prof. Ing. Václava Lašová, Ph.D., University of West Bohemia in Pilsen/Faculty of Mechanical Engineering, Co–principal investigator for Compo Tech PLUS: Ing. Ondřej Uher, Ph.D.

Responsible person

- Ing. Ondřej Uher, Ph.D. – research and development director

4.2.20 COLOR SPECTRUM A.S.

Anenská 1, 695 01 Hodonín, I.D.: 25312944

www.colorspectrum.cz

A brief description of the Company

Color Spectrum a.s. was founded in 1996 as a legal successor to Color Spectrum s.r.o. The Company is active in development and manufacturing of industrial paint. Its manufacturing portfolio includes a wide range of products usable both in a corrosive environment, C2 – C5, and for general and specific industrial applications. The main types of base materials are metal, as well as wood and concrete.

Number of employees: 31

Annual turnover: CZK 38 million (2011)

Activity in nanotechnologies
Participation in the project described below:

- Project MIT, TANDEM programme, FT–TA4/064 – "Coatings that fulfill new environmental requirements of the EU," 7/2007–12/2010; Principal investigator: Ing. Libuše Hochmannová, Ph.D., SYNPO, a. s., Pardubice, Co–principal investigator for Color Spectrum: Ing. František Drobný, CSc.

Responsible person

- Bc. Martin Řehánek – technical development

4.2.21 CONTIPRO BIOTECH S.R.O.

Dolní Dobrouč 401, 561 02 Dolní Dobrouč, I.D. 25281844

www.contipro.com

A brief description of the Company

Contipro Biotech s.r.o. (until 31 December 2011 CPN spol. s r.o.) is part of the Contipro Holding group, which is focused on research, development and manufacturing of biopolymers and their derivates for use in pharmaceutics and cosmetics and on the development and manufacturing of final pharmaceutical products based on such polymers. The Contipro Holding group produces a range of biopolymers by biological means and is one of the largest producers of hyaluronic acid in the world.

The Company was founded in 1997. Since its inception, it has been active in biotechnological production of biopolymers as raw materials for the cosmetic industry and as active nutritional substances (raw materials for the pharmaceutical industry are produced by Contipro Pharma – another subsidiary of the holding company). The Company puts great emphasis on innovation, research and experimental development. In 2009 the Company opened a newly built Research and Development Centre for Medical Nanotechnologies to carry out its research. For this Contipro Biotech received the 2008 Investor of the Year Award, for the project with the greatest innovation potential. Two years later the research centre was further expanded and this follow up project placed second in the 2010 Business Project of the Year competition.

The company also cooperates with academic institutions on educational projects, in which it acts as a partner for practical research internships (School of Molecular Biotechnology, Modern Trends in Immunology Studies, Innovation, Ph.D. studies). The company also took part in the foundation of the Institute for the Research of Medical Nanobiotechnology, a common facility of the companies of the holding and universities dedicated especially to the training of doctoral programme students.

Number of employees: 99 (2011)

Annual turnover: CZK 263.55 million (2011)

Activity in nanotechnologies

Development of nanofibres and microfibres from biopolymers, products for healing wounds, development of carriers for targeted distribution and controlled release of biologically active polymer based substances and products for tissue engineering

Projects implemented in nanotechnologies

Currently running research projects

- Project MIT FR–TI2/246 – "Development of equipment for non–invasive diagnostics," 2010–2013; Co–principal investigators: Safibra s.r.o., Charles University in Prague/Faculty of Mathematics and Physics
- Project MIT FR–TI1/151 – "New wound dressings based on nano– and micro– carriers," 2009–2012; Co–principal investigators: Pardubice University, Brno/University of Technology
- Project Technological Agency of the Czech Republic – "Innovative wound dressings based on nanofibres and hyaluronan staple microfibres, and chitin–glucan complex," 2012–2015; Co–principal investigator: University of Pardubice
- Project MNT ERA–NET II EU – "Biodegradable hydrogel repair system for cartilage (ArtiCart)," 2011–2014; Co–principal investigator: Warsaw University of Technology

Completed research projects

- Project MIT FI–IM4/205 – "Nanotechnology in medicine – tissue carrier for connective tissues reconstruction," 2007–2010; Co–principal investigators: 2nd LF CU, Brno University of Technology
- Project MIT 2A–2TP1/141 – "Nanotechnology in medicine – tissue carrier for connective tissue reconstruction," 2007–2010; Co–principal investigators: VUOS a.s., Inotex spol. s.r.o.
- Project MIT FR–TI1/150 – "New hydrogels in regenerative medicine and cosmetic dermatology," 2009–2011; Co–principal investigator: Brno University of Technology
- Project AS CR, "Nanotechnology for Society" programme, KAN200520703 – "The use of ultrasound in nanomedicine," 2007–2011; Principal investigator: Institute of Biotechnology AS CR., Prague, Co–investigator: CPN spol. s r.o.

Experts/Field

- Ing. Jiří Běťák – biopolymer microfibres
- Mgr. Radovan Buffa, Ph.D. – chemical modifications of biopolymers
- Mgr. Gloria Huerta–Angeles, Ph.D. – chemical modifications of biopolymers
- Mgr. Jiří Mrázek – luminescent and magnetic nanoparticles
- Ing. Marek Pokorný, Ph.D. – electrospinning process
- Ing. Jana Růžičková, Ph.D. – biopolymer nanofibres

- Ing. Daniela Šmejkalová, Ph.D. – carriers
- Ing. Zuzana Valentová, Ph.D. – wound healing dressings
- Ing. Lucie Wolfová, Ph.D. – scaffolds

4.2.22 CRYTUR, SPOL. S.R.O.

Palackého 175, 541 01 Turnov, I.D. 25296558

www.crytur.cz

A brief description of the Company

Production and development of scintillation material and detectors, laser bars and their components (mirrors), precise optics, sapphire profiles, monocrystals for lasers and electron microscopes

Number of employees: 51

Annual turnover: CZK 49.61 million (2010)

Activity in nanotechnologies

Research and development of materials useable in nanotechnology; collaboration on the research projects defined below:

- Project MITFR–TI1/356 – "Compact eye–safe nanosecond laser," 2009–2012; Principal investigator: Ing. Karel Nejezchleb, Co–principal investigator: prof. Ing. Helena Jelínková, DrSc., Czech Technical University in Prague/Faculty of Nuclear Sciences and Physical Engineering
- Project AS CR, "Nanotechnology for Society" programme, KAN300100802 – "Nanocomposite ceramic and thin–layer scintillators," 2007–2011; Principal investigator: Ing. Martin Nikl, CSc., Institute of Physics AS CR, Prague, Co–principal investigator for CRYTUR: Mgr. Jindřich Houžvička, Ph.D.

Responsible person

- Mgr. Jindřich Houžvička, Ph.D. – executive officer and the owner of the company

4.2.23 DAKO BRNO SPOL. S.R.O.

Špitálka 70/16, 602 00 Brno, I.D. 63492792

www.dakobrno.com

A brief description of the Company

DAKO Brno spol. s r.o. is active in three areas. The façade section manufactures and installs ventilated façade systems, especially systems using glass fibre concrete, on which the façade lines DAKOBET and FIBRE–C are based. This section also supplies and installs the Caparol, Baumit and Hasit contact insulating systems. Another section of the Company manufactures special automatic vandal–proof public toilets, in cooperation with HeringBau. Additional

parts of the Company portfolio are sound walls and other large–size municipal landscaping elements.

Number of employees: 10

Annual turnover: CZK 22.52 million (2011)

Activity in nanotechnologies

Use of nanotechnology in construction systems made by the company.

Responsible person

- Ing. Petr Lederer – executive officer

4.2.24 DELONG INSTRUMENTS A.S.

Palackého tř. 153b, 612 00 Brno, I.D. 46903879

www.dicomps.com

A brief description of the Company

The Company established in 1992 is engaged in research, development, manufacturing, assembling and testing of electronic microscopes and various scientific instruments including control electronics and software. It is active mainly in electron and X-ray microscopy and vacuum technology. The Company offeres its own products, but serves also as a contract developer of unique devices.

Number of employees: 72

Annual turnover: CZK 136 million (2011)

Activity in nanotechnologies

Development of instruments that use electron beams in their operation, or more precisely in the formation of nanostructures for low voltage scanning electron microscopy. This method can be for used both for studying biological and macromolecular composites and microelectronic and micromechanical products and for making such structures. The company's specialties are electron–optical instruments that use multiple bands, which is the only approach that successfully addresses the problem of productivity in nanolithography inspection and mass inspection of semiconductor systems.

Projects implemented in nanotechnologies

- Project MEYS7D11002 – "Development of benchtop equipment for automated characterisation of viruses and other biological nanoparticles," 2011–2014; Principal investigator: RNDr. Michal Drštička
- Project MIT, TANDEM programme, FT–TA4/126 – "Research of semiconductive nanotubes for implementation of cold–emission components," 2007–2010; Principal investigator: Ing. Stanislav Štarman, Ph.D., STARMANS Electronics, s.r.o., Prague, Co–principal investigator for Delong Instruments: RNDr. Michal Drštička.

- Project 7FP EU Small –NMP Thematic Priority, Project name: MAGISTER – Magnetic Scaffolds for in vivo Tissue Engineering, 2008–2011; 9 partners from 5 countries, Project budget: EUR 1.43 million, Coordinator: Caterina E. Ghio, Consiglio Nazionale Delle Ricerche (Italy), DELONG INSTRUMENTS a.s. was a partner in the project.
- Project 7FP EU ICT Thematic Priority, Project name: MAGIC – Maskless lithography for IC manufacturing, 2008–2010; 14 partners from 8 countries, Project budget: EUR 16.69 million, Coordinator: Marie–Laure Page, Commissariat a l Energie Atomique et aux Energies Alternatives CEA–DRT/ETI/DIHS/GESTION (France), Delong Instruments was a partner in the project.

Responsible persons

- Ing. Tomáš Papírek – member of the board of directors
- RNDr. Michal Drštička – research and development

4.2.25 DEKONTA, a.s.

Dřetovice 109, 273 42 Stehelčeves, I.D. 25006096

www.dekonta.cz

A brief description of the Company

Dekonta, a.s. was established in 1992. It specialises in the processing and removal of hazardous waste and remediation of contaminated areas, including by biological means. It is one of the leading Czech waste management, consulting and engineering companies offering comprehensive package of environmental services.

Number of employees: 97 (2011)

Annual turnover: CZK 302.09 million (2011)

Activity in nanotechnologies

Research and development of new nanomaterials for use in de–contamination technologies, procedures of nanomaterial application in geologic environments, mathematic modelling of nanoparticle dissemination in contaminated geologic environments.

Projects implemented in nanotechnologies

a) *Projects implemented by the Company:*

- Project MIT FR–TI3/678 – "In–situ groundwater and soil remediation with the use of nanobubbles and suitable gases," 2011–2013; Principal investigator: Ing. Robert Raschman
- Project MIT FI–IM4/143 – "Nanoparticle application in decontamination technology," 2007–2010; Principal investigator: Mgr. Petr Dosoudil
- Project MIT, FI–IM4/143 – "Nanoparticle application in decontamination technology," 6/2007–5/2010; Principal investigator: Ing. Lenka Veselá–Wimmerová, MSc.,Ph.D.

b) *Projects in which the company participates as a co–investigator:*

- Project TA CRTA01021792 – "Development of combined nano–bio technology for the treatment of chromium contamination," 2011–2014; Principal investigator: RNDr. Jan Němeček, Enacon s.r.o., Co–principal investigator for Dekonta, a.s.: Ing. Lenka Veselá–Wimmerová, MSc., Ph.D.
- Project MEYS 2B08062 – "Genetic and physiologic manipulation of bacterial degradation agents of aromatic pollutants and their use," 1/2008–12/2011; Principal investigator: Ing. Miroslav Pátek, CSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for Dekonta, a.s.: Ing. Petra Žáčková

Experts/Field

- Mgr. Petr Dosoudil – remediation of contaminated areas
- Ing. Martin Polák – groundwater rehabilitation technology
- Ing. Robert Raschman – decontamination technology
- Ing. Lenka Veselá–Wimmerová, MSc., PhD – development of innovative methods for geologic environment rehabilitation

4.2.26 ECOTEX S.R.O.

Dráby 785/IV, 566 01 Vysoké Mýto, I.D. 63216141

www.ecotex.cz

A brief description of the Company

The company with forty years long history (manufacturing of filter elements at Vysoké Mýto by the VKUS cooperative) was established in 1995. It is active in the field of industrial filtration of gases and liquids, manufacture of support baskets and metal components. It is a part of the international KAYSER Filtration Group fromGermany.

Number of employees: 81 (2011)

Annual turnover: CZK 181.29 million (2011)

Activity in nanotechnologies

Research, development and use of nanofilters; participation in the project described below:

- Project MIT FR–TI1/457 – "Research and development of filtration nanomaterials – reduction of flue gases and other industrial emissions," 2009–2012; Principal investigator: prof. Dr. Ing. Jiří Maryška, CSc., Co–principal investigator for Ecotex: Ing. Martin Šprync

Responsible person

- Ing. Roman Poslušný, MBA – executive officer

4.2.27 ELCERAM A.S.

Okružní 1144, 500 03 Hradec Králové, I.D. 60108681

www.elceram.cz

A brief description of the Company

Elceram a.s. (formerly the Czech–Japanese joint venture TESLA–Y.S., a.s.) is a manufacturer of both white and printed corundum ceramics for electro–technical and electronic industry.

Number of employees: 63

Annual turnover: CZK 44.98 million (2011)

Activity in nanotechnologies

Research and development of microelectronic and sensor technology based on combining energy beam technology (laser, UV light, ion beam, microwave rays, etc.) and the technology of micro and nanolayers deposited by vacuum, plasma, and wet process technologies; participation in the project described below:

- Project MIT, TANDEM programme, FT–TA2/018 – "Using advanced beam technology in treating surfaces for electronic manufacturing," 1/2005–12/2008; Principal investigator: Ing. Karel Strobl

Responsible person

- Ing. Karel Strobl – chairman of the board of directors

4.2.28 ELMARCO S.R.O.

Svárovská 621, 460 10 Liberec 10, I.D. 25421719

www.elmarco.com

A brief description of the Company

The company was established in 2000 and it is focusing on development and manufacturing of equipment for the nanofibre industry. Elmarco develops and manufactures machines for industrial production of nanofibres using electrospinning technology. Elmarco's unique Nanospider^{TM} technology is designed for ease of use, scalability, modularity and flexibility in producing nanofibers. The majority share of the Company is held by a group of international investment funds, mostly from Switzerland and France.

Number of employees: 85

Activity in nanotechnologies

Manufacturing and sale of Nanospider^{TM} machines for industrial production of nanofibre non–woven textiles (since 2005 the company has sold 100 of such machines); research and development of materials and final products made from nanofibres. Applications: air and fluid filtration, functional wear, medicine, battery cells, acoustics.

Projects implemented in nanotechnologies

a) *Projects in which Elmarco is participating as an investigator:*

- Project MIT FR–TI3/845 – "Technology for manufacturing inorganic nanofibres," 2011–2014; Principal investigator: Libor Samek, Co–principal investigator: prof. Ing. Ladislav Ševčík, CSc., Technical University of Liberec/Faculty of Mechanical Engineering,

- Project MIT FR–TI1/454 – "Nanocatalysts for removal of harmful substances from exhaust gases," 2009–2012; Principal investigator: Ing. Jana Trčková, Ph.D.

- Project MIT FR–TI1/451 – "Productive technology production of nanofibres," 2009–2012; Principal investigator: Ing. Milan Nýdrle

- Project MIT FR–TI1/436 – "Using nanofibre membranes for controlled release of active substances," 2009–2012; Principal investigator: Ing. Denisa Stránská

- Project MIT FR–TI1/235 – "Improvement of useful characteristics of nanofibres, including plasma–chemical modification," 2009–2012; Principal investigator: Ing. Radim Křenek, Co–principal investigator: Mgr. Miloš Klíma, Ph.D., Masaryk University in Brno/Faculty of Science

b) *Projects in which Elmarco is participatingas a co–investigator:*

- Project 7FP EU Small – NMP Thematic Priority, Project name: SANS Sensitizer Activated Nanostructured Solar Cells, 2011–2013; 11 partners from 7 countries, Project budget: EUR 5.27 million, Coordinator: Linda Polik, The Chancellor, Masters and Scholars of the University of Oxford (Great Britain), Elmarco is a partner in the project.

- Project GA CR, GA106/09/1000 – "Bioinspired nanocomposite structures for bone tissue regeneration," 2009–2012; Principal investigator: Ing. Karel Balík, CSc., Institute of Rock Structure and Mechanics AS CR, Co–principal investigator for Elmarco: Ing. Denisa Stránská

- Project MIT FR–TI3/605 – "Bio–Nano–mat II – second generation nanomaterials for biomedicine," 2011–2012; Principal investigator: Ing. Jakub Schůrek, PhD. MBA, PrimeCell, a.s., Co–principal investigator for Elmarco: Ing. Denisa Stránská

- Project MIT FR–TI1/457 – "Research and development of filtration nanomaterials – reducing emissions from flue gas and industrial gases," 2009–2012; Principal investigator: prof. Dr. Ing. Jiří Maryška, CSc., Co–principal investigator for Elmarco: Ing. Jana Trčková, Ph.D.

- Project AS CR, "Nanotechnology for Society" programme, KAN200100801 – "Bioactive biocompatible surfaces and new nanostructure composites for medical and pharmaceutical applications," 1/2008–12/2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics AS CR, Prague, Co–principal investigator for Elmarco: Ing. Denisa Stránská

- Project AS CR, "Nanotechnology for Society" programme, KAN200520804 – "Biocompatible nanofibre scaffolds forming new drug matrices for the application of biologically and pharmacologically active substances," 1/2008–12/2012; Principal

investigator: as.prof. RNDr. Vladimír Holáň, DrSc., Institute of Molecular Genetics, Prague, Co–principal investigator for Elmarco: Ing. Denisa Stránská

Results of research and development in nanotechnologies/cooperation

- Opening the centre for nanotechnology research and development in Liberec
- Opening branches in the USA and Japan
- Introduction of second generation of Nanospider^{TM} on the market

Responsible person

- Ing. Aleš Gardián, MBA – chief technology officer

4.2.29 ENACON, S.R.O.

Registered address: Na holém vrchu 708/3, Prague 12, 143 00, I.D. 26494931

Company address: Krčská 16, 140 00, Prague 4, 140 00

www.enacon.cz

A brief description of the Company

A consulting firm (founded in 2001), provides services in the area of environmental protection and work safety, incl. pollution research.

Number of employees: 5 (2011)

Annual turnover: CZK 10.48 million (2011)

Activity in nanotechnologies
Work on implementation of the project described below:

- Project TA CR, TA01021792 **– "**Development of combined nano–bio technology for rehabilitation of chromium contamination**,"** 2011–2014; Principal investigator: RNDr. Jan Němeček, Co–principalinvestigators: Ing. Ondřej Lhotský, Dekonta a.s., and as.prof. Dr. Ing. Miroslav Černík, CSc., Technical University of Liberec

Responsible person

- RNDr. Jan Němeček – executive officer

4.2.30 EURO SUPPORT MANUFACTURING CZECHIA, S.R.O.

Záluží 1, 436 70 Litvínov, I.D. 25417681

www.eurosupport.nl

A brief description of the Company

The Company is a subsidiary of a Dutch company, Euro Support Manufacturing BV. It focuses most of its activity on the research and production of modern catalysts for chemical processes.

Number of employees: 133 (2011)

Annual turnover: CZK 348.67 million (2011)

Activity in nanotechnologies

Research and application of zeolite and mesoporous structures (nanostructures) for catalysts; participation in the project described below:

- Project AS CR, "Nanotechnology for Society" programme, KAN100400702 – "Nanostructured materials for catalytic, electrocatalytic and sorption applications," 1/2007–12/2010; Principal investigator: prof. RNDr. Zdeněk Samec, DrSc., J. Heyrovsky Institute of Physical Chemistry AS CR, Prague, Co–principal investigator for Euro Support Manufacturing: Ing. Milan Říčánek, CSc.
- Project MIT, TANDEM programme, FA–TA3/080 – "Synthesis of titanosilicates and their application," 4/2006–12/2009; Principal investigator: Ing. Věnceslava Tokarová, Inorganic Chemistry Research Institute, a.s., Ústí nad Labem, Co–principal investigator for Euro Support Manufacturing: Ing. Milan Říčánek, CSc.

Responsible person

- Ing. Milan Říčánek, CSc. – director

4.2.31 EUTIT S.R.O.

Stará Voda 196, 353 01 Mariánské Lázně, I.D. 47714930

www.eutit.cz

A brief description of the Company

Eutit s.r.o. was founded in 1993 and in 1995 it took over the state enterprise Eutit Stará Voda. It is a top European manufacturer of basalt castings (pavers, tubing, industrial products) with high resistance against abrasion and chemical corrosion. Most of its production is exported.

Number of employees: 185

Annual turnover: CZK 265.99 million (2011)

Activity in nanotechnologies

Participation in the project described below:

- Project AS CR, "Nanotechnology for Society" programme, KAN300430651 – "Nanocrystallisation of plasma sprayed coatings based on eutectic ceramic alloys," 7/2006–12/2009; Principal investigator: Ing. Tomáš Chráska, Ph.D., Institute of Plasma Physics AS CR, Praha, Co–principal investigator for Eutit: Vladimír Havlíček.

Responsible person

- Vladimír Havlíček – executive officer

4.2.32 EXBIO PRAHA, A.S.

Nad Safinou II 366, 252 42 Vestec, I.D. 25548611

www.exbio.cz

A brief description of the Company

Company was founded in 1990 as a spinoff of the Academy of Sciences of the Czech Republic. It manufactures monoclonal antibodies and other immunological reagents. Besides the production of their own antibodies the company also distributes on the Czech and Slovak market a range immunological and molecular biology products from international companies.

Number of employees: 32 (2010)

Annual turnover: CZK 70.40 million (2010)

Activity in nanotechnologies

Development and production of monoclonal antibodies, proteins, etc. – bionanotechnology products; participation in the projects described below:

- Project 7FP EU SME Large, NMP Thematic Priority, Project Name:NANOFOL – "Folate–based nanobiodevices for integrated diagnosis/therapy targeting of chronic inflammatory diseases," 2009–2013; 13 partners from 8 countries, Project budget: EUR 6.63 million, Coordinator: Artur Paulo Cavaco, Universidade Do Minho (Portugal), Exbio a.s. is a partner in the project.
- Project MEYS 1M0506 – "Centre of Molecular and Cellular Immunology," 1/2005–12/2011; Principal investigator: prof. RNDr. Václav Hořejší, CSc., Institute of Molecular Genetics AS CR, Prague, Co investigator for Exbio: Ing. Miloslav Suchánek, Ph.D.
- Project MEYS, Research Centres programme, 1M0505 – "Centre of targeted therapeutic drugs," 1/2005–12/2011; Principal investigator: as.prof. MUDr. Vladimír Viklický, CSc., ÚJV Řež a.s., Husinec – Řež, Co investigator for Exbio: Ing. František Škrob
- Project MEYS 2B06056 – "Diagnostics of DNA damage by polyaromatic compounds using nanotechnology and bioanalytical methods in early detection of carcinomas," 7/2006–6/2010 Principal investigator: Mgr. Jan Přibyl, Ph.D., Masaryk University in Brno/Faculty of Sciences, Co–investigator for Exbio: Ing. Miloslav Suchánek, Ph.D.

Responsible person

- Ing. Miloslav Suchánek, Ph.D. – research and development, transfer of technologies

4.2.33 FAVEA, SPOL. S.R.O.

Boženy Němcové 580, Kopřivnice 74221, I.D. 60318287

www.favea.cz

A brief description of the Company

Czech pharmaceutical company founded in 1994 is engaged in the development, manufacture and marketing of food supplements, cosmetics and food substances. It is certified by Good

Manufacturing Practice for the manufacture of human and veterinary drugs. The company also researches and develops new formulations of active substances on the micron size.

Number of employees: 68 (2010)

Annual turnover: CZK 91.89 million (2010)

Activity in nanotechnologies

Use of nanotechnology procedures in the manufacture of nutritional supplements and medicine with the goal of increasing their effectiveness and reducing their toxicity and undesired effects; work on implementation of the research project described below:

- Project MIT FR–TI1/200 – "Development of products with content of anti–sense oligonucleotides in nanoparticles for the local treatment of herpes virus infections caused by the HSV–1 and HSV–2 viruses," 2009–2013; Principal investigator: PharmDr. Milan Krajíček, FAVEA, Other participants in the project: GENEX, RNDr. Radek Horváth, Ph.D., Veterinary and Pharmaceutical University Brno/Faculty of Veterinary Medicine, as.prof. MVDr. Vladimír Celer, Ph.D.

Responsible person

- PharmDr. Milan Krajíček – executive officer

4.2.34 GASCONTROL PLAST, A.S.

Dělnická 46 Havířov 73564, I.D. 25835769

www.gascontrolplast.cz

A brief description of the Company

The company was founded in 1999. It is engaged in manufacturing of plastic high–pressure tubing systems for the distribution of gas and water. It delivers comprehensive systems for laying gas pipeline and water pipes and plastic plates.

Number of employees: 41 (2011)

Annual turnover: CZK 104.90 million (2011)

Activity in nanotechnologies

Development and manufacture of thermoplastic sheets and thermoplastic composites with the use of micro and nanofillers, chemical and physical weight reduction procedures and other additives leading to the reduction of surface weight. Collaboration on the implementation of the project defined below:

- Project MIT FR–TI1/232 – "Innovative types of the extruded thermoplastic sheets," 2009–2012, Principal investigator: Roman Hájek, Co–principal investigator: RNDr. Ladislav Pospíšil, CSc., Polymer Institute Brno, s.

Responsible person

- Ing. Roman Buryjan – chairman of the board of directors

4.2.35 GENERI BIOTECH s.r.o.

Machkova 587, 500 11 Hradec Králové, I.D. 63221667

www.generi–biotech.com

A brief description of the Company

Generi Biotech s.r.o. is a Czech biotechnology company active in the area of molecular genetic medical diagnostics and development and manufacturing of biotechnological components for molecular biology and gene therapy products.

Number of employees: 31 (2011)

Annual turnover: CZK 20.23 million (2011)

Activity in nanotechnologies

Research and development in the area of nanobiotechnology and nanomedicine.

- Project 7FP EU Small – KBBE Thematic Priority, Project title: DINAMO – "Development of diamond intracellular nanoprobes for oncogen transformation dynamics monitoring in living cells," 2010–2013; 8 partners from 5 countries, Project budget: EUR 3.7 million, Coordinator: Christine Van Houtven, Interuniversitair Micro–Electronica Centrum VZW (Belgium), GENERI BIOTECH is a partner in the project.
- Project AS CR, "Nanotechnology for Society" programme, KAN200100801 – "Bioactive biocompatible surfaces and new nanostructured composites for medical and pharmaceutical applications," 1/2008–12/2012; Principal investigator: prof. RNDr. Miloš Nesládek, CSc., HDR, Institute of Physics AS CR, Prague, Co–principal investigator for Generi Biotech: RNDr. Martin Bunček, Ph.D.
- Project AS CR, "Nanotechnology for Society" programme, KAN401770651 – "Molecular nanosystems and nanodevices: electric transport properties," 7/2006–12/2010; Principal investigator: Ing. Martin Weiter, Ph.D., Brno University of Technology/Faculty of Chemistry, Co–principal investigator for GENERI BIOTECH: RNDr. Martin Bunček, Ph.D.

Responsible persons

- RNDr. Radovan Haluza, Ph.D. – executive director and the owner of the company
- RNDr. Martin Bunček, Ph.D. – researcher

4.2.36 GEOTEST BRNO, A.S.

Brno, Šmahova 112/1244, Brno, PSČ 659 01, I.D. 46344942

www.geotest.cz

A brief description of the Company

GEOtest Brno, a.s. is a company with a 40–year tradition in engineering geology, geotechnology and hydrogeology.

Number of employees: 140 (2011)

Annual turnover: CZK 304.76 million (2011)

Activity in nanotechnologies

Research and development of technologies for the treatment of toxic industrial wastewater and water from areas with long–term environmental pollution and with a focus on the removal of heavy metals and organic compounds; work on implementation of the research project defined below:

- Project MIT FR–TI1/389 – "Nano–carbon sorbents for the removal of heavy metals from water," 2009–2013; Principal investigator: RNDr. Alena Polenková, Co–principal investigator: Ing. Ivan Kolb, CSc., Institute of Organic Syntheses, a.s.

Responsible person

- as.prof. Ing. Jaroslav Veselý, CSc. – member of the board of directors

4.2.37 HET SPOL. S.R.O.

417 65 Ohníč u Teplic 14, I.D. 43223168

www.het.cz

A brief description of the Company

Het spol.s r.o. was founded in 1991.It produces interior and HET facade paint, caulking and construction compounds.

Number of employees: 121

Annual turnover: CZK 461.30 million (2010)

Activity in nanotechnologies

Application of nanomaterials in paint; participation in the project described below:

- Project MIT FT–TA4/025 – "Next generation nanomaterials and their industrial applications," 3/2007–12/2010; Principal investigator: Ing. Pavel Hynčica, Czech Technology Centre for Inorganic Pigments a.s., Přerov, Co–principal investigator for Het: Ing. Martin Rozhon

Responsible person

- Ing. Vlastimil Voborský – Technical Director

4.2.38 HOFMEISTER, SPOL. S.R.O.

Mezi Ploty 12, 326 00 Pilsen, I.D. 26319101

www.hofmeister.cz

A brief description of the Company

Hofmeister, spol.s r.o. is a Czech family–owned company founded in 1990 as an association; in 2000 was restructured as a limited liability company. It is focused on the development and

manufacturing of blade cutting tools and jigs, CNC machining and the resale of tools and machining measuring instruments.

Number of employees: 100

Annual turnover: CZK 210 million (2011)

Activity in nanotechnologies

Development and introduction of new tools with the use of progressive nanolayers and thin sandwich layers for the cutting of difficult–to–machine materials.

Responsible person

- Václav Hofmeister – executive officer

4.2.39 HVM PLASMA, SPOL. S.R.O.

Na Hutmance 347/2, 158 00 Prague 5 – Jinonice, I.D.: 45309787

www.hvm.cz

A brief description of the Company

HVM Plasma, spol. s r.o. does custom PVD and PAVCD surfacing (hard layers, tribological surfaces – DLC, decorative surfacing). Research and development is oriented towards surfacing technology, development of particle sources (magnetrons, arc and ion sources) and also towards modelling, analysis of thin layers and plasma diagnostics.

Number of employees: 86 (2011)

Annual turnover: CZK 270.43 million (2011)

Activity in nanotechnologies

Research and development of nanolayer production technology and research of nanolayer properties; participation in the projects described below:

- Project AS CR, "Nanotechnology for Society" programme, KAN101120701 – "Nanocomposite layers and nanoparticles created in low–pressure plasma used in surface modification," 1/2007–12/2011; Principal investigator: prof. RNDr. Hynek Biederman, DrSc., Charles University in Prague/Faculty of Mathematics and Physics, Co–principal investigator for HVM Plasma: Ing. Jiří Vyskočil, CSc.
- Project AS CR, "Nanotechnology for Society" programme, KAN200040651 – "Electrotechnical and optical analysis of biomolecules on microelectrodes coated with nanolayers of electro active material," 2006–2010; Investigator: Mgr. Stanislav Hasoň, Ph.D., Institute of Biophysics AS CR, Brno, Co–principal investigator for HVM Plasma: Ing. Jiří Vyskočil, CSc.

Responsible person

- Ing. Jiří Vyskočil, CSc. – executive director, executive officer

4.2.40 H+A ECO CZ, S.R.O.

Tř. 1.máje 816/13, 77 200 Olomouc, I.D. 26862662

www.ecocz.cz

A brief description of the Company

H+A Eco Cz, s.r.o. was founded in 2005. It focuses on development of liquid purification technology, including water. All presented technologies are property of the founders of the company H+A Eco Cz. The technologies are patented and all rights are protected in the Czech Republic and other 120 countries.

Activity in nanotechnologies

Use of nanoparticles of iron oxides for water purification.

- Project AS CR, "Nanotechnology for Society" programme, KAN115600801 – "New technology of preparation and use of iron oxide based nanoparticles for environmental, industrial and medical applications," 1/2008–12/2012; Principal investigator: prof. RNDr. Radek Zbořil, Ph.D., Palacky Univerzity Olomouc/Faculty of Science, Co–principal investigator for H+A Eco Cz: Ing. Oleg Lysytchuk, CSc.

Responsible person

- Ing. Oleg Lysytchuk, CSc. – co–owner of the company, particle research and production

4.2.41 CHEMCOMEX PRAHA, A.S.

Pražská 810/16 Prague 15 10221, I.D. 25076451

www.chemcomex.cz

A brief description of the Company

CHEMCOMEX Praha, a.s., a Czech–owned company, was founded in 1990. It specialises in building preparation, design, engineering activities, investment construction, consulting, geology and rehabilitation – mostly in energy and heat production and chemical industry.

Number of employees: 87 (2010)

Annual turnover: CZK 439.14 million (2010)

Activity in nanotechnologies

Work on implementation of the project described below:

- Project MIT FR–TI1/204 – "Development of technology for preparation and use of elementary nano iron for rehabilitation of geologic environments," 2009–2011; Principal investigator: Ing. Václav Urbánek, Co–principal investigator: Ing. Tomáš Patočka, Institute of Chemical Technology, Prague/Faculty of Environmental Technology

Responsible person

- Ing. Otakar Bárta, CSc. – chairman of the board of directors

4.2.42 CHEMSTAR CZECH REPUBLIC, S.R.O.

Alej Svobody 56, 323 00 Plzeň–Bolevec, I.D. 49786164

www.chemstar.cz

A brief description of the Company

Consulting and advisory services focused especially on the areas of chemistry and environmental protection. Research and development of graffiti–resistant surface treatment.

Activity in nanotechnologies

Work on implementation of the project described below:

- Project 7FP EU – SME, SME Thematic Priority, Project title:HEFEST – "Smart fire–retardant coating based on intumescent nanocomposites," 2008–2011; 8 partners from 5 countries, Project budget: EUR 986 thousand, Coordinator: Izaskun Garmendia, CIDEMCO–Centro De Investigación Technologica (Spain), CHEMSTAR Czech Republic was a partner in the project.

Responsible person

- as.prof. Ing. Petr Duchek, CSc. – executive officer

4.2.43 INOTEX SPOL. S.R.O.

Štefánikova 1208, 544 01 Dvůr Králové n. L., I.D. 47451963

www.inotex.cz

A brief description of the Company

INOTEX spol.s r.o. was founded in 1992.In 1996 the company purchased the Research Institute of Textile Improvement.It conducts technological research, innovation and technological transfer in the area of wet processes of textile manufacturing. The development of the Company is supported by the production of (bio)chemical specialised products – textile additives, small–scale production in improvement and surface treatment of textile and manufacturing of machine equipment. The company has an accredited testing facility.

Number of employees: 51 (2010)

Annual turnover: CZK 64.92 million (2010)

Activity in nanotechnologies

- Researching the possibilities of nanosystem and biotechnology use for the development and pilot manufacturing of new (multi)functional textile materials (protective clothing, technical barrier textile, nonwoven textiles with added value). More specifically, this involves the activation of surfaces of textile substrates aimed at increasing effectiveness and useful life (silanes, plasma, biotechnologies), hydrophilization/hydrophobization of surfaces, photo activation and photo catalysis, textile based bioactive materials and surface coating,

- The development and improvement of cleaner production technologies,
- Membership in the NANOMEDIC research cluster – nanomaterials for medicine and membership in the CLUTEX technical textile cluster.

Projects implemented in nanotechnologies

a) *International research projects:*

- Project 7FP EU – SME, NMP Thematic Priority, Project name: BIOAGROTEX – "Development of new agrotextiles from renewable resources and with a tailored biodegradability," 2008–2012; 17 partners from 7 countries, Project budget: EUR 4.37 million, Project Coordinator: Michele Adams, Centre Scientifique & Technique de L'industrie Textile Belge (Belgium), INOTEX is apartner in the project**.**
- Project 7FP EU – CSA Thematic Priority, Project name: NaPolyNet – "Establishing intensive research clusters focused on polymer nanostructures throughout the EU on characterisation of polymer nanostructures," 2008–2011; 16 partners from 10 countries, Project budget: EUR 1.46 million, Coordinator: Cosimo Carfagne, Consiglio Nazionale Delle Richerche (Italy), INOTEX was a partner in the project.
- Project 7FP EU – SME, NMP Thematic Priority, Project name: SAFEPROTEX – "High–protection clothing for complex emergency operations," 2010–2013; 20 partners from 9 countries, Project budget: EUR 4.2 million, Coordinator: Fani Kotzia, IA Technologikis Anaptixis KL Ostoufantourgias Endysis Kai Inon E (Greece), INOTEX is a partner in the project.
- Project 6FP EU – STREP, PhotoNanoTech – Photozyme nanoparticle applications for water purification, textile finishing, photodynamic biomineralisation and biomaterial coating, 4/2007–3/2011; 11 participants, INOTEX was a partner in the project.
- Project 7FP EU CSA Type, NMP–NAPOLYNET Thematic Priority – "Establishing intensive research clusters focused on polymer nanostructures throughout the EU," 2008–2011; 15 partners from 10 countries, Coordinator: Clara Silvestre, ICTP–CNR (Italy), INOTEX was a partner in the project.
- Project EUREKA E! 3778, MANGO Programme – "Managing contamination by fibrous product systems," 1/2007–1/2010; Coordinator and Principal investigator: VTT, Technical Research Centre of Finland, 10 participants, INONTEX was a co–principal investigator.
- Participation in the COST 868 Programme – "Biotechnological functionalisation of renewable polymeric materials," 9/2006–9/2010; 24 countries, INOTEX was a partner in the project.

b) *Other research projects:*

- Project MIT FT–TA4/134 – "New multifunctional textiles for the medical industry," 2007–2009; Principal investigator: Ing. Jan Marek, CSc., Co–principal investigators: as.prof. MUDr. Zdeněk Krška, CSc., General University Hospital, Prague, Ing. Jiří Humpl, Krajská zdravotní a.s., Ing. Jiří Burda, Hedva, a.s., Ladislav Kopecký, Licolor, a.s., Ing. Zdeněk Hroch, Ph.D., Spolsin, s.r.o.

- Project MIT, “Sustainable Prosperity” programme, 2A–3TP1/126 – “In–line plasma–treatments and surface nano–treatments of nonwoven fabrics,” 4/2008–12/2011; Principal investigator: Ing. Zdeněk Mečl, PEGAS NONWOVENS s.r.o., Co–principal investigator at INOTEX: Ing. Jan Marek
- Project MIT, TANDEM programme, FT–TA5/007 – “Advanced research of nanomaterials for textile,” 3/2008–11/2010; Principal investigator: Ing. Antonín Mlčoch, Czech Technology Centre for Inorganic Pigments a.s., Přerov, Co–principal investigator for INOTEX: Ing. Lenka Martínková

Achievements in research and development in nanotechnologies

Participation in the TEG 3 Bio–based materials, biotechnology and environmental remediation processes within the framework of the EURATEX European Technology Platform.

Responsible persons/experts

- Ing. Viktor Antonov – textile biotechnology
- Ing. Jan Marek, CSc. – textile chemistry, biotechnology, functional textile, executive officer and co-owner of the company
- Ing. Lenka Martinková – textile chemistry, improvement, functional (nano)materials

4.2.44 INSTITUTE OF APPLIED BIOTECHNOLOGIES A.S.

Služeb 4, 108 52 Prague 10, I.D. 27225712

www.iabio.cz

A brief description of the Company

IAB is active in the research and development of molecular biotechnology, genomics and in vitro diagnostics.

Number of employees: 19 (2011)

Annual turnover: CZK 50 million (2011)

Activity in nanotechnologies

Bionanotechnology; work on implementation of the project described below:

- Project AS CR, “Nanotechnology for Society” programme, KAN200520801 – “Targeted expression and transport of bioactive molecules,” 1/2008–12/2012; Principal investigator: Mgr. David Staněk, Ph.D., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for Institute of Applied Biotechnologies: MUDr. Josef Fišer

Responsible persons

- Milan Hrouda – executive director
- MUDr. Josef Fišer – member of the board of directors

4.2.45 IONBOND CZECHCOATING, S.R.O.

20 Dolní Bečva 75655, I.D. 26782723

www.czechcoating.cz

A brief description of the Company

Ionbond CzechCoating s.r.o. (to May 2012 operated as CzechCoating, s.r.o.) is active in hard layer applications using Physical Vapor Deposition (PVD). The company has been active in the Czech Republic since 2002 and is incorporated in the largest network in the world of companies engaged in IonBond deposition.

Annual turnover: CZK 34.18 million (2009)

Activity in nanotechnologies

Cooperation on the project described below:

- Project MIT FT–TA4/082 – "Development and optimising surface treatment of tools," 2007–2010; Principal investigator: Ing. Josef Fajt, CSc., Pilsen Tools s.r.o., Co–principal investigator for CzechCoating: Ing. Jaroslav Číp

Responsible person

- Ing. Jaroslav Číp – executive officer

4.2.46 ISATECH, S.R.O.

S. K. Neumanna 1316, Pardubice V 532 07, I.D. 25935861

www.isatech.cz

A brief description of the Company

ISATech, s.r.o. was founded in 2000; it conducts expert consulting and analytical activity in the area of chemical engineering, industrial safety, safety in building security, crisis management and environmental protection. It also conducts research and application of hot–dry–rock, storage of energy in geologic environment, effects of heat stress on rock and natural sealing materials and the use of abandoned mines.

Activity in nanotechnologies

Work on implementation of the research project described below:

- Project TA CR TA01020348 **–** "Reversible storage of energy in rock massif", 2011–2014; Principal investigators: Mgr. Vladimír Lachman, Mgr. Michal Vaněček, Mgr. Petr Novák, Mgr. Pavel Bílý and Mgr. Jana Michálková, Co–principal investigators: Czech Geological Survey, ARCADIS Geotechnika, a.s., PROGEO, s.r.o., Institute of Rock Structure and Mechanics AS CR, Technical University of Liberec/Faculty of Mechatronics and Interdisciplinary Engineering Studies

Responsible person

- Ing. Michal Vaněček**–** executive officer and executive director

4.2.47 J–VST, S.R.O.

Ulrychova 67, Brno–Komín, 624 00, I.D. 25583620

www.j–vst.wz.cz

A brief description of the Company

The company is focused on manufacturing of machine parts by cold large–volume forming, machining of formed parts, design of forming tools for large–volume forming on single–operation presses and automatic forming machines, R&D of large–volume cold forming.

Annual turnover: CZK 14.05 million (2010)

Activity in nanotechnologies

Work on implementation of the project described below:

- Project MEYS 7D08006 – "New generation of forging tools," 2008–2011; Principal investigator: Ing. Bohumil Jedovnický

Responsible person

- Ing. Bohumil Jedovnický – executive officer

4.2.48 KERTAK NANOTECHNOLOGY, S.R.O.

Vodičkova 791/41, 110 00 Prague 1, I.D. 26077914

www.kertaknanotechnology.com

A brief description of the Company

The company was founded in 2004. It is the exclusive distributor and marketing partner of Pardam s.r.o., a producer of inorganic nanofibre materials. The nanofibre materials distributed by Kertak Nanotechnology around the world are manufactured using power spinning technology and they are used in a great number of industrial applications, such as filtration of water and air, in composite materials, catalysts, batteries, and solar and fuel cells.

Number of employees: 4

Annual turnover: CZK 15 million (2011)

Responsible person

- Daniel Možíš – executive officer and general director

4.2.49 KNITVA, S.R.O.

Harantova 1172, 509 01 Nová Paka, I.D. 252 97 597

www.knitva.cz

A brief description of the Company

Manufacturing of knitted goods and knitted materials, textile and garments, dyeing and chemical treatment of textiles.

Number of employees: 28

Annual turnover: CZK 4 million (2010)

Activity in nanotechnologies

Development of new functional systems for treatment of knitted sock products; work on implementation of the research project defined below:

- Project MIT FI–IM4/145 – "Research and development of using functional treatments, fibres and structures for producing socks and functional knitted products," 2007–2009; Principal investigator: Ing. Zdeněk Věchet, Co–principal investigator: Ing. Jan Marek, CSc., INOTEX s.r.o.

Responsible person

- Ing. Zdeněk Věchet – executive officer

4.2.50 KRD—obchodní společnost s.r.o.

Pekařská 12, 155 00 Prague 5, I.D. 26424991

www.krd.cz

A brief description of the Company

A distribution company specialising in the sales of instruments and equipment and in molecular biology. The Company also carries out biological research in its own laboratory facility.

Number of employees: 11 (2010)

Annual turnover: CZK 114.79 million (2010)

Activity in nanotechnologies

The company offers quantum dots – fluorescent nanocrystals for microscopy and detection, produced by Invitrogen company; work on implementation of the research project defined below:

- Project AS CR, "Nanotechnology for Society" programme, KAN200520703 – "The use of ultrasound in nanomedicine," 1/2007–12/2011; Principal investigator: as.prof. Ing. Jiří Neužil, CSc., Institute of Biotechnology AS CR, Prague, Co–principal investigator for KRD: MUDr. Zdeněk Kleibl, Ph.D.

Responsible persons/experts

- MUDr. Zdeněk Kleibl, Ph.D. – research
- Mgr. Viktor Krivjanský – executive officer and co-owner of the company

4.2.51 LAO — průmyslové systémy, s.r.o.

Na Floře 1328/4, 143 00 Prague 4 – Modřany, I.D. 25705512

www.lao.cz

A brief description of the Company

Laser technology for cutting, welding, marking, manufacturing of laser machines and equipment, laser accessories (optical and optomechanical parts), service, expendable supplies, replacement parts, customer and single–purpose systems, integration into production lines including automation.

Number of employees: 13

Annual turnover: CZK 136 million (2011)

Activity in nanotechnologies

Development and manufacture of UV spectrum lasers and related optical systems, excimer lasers from 157 nm, solid–substance lasers from 266 nm, supply of nanopositioning tables with manual and power control.

Development and manufacture of nanostructure measuring instruments – atomic forces microscopes, optical profile measuring instruments, mechanical needle profile measuring instruments, ellipsometers, nanoindenters, supply of lasers for scientific institutions and universities.

Responsible persons/experts

- Ing. Martin Klečka – laser systems for scientific institutions, measuring devices
- Ing. Pavel Kořán – laser technology for cutting, welding, marking

4.2.52 LICOLOR, A.S.

Americká 2 Liberec 46002, I.D. 49903268

www.licolor.cz

A brief description of the Company

Licolor, a.s. was founded in 1994, after the Company separated from Seba Tanvald a.s.It focuses on cotton and cotton/polyester blend fabric dyeing.

Number of employees: 41 (2011)

Annual turnover: CZK 72.82 million (2011)

Activity in nanotechnologies

Cooperation on the project described below.

- Project MIT FT–TA4/134 – "New multifunctional textiles for health care," 2007–2009; Principal investigator: Ing. Jan Marek, CSc., INOTEX s.r.o., Co–principal investigator for Licolor: Ladislav Kopecký

Responsible person

- Ing. Jan Híře – chairman of the board of directors

4.2.53 LIFETECH S.R.O.

Chládkova 24 c, 602 00 Brno, Operations facility – Brno, Šumavská 15, I.D. 25504401

www.lifetech.cz

A brief description of the Company

Lifetech s.r.o. was founded in 1997 and is active in the area of development, design and distribution of ozone generators and other equipment for treatment and cleaning of water and air and other technological systems that serve related purposes. It also manufactures chemical products for cleaning water (BlueSpark® – patented product).

Number of employees: 15 (2011)

Annual turnover: CZK 13.69 million (2011)

Activity in nanotechnologies

- Project AS CR, "Nanotechnology for Society" programme, KAN101630651 – "Preparation of nano–films and nano–coatings on textiles using plasma surface treatment at atmospheric pressure," 07/2006–12/2010; Principal investigator: prof. RNDr. Mirko Černák, CSc., Masaryk University inBrno/Faculty of Sciences, Co–principal investigator for Lifetech: as.prof. RNDr. Jiří Dřímal, CSc.

Responsible person

- as.prof. RNDr. Jiří Dřímal, CSc. – owner and executive officer

4.2.54 LYCKEBY AMYLEX, A.S.

Strakonická 946 Horažďovice 34101, I.D. 49790340

www.lyckeby.cz

A brief description of the Company

The largest producer of potato starch, dextrin and cationic starch in the Czech Republic.

Number of employees: 44

Annual turnover: CZK 339 million (2011)

Activity in nanotechnologies

Work on the project described below:

- Project MIT FR–TI1/566 – "Research and development of high added–value nanocomposite biodegradable materials," 2009–2013; Principal investigator: Ing. Eva Vlnová, Co–principal investigator: as.prof. Ing. Petr Duchek, CSc., University of West Bohemia in Pilsen/Faculty of Mechanical Engineering

Responsible person

- Ing. Josef Jonáš – deputy chairman of the board of directors

4.2.55 MILCOM, A.S.

Ke Dvoru 12ª, Prague 6, 160 00, I.D. 16193296

www.milcom–as.cz

A brief description of the Company

MILCOM, a.s. was founded in 1991. In its plant in the town of Dvůr Králové nad Labem it manufactures equipment for packaging butter and farmer's cheese. In its facility in the town of Tábor it produces rennet and growth medium for food processing and water treatment laboratories, and baking and pastry mixtures for food processing use. VÚM s.r.o., the Dairy Research Institute, joined the Company in 2004.

Number of employees: 90

Annual turnover: CZK 500 million (2010)

Activity in nanotechnologies

- Project MEYS 2B06053 – "New methods for the characterization and identification of probiotic bacterial strains suitable for functional foods," 2006–2011; Principal investigator: as.prof. Ing. Bohuslav Rittich, CSc., Masaryk University in Brno/ Faculty of Sciences, Co–principal investigator for MILCOM: Ing. Vladimír Dráb

Responsible person

- Ing. Josef Vychodil – director

4.2.56 MEDIHOPE S.R.O.

Dobšická 33, 193 00 Prague 9, I.D. 26710617

Work station: Mathonova 1, 796 04 Prostějov

www.medihope.cz

A brief description of the Company

MEDIHOPE s.r.o. was founded 2002 to provide magnetic resonance in the Olomouc Region. The diagnostic facility is located in Prostějov.

Number of employees: 25 (2010)

Annual turnover: CZK 62.09 million (2010)

Activity in nanotechnologies

Research of the use of nanomaterials in magnetic resonance and participation in the project described below:

- Project AS CR, "Nanotechnology for Society" programme, KAN115600801 – "New technologies of preparation and use of iron oxide–based nanoparticles for environmental, industrial and medical applications," 1/2008–12/2012; Principal investigator: as.prof. RNDr. Radek Zbořil, Ph.D., Palacký University Olomouc/Faculty of Science, Co–principal investigator for MEDIHOPE: MUDr. Pavel Novák.

Responsible person

- MUDr. Pavel Novák – head physician, magnetic resonance

4.2.57 MEGA A.S.

Registered address: Drahobejlova 1452/54, 190 00 Prague 9, I.D. 44567146

Main work facility: Pod Vinicí 87, 472 27 Stráž pod Ralskem

www.mega.cz

A brief description of the Company

MEGA a.s. was founded in 1992. It carries on the tradition of the Central Laboratories of the Czechoslovak Uranium Industry. The Company focuses on the purification and treatment of water and industrial solutions, membrane technologies, manufacture of ionic exchange membranes and comprehensive environmental services. The company is divided into three divisions: membrane processes, surface treatment and environmental and rehabilitation applications. Research related to nanotechnology is conducted by the Membrane Division.

Number of employees: 93 (2010)

Annual turnover: CZK 393.08 million (2010)

Activity in nanotechnologies

Cooperation on the projects described below:

a) *Projects implemented by the Company:*

- ProjectTA CR TA01021304 – "Application of electrical field for remediation of sites contaminated by organic pollutants," 2011–2013; Principal investigator: RNDr. Jaroslav Hrabal, Co–principal investigators: as.prof. Dr. Ing. Miroslav Černík, CSc. and Ing. Jaroslav Nosek, Ph.D., Technical University of Liberec/Faculty of Mechatronics and Interdisciplinary Engineering Studies
- Project MIT FR–TI3/622 – "Development and use of diffuse reactive barriers based on micro–Fe and nano–Fe for rehabilitation," 2011–2014; Principal investigator: RNDr. Jaroslav Hrabal, Co–principal investigators: prof. RNDr. Radek Zbořil, Ph.D., Palacký University Olomouc/Faculty of Science, as.prof. Ing. Dr. Miroslav Černík, CSc., Technical University of Liberec

b) *Projects in which the Company is participating:*

- Project 7FP EU CSA type, NMP Thematic Priority, Project name:"MemBridge – Bridge between environment and industry designed with membrane technology", 2009–2011; 16 partners from 8 countries, Project budget: EUR 0.68 million, Coordinator: Gilbert M Rios., Pean Membrane House (Belgium), MEGA a.s. was a partner in the project.
- Project MIT 2A–3TP1/140 – "Ion exchange materials in the form of membranes and nanofibres prepared using nanotechnology," 2008–2010; Principal investigator: Ing. Aleš Černín, Ph.D., MEGA, a.s., Co–principal investigator: Ing. Denisa Stránská, Elmarco, s.r.o.

Responsible person/experts

- Ing. Libor Nejedlý – division director
- Ing. Luboš Novák, CSc.– owner of the company

4.2.58 MEGA SYSTEM, SPOL. S.R.O.

Skyřická 8, 434 01 Most – Velebudice, I.D. 44222343

www.volny.cz/megasystem

A brief description of the Company

Manufacturing of sprinkler systems (de–dusting), water treatment services (filtration stations, industrial wastewater treatment).

Number of employees: 6 (2011)

Annual turnover: CZK 12.9 million (2011)

Activity in nanotechnologies

Participation in the project described below:

- Project MIT, IMPULS programme, FI–IM3/061 – "Preparation of conducting and semiconducting polymers doped with nanoparticles and nanotubes based on carbon," 5/2006–12/2009; Principal investigator: Mgr. Václav Štengl, Ph.D., Inorganic Chemistry

Research Institute, AS CR, Husinec – Řež, Co–principal investigator for MEGA SYSTEM: Ing. Josef Beneš.

Responsible person

- Ing. Josef Beneš – executive officer

4.2.59 MEMBRAIN, S.R.O.

Pod Vinicí 87, Stráž pod Ralskem, 471 27, I.D. 28676092

www.membrain.cz

A brief description of the Company

MemBrain, s.r.o.,established in 2008 by the Czech company MEGA a.s., is a research, engineering technological company focused on basic and applied research and other innovation activities in the area of membrane processes and especially on the transfer of results of research into commercial activities. The main areas of activity are membrane and separation processes (electrodialysis, electrodeionisation, membrane electrolysis, reverse osmosis, microfiltration, ultrafiltration and nanofiltration) including required pre–treatment (oxidation, reduction, ionic exchange, filtration, flotation, flocculation and sedimentation).

Number of employees: 27 (2011)

Annual turnover: CZK 17.18 million (2011)

By the end of 2014 MemBrain s.r.o. will complete building, outfitting with instruments and hiring personnel for the **MEMBRANE INNOVATION CENTRE (MIC).** This will thus lead to the creation in Stráž pod Ralskem of a new prestigious research facility focused on applying membrane separation processes to various fields of industry. This is a four–year project, CZ.1.05/2.1.00/03.0084 of the Operation Programme Research and Development for Innovation, with a budget of CZK 512 million (including a CZK 370 million grant). MIC research activities are divided into three research programmes: R&D of membranes and membrane materials, Research of membrane modules, equipment and membrane processes, and Research of membrane technologies and their application.

Activity in nanotechnologies

Nanofiltration; work on the projectsdescribed below:

- Project MIT 2A–1TP1/116 – "Functional polymers in membranes for alternative energy and bio–specific sources," 2006–2009; Principal investigator: Ing. Aleš Černín, Ph.D., Co–principal investigator: Ing. Miroslav Bleha, CSc., Institute of Macromolecular Chemistry AS CR .
- Project MIT 2A–3TP1/140 **– "**Ion exchange materials in the form of membranes and nanofibres prepared using nanotechnology," 2008–2010; Principal investigator: Ing. Aleš Černín, Ph.D., Co–principal investigator: Ing. Denisa Stránská, Elmarco, s.r.o.

Responsible person

- Ing. Aleš Černín, Ph.D. – executive officer and general director

4.2.60 MESING, SPOL. S.R.O.

Mariánské náměstí 1, 617 00 Brno, I.D. 25579835

www.mesing.cz

A brief description of the Company

Development, construction and manufacture of special custom measuring instruments for checking high precision parts, especially for automotive and bearing industry, research and manufacture of special induction sensors, including the equipment for their checking, calibration instruments and equipment for surface defect measurement and also straightening presses.

Number of employees: 26 (2012)

Annual turnover: CZK 52 million (2011)

Activity in nanotechnologies

Development of methods and equipment for the detection of hard–to–see surface and surface finishing technology defects based on the detection of dispersed laser light, used in the automotive and bearing industries and also methods and equipment for checking high–sensitivity sensors, including laser interferometers for length nano measuring for measuring laboratories with high–precision manufacturing.

Projects implemented in nanotechnologies

- Project MIT FR–TI1/241 – "Components for nanometric diagnostics of length fluctuations, deviations in shapes and surface defects," 2009–2013; Principal investigator: Ing. Jan Kůr, Co–principal investigators: Mgr. Petr Klapetek, Ph.D., Czech Metrology Institute, Ing. Ondřej Číp, Ph.D., Institute of Scientific Instruments AS CR
- Project MIT FT–TA3/133 – "System of laser interferometers for nanometrology of lengths," 3/2006–12/2009; Principal investigator: Ing. Jan Kůr
- Project MIT FR–TI2/705 – "Non–contact optical measuring methods and systems for precise engineering," 2010–2014; Principal investigators: Ing. Jan Kůr, Ing. Boris Kůr, Co–principal investigator: Ing. Ondřej Číp, Ph.D., Institute of Scientific Instruments AS CR

Responsible persons

- Ing. Pavel Konečný – equipment for checking sensors and interferometers for nano measuring of length
- Ing. Boris Kůr – surface defect measuring, measuring methods and systems for high–precision machining
- Ing. Jan Kůr– executive officer, work coordination, systems for high–precision machining

4.2.61 MEVI–CZ, S.R.O.

Areál Svit, a.s., building no. 17, 760 06 Zlín, I.D. 25522671

www.mevi.cz

A brief description of the Company

Manufacture of high–precision machine parts on conventional CNC machines in custom and small–series production. Supplying companies active in the packaging, pharmaceutical, electro technical and food processing industries in the manufacturing of prototypes, bathroom fixtures, automation, transport and handling equipment.

Number of employees: 42

Annual turnover: CZK 43.69 million (2011)

Projects implemented in nanotechnologies

- Project 7FP EU SME Thematic Priority, Project name: FRACFIX – "Elimination of secondary surgery for removal of internal fixations of fractured bones", 2008–2011; 9 partners from 5 countries, Project budget: EUR 1.44 million, Coordinator: Rune Nilsen, Nor Tek Teknologisenter AS (Norway), MEVI–CZ spol. s r.o. was a partner in the project.

Responsible person

- Ing. Luděk Šiška – executive officer

4.2.62 MIKROCHEM LKT, SPOL. S.R.O.

Přeseka 52, 376 01 Třeboň, I.D. 49060007

www.mikrochem.cz

A brief description of the Company

MikroChem LKT, spol. s r.o. specialises in environmental protection and the development of special technology applications, environmental toxicology analysis, and in cooperation with the Czech Academy of Sciences also in chemical analysis of environmental protection samples and in the development of technologies for the removal of hazardous waste. The Company provides expert evaluations and consulting services in the areas of environmental protection, rehabilitation of historically contaminated sites, removalof hazardous liquid waste and composting of biologically degradable waste. An important programme is also the development and application of biodegradation technologies. Since 2003 MikroChem LKT has been a subsidiary of AWAST a.s.

Number of employees: 21 (2010)

Annual turnover: CZK 50 million (2010)

Activity in nanotechnologies

Rehabilitation using zero–valent iron.Cooperation on the projects described below:

- Project MIT FR–TI1/456 – "Development and implementation of the tools additively modulating soil and water bioremediation," 2009–2013; Principal investigator: Mgr. Zdeněk Kozlíček

- Project MIT, TANDEM programme, FT–TA3/077 – "Groundwater remediation by means of permeable reactive barriers," 5/2006 – 4/2010; Principal investigator: Ing. Josef Kozler, CSc., Inorganic Chemistry Research Institute a.s., Ústí nad Labem, Co–principal investigator for MikroChem LKT: Ing. Karel Koranda

- Project MEYS 2B08062 – "Genetic and physiological manipulations in bacterial degraders of aromatic pollutants and their application," 1/2008–12/2011; Principal investigator: Ing. Miroslav Pátek, CSc., Institute of Microbiology AS CR, Prague, Co–principal investigator for MikroChem LKT: Mgr. Marian Byss

Responsible person

- Ing. Karel Koranda – executive director

4.2.63 MIKROPUR, S.R.O.

Wonkova 799, 500 02 Hradec Králové, I.D. 60111623

www.mikropur.cz

A brief description of the Company

Research, development and sales of laboratory equipment for filtration, membrane separation, micro and nanofiltration, pervaporation, reverse osmosis, centrifuging, analysis of dissolved and non–dissolved substances, photocatalysis, laboratory filtration, decontamination of liquids.

Annual turnover: CZK 1.9 million (2010)

Activity in nanotechnologies

Development of nanofiltration equipment, laboratory and testing equipment for separation, filtration, pervaporation, engineering solutions for filtration process solutions (including nanofiltration) and membrane separation, research of photocatalytic destruction of organic pollutants in water solutions.

Projects implemented in nanotechnologies

- Project MIT FR–TI3/088 – "Development of implants, tools and fixators with antibacterial coating on the basis of nanostructured surfaces," 2011–2013; Principal investigator: Ing. Zdeněk Čejka, ProSpon, s.r.o., Co–principal investigator for Mikropur s.r.o.: Ing. Jaroslav Přidal, CSc.

- Project MEYS LA10016 – "Participation in scientific committees and conferences focused on filtration, separation and catalysis," 2010–2012; Principal investigator: Ing. Jaroslav Přidal, CSc., Mikropur s.r.o.

- Project 6FP EU Excellence Network, NanoMemPro – "Expanding membrane macroscale applications by exploring nanoscale material properties," 2004–2008; 13

participants, Mikropur was a partner in the project.The goal of the project was the integration of research capacities in membrane separation, development of research strategy and foundation of non–profit organisation, European Membrane House, serving this purpose.

Responsible person

- Ing. Jaroslav Přidal, CSc. – director and co-owner of the company

4.2.64 MOLECULAR CYBERNETICS, S.R.O.

Strážovská 65/7, 153 00 Prague 5 – Radotín, I.D. 49621386

A brief description of the Company

Research and development focused on preparation and characterisation of nanomaterials.

Activity in nanotechnologies

Research and development of small–dimensioned nanostructures (nanoplates, nanotubes, nanofibres) for nanoelectronics; cooperation on the projects described below:

- Project MIT FT–TA4/126 – "Research of semiconductive nanotubes for implementation of cold emission components," 1/2007–12/2010; Principal investigator: Ing. Stanislav Štarman, Ph.D., Co–principal investigator for Molecular Cybernetics: RNDr. Zdeněk Kváča
- Project MIT 2A–1TP1/092– "Research of preparation nanoform layered piezoelectric material for implementation and production of high temperature ultrasonic transducers," 7/2006–12/2011; Principal investigator: Ing. Stanislav Štarman, PhD., Co–principal investigator for Molecular Cybernetics: RNDr. Zdeněk Kváča
- Project MIT 2A–2TP1/147 – "Research of semiconductive nanotubes for implementation of photoelectric components," 1/2007–12/2010; Principal investigator: Ing. Stanislav Štarman, Ph.D., Co–principal investigator for Molecular Cybernetics: RNDr. Zdeněk Kváča

Responsible person

- RNDr. Zdeněk Kváča – executive officer and owner of the company

4.2.65 MORAVIAN - BIOTECHNOLOGY, SPOL. S.R.O.

Taussigova 982/1, 615 00 Brno, I.D. 25300024

www.moravian–biotech.com

A brief description of the Company

Development and manufacture of custom monoclonal and polyclonal antibodies.

Number of employees: 5 (2010)

Annual turnover: CZK 4.1 million (2010)

Activity in nanotechnologies

- Project 7FP EU SME Large, NMP Thematic Priority, Project Name: NADINE – "Nanosystems for early diagnosis of neurodegenerative diseases", 2010–2015; 16 partners from 9 countries, Project budget: EUR11.65 million, Coordinator: Jörg Kutter, Danmarks Tekniske Universitet, Moravian–Biotechnology. is a partner in the project.

Responsible person

- MUDr. Rudolf Nenutil – executive officer

4.2.66 NAFIGATE CORPORATION, A.S.

Kolbenova 568/29, 198 00 Prague 9, I.D. 24166855

www.nafigate.com

A brief description of the Company

Nafigate Corporation, a.s. was founded in 2011 and since 2012 has been running the NanoFibers Gateway (www.nafigate.com) global portal whose goal is to expedite and simplify the introduction of new nanofibre applications. The quality of information is guaranteed by a committee of world–renowned scientists and representatives of top international companies active in the area of nanofibres and their applications. The information is divided into categories and subcategories: filtration of liquids, energy, environmental protection, advanced materials, food and packaging, health and personal care.

Responsible person

- Ing. Ladislav Mareš – chairman of the board of directors

4.2.67 NANOBALA S.R.O.

Bohuslávky 16, 751 31 Lipník nad Bečvou, I.D. 28625111

www.nanobala.cz

A brief description of the Company

Nanobala s.r.o. was founded in 2010 and it manufactures and sells nanotechnology–based products, and develops and manufactures liquid protective preparations comprised of a carrying substance and manometer–sized components.

Activity in nanotechnologies

Development and manufacture of preparations using nanocomponents.

Responsible person

- Bc. Emílie Kovaříková – executive officer

4.2.68 NANO6 S.R.O.

Náměstí Sítná 3105, 272 01 Kladno – Kročehlavy, I.D. 24762300

www.nano6.eu

A brief description of the Company

Nano6 s.r.o. was founded in 2010 and it focuses on depositing nano–crystal diamond films using microwave chemical technology plasma deposition at low temperatures (below 400 °C) for use in electronics and medicine.

Responsible person

- Ing. František Fendrych, Ph.D. – executive officer

4.2.69 NANOFUTURE, S.R.O.

Hořejšího 1911, 190 16 Prague 9, I.D. 28479289

www.nanofuture.cz

A brief description of the Company

Nanofuture, s.r.o. was founded in 2008 and sells nanotechnology–based products. These are chiefly products for the treatment of various surfaces and materials. The products are mostly for impregnation of a variety of porous materials, such as protecting wood against moisture; products are colour pigmented. They are mostly colourless liquids.

Responsible person

- Ing. Ema Matějů – executive officer

4.2.70 NANOGRAPH S.R.O.

Opletalova 1015/55, 110 00 Prague 1, I.D. 24753319

www.nanograph.cz

A brief description of the Company

NANOGRAPH was founded in 2010 with the goal of upholding and developing the tradition of R&D and manufacturing of special technical paper in the Czech Republic (in Štětí). It took over the programme of the former Paper and Cellulose Research Institute (IRAPA).

Number of employees: 3

Activity in nanotechnologies

Use of nanotechnology in manufacturing special paper.

Responsible person

- JUDr. Vladimír Sitta – executive officer

4.2.71 NANOIMPREG, SPOL. S.R.O.

Roudničská 25847a, 500 02 Hradec Králové, I.D. 28798457

www.nanoimpreg.cz

A brief description of the Company

NANOIMPREG, spol.s r.o. was founded in 2010, it applies professional protective spray–on surface treatment containing nanoparticles on various types of surfaces and materials.

Activity in nanotechnologies

Nanotechnology based spray–on protective surface treatment.

Responsible person

- Martin Sedláček – executive officer

4.2.72 NANOMAT, S.R.O.

Šlechtitelů 813/21, 779 00 Olomouc, Holice, I.D. 27813762

A brief description of the Company

Palacký University Olomouc/Faculty of Science spin–off founded in 2007 with the aim to be active in the manufacturing of nano iron.

Annual turnover: CZK 300 thousand (2010)

Activity in nanotechnologies

Manufacture of nanopowder iron for cleaning groundwater.

Responsible persons

- prof. RNDr. Miroslav Mašláň, CSc. – executive officer
- prof. RNDr. Radek Zbořil, Ph.D. – executive officer

4.2.73 NANOPHARMA, A.S.

Ukrajinská 1448/10, 101 00 Prague 10, I.D. 28448898

www. nanopharma.cz

A brief description of the Company

Nanopharma, a.s. was founded in 2008. It focuses on the development, manufacturing and use of nanofibre structures in medicine. More specifically this is the production of nanofibres from polymer materials including biodegradable ones, custom preparation of composite carriers for tissue engineering, custom production and preparation of intelligent carriers for controlled substance dispensing, preparation of intelligent cover and surgery netting,

manufacture of preparations for somatic therapy, and development of spinning methods for various materials.

Number of employees: 2

Annual turnover: CZK 96 thousand (2010)

Activity in nanotechnologies

Development of nanofibres for medicinal purposes, cooperation with facilities of universities and the Academy of Sciences of the Czech Republic in the development of nanofibres suitable for testing the use nanofibres in biomedicine.

Responsible person

- Ing. Zdeněk Šlais – chairman of the board of directors

4.2.74 NANOPRO S.R.O.

Lažany 7 – Vyskeř, 511 01 Turnov, I.D. 28816021

www.nanopro.cz

A brief description of the Company

NANOPRO s.r.o. was founded in 2011 and it functions as the certified partner of Nanopool GmbH in the Czech Republic. It specialises in the application of nanocoating.

Activity in nanotechnologies

Surface treatment using liquid glass

Responsible person

- Rostislav Vocásek – executive officer

4.2.75 NANOPRODUKT, S.R.O.

Švermova 267/76, 460 10 Liberec, I.D. 28488466

www.nanoprodukt.cz

A brief description of the Company

Nanoprodukt, s.r.o. was founded in 2008.It operates an e–shop with nanotechnology–based products for surface treatment of various materials. Nano–impregnation and liquid glass.

Number of employees: 3

Annual turnover: CZK 600 thousand (2011)

Responsible person

- Mgr. Irena Tyagurová – executive officer

4.2.76 NANOPROTEX S.R.O.

Dýšina 408, PSČ 330 02, I.D. 29124158

A brief description of the Company

Nanoprotex s.r.o. was founded in 2012. With the support of the Technical University of Liberec/Faculty of Textile Engineering, the Company has developed a unique nanofibre membrane.Its properties make it especially suitable for outdoor, sports and military applications. Start of industrial manufacturing is planned for as early as 2012.

Responsible person

- Roman Knížek – executive officer

4.2.77 NANOSPOL, S.R.O.

Bohunická 238/67, 619 00 Brno, I.D. 28271068

www.nanospol.cz

A brief description of the Company

Nanospol, s.r.o. was founded in 2008.It focuses on development and manufacturing of multifunctional clotting and woven textiles with antibacterial properties.

Number of employees: 2

Annual turnover: CZK 3.5 million (2010)

Activity in nanotechnologies

Use of natural antibacterial properties of silver nanoparticles in connection with polymer nanofibres.

Responsible person

- Ing. Petr Nádvorník – executive officer

4.2.78 NANO SYSTEMS, S.R.O.

Na Nivách 2147/16, 700 30 Ostrava – Zábřeh, I.D. 46577084

www.nano–systems.cz

A brief description of the Company

Internet–based sales of nanotechnology products for everyday household use, car care and protection of wood and stone.

Responsible persons

- Radim Křížovský – executive officer

4.2.79 NANOTEAM, S.R.O.

Petrův důl 1140/30, 794 01 Krnov, I.D. 28603745

www.nanoteam.org

A brief description of the Company

Nanoteam, s.r.o. is a sales company founded in 2009. It is active in surface treatment and sells special chemical products.

Activity in nanotechnologies

Nanoteam, s.r.o. focuses on ultra–thin surface coating using nanotechnology for products used mostly in transport, construction, wellness and healthcare and also in anti–slip surface treatment.

Responsible person

- Adam Nytra – executive officer

4.2.80 NANOTECH SERVICE CZ, S.R.O.

Durďákova 336/269, 613 00 Brno – Černá Pole, I.D. 29236525

www.ntsc.cz

A brief description of the Company

NanoTech Service CZ, s.r.o. was founded in 2010. The Company designs, supplies and assembles equipment used mostly for R&D, manufacturing and storage of nano and biomaterials. The company provides comprehensive service in the area of nanotechnology.

Activity in nanotechnologies

Supply of technical equipment, chiefly: Experimental equipment for the production of nanofibre materials from organic polymers, industrial and manufacturing equipment for production of nanofibre materials, experimental, laboratory and industrial equipment for surface coating of textiles, papers and surface carriers of nanofibres, both single and multiple layered, experimental equipment for the production of non–homogenous three–dimensional nanofibre structures from conventional and tubular nanofibres, equipment for the design, treatment and modification of nanomaterial size, equipment and systems for monitoring the quality and conformity of nanomaterial production, equipment and systems for optimising nanofibre production in conditions which require increased air purity, equipment for treating biological materials used in the production of nanomaterials, comprehensive equipment for measuring and regulation of systems of instruments and equipment for the preparation, production, modification, enrichment and treatment of nanomaterials, instruments and equipment for sterilisation of nanomaterials, analytic and diagnostic instruments for work with nanomaterials, biological samples and production raw materials etc..

Responsible person

- Markéta Dohnalíková – executive officer

4.2.81 NANOVIA, S.R.O.

Registered address: Vaněčkova 2695, 269 01 Rakovník, I.D. 27381277

Manufacturing facility: Podkrušnohorská 271, 436 03 Litvínov

A brief description of the Company

NANOVIA, s.r.o. was founded in 2005 and operates equipment for the production of nanofibres. It manufactures three–layered membranes used in medicine as textile barriers against the infiltration of allergens (useable also for bedding) and microorganisms (used in work clothes for medical personnel, respirators, etc.). It also manufactures filtration materials with nanofibre layer (filtration of gases, fluids, HEPA filtration). The company also offers facilities for research and development of new nanomaterial products.

Number of employees: 0 (2011)

Annual turnover: CZK 13.4 million (2011)

Activity in nanotechnologies

Manufacture of nanofibre textile.

Responsible persons

- Ing. Jiří Dudjak, PhD. – director
- Jan Halada – executive officer and owner of the company

4.2.82 NANO ENERGIES, A.S.

Hlavní 130, 250 68 Řež, I.D. 28392191

www.nano–energies.cz

A brief description of the Company

Nano Energies, a.s. has been active on the market since 2002. It is active in sales of applications of modern technologies used in decentralised production and accumulation of electricity.

Number of employees: 0 (2011)

Annual turnover: CZK 655 thousand (2011)

Activity in nanotechnologies

The use of nanotechnology in the production of renewable energy sources.

Responsible person

- Ing. Petr Rokůsek – member of the board of directors

4.2.83 NANO IRON, S.R.O.

Štefánikova 116, 664 61 Rajhrad, I.D. 28298055

www.nanoiron.cz

A brief description of the Company

The main activity of NANO IRON, s.r.o. is the production of nanoparticles of elementary iron Fe(0) on an industrial scale and technical support in its application.

Due to the extraordinary reduction properties, small size and high reactivity of the nanoparticles the company focuses its activity on reduction technology used in rehabilitation of groundwater, surface and mine water and number of other applications. The company is also active in the development of new iron–based products, research of other applications of the already produced nanoparticles and study of the possibility of their effective stabilisation and reactivity with selected pollutants.

Activity in nanotechnologies

Production of nanoparticles of zero–valent iron, research and development of its applications for environmental protection and other possible uses. Successful pilot tests of nano iron application in removing groundwater contamination at the KARA Trutnov facility.

Responsible person

- Ing. Jan Slunský – director

4.2.84 NANOTRADE S.R.O.

Mozartova 178/12, 779 00 Olomouc, I.D. 45307971

www.nanotrade.cz

A brief description of the Company

NanoTrade s.r.o. was founded in 2004. It conducts applied research and development in the area of nanotechnology, it is active in the popularisation of nanotechnology, commercial application of research and it conducts manufacturing and sales activity.

Number of employees: 5

Annual turnover: CZK 11 million (2011)

Activity in nanotechnologies

Applications using antibacterial properties of silver, surface protection and improvement of surfaces using nanomaterials, nanomaterials in energy generation and environmental protection, development and supply of additives for liquid and solid fuel, development and manufacture of products for cosmetics and veterinary applications, development and manufacture of functional underwear under the Nanosilver® brand (the company is the owner of the Nanosilver® Trade Mark), number of applied uses of technology in manufacturing and sales of licenses, for example food warmer, service and calibration facility, special packaging, antibacterial packaging, etc.

Projects implemented in nanotechnologies

- Project 7FP EU CSA type NMP Thematic Priority, Project name: NANOCOM – "Lowering barriers for nanotechnology commercialisation via open innovation," 2009–2012; 16 partners from 10 countries, Project budget: EUR 2.04 million, Coordinator: Paul Cartledge, The University of Nottingham (United Kingdom), NanoTrade is a partner in the project.
- Project 7FP EU Small – NMP Thematic Priority, Project name: NANOFATE – "Nanoparticle fate assessment and toxicity in the environment," 2010–2014; 12 partners from 9 countries, Project budget: EUR 3.25 million, Coordinator: Claus Svendsen, Natural Environment Research Council (United Kingdom), NanoTrade is a partner in the project.
- Project MIT FR–TI2/205 – "Research and development of medical devices based on nanomaterials," 2010–2013; Principal investigator: RNDr. Jiří Oborný, NanoTrade, Co–principal investigator: prof. RNDr. Jitka Ulrichová, CSc. Palacky University Olomouc/Faculty of Medicine
- Project TA CR 02010148 – "Diagnostics and therapy with light upconversion nanoparticles," 2012–2016; Principal investigator: RNDr. Jiří Oborný, NanoTrade, Co–principal investigators: RNDr. Petr Ježek, DrSc., Institute of Physiology AS CR, as.prof. MUDr. Roman Šmucler, CSc., Asklepion s.r.o.

Responsible persons

- RNDr. Jiří Oborný – director for research and development
- Ing. Ladislav Torčík – company director

4.2.85 NOLIAC CERAMICS S.R.O.

Školní 86, 503 44 Libřice, I.D. 25932888

www.noliac.com

A brief description of the Company

Noliac Ceramics s.r.o. (formerly Piezoceram s.r.o.) was founded in 2000.In 2006 the Company joined the Noliac Group (the majority share is owned by the Danish company, OLIAC A/S). It focuses on manufacturing and testing piezo–ceramics – high precision piezo–ceramic converters, discs, rings, bars, plates and tubes; piezo–ceramic substance and microwave dielectric products – coaxial sensors, dielectric resonators, dielectric substrates, etc.

Number of employees: 41

Annual turnover: CZK 30.7 million (2010)

Activity in nanotechnologies

- Project 7FP EU SME Large, NMP Thematic Priority, Project Name: HIPER–Act "Innovative technology for high–performance piezoelectric actuators," 2008–2012, 15

partners from 6 countries, Project budget: EUR 7.91 million, Coordinator: Bjorn Andersen, NOLIAC A/S (Denmark), Noliac Ceramics is a partner in the project.

- Project AS CR, "Nanotechnology for Society" programme, KAN301370701 – "Nanostructured macroscopic systems – technology and characterisation," 1/2007–12/2011, Principal investigator: prof. RNDr. Miroslav Hrabovský, DrSc., Palacký University Olomouc/Faculty of Science, Co–principal investigator for Noliac Ceramics (PIEZOCERAM): Ing. Miroslav Boudyš, CSc.
- Project MIT 2A–1TP1/092 – "Research of preparation of nanoforms layered piezoelectric material for implementation and production of high temperature ultrasonic transducers," 7/2006–12/2011; Principal investigator: Ing. Stanislav Štarman, PhD., STARMANS electronics, s.r.o., Prague, Co–principal investigator for Noliac Ceramics (PIEZOCERAM): Bořivoj Tylš

Responsible person

- Ing. Miroslav Boudyš, CSc. – executive officer

4.2.86 OLCHEMIM S.R.O.

Šlechtitelů 241/27, 770 10 Olomouc, I.D. 47154845

www.olchemim.cz

A brief description of the Company

Olchemim s.r.o. was founded in 1992. It supplies reagents for laboratory research (antibodies, cytokines, anticytokines, auxins, etc.).

Activity in nanotechnologies

Participation in the project described below

- Project AS CR, "Nanotechnology for Society" programme, KAN200380801 – "Immunonanotechnologies for hormone diagnostics," 01/2008–12/2012; Principal investigator: prof. Miroslav Strnad, DrSc., Institute of Experimental Botany AS CR, Co–principal investigator for OlChemIm: RNDr. Luděk Fröhlich.

Responsible person

- RNDr. Luděk Fröhlich – executive officer and co–owner of the company

4.2.87 OMEGA ALTERMED A.S.

Drážní 253/7, 627 00 Brno-Slatina, I.D. 2538827

www.altermed.cz

A brief description of the Company

Company (established in 1998 as NOVA OLPLANT OLOMOUC a.s. in Olomouc and from the year 2003 it operated as ALTERMED CORPORATION a.s.) is active in development,

production and sales of pharmaceutical cosmetics, health products and nutritional supplements. From the year 2008 it is an integral part of the Omega Pharma Group from Belgium operating in 40 countries.

Number of employees: 56 (2010)

Annual turnover: CZK 132.33 million (2010)

Activity in nanotechnologies

Use of nanoparticles in pharmaceutical products; work on implementation of the project described below:

- Project MEYS OE08005 – "Application of antimicrobial properties of nanotechnically processed silver particles in pharmaceutical products (human and veterinary), health products and cosmetics," 2008–2011; Principal investigator: Ing. Tomáš Hradil

Responsible persons

- Ing. Tomáš Hradil – development
- Ing. Peter Húževka – chairman of the board of directors

4.2.88 OPTAGLIO S.R.O.

Husinec – Řež 199, 250 68 Prague–východ, I.D. 48950076

www.optaglio.cz

A brief description of the Company

Optaglio s.r.o. is a member of the Optaglio Group, along with Optaglio Limited (Great Britain) and Metallic Security (Czech Republic). It focuses on the development and manufacture of state of the art safety optical elements and holograms. This work involves electron lithography technology and optical holographic recording.

Number of employees: 63

Annual turnover: CZK 312.10 million (2010)

Activity in nanotechnologies

- Structures suitable for RFID applications: development of optical variable elements of holograms and relief diffraction structures
- Design, calculations, optimising and implementation of relief structures (typically in resolution up to 254 000 dpi, relief depth generally 150 – 190 nm) or customer masks (4" substrates, details, min. 500 nm)

Projects implemented in nanotechnologies

- Project 7FP EU Small, NMP Thematic Priority, Project name: NANOBIOTOUCH – "Nano–resolved multi–scale investigations of human tactile sensations and tissue engineered nanobiosensors", 2010–2013; 12 partners from 8 countries, Project budget:

EUR 4.93 million, Coordinator: Robert Fekete, University of Birmingham (Great Britain), Optaglio is a partner in the project.

- Project MIT FR–TI1/595 – "Amorphous oxide nanolayers caoted from aqueous solution usable for industrial applications," 2009–2011; Principal investigator: Ing. Kateřina Koňáková, Co–principal investigator: Ing. Zbyněk Černý, CSc., Inorganic Chemistry Research Institute AS CR

- Project AS CR, "Nanotechnology for Society" programme, KAN400100701 – "Functional hybrid nanosystems of semiconductors and metals with organic materials," (FUNS), 2007–2011; Principal investigator: RNDr. Bohoslav Rezek, Ph.D., Institute of Physics AS CR, Prague, Co–investigator for Optaglio: Ing. Libor Kotačka, Ph.D.

Responsible person

- Vladimír Zhukov – executive officer

4.2.89 PARDAM S.R.O.

Registered address: Jindřišská 2025, 530 02 Pardubice, I.D. 25268694

Manufacturing facility: Soškova 1562, 592 31 Nové Město na Moravě

www.pardam.cz

A brief description of the Company

Pardam s.r.o. was founded in 1997. The Company produces nanofibre materials based on organic and inorganic substances. The materials are produced using a unique technology based on the power spinning technology that uses centrifugal forces.

Nanofibre polymer membranes based on PA6, PUR and PAN polymers are the most commonly used as filtration membranes in liquid and gas environments. Inorganic nanofibre materials based on TiO_2, SiO_2, Al_2O_3, ZrO_2, LTO, CeO_2, ITO materials are used in industrial applications such as composite materials, catalysts, batteries, gas sensors, and solar or fuel cells.

Pardam products are distributed world–wide by its exclusive sales and marketing partner Kertak Nanotechnology s.r.o.

Number of employees: 9

Annual turnover: CZK 8 million (2011)

Responsible persons

- Daniel Možíš – executive officer and general director

4.2.90 PILANA TOOLS KNIVES, S.R.O.

Nádražní 804 Hulín 76824, I.D. 48530115

www.pilanamarket.cz

A brief description of the Company

Manufacturing and sales of tools, service of machining tools for wood and plastics, custom tool manufacturing.

Number of employees: 173

Annual turnover: CZK 446.7 million (2010)

Activity in nanotechnologies

Participation on the project described below:

- Project MIT FR–TI3/373 – "Research and Development of new subledeburitic steel for wood working with improved performance," 2011–2014; Principal investigator: Ing. Jiří Krejčík, Co–principal investigator for PILANA TOOLS Knives s.r.o.: Ing. Zdeněk Kolář

Responsible person

- Tomáš Čudrnák – director and executive officer

4.2.91 PILSEN TOOLS S.R.O.

Tylova 57 Pilsen 3 31600, I.D. 25237314

www.pilsentools.cz

A brief description of the Company

The company originated in 1999 as ŠKO–TOOLS s.r.o., which took over the activities and the employees of the former company, ŠKODA UNITECH s.r.o.In 2005 the Company changed its name to ŠKO–TOOLS Group s.r.o. and since 2008 it has been called PILSEN TOOLS s.r.o. The Company is divided into three divisions; two manufacturing – the Tool Division and Machine Repair Division – and a non–manufacturing one – the Finance Division.

Activity in nanotechnologies

Implementation of the project described below:

- Project MIT FT–TA4/082 – "Development and optimising surface treatment of tools," 2007–2010; Principal investigator: Ing. Josef Fajt, CSc.,PILSEN TOOLS s.r.o., Co–principal investigators: Ing. Jaroslav Číp, Ionbond CzechCoating s.r.o. and RNDr. Ivo Štěpánek, University of West Bohemia in Pilsen/Faculty of Mechanical Engineering

Responsible person

- Ing. Petr Jícha – executive officer

4.2.92 POULEK SOLAR S.R.O.

Eliášova 327/12, 160 00 Prague 6, I.D. 65416791

www.solar–trackers.com

A brief description of the Company

POULEK SOLAR s.r.o. was established in 1994; it manufactures and supplies chiefly non–movable and movable stands for solar energy collectors.

Number of employees: 0 (2011)

Annual turnover: CZK 6.6 million (2011)

Activity in nanotechnologies

Cooperation on the project described below:

- Project 7FP EU SME Thematic Priority, Project name: ORION – "Optimization of Si solar cells, plastic materials and technologies for the development of more efficient concentration photovoltaic systems", 2008–2011; 6 partners from 4 countries, Project budget: EUR 2.92 million, Coordinator: Franco Rasello, Integra Renewable Energies Srl., POULEK SOLAR spol. s r.o. was a partner in the project.

Responsible person

- Ing. Vladislav Poulek – executive officer and majority owner of the company

4.2.93 PRIMECELL A.S.

Koněvova 2660/141 Prague 3 13083, I.D. 27660320

www.primecell.cz

A brief description of the Company

PrimeCell a.s. was established in 2007. The Company focuses on applications involving autologous and allogeneic human body cells and on the development of material product engineering (mostly with the use of nanotechnology), which are suitably combined. The key areas of interest for the PrimeCell Group are medical products for modern therapy, including tissue engineering products, somatic cell and gene therapy. In 2010 PrimeCell held manufacturing know–how for 52 products in the area of modern therapy and bio–implantology.

Number of employees: 3 (2010)

Annual turnover: CZK 1.69 million (2009)

Activity in nanotechnologies

Development of polymer nanomaterials for patient treatment and cooperation on the project described below.

- Project MIT FR–TI3/605 – "Bio–Nano–mat II – second generation nanomaterials for biomedicine," 2011–2012; Principal investigator: Ing. Jakub Schůrek, PhD. MBA, Co–principal investigator: Ing. Marcela Munzarová, ELMARCO s.r.o.

Responsible persons

- Ing. Josef Heller, MBA – chairman of the board of directors
- Ing. Jakub Schůrek, MBA – director

4.2.94 PRO–AQUA CZ, S.R.O.

Hrnčířská 56/12, Ústí nad Labem–město 400 01, I.D. 25471406

www.pro–aqua.cz

A brief description of the Company

PRO–AQUA CZ, s.r.o. was formed in 2003; it specialises in supply and assembly of technological units and equipment for wastewater and drinking water treatment.

Number of employees: 12 (2011)

Annual turnover: CZK 51.6 million (2011)

Activity in nanotechnologies

Work on the project described below:

- Project TA CR TA01021764 – "Modified biomass carriers for wastewater treatment," 2011–2014; Principal investigators: Ing. Libor Novák, Vladimír Janeček, Dr. Ing. Radovan Šorm, Co–principal investigators: Ing. Tomáš Lederer, Ph.D., Ing. Libor Polách, Aquatest a.s., RNDr. Alena Ševců, Ph.D., Technical University of Liberec

Responsible person

- Dr. Radovan Šorm – executive officer

4.2.95 PROGEO, S.R.O.

Tiché údolí 113, Roztoky u Prahy 252 63, I.D. 49551019

www.1progeo.cz

A brief description of the Company

PROGEO, s.r.o. specialises in designing, evaluating and implementing hydrological and hydrogeological projects, including groundwater protection, optimising operation of catchment territories, evaluating and optimising contaminated groundwater rehabilitation work, applying mathematical models, calculating mineral deposit reserves, conducting hydro–geologic calculations related to opening and closing mining projects, etc.

Number of employees: 9

Annual turnover: CZK 4.70 million (2011)

Activity in nanotechnologies

Participation on the project described below:

- Project TA CR TA01020348 – "Reversible storage of energy in the rock massif," 2011–2014; Principal investigators: Mgr. Michal Vaněček, Mgr. Jana Michálková, RNDr. Dagmar Trpkošová, ISATech, s.r.o., Co–principal investigator for PROGEO: Ing. Jan Uhlík

Responsible person

- Ing. Jan Uhlík Ph.D. – executive officer

4.2.96 PROSPON S.R.O.

Jiřího Voskovce 3206, 272 01 Kladno, I.D. 45145466

www.prospon.cz

A brief description of the Company

ProSpon s.r.o. focuses on the development and distribution of implants and tools for orthopaedics, traumatology and surgery. In its development work the company cooperates with many scientific institutions Czech Technical University in Prague/Faculty of Mechanical Engineering/ Institute of Solid Mechanics, Biomechanics and Mechatronics, Charles University in Prague/1st Faculty of Medicine, several institutes of Academy of Science CR and others.

Number of employees: 26

Annual turnover: CZK 38.2 million (2011)

Activity in nanotechnologies

Cooperation on the project described below:

- Project MIT FR–TI3/088 – "Development of implants, tools and fixators with antibacterial coating on the basis of nanostructured surfaces," 2011–2013; Principal investigator: Ing. Zdeněk Čejka, ProSpon, spol. s r.o., Co–principal investigators: Ing. Jaroslav Přidal, CSc., MIKROPUR s.r.o., MUDr. Lucie Bačáková, CSc., Institute of Physiology AS CR .
- Competence Centre Project TE01020390 – "Centre of the development of advanced metallic biomaterials for medical implants," 2012–2018; Cooperation with the following institutions: Institute of Chemical Technology, Prague/Faculty of Chemical Technology, BEZNOSKA, s.r.o., LASAK, spol. s r.o., První brněnská strojírna Velká Bíteš, a. s., S.A.M. Holding s.r.o., and UJP PRAHA a.s.

Responsible person

- Ing. Zdeněk Čejka – executive officer and company director

4.2.97 PROTEIX S.R.O.

Nad Safinou II 365, Vestec, 252 42 Jesenice, I.D. 27386091

www.proteix.cz

A brief description of the Company

The firm (founded in 2005) manufactures highly pure and biologically active recombinant proteins.

Number of employees: 5

Annual turnover: CZK 1.1 million (2010)

Activity in nanotechnologies

- Project of AS CR, "Nanotechnology for Society" programme, KAN200520702– "Nanoimmunosensors for cytokine detection," 2007–2011; Principal investigator: Ing. Peter Šebo, CSc., Biotechnology Institute of AS CR, Prague, Co–principal investigator for Proteix: Ing. Jiří Špička.

Responsible person

- Ing. Jiří Špička – executive officer

4.2.98 RADANAL S.R.O.

Okružní 613, 530 03 Pardubice, I.D. 49813994

www.radanal.cz, www.indc.cz

A brief description of the Company

The firm focuses on applications of separation methods and electrochemistry applied in monitoring the effects of natural substances and nutrition on human health. It studies the catalytic effect of nanoporous graphite in oxidation simulation of substances with potential biological activity for predicting their oxidation stability and antioxidative properties.

Number of employees: 10

Annual turnover: CZK 5 million (2011)

Activity in nanotechnologies

- Project AS CR, "Nanotechnology for Society" programme, KAN208130801 – "New design and exploiting nanobiosensors and nanosensors to target medicine (NANOSEMED)," 2008–2012; Principal investigator: Ing. Jaromír Hubálek, Ph.D., Brno University of Technology/Faculty of Electrical Engineering and Communication, Co–principal investigator for RADANAL: as.prof. Ing. Aleš Horna, CSc.

Responsible person

- as.prof. Ing. Aleš Horna, CSc. – executive officer, chemist – physical organic chemistry

4.2.99 REFLEX s.r.o.

Novodvorská 994, 142 21 Prague 4 – Braník, I.D. 25082124

www.reflex–co.cz

A brief description of the Company

REFLEX s.r.o. focuses on development and manufacturing of precision X–ray instruments for industrial and scientific applications. REFLEX is a subsidiary of the British company, Bede plc.

Activity in nanotechnologies

Cooperation on the projects described below

- Project AS CR, "Nanotechnology for Society" programme, KAN300100702 – "Creating and probing nanostructures with X–ray lasers," 2007–2012; Principal investigator: Ing. Bedřich Rus, Dr., Institute of Physics AS CR, Prague, Co–principal investigator for REFLEX: as.prof. PhDr. Ing. Ladislav Pína, DrSc.
- Project AS CR, "Nanotechnology for Society" programme, KAN401220801 – "Nanostructures of controlled size and dimensions," 2008–2012; Principal investigator: prof. Ing. Pavel Fiala, CSc., Czech Technical University in Prague/ Faculty of Nuclear Sciences and Physical Engineering, Co–principal investigator for REFLEX: as.prof. PhDr. Ing. Ladislav Pína, DrSc.
- Project MIT, TANDEM programme, FT–TA3/112 – "X–ray multilayer mirrors replication technology," 2006–2009; Principal investigator: as.prof. PhDr. Ing. Ladislav Pína, DrSc.

Responsible person

- as.prof. PhDr. Ing. Ladislav Pína, DrSc. – executive officer

4.2.100 RICARDO PRAGUE S.R.O.

Thámova 11–13/289 Prague 8 18600, I.D. 27160572

www.ricardo.com

A brief description of the Company

Ricardo Prague s.r.o. has been active since 2005 and focuses on research and development of technical solutions for the automotive industry, such as the design of engines, transmissions and vehicles and technical calculations. The company is 100% daughter company of the British Ricardo Consulting Engineers, Ltd.

Number of employees: 129 (2010)

Annual turnover: CZK 199 million (2010)

Activity in nanotechnologies

Participation in the project described below

- Project MIT FT–TA3/106 – "The creation of a know–how database for handling the design, technology and production of next generation piston rings," 2006–2008; Principal investigator: Ing. Petr Mašek, Buzuluk, Co–principal investigator for Ricardo Prague: Ing. Vladimír Volák

Responsible person

- Ing. Vladimír Volák – executive officer

4.2.101 ROKOSPOL A.S.

Registered address: Krakovská 1346/15, 110 00 Praha–Nové Město, I.D. 25521446

Manufacturing facility: Kaňovice 101, 763 41 Biskupice u Luhačovic

www.rokospol.cz

A brief description of the Company

ROKOSPOL a.s. is a Czech manufacturer of construction compounds and paints. The Company conducts its own research and development.In 2012 the company built a new facility in Kaňovice where is concentrated production of a photocatalytic paints, research and development center of paints and of construction chemicals as well as a testing center.

Number of employees: 77

Annual turnover: CZK 133.5 million (2009)

Activity in nanotechnologies

Using nanoparticles in construction compounds and paints to improve their useful qualities.

Projects implemented in nanotechnologies

- Project MIT FI–IM4/175 – "Research and development of dispersion carrier in water–free environment for the new line of ecologic coating compounds," 4/2007–10/2009; Principal investigator: PhDr. Antonín Kočař, CSc.
- Project MIT IMPULS Programme, FI–IM5/231 – "Development of new nanostructures based on nanodispersive oxo–bisulphides Ti, Cd, Zn as active materials for degradation of warfare agents," 6/2008–12/2010; Principal investigator: Mgr. Václav Štengl, Ph.D., Inorganic Chemistry Research Institute, AS CR, Husinec – Řež, Co–principal investigator for ROKOSPOL: PhDr. Antonín Kočař, CSc.

Results/Cooperation

The development of the **Detoxy Color**– a product which causes active reduction in harmful substances in atmosphere using photo–catalytic reaction. The product was developed in colaboration with the Inorganic Chemistry Research Institute, AS CR. More specifically it is the application of spherical nanodispersion particles of TiO_2.

Responsible person

- Ing. Pavel Kaszonyi – general director

4.2.102 SAFIBRA, S.R.O.

Černokostelecká 1621, 251 01 Říčany, I.D. 25787012

www.safibra.cz

A brief description of the Company

SAFIBRA, s.r.o. specialises in research and development in the area of optics, in particular of optical fibre sensors and systems.

Number of employees: 11

Annual turnover: CZK 26.3 million (2011)

Activity in nanotechnologies

Participation in the project described below:

- Project 7FP EU SME, NMP Thematic Priority, Project name: I–PROTECT – "Intelligent PPE system for personnel in high risk and complex environments," 2009–2013; 16 partners from 7 countries, Project budget: EUR 3.6 million, Coordinator: Katarzyna Buszkiewicz–Seferynska, Cenetralny Institut Ochrony Pracy–Panstwowy Institut Badawczy (Poland), SAFIBRA, s. r.o. is a partner in the project.

Responsible person

- Ing. Ladislav Šašek, CSc. – executive officer

4.2.103 SEVAPHARMA A.S.

Průmyslová 1472/11, 102 19 Prague 10 – Hostivař, I.D. 25107305

www.sevapharma.cz

A brief description of the company

A manufacturer of preparations, diagnostics and hyposensitization allergens, Immodin –a normalising preparation for weakened immunity, as well as bacterial and virus vaccinations – mostly those which are used in mandatory immunisation of children.

Number of employees: 34 (2010)

Annual turnover: CZK 23.1 million (2010)

Activity in nanotechnologies

- Project AS CR, programme Nanotechnology for Society Programme – KAN200520704 "New nanoparticles for ultrastructural diagnostics," 01/2007–12/2011; Principal investigator: as.prof. RNDr. Pavel Hozák, DrSc., Institute of Molecular Genetics As CR, Prague, Co–principal investigator for SEVAPHARMA: RNDr. Marek Moša, Ph.D.

Responsible person

- Ing. Tibor Bílý – executive director

4.2.104 SHM, s.r.o.

Průmyslová 3020/3, 787 01 Šumperk, I.D. 47976519

www.shm–cz.cz

A brief description of the company

SHM, s.r.o. is a coating centre, which focuses on applying abrasion resistant coating on cutting, forming, pressing, sheer–cutting, forms for pressure–casting of aluminium and components for automotive industry. It applies nanolayer and nanocrystal PVD coatings.

Number of employees: 70

Annual turnover: CZK 83 million (2011)

Activity in nanotechnologies

Research and development of nanostructured and nanocomposite abrasion resistant layers prepared with the use of PVD technology, development and design of equipment for nanostructured PVD coating application.

Research and development achievements in nanotechnology

- Applied nanostructured coating on several million of replaceable blade plates and several hundred thousand spindle tools
- SHM designed coatings were brought to the manufacturing process and introduced on the market as part of the EU 6FP EU MACHERENA project, – "New tools and processes for improving machining of heat resistant alloys used in aerospace applications," 1/2004–6/2007;

Responsible persons/experts

- RNDr. Pavel Holubář – coating development and company director
- Mojmír Jílek – coating technology development and research and development manager
- RNDr. Michal Šíma – coating development

4.2.105 SINBIO, S.R.O.

Na Baštách 1, 281 23 Starý Kolín, I.D. 24733067

www.sinbio.cz

A brief description of the company

SinBio, s.r.o. focuses on research and development of applications in the area of regenerative medicine, especially in cell therapy and tissue engineering application. It is a non–consolidated member of the Sindat Group.

Number of employees: 5

Annual turnover: CZK 3 million (2011)

Activity in nanotechnologies

Research and development in the area of tissue engineering with the use of nanofibres.

Responsible person

- Ing. Karel Havlíček, Ph.D, MBA – chairman of the board of directors

4.2.106 SOLARTEC SPOL. S.R.O.

Televizní 2618, 756 61 Rožnov pod Radhoštěm, I.D. 49610040

www.solartec.cz

A brief description of the company

Solartec spol.s r. o. has specialised in photovoltaic applications since its foundation in 1993 by the employees of the former Tesla company. Besides manufacturing solar cells and panels from monocrystalline silica the company also designs and manufactures photovoltaic systems and power generation facilities (FVS, FVE), supplies photovoltaic panels and components, provides solutions in powering industrial applications and brings electric power to locations without access to the power grid.

Number of employees: 63

Annual turnover: CZK 2,000.00 million (2010)

Activity in nanotechnologies

Cooperation on the project described below:

- Project 7FP EU SME Large, NMP Thematic Priority, Project Name:“N2P Flexible production technologies and equipment based on atmospheric pressure plasma processing for 3D nano structured surfaces,” 2008–2012; 22 partners from 8 countries, Project budget: EUR 10.47 million, Coordinator: Walter Krause, Fraunhofer–Gesellschaft zur Foerderung der Angewandten Forschung E. V (Germany), Solartec spol. s r.o. is a partner in the project.
- Project AS CR, Nanotechnology for Society Programme KAN100500652 – “Heterogeneous and hybrid nanocomposite materials for solar cells,” 07/2006–12/2010; Principal investigator: RNDr. Jiří Pfleger, CSc., Institute of Macromolecular Chemistry AS CR, Co–principal investigator for Solartec: Dr. Ing. Aleš Poruba, Dr.

Responsible persons

- Dr. Ing. Aleš Poruba, Dr. – development
- Ing. Jaromír Řehák – executive director

4.2.107 SINTEX A.S.

Moravská 1078, 560 02 Česká Třebová, I.D. 25298496

www.sintex.cz

A brief description of the company

In 2009 SINTEX a.s. merged with its sister company, Spolsin s.r.o.The Company focuses on research, development and manufacturing of technical textiles (woven and knit) with antibacterial properties aimed mainly towards the protection of human health and the material itself. The Company participates in verification of processability and searching for suitable applications for nano–modified fibres and nanofibre materials.

Number of employees: 113

Annual turnover: CZK 197.7 million (2011)

Activity in nanotechnologies

Development of barrier textile with high efficiency of UV ray, microbial and other protection; participation in implementation of the research projects defined below:

- Project MIT FT–TA4/134 – "New multifunctional textile for health care," 2007–2009; Principal investigator: Ing. Jan Marek, CSc., Inotex s.r.o., Co–principal investigator for Spolsin (now SINTEX): Ing. Zdeněk Hroch, Ph.D.
- Project EUREKA E! 3778, MANGO Programme – "Managing contamination by fibrous product systems," 1/2007 –1/2010; Coordinator and Principal investigator: VTT, Technical Research Centre of Finland, 10 participants, Spolsin (now SINTEX) is a project co–researcher.

Achievements in nanotechnology research and development

- Complete product: antibacterial textile with increased UV protection

Responsible person

- Ing. Jaromír Kašpar – chairman of the board of directors

4.2.108 STARMANS electronics, s.r.o.

V Zahradách 24,180 00 Prague 8, I.D. 49705733

www.starmans.net

A brief description of the company

STARMANS electronics, s.r.o. is a engineering and supply company focused on development and manufacturing of ultrasound systems and chiefly ultrasound probes, thickness–meters, defectoscopic devices and automated defectoscopic lines.

Number of employees: 40

Annual turnover: CZK 99 million (2005)

Activity in nanotechnologies

Coordination of research work conducted within the framework of the projects listed below; participation in implementation of the research projects defined below:

- Project MIT, "Sustainable Prosperity" programme, 2A–2TP1/147 – "Research and semiconductive nanotubes for implementation of photoelectric components," 5/2007–12/2011; Principal investigator: Ing. Stanislav Štarman, Ph.D.
- Project MIT, "Sustainable Prosperity" programme, 2A–1TP1/092 – "Researching preparation of nanoforms of layered piezoelectrics for high–temperature ultrasound converters," 7/2006–12/2011; Principal investigator: Ing. Stanislav Štarman, PhD.
- Project MIT, TANDEM programme, FT–TA4/126 – "Research of semiconductive nanotubes for implementation of cold emission components," 1/2007–12/2010; Principal investigator: Ing. Stanislav Štarman, Ph.D.

Responsible person

- Ing. Stanislav Štarman, Ph.D. – executive officer

4.2.109 SVCS PROCESS INNOVATION S.R.O.

Optátova 37, Brno–Jundrov, 637 00, I.D. 27711170

www.svcs.cz

A brief description of the company

SVCS Process Innovation s.r.o. designs and manufactures furnaces for the semiconductor and photovoltaic industry.

Number of employees: 23 (2010)

Annual turnover: CZK 25.4 million (2010)

Activity in nanotechnologies

Work on the project described below:

- Project TA CR TA01011740 – "Hybrid high–density low–temperature microwave plasma sources in matrix configuration suitable for growth of advanced materials and their (nano) composites on 2D and 3D substrates," 2011–2014; Principal investigators: Ing. Anton Piják, Ing. Jaroslav Dolák, Ing. Pavel Martinek and Ing. Jiří Pitrun from SVCS Process Innovation s.r.o., Co–principal investigators: Ing. Alexander Kromka, Ph.D., Mgr. Martin Čada, Ph.D., Mgr. Zdeněk Hubička, Ph.D., RNDr. Lubomír Jastrabík, CSc. RNDr., Vítězslav Straňák, Ph.D., Institute of Physics AS CR

Responsible person

- Ing. Jaromír Dolák – executive director

4.2.110 TECHNISTONE, A.S.

Bratří Štefanů 1070 Hradec Králové 50003, I.D. 25932080

www.technistone.eu

A brief description of the company

Technistone, a.s. is a manufacturer of conglomerated stone used for kitchen counters, wall and floor tiling, window sills, etc. The hardened Technistone® stone is 90% comprised of natural materials – mostly quartz and granite. Additional components are resin, colour pigments and selected additives.

Number of employees: 182

Annual turnover: CZK 457 million (2010)

Activity in nanotechnologies

Participation on the project described below

- Project MIT FR–TI1/302 – "Engineered stone and its functional surface treatments," 2009–2012; Principal investigator: Ing. Jiří Ludvík, Co–principal investigators: Ing. Lubomír Kubáč, Centre for Organic Chemistry Ltd., Ing. Libor Mastný, CSc. – Institute of Chemical Technology, Prague/Faculty of Chemical Technology

Responsible person

- Ing. Michal Tamchyna – chairman of the board of directors

4.2.111 TECHNOLOGIE A INOVACE O.S.

Davídkova 987/123, 180 00 Prague 8, I.D. 27000656

www.transfertechnologii.eu

A brief description of the company

A civic association focused on the support and implementation of technology transfer, innovation in industrial companies and support of education in the area of innovation.

Projects implemented in nanotechnologies

- Project 7FP EU Network, KBBE Thematic Priority, Project name: HIGHTECH EUROPE – "European network for integrating new technologies for food processing," 2009–2013; 22 partners from 10 countries, Project budget: EUR 704 million, Coordinator: Volker Heinz, Deutches Institut Fur Lebensmitteltechnik (Germany), Technologie a inovace is a partner in the project.
- Transfer of technology and development of new principles of manufacturing nanofibres and their application.Cooperation with the Research Institute of Food Industry Prague

Responsible person

- Ing. Miloš Beran – head of the nanostructured materials development project

4.2.112 TERMIZO A.S.

Dr. Milady Horákové 571, 460 06 Liberec, I.D. 64650251

www.termizo.mvv.cz

A brief description of the company

TERMIZO a.s. focuses on processing of waste and heat and power generation.

Number of employees: 38

Annual turnover: CZK 264 million (2010)

Activity in nanotechnologies

Development of technology for manufacturing nanofilters to separate solid pollutants.

Projects implemented in nanotechnologies

- Project MIT FR–TI1/457 – "Research and development of filtration nanomaterials – reduction of flue gases and other industrial emissions," 2009–2012; Principal investigator: prof. Dr. Ing. Jiří Maryška, CSc., Co–principal investigator for ECOTEX Ing. – Martin Šprync, Co–principal investigator for TERMIZO a.s. Ing. Petr Novák

Responsible person

- Ing. Pavel Bernát – chairman of the board of directors

4.2.113 TESCAN, A.S.

Libušina tř. 21, 623 00 Brno, I.D. 41600240

www.tescan.com

A brief description of the Company

TESCAN is a modern company focused on the development, production and sale of scanning electron microscopes, accessories for microscopes and software. It is a supplier of individual instruments, systems and solutions for a wide variety of applications, often designed to meet clients' special requirements.

Number of employees: 165

Annual turnover: CZK 660 million (2011)

Activity in nanotechnologies

Development and production of instruments and workstations for visualisation and analysis of nano objects, nano fabrication of ion beams, nano manipulation.

Projects implemented in nanotechnologies

- **Project 7FP EU Project name: "UnivSEM – Universal SEM as a Multi–nano analytical tool,"** 2012 –2015; 8 partners from 3 countries, **Coordinator: IngJaroslav**

Jiruše, PhD., TESCAN, a.s. Partners in the project: TOFWERK AG (Switzerland), Swiss Federal Laboratories for Materials Testing and Research – EMPA (Switzerland), Max Planck Institute for the Science of Light (Germany), SPECS Surface Nano Analysis GmbH (Germany), BUT, AMIRES Sárl (Switzerland), WITec Wissenschaftliche Instrumente und Technologie GmbH (Germany).

- Project –7FP EU SME type, NMP thematic priority, project name:"FIBLYS – Multi–functional Analytical Focused ion beam tool for nanotechnology," 2008–2011; 8 partners from 4 countries, Coordinator: Frank Sondermann, Institut fur Photonische Technologien E.V. (Germany); TESCAN was a partner in the project.

- Project MIT FR–TI2/756 – "Advanced automated nano structuring using electron and ion beams," 2010–2012; Principal investigator: Ing.Martin Zadražil, PhD.

- Project MIT FR–TI2/736 –"Modular scanning electron microscopy," 2010–2014; Principal investigator: Ing.Jaroslav Jiruše, PhD., Co–principal investigators: Ing. Alexander Kromka, Ph.D., Institute of Physics AS CR, prof. RNDr. Tomáš Šikola, CSc.,Brno University of Technology/Faculty of Mechanical Engineering

- Project MIT FR–TI4/660 – "Multimodal holographic microscope," 2012–2014; Principal investigator: TESCAN, a.s., Partners in the project: Brno University of Technology and the Institute of Molecular Genetics AS CR

- Project Ministry of Interior VG20102015065 – "Introduction of field ion microscopy techniques (FIB) into forensic casework and expert practices of the Police of the Czech Republic for analysis of traces in graphic, physicochemical and technical expertise," 2010–2015; Principal investigator: Institute of Criminology, Partners in the project: TESCAN, a.s. and Charles University in Prague

- Project TA CR TA02011272 – "The development of an interaction chamber for laser–induced breakdown spectroscopy (LIBS)," 2012–2014; Principal investigator: Brno University of Technology, Partner in the project: TESCAN, a.s.

- Project TA CR TE01010233 – "Advanced microscopy and spectroscopy platform for research and development in nano and microtechnologies – AMISPEC," 2012–2019; Principal investigator: Brno University of Technology, Partners in the project: TESCAN, a.s., Institute of Scientific Instruments AS CR, v.v.i., OPTAGLIO, s.r.o., and ON SEMICONDUCTOR CZECH REPUBLIC, s.r.o.

- Project MIRA – the development and implementation of manufacturing of higher resolution REM with Schottky's cathode

- Project LYRA – the development and implementation of manufacturing of equipment with focused electron and ion beams for visualisation, analysis and creation of nano–objects

Results of research and development in nanotechnologies

- MIRA – the manufacture and sale of next–generation high–resolution REM, co–operation with Charles University in Prague

- LYRA – completion of prototype development, cooperation with EMPA – the Swiss research institute

- 3D Live – patent application for a 3D system for nano object imaging
- EBSD electron detection method (2008)
- TIMA – focused beam analysis (2010)
- Equipment for beam imaging (2008)

Responsible person

- Ing. Jaroslav Klíma – chairman of the board of directors

4.2.114 TIMPLANT S.R.O.

Sjednocení 77/1, 725 25 Ostrava–Polanka, I.D. 27857816
www.timplant.cz

A brief description of the Company

The Company focuses on the development and manufacture of dental and veterinary implants and nanoimplants, surgical instruments, accessories and alveolar distraction instruments.

Number of employees: 5

Annual turnover: CZK 4.62 million (2011)

Activity in nanotechnologies

Research and development of bulk nanostructured materials for medical applications, application of nanostructured titanium in the production of dental implants and research and development of technology for the production of nano coatings for dental implants. The development of nanostructured titanium and nanostructured nickel titanium.cal applications.

Projects implemented in nanotechnologies

- Project FP7 EU – ViNaT Project name: "Theoretical Analysis, Design And Virtual Testing of Biocompatibility and Mechanical Properties Of Titanium Based Nanomaterials," 2011–2013; Principal investigator: Dr.Luděk Dluhoš, Timplant s.r.o.
- Project MIT FR–TI1/4150–"Research and development of nanostructured materials for medical applications," 2009–2012; Principal investigator: Ing.Michal Zemko, Ph.D., COMTES FHT a.s., Co–principal investigator for Timplant s.r.o.: Dr. Ing. Luděk Dluhoš

Results of research and development in nanotechnologies

Product – Nanoimplant dental implants, veterinary implants, distracters

Responsible person

- Dr. Ing. Luděk Dluhoš – ownerof the company, research

4.2.115 TOP–BIO, S.R.O.

Jordana Jovkova 3262, 143 00 Prague 4, I.D. 64578895

www.top–bio.cz

A brief description of the Company

The Company is a Czech manufacturer of agents for biochemistry with an accent on complete securing of high quality reagents for amplification of DNA fragments using polymer chain reactions (PCR), the manufacturer of equipment for quick isolation of RNA from cells, tissues and body fluids, and reverse transcription of RNA on cDNA.

Number of employees: <5

Annual turnover: CZK 8.2 million (2010)

Activity in nanotechnologies

Cooperation on implementation of the projects described below:

- Project, AS CR, "Nanotechnology for Society" programme, KAN200520701 – "Nano–PCR – an ultrasensitive test for the detection of specific proteins in body fluids," 1/2007–12/2011, Principal investigator: RNDr.Petr Dráber, DrSc., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for TOP–BIO: Marek Dráber, MBA
- Project AS CR, "Nanotechnology for Society" programme, KAN200520703 – "The use of ultrasound in nanomedicine," 1/2007–12/2011, Principal investigator: as.prof. Ing. Jiří Neužil, CSc., Biotechnology Institute AS CR, Prague, Co–principal investigator for TOP–BIO: Marek Dráber, MBA

Responsible person

- RNDr. Petr Dráber, DrSc.– executive officer and co-owner of the company

4.2.116 TTS, S.R.O.

Novodvorská 994, 142 21 Prague 4, I.D. 48026395

www.tts–co.eu

A brief description of the Company

The Company focuses of development and manufacture of specialised vacuum deposition of metal and dielectric films, starting with thickness of 2 nm, for applications in microelectronics, X–ray optics, sensors etc., ion etching of sputtered films.

Number of employees: 3

Annual turnover: CZK 4.5million (2010)

Activity in nanotechnologies

Special deposition methods enabling the creation of thin films and multi films with subnanometre–structure and layers thicknesses from 2 nm; participation in implementation of research project defined below:

- Project MIT FT–TA2/018 – High–tech energy beam technologies for the deposition and treatment of films for the production of electronics," 1/2005–12/2008; Principal investigator: Ing.Karel Štrobl, ELCERAM a.s., Hradec Králové, Co–principal investigator for TTS: RNDr.Jaroslav Merta, CSc.
- Project MIT FT–TA3/112 – "X–ray multilayer mirror replication technology," 4/2006–12/2009; Principal investigator: as.prof. Ing. Ladislav Pína, DrSc., REFLEX s.r.o., Prague, Co–principal investigator for TTS: RNDr.Jaroslav Merta, CSc.

Experts/field

- Ing. Jaromír Mirovský – vacuum film sputtering
- RNDr. Jaroslav Merta, CSc.– vacuum film sputtering

4.2.117 UJP PRAHA, A.S.

Nad Kamínkou 1345, 156 10 Prague – Zbraslav, I.D. 60193247

www.ujp.cz

A brief description of the Company

The Company is a successor to the ormer Institute of Nuclear Fuels, which was a detached facility of the DIAMO state enterprise. The Company specialises in research, development and production of radiation therapy systems. The core production programme is cobalt irradiator for radiation therapy.In materials engineering, the Company is involved in the development of special alloys and pseudoalloys, it carries out corrosion experiments and analyses, analyses of structure, useful life and safety of technological units.

Number of employees: 86 (2011)

Annual turnover: CZK 261.20 million (2011)

Activity in nanotechnologies

Work on the projects described below

- Project MIT 2A–1TP1/037 "Nuclear power plant safety in the event of LOCA–type emergencies," 2006–2011; Principal investigator: Ing. Olga Bláhová, Ph.D., the University of West Bohemia in Pilsen/Faculty of Applied Science, Co–principal investigator: Ing. Karel Kloc, CSc., UJP Praha a.s.
- Project MEYS OC 103 – Photocatalytic technologies and new nanosurface materials – issues in the application of photocatalytic nanosurface materials in European safety risk resolution," 2006–2009; Principal investigator: Ing. František Peterka, Ph.D.

Responsible persons

- Ing. Josef Čmakal – research and development
- Ing. Karel Kloc, CSc. – chairman of the board of directors

4.2.118 VAKOS XT A.S.

Pernerova 28a, 180 00 Prague 8, I.D. 256 56 180

www.vakosxt.cz

A brief description of the Company

The Company is active in research, development and consulting activities in pharmacy, cosmetics and dietary supplements.

Activity in nanotechnologies

The disinfectant effects of nanoparticles, the use of nanoparticles in dermatology.

Projects implemented in nanotechnologies

- Project MIT FT–TA5/005 – "Advanced types of zeolites and their applications," 2008–2010; Principal investigator: Ing.Věnceslava Tokarová, CSc., Inorganic Chemistry Research Institute, Co–principal investigators: Ing. Josef Konečný, Vakos XT, a.s., and prof. Ing. Jiří Čejka, DrSc., J. Heyrovský Institute of Physical Chemistry AS CR
- Project MIT FR–TI1/548 – "Pilot project for manufacturing of nanoparticles of oxides and mixed oxides of Zr, Ti, Al, Li and Mn," 2009–2012; Principal investigator: prof. Ing. Bohuslav Doležal, CSc., Co–principal investigators: Ing. Josef Konečný, Vakos XT a.s, and Ing. Vladimír Ždímal, CSc.,ICT/Faculty of Chemical Engineering

Responsible person

- Ing. Bohuslav Doležal – chairman of the board of directors

4.2.119 VIDIA SPOL. S.R.O.

Nad Safinou II č. 365, Vestec, 252 42 Jesenice u Prahy, I.D. 16556267

www.vidia.cz

A brief description of the Company

The Company is a Czech manufacturer of diagnostic systems for the detection of the herpes virus and antibody and other biomarkers for research purposes, the design of ELISA tests, their development and optimisation, custom synthesis of peptides for human and veterinary medicine and for research in biochemistry, pharmacology and immunology.

Number of employees: 25

Annual turnover: CZK 37 million (2011)

Activity in nanotechnologies

Cooperation on implementation of the projects described below:

- Project MIT FR–TI1/313 – "New technologies for diagnostics of selected pollutants in the environment," 2009–2012; Principal investigator: RNDr. Alena Forejtová, Ph.D.,

Co–principal investigator for the Institute of Chemical Technology, Prague/Faculty of Food and Biochemical Technology: prof. Ing. Pavel Rauch, DrSc.

- Project, AS CR, "Nanotechnology for Society" programme, KAN200520701 – "Nano–PCR – an ultrasensitive test for the detection of specific proteins in body fluids," 1/2007–12/2011; Principal investigator: RNDr. Petr Dráber, DrSc., Institute of Molecular Genetics AS CR, Prague, Co–principal investigator for VIDIA: Ing. Michaela Poláková

- Project AS CR, "Nanotechnology for Society" programme, KAN200520702 – "Nano immunosensors for cytokine detection," 1/2007–12/2011; Principal investigator: Ing.Petr Šebo, CSc., Biotechnology Institute AS CR, Prague, Co–principal investigator for VIDIA: RNDr. Luděk Lepša, Ph.D.

- Project AS CR, "Nanotechnology for Society" programme, KAN200670701 – "Surface plasmon resonance biosensors and protein arrays for medical diagnostics," 1/2007–12/2011; Principal investigator: Ing. Jiří Homola, CSc., Institute of Photonics and Electronics AS CR, Prague, Co–principal investigators for VIDIA: MUDr. Pavel Jinoch, dr. Bědajánková

Responsible persons

- RNDr. Luděk Lepša, Ph.D. – researcher

- Ing. Michaela Poláková – executive officer

4.2.120 VODNÍ ZDROJE CHRUDIM, S.R.O.

U Vodárny 137, Chrudim 53701, I.D. 15053865

www.vz.cz

A brief description of the Company

The Company has been active in water management and environmental protection.

Number of employees: 25

Annual turnover: CZK 33.8 million (2011)

Activity in nanotechnologies

Work on the project described below:

- Project TA CR TA01010552 – "The use of membranes with nanopores to reduce the health risks of VOCs from small water sources," 2011–2013; Principal investigators: Ing. Lubomír Kříž, Ph.D., Ing. Marek Čáslavský, Ph.D., Co–principal investigators: MUDr. Magdalena Zimová, CSc. National Institute of Public Health in Prague, prof. RNDr. Pavel Danihelka, CSc., Mining University – Technical University Ostrava/Faculty of Safety Engineering, prof. Ing. Zdeňka Wittlingerová, CSc., Czech University of Life Sciences, Prague/Faculty of Environmental Science

Responsible person

- Ing. Lubomír Kříž – executive officer

5. OTHER ORGANISATIONS

5.1 THE CZECH SOCIETY FOR NEW MATERIALS AND TECHNOLOGIES

Novotného lávka 5, 116 68 Prague, ID: 49370626

www.csnmt.cz

A brief description of the Society

The Czech Society for New Materials and Technologies (CSNMT), founded in 1993, is a voluntary association of individual members and institutions which have a registered address in the Czech Republic. It is governed by its own by laws.Since 1993, CSNMT has been a member of the Federation of European Materials Societies (FEMS), which associates 22 materials companies from 22 European countries. Since 2004, CSNMT has also been a member of the Czech Association of Scientific and Technical Societies (CSVTS), which is a voluntary association of over one hundred scientific entities in the Czech Republic.

The activity of CSNMT is focused on developing the creative and professional skills of its members, expanding scientific and technical development in the area of new materials and technologies, including their applications in manufacturing, and on supporting international cooperation. The president of the association is as.prof.Ing. Karel Šperlink, CSc., FEng.

Activity in nanotechnologies

Within CSNMT there is a Section of Nanosciences and Nanotechnology (www.csnmt.cz/nano), which has 140 members. The manager of the section is Ing. Jiřina Shrbená.

Organisation of professional conferences, seminars and lectures

- Since 2009, in cooperation with Tanger s.r.o., CSNMT has organised the **NANOCON international conference** (www.nanocon.cz). The third annual conference, which took place in Brno on 21 – 23 September 2011 in the Voroněž Hotel, was co–organised with tha participation of the Regional Centre of Advanced Technologies and Materials at the Palacký University Olomouc and was attended by 355 experts from 28 countries. NANOCON has become an important event of its kind in the Central European Region. In 2012 this conference will take place on 23 – 25 October in Brno. Participation of 370 experts from 32 countries is expected. The NANOCON conference follows in the tradition of the NANO Conference, which was organised from 2002 – 2005 at the Brno University of Technology/Faculty of Mechanical Engineering.

- The implementation of Project Ministry of Education, Youth and Sports LA09045 – "Participation of the CSNMT in support of research of nanotechnology and nanomaterials in the European Union", 2009–2012, Project manager: Ing. Jiřina Shrbená. Thanks to the project CSNMT has been engaged in an international dialogue on responsible nanotechnology research and EU level standardisation. One of the project's focuses is also mapping nanotechnology research and its use in the Czech Republic.

- Participation in the activities of the European Initiatives, MNT ERA NET (2006–2008) and MNT ERA NET II (2009–2011) within the framework of the 6FP EU and 7 FP EU as one of the 24 members of the European consortium. Since 2007, despite persisting ambiguity about government support of ERA NET research in the Czech Republic, 8 research projects in basic and applied research created within the MNT ERA NET II initiatives with the participation of the total of 11 Czech organisations were implemented.

Publishing activity

- The publication "Nanotechnologies," Authors: Ing. Tasilo Prnka, DrSc. and as.prof. Ing. Karel Šperlink, CSc., 2004, ISBN 80–7329–070–7

- The publication "Nanotechnologies in the Czech Republic 2005," Authors: Ing. Libor Kraus, as.prof. RNDr. Jitka Kubátová, CSc., Ing. Tasilo Prnka, DrSc., Ing. Jiřina Shrbená and as.prof. Ing. Karel Šperlink, 2005, ISBN 80–7329–111–8

- The publication "Nanotechnologie v České republice 2008," Authors: Ing. Tasilo Prnka, DrSc., Ing. Jiřina Shrbená and as.prof. Ing. Karel Šperlink, 2008, ISBN 978–80–7329–187–7

- The publication "Nanotechnologies in the Czech Republic 2008," Authors: Ing. Tasilo Prnka, DrSc., Ing. Jiřina Shrbená and as.prof. Ing. Karel Šperlink, CSc., FENg., 2008, ISBN 978–80–7329–193–8

6. EDUCATION IN NANOTECHNOLOGIES IN THE CZECH REPUBLIC

Nanotechnologies are considered to be one of the most important technologies for the 21st century, since they can solve many of today's problems using ultra–small, light, faster, efficient and more effective materials, components and systems, which often work on completely new principles. For the full potential of nanotechnologies to be utilised, qualified professionals are necessary in this cross–disciplinary field, besides research and development of new products and educational techniques. At the present time nanotechnologies must be understood as a field which combines the natural sciences with technical and biomedical fields to achieve new, non–traditional solutions. Education in nanotechnologies consequently requires, more than in other disciplines, an interdisciplinary approach and the education of experts who are knowledgeable in a variety of disciplines, which until now have been taught separately.At the same time educational activities must include, besides scientific knowledge, training and education related to respecting the health, environmental, safety, ethical, legal and social risks connected with research and use of nanotechnologies.

The first steps in the field directly focusing on education in nanotechnologies were not noted in the Czech Republic until 2005. In other words, there was a certain delay in comparison with certain countries in Western Europe or the USA. In the past few years, however, practically all the institutes of higher learning in the Czech Republic which are focused on science and technology have applied for the accreditation of a study programme related to nanotechnologies.

The first university in the Czech Republic to acquire accreditation of a three–year bachelor's and two–year master's programme in nanotechnologies was the **Mining University – Technical University of Ostrava** (http://nanotechnologie.vsb.cz). The "Nanotechnology" study programme was launched in the 2007/2008 academic year, in Czech and in English. The bachelor's degree programme provides a foundation in mathematics, physics and chemistry and an overview of nanosciences and nanotechnologies. The master's programme offers a deeper look at the electronic structures of materials, optical and magnetic properties and new experimental methods in chemical or physical specialisation. Graduates can continue in the integrated doctoral study programme.

The study is based on scientific disciplines (in particular physics and chemistry) and engineering approaches and takes advantage of the personnel and laboratory facilities of the participating subjects. The basic goal of the Nanotechnology study programme is to familiarise students with the revolutionary properties of nanostructures, nanoparticles and nanoinstruments and their possible applications in the near future within three basic modules:

1) Technologies of nanostructured materials, their preparation and synthesis,
2) Application of nanostructures in optics, magnetism, chemistry, electronics and mechanics,
3) Diagnostics and measurement techniques for nanomaterial characterisation.

The following TUO institutes participate in the realisation of the study programmes:

The Institute of Physics at the Faculty of Mining and Geology and the Centre for Nanotechnology University Institute, which guarantee most of the subjects, as well as the institutes and departments from the Faculty of Machine Engineering, the Faculty of

Metallurgy and Material Engineering, and the Faculty of Electrical Engineering and Informatics.

At the **CzechTechnical University in Prague – Facultyof Nuclear Science and Physical Engineering** (http://kfe.fjfi.cvut.cz) the "**Physics of Nanostructures**" major was created in 2005in the "Physical Electronics" master's study programme together with other departments at CTU and institutes of AS CR.The guarantor of this specialisation is the Department of Physical Electronics at the CTU Faculty of Nuclear Science and Physical Engineering. Employees from the Institute of Physics AS CR also take part in teaching. Students have the opportunity to participate in research tasks of the Institute of Physics mainly as part of work on master's and doctoral theses.

This specialisation builds on the preceding bachelor's study in Physical Engineering.Integrated doctoral study is available to graduates in "Physical Engineering and Applied Physics." Practically all subjects approach nanotechnologies, primarily from the perspective of physics.

In the master's study programme, students expand their theoretical and experimental knowledgein quantum physics, solid state physics and optics to the field of spatially limited systems such as nanostructures, particularly nanoparticles. Students further acquire a broad knowledge in fieldsclosely connected with these, such as optics (photonics), nanoelectronics, including characterisation methods of nanoscopy and measuring etc. The study is connected with acquiring advanced practical experience and a system of visiting top–level workplaces in the field, particularly in Prague. Graduates with engineering degrees can find applications for their degrees in research as well as in the modern, developing nanoindustry and healthcare industry.

At the **Czech Technical University in Prague – the Faculty of Electrical Engineering** (http:/www.fel.cvut.cz) the **Nanotechnology course** has been mandatory since 2009 in Czech and in English in the "Electronics" master's study programme. Lectures and assignments in this course are put together with consideration for multidisciplinarity. In the integrated doctoral programme in the "Materials and Electrotechnology" or "Electronics" fields, it is possible to become involved in projects focusing on nanotechnologies.

At the **Czech Technical University in Prague – the Faculty of Mechanical Engineering** (http://www.fs.cvut.cz) the new **Nanotechnology course** has been taught since the 2005/2006 academic year. Instruction is organised by the Precision mechanics and optics division at the Department of Instrumentation and Control Engineering. The goal of the Nanotechnologies course is to prepare Faculty of Mechanical Engineering graduates to work in the field of nanotechnologies and technologies related to it in science, technology and practice. The course's goal is for students to acquire a sense of what nanotechnologies are and what they represent, how to create nanomaterials and measure them, and where one can expect to use and apply them in practice. This is all with an emphasis on the possibilities, products and applications of mechanical and optical elements, as a further expansion of precision mechanics in the direction of smaller dimensions.

At the **Czech Technical University in Prague – the Faculty of Biomedical Engineering** (http://www.fbmi.cvut.cz) a new Nanotechnologycourse is being offered to students in the Instruments and methods for biomedicine master's study programme. The Department of Sciences organises instruction of the course.Specialists in nanotechnology from a variety of academic institutions are involved as lecturers. The goal of the course is to introduce students to research in nanoscience and nanotechnologies, including their applications. Specifically, instruction is focused on analytical tools for nanotechnologies, nanoparticles,

nanocomposites, nanocrystalline layers, semiconductive nanostructures and nanoelectronics, further on carbon nanostructures, sensors, nanofibres, nanomedicine and the risks associated with nanotechnologies.

In 2008 the new doctoral study field "**Nanostructure Physics**" was opened at **Charles University in Prague – Faculty of Mathematics and Physics**(www.mff.cuni.cz). It builds on a wide range of topics in science from previous study.Similarly as at CTU – FNSPE courses approach nanotechnologies primarily from the perspective of physics. Employees from the Institute of Physics AS CR also take part in teaching. Students have the opportunity to participate in research tasks of the Institute of Physics, mainly as part of work on their doctoral theses.

At the **Brno University of Technology – Faculty of Mechanical Engineering, Department of Physical Engineering** (http://physics.fme.vutbr.cz), together with Masaryk University in Brno, a new "**Physical Engineering and Nanotechnology**" study programme was launched in the 2009/2010 academic year. Cooperation between both universities enables scientific and engineering fields and technical and biological fields to be covered. Starting in the 2008/2009 academic year a separate Nanotechnology course was first taught at BUT.

At the **Brno University of Technology – Faculty of Chemistry** (http://www.fch.vutbr.cz) a new undergraduate major "**Chemistry for Medical Nanobiotechnology**" was to be opened in the 2011/2012 academic year. It was prepared at the request and according to the proposal of the Nanomedic cluster (http://www.nanomedic.cz) together with the head of the cluster member – the Contipro Group biotechnology holding company. The study plan includes courses in chemistry and biology as well as theoretical and practical knowledge from selected areas in bio– and nanotechnology, supplemented with knowledge from medical fields. The goal of the study programme is to introduce students not only to the theoretical foundations of the above fields, but also to the most modern approaches in nanobiotechnology. Moreover thanks to the state–of–the–art facilities at the Centre of Material Research at the Faculty of Chemistry, BUT, and cooperation with the Contipro group, students are able to acquire practical skills and experience with methods currently used by industries. Bachelor–level graduates of the Chemistry for Medical Nanobiotechnology programme should find use for their skills in particular in promising fields which are focused on manufacture and development of products for medicine, pharmacy, targeted drug distribution, cosmetology, and other areas in biomedical practice and modern biotechnologies. The Faculty plans also to start an integrated master's study programme.

A "**Nanotechnology**" bachelor's and master's study programme in the **Nanomaterials** study programme was launched at the **Technical University of Liberec** (http://www.tul.cz) in the 2009/2010 academic year. The bachelor's programme contains mainly physics, as well as chemistry, special topics and mathematics. The master's study programme further contains applied science and technology for nanofibre processing. The guarantor is the Faculty of Mechatronics and Interdisciplinary Studies. Instruction in the Nanotechnology programme is organised by experts from four TUL faculties (the Faculty of Mechanical Engineering, the Faculty of Textile Engineering, the Faculty of Mechatronics and Interdisciplinary Studies and the Faculty of Education). The Institute of Physics AS CR also participates in instruction. Part of practical instruction takes place at the Institute and students also have the opportunity to become involved in the Institute's research assignments as part of work on their theses.

Characteristics of the NANOMATERIALS field of study:

This is a highly multidisciplinary field of study, which rests on the results of university workplaces in research and development of nanomaterials and their applications. The study

plan aims at striking an appropriate balance between theory and practical skills by including numerous laboratory exercises and experimental methods of studying the structure and properties of nanomaterials.

Three–year bachelor's study program, title bachelor in science (Bc.)– the study programme provides its students with information about developments in the field, an overview of a variety of types of nanomaterials, their properties and use in practice. Attention is devoted to methods of nanostructure preparation, experimental methods of their study and characterisation of their useful properties. The goal of study is to prepare graduates to work in material research and the management of modern operational technologies in a variety of industries with a relationship to nanotechnologies. Graduates are also prepared for the integrated master's study programme in Nanomaterials.

The two–year integrated master's study programme, title master of engineering (Ing.) is designed for graduates of the bachelor's programme in Nanomaterials and graduates of bachelor's study programmes with a focus on applied physics, applied chemistry, modern materials and technology. It contains advanced methods of studying structures and properties of nanomaterials. Theoretical courses include study of electron structure, optical and magnetic properties and are involved in the relationship between nanomaterials and their functioning.Emphasis is placed on experimental methods and laboratory work. The goal of study is to prepare researchers and technicians in industrial companies, e.g. in research institutions, where they will be involved in the development, production and applications of modern materials, particularly nanomaterials.

Doctoral study (Ph.D.) – it is expected that some graduates will continue in doctoral study programmes at TUL in the university's existing doctoral programmes: Material Engineering, Physical Engineering, Textile Engineering, Applied Sciences Engineering, or in doctoral studies at the Institute of Physics AS CR.

At the **Palacký University Olomouc – Faculty of Science** (http://www.prf.upol.cz) a new "**Nanotechnology**" master's study programme will be taught starting in the 2012/2013 academic year. It builds on the Applied Physics bachelor's study programme. The Nanotechnology field is based on the interdisciplinarity of mathematics, physics, chemistry, molecular biology, electronics and informatics.It is directed at nanomaterials and their applications, particularly in photonics and electronic nanostructures. At the Palacký University in Olomouc nanotechnologies have been a subject of study since the 1990s, primarily at the Centre for Nanomaterial Research, and since 2011 at the Regional Centre for Advanced Technologies and Materials.

The study programme has the goal of training graduates with an independent, creative and interdisciplinary approach to experimental work in fields oriented towards nanomaterial development and application. The programme educates students with an emphasis on a high level of professionalism in interdisciplinary fields including the elements of mathematics, physics, chemistry, molecular biology and informatics. Successful graduates can enter doctoral studies of Applied Physics at the Regional Centre of Advanced Technologies and Materials.

At the Palacký University's Faculty of Science the Department of Physical Chemistry has also been awarded accreditation for its "**Nanomaterial Chemistry**" bachelor's study programme. This is a major from which students can continue directly to the "Material Chemistry" master's programme.

In the 2012/2013 academic year the "**Applied Nanotechnology**" bachelor's study programme will be launched at the **Jan Evangelista Purkyně University in Ústí nad Labem – Faculty of Science** (sci.ujep.cz). Graduates will acquire basic knowledge and skills in physics, mathematics and chemistry as well as an appropriate level of knowledge and skills in fields related to nanotechnologies (applied physics, nanotechnologies, nanobiotechnologies and bioanalytics) and in the field of material diagnostics and characterisation. Graduates will be able to work as university–qualified employees in companies and institutions which are involved in nanotechnologies, where they will be able to hold positions as specialists for diagnostics, expert company consultants and sales representatives in advanced nanotechnologies etc.

In the 2012/2013 academic year the new "**Nanotechnologies**" master's programme will also be launched at the faculty. The composition of courses is designed to provide balanced coverage of physical and chemical methods in nanotechnologies and nanobiotechnologies and to reflect current trends in material research in applied nanotechnologies. The study programme relies on the research and educational foundation of the Faculty in:the use of plasma and chemical technologies in the preparation of nanomaterials, research in supramolecular systems for new drug forms, research in polymer nanostructures for tissue engineering, research in biosensors etc. The proposed study programme tries to reflect the needs of the region's industry, which is traditionally focussed on chemistry. Graduates will have mastered the technologies of nanomaterial preparation. Besides being acquainted with basic analytical methods in material research – spectroscopy, diffraction and bioanalytical methods – they will also be familiarised with special nanomaterial diagnostic methods.

At the **Institute of Chemical Technology in Prague – Faculty of Chemical Technology** (http://www.vscht.cz/fcht) a new "**Nanomaterials**" major will be launched in the 2012/2013 academic year as part of the "Chemistry of Materials and Material Engineering" master's study programme.

The Nanomaterials major builds on "classical" majors in material sciences and material engineering. It expands on these and develops them in nanostructured materials areas. The properties of nanomaterials are notably dependent on the characteristic dimensions of a given structure (nanoparticles, nanofibres, nanolayers, nanocrystalline and nanocomposite materials), while these properties differ in many cases markedly from the properties of macroscopic materials of the same composition. The approach to this problematic is physical–chemical, is derived from the chemical composition and atomic structure of materials subject to preparation method and conditions and explains the relations and connections with macroscopic material properties. It uses both a top–down approach (extrapolation of macroscopic behaviour on the nanostructure level) as well as a bottom–up approach (description of nanostructures derived from the behaviour of individual atoms/molecules) for clarification of these relations. Students in the field acquire basic knowledge of the principles defining chemical composition, structure and properties of nanomaterials, the possible ways of identifying them, analysis and characterisation and methods of preparation and processing of nanostructured materials for applications in fields of advanced construction materials, materials for electronics and information technologies and materials for medicine and other bioapplications.

In the 2012/2013 academic year the "Applied Physics" bachelor's study programme, called "**Nanotechnologies–Applied Physics**," will be launched at **Masaryk University – Faculty of Sciences** (http://www.sci.muni.cz).

The goal of the major is to prepare graduates who will be familiarised with theory, diagnostic methods and the wide spectrum of potential applications for their physical foundation. Special emphasis will also be placed on the use of knowledge of the surface treatments of materials and preparation of nanolayers with atypical properties. Students will also be introduced to nanotechnologies which are used in practice at the present time and which are now being developed for the needs of application partners. The proposed field of study offers a qualitatively higher level of education than general mastery of knowledge of physics, chemistry and other fields and/or mere mastery of experimental techniques. The targeted interconnection of theoretical and experimental knowledge (with command of physical–chemical principles on a sufficiently high level) of the preparation and use of nanolayers will allow graduates to successfully apply in practice the knowledge they have acquired.

Besides basic knowledge and skills of the joint study program as a whole, graduates in the Nanotechnology – applied physics major will acquire basic knowledge from electronics and the creation of semiconductor structures and nanostructures, surface analysis, plasma and nanotechnological treatments of materials, deposition techniques and measuring techniques. Graduates will acquire an overview and practical experience in the use of diagnostic and analytical methods for nanolayer and nanostructure preparation and diagnostics (e.g. electron microscopy, mechanical tests including tribological and nanoindentation methods, surface diagnostics, mass spectroscopy, XPS, FTIR, OEM, X–ray diagnostics, separation techniques etc.). Interdisciplinary instruction will be organised at the university by experts from three institutes: the Institute of Physical Electronics, the Institute of Condensed Matters and the Institute of Chemistry. Close cooperation with technical universities and scientific institutions is expected.

Thanks to the physical mathematical and chemical base covered as part of the programme with added nanotechnology, graduates will be able to find a use for their skills in basic and applied research for national and government organisations, as well as in laboratories and at companies using high–tech nanotechnologies etc. Graduates with this type of education will be useful in positions which organise the rapid transfer of nanotechnologies into practice and their problem–free use.

7. HEALTH AND ENVIRONMENTAL PROTECTION ASPECTS OF NANOMATERIALS AND NANOTECHNOLOGIES

Nanomaterials and products made using nanomaterials are useful, but their manufacture and use and the application of nanosciences and nanotechnologies (NsNT) may raise some concerns. **The possible impact** of certain "nanomaterials" and "nanoproducts" **on human health and the environment** is still **not fully known.** The goal in the area of health, safety and the environment is to enable **the safe development and use of** NsNT and ensure that society is able to **make use of the innovations** which NsNT may bring while being **protected against their possible negative impacts**.

However, the approach to date, whose results are (for now just) international regulations and technical standards, does not fully satisfy the above requirements. This is in particular because the solution of this problem was sought relatively late, not until the year 2005. Nevertheless, since then many specific measures have been taken and other step–by–step solutions are planned on both the international and the national level. These raise hopes that the present–day fears will be gradually eliminated.

On 7 June 2005 the European Commission (EC) adopted the communication "**Nanosciences and nanotechnologies:Action plan for Europe 2005–2009**," [2], which defined a series of articulated and interconnected steps for the immediate implementation of a safe, integrated and responsible approach for nanosciences and nanotechnologies.

Independently of this, Directive 2006/121/EC of the European Parliament and of the Council of 18 December 2006, **known under the acronym REACH**[3] was approved. This directive applies to all chemical substances regardless of their dimensions, shape or physical condition, in other words, for nanomaterials as well. It proceeds from the principle that manufacturers, suppliers and users are responsible for the fact that they manufacture, place on the market or use such substances and mixtures which, after the proper verification of their properties and the following standard of labelling, do not present (with handling which is appropriate to the hazardousness of the substances or mixtures) an unacceptable risk of damage to human health or the environment.

Because this measure was not sufficient to satisfy the abovementioned goal related to nanotechnologies and nanosciences, the European Parliament initiated the publication of a directive explicitly concerning nanomaterials. This meant the introduction of a serious definition of nanomaterials, creating an inventory of all products and nanomaterials on the market and the compulsory labelling of such products. On 7 February 2008 the European Commission (EC) published the recommendation "Code of Conduct for Responsible

[2] COM (2005) 243 final

[3] Directive of the European Parliament and of the Council (EC) No. 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC

Nanosciences and Nanotechnologies Research"[4)]. In the Code the EC recommends universities, research institutions and companies to respect that following seven principles in nanoscience and nanotechnology research:

1. Meaning 2. Sustainability 3. Precaution 4. Inclusiveness 5. Excellence 6. Innovation 7. Accountability

Pursuant to the obligations stipulated by the Action Plan the European Commission conducted a regulatory review of the relevant legal regulations of the Union for the purpose of determining the serviceability of existing legislation for the possible risks connected with nanomaterials. The result is the EC communication from 17 June 2008 "**Regulatory Aspects of Nanomaterials**"[5)]. The Communication reached the conclusion that the term "nanomaterials" is not defined specifically in Union legislation but that existing legal regulations cover the possible health and safety risks and risks for the environment which are related to nanomaterials.

The European Parliament addressed in its **resolution on aspects of nanomaterials** [6)] the absence of definition by calling for the introduction of a comprehensive science–based **definition of nanomaterials** in Community legislation.It should be used as a foundation to determine whether it is possible to consider certain material to be "nanomaterials" for the purposes of legal regulations and policies in the European Union. It should be founded on available scientific knowledge and only on the size of particles from which material is created, regardless of danger or risk. It should apply to natural materials, materials created as by–products and materials that are manufactured. The European Commission entrusted the Scientific Committee on Emerging and Newly Identified Public Health Risks (SCENIHR) with this task. The Committee issued on 8 December 2010 (i.e. one and half years later) its written procedure "**Scientific Basis for the Definition of the Term 'Nanomaterial',"**[7)] which became the foundation for the EC.

On the basis of the mentioned call, the EC adopted on 18 October 2011 its Recommendation for a Definition of Nanomaterial, in which Member States, Union agencies and economic operators are invited to use the definition of the term "nanomaterial"[8)] in the adoption and implementation of legislation and policy and research programmes concerning products of nanotechnologies:

- In this recommendation "**nanomaterial**" means a natural, incidental or manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate, where for 50% or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm-100 nm.

- In specific cases and where warranted by concerns for the environment, health, safety or competitiveness the number size distribution threshold of 50% may be replaced by a threshold between 1 and 50%.

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[4] The Czech version "Kodex chování pro odpovědný výzkum v oblasti nanověd a nanotechnologií," can be found at http://eur-lex.europa.eu/LexUriServ /LexUriServ.do? uri=OJ:L:2008:116:0046:0052:CS:PDF

[5] COM (2008) 366 final

[6] P6_TA(2009) 0328

[7] http://ec.europa.eu/health/scientific_committees/emerging/docs/ scenihr_o_032.pdf

[8] R_2011_696_EU_L275_38 Official Journal of the European Union 20 October 2011

- Fullerenes, graphene flakes and single wall carbon nanotubes with one or more external dimension below 1 nm should be considered as nanomaterials.

- "Particle" means a minute piece of matter with defined physical boundaries; "agglomerate" means a collection of weakly bound particles or aggregates where the resulting external surface area is similar to the sum of the surface areas of the individual components; "aggregate" means a particle comprising of strongly bound or fused particles.

- Where technically feasible and requested in specific legislations, compliance with the definition may be determined on the basis of the specific surface area by volume. A material should be considered as a nanomaterial where the specific surface area by volume is greater than 60 m^2/cm^3. However, a material which, based on its number size distribution, is a nanomaterial should be considered as complying with the definition even if the material has a specific surface area lower than 60 m^2/cm^3.

(Text was prepared by Ing. Václava Křečková)

8. STANDARDISATION IN NANOTECHNOLOGIES

Standardisation, or normalisation, activity, in other words the creation of technical standards, is managed centrally in individual countries in the EU, including the Czech Republic, by national standardisation (normalisation) institutions. Standard creation activity in the Czech Republic is based on standards adopted in the European Union and around the world.

Standardisation within the European Union

CEN (the European Committee for Standardization), located in Brussels, is occupied with standardisation and normalisation effective for the European Union. It is subordinate to the European Commission.

Nanotechnologies fall under **CEN TC (Technical Commission) 352**. This commission was formed on the basis of the recommendation of WG (Working Group) 166 (CEN), which already in 2004 conducted a questionnaire of research and industrial organisations all around Europe with the goal of determining the standardisation needs in nanotechnology. Individual countries can be included on one of two levels, as a full member (M), or as an Observer (O). Only members have voting rights and thus can help make decisions on strategy and work plans of the commission.

The Czech Republic has the status of member. In 2011 the Czech Republic took over the position of secretariat of the CEN/TC 352 committee, working with the organisations ÚNMZ (the Czech Office for Normalisation, Metrology and State Testing) and AFNOR (France). This was a great success for the Czech Republic. A "twin model" has been created, i.e. a joint work on the plans by two secretaries and two commission chairmen, who cooperate and take turns in preparing regular meetings. The secretary of the CEN/TC 352 commission for the Czech Republic is Ing. Tomáš Velát (ÚNMZ) and the co–chairman is Ing. Jan Hošek, CSc. (FS CTU).

In 2010 the European Commission issued Mandate M/461 for normalisation activities concerning nanotechnologies and nanomaterials with an emphasis on ensuring safety of the public and environmental protection.The mandate concerns the following four areas:

- Methodologies for characterisation of nanomaterials in the manufactured form and prior toxicity and eco–toxicity testing
- Sampling and measurement of workplace, consumer and environment exposure to nanomaterials
- Methods to simulate exposure to nanomaterials
- Health, safety and the environment

Technical Committee CEN/TC 352 was appointed to administrate implementation of this mandate. When the mandate was analysed, however, it was found that cooperation with 13 other technical committees of CEN, ISO and IEC would be necessary to fulfil the mandate. According to the current plan 47 standardisation documents of different levels will be created in the next twelve years as part of the mandate's implementation. These are European standards (EN), technical specifications (CEN/TS) and technical reports (CEN/TR). A roadmap for work was prepared for this. At the present time discussions are still underway with the respective committees with the request that they themselves initiate the new work items (NWI) in compliance with the roadmap for mandate implementation. CEN/TC 352 has already approved 5 new work items for the mandate and roadmap.

Standardisation globally

The organisation with global reach bringing together the standard creation authorities from Europe, America, Asia and Africa is the **ISO** (the International Organization for Standardization). For nanotechnology the ISO has set up a special committee –**ISO TC 229**.

For specialised electrotechnical activities another standardisation organisation is located in Geneva, the **IEC** (International Electrotechnical Commission). The IEC established the commission **IEC TC 113** Nanotechnology – Standards for electrical and electronic products and systems.

Standardisation in the Czech Republic

Standard creation activity is **managed in the Czech Republic by the Office for Normalisation, Metrology and State Testing** (ÚNMZ) and the **Czech Metrology Institute** (CMI). **State testing facilities** play a special role in this system.

ÚNMZ is a regulatory body, whose main activity consists of publishing technical standards (CSN – Czechoslovak State Norms). It acts as a national partner for activities of the European Commission for Standardisation (CEN) as well as for ISO. **CMI** ensures unity and precision of measurement tools and measuring in all scientific and technical fields and economic activities.Individual countries create **Technical Commissions** (**TNK**) for the creation, adoption and assessment of new standards. The commissions perform advisory and standard creation activities. Their goal is to concentrate experts for individual fields and to prepare national norms and standards (either their own or international standards, which are expertly translated and adapted for the environment in the Czech Republic). The created commission authority only in a specific field, while more than one field may overlap to a greater or lesser degree.

With respect to nanomaterials and nanotechnologies, **TNK 144 – Nanotechnologies and their subcommittee for photocatalysis** works in the Czech Republic under ÚNMZ. They were created in 12/2007 (still under the Czech Standards Institute, which was disbanded in 2008) and their members are leading experts in the issues at hand and representative of regulatory and central institutions, i.e. ÚNMZ, government ministries and other institutions. At the present time the chairman of TNK 144 is RNDr.Michael Solar, CSc. and the subcommittee for photocatalysis is led by Ing.František Peterka, Ph.D.

The scope of authority of TNK Nanotechnologies covers the following areas: Terminology, Metrology, The environment and Electronics and electrical engineering.

The National TNK in the Czech Republic is linked with activities of the following international standardisation commissions:

- ISO/TC 229 Nanotechnology
- CEN/TC 352 Nanotechnology
- IEC/TC 113 Nanotechnology standardization for electrical and electronic products and systems
- CSC/SR 113 Nanotechnology standardization for electrical and electronic products and systems
- ISO/TC 206 Fine ceramics

- CEN/TC 386 Photocatalysis
- ISO/TC 61 Plastics

For the present time in the Czech Republic primarily EN, ISO or IEC standards have been adopted as national i.e. (in their final state) as CSN EN, CSN ISO and CSN IEC.However at the present time they have also been adopted as CSN P – i.e. temporary standards, or TNI – technical normalisation information etc. We are not aware that any "own" CSN standards are being planned in the Czech Republic for nanotechnologies.

At the present time the following standards are available in the Czech Republic:

- **CSN P ISO/TS 80004–3 (01 2003)** Nanotechnologies. Dictionary. Part 3:Carbon nano–objects
- **TNI ISO/TR 12885 (01 2010)** Nanotechnologies.Health and safety practices in occupational settings relevant for nanotechnologies
- **CSN P CEN ISO/TS 27687 (01 2011)** Nanotechnologies.Terminology and definitions for nano–objects.Nanoparticle, nanofibre and nanoplate
- **TNI ISO/TR 11360 (01 2012)** Nanotechnologies.Methodology for the classification and categorisation of nanomaterials
- **CSN EN ISO 10808 (01 2013)** Nanotechnologies.Characterisation of nanoparticles in inhalation exposure chambers for inhalation toxicity testing
- **CSN EN ISO 10801 (01 2014)** Nanotechnologies.Generation of metal nanoparticles for testing inhalation toxicity using the evaporation/condensation method
- **CSN EN ISO 29701 (01 2015)** Nanotechnologies.Endotoxin test on nanomaterial samples for in vitro systems.Limulus amebocyte lysate (LAL) test
- **CSN EN ISO 28439 (83 3630)** Workplace atmospheres.Characterisation of ultrafine aerosols/nanoaerosols.Determination of the size distribution and number concentration using differential electrical mobility analysing systems

From this overview it is clear that the field of nanotechnology is far from being covered by technical standards. Sooner or later the set of standards will have to be expanded to fulfil the goals set out in the introduction to this article. Achievement of these goals depends on the activities of CEN, ISO and IEC in this area.

(Text prepared by RNDr. Michael Solar, CSc. and Ing. Václava Křečková)

9. CONCLUSION

Just as in the previous two publications –*Nanotechnologies in the Czech Republic* (ISBN80–7329–111–8) and *Nanotechnologies in the Czech Republic 2008* (ISBN978–80–7329–187–7) – the goal of the new publication has been to present an up–to–date view of the fields of nanosciences and nanotechnologies in the Czech Republic which are being investigated, the nanotechnologies and nanomaterials which are being developed in the Czech Republic, and the workplaces and companies where this is being done and by which research and development teams.

The authors of the publication are aware that the overview cannot be a complete one, due to the fast changing situation and rapid development in the field.

The nanotechnological map of the Czech Republic has undergone major changes in the past four years. Above all, it has become much denser, as can be seen from the table below.In comparison with 2008, there has been an increase in the number of research institutes, universities, faculties, contributory organisations, private sector research institutions and most of all private companies which are involved in nanotechnologies. The largest growth occurred in the private sector. While in 2008 roughly 70 companies were involved in nanotechnologies in the Czech Republic (to a greater or lesser extent) by 2011, this number had more than doubled.

Nanotechnologies in the Czech Republic – entities identified in 2005, 2008 and 2011

Institution	2005	2008	2011
Institutes of the Academy of Sciences of the Czech Republic	18	26	29
Universities	13	15	18
Faculties and other university institutes	28	37	50
Contributory organisations	4	9	16
Private research organisations	9	15	25
Large enterprises	6	12	22
Small and medium enterprises	19	57	120

Source: CSNMT, 2012

Of the 35 Institute of the Academy of Sciences of the Czech Republic which are focused on life sciences, chemical science and physical science, 29 entities are involved in nanotechnologies.There are 26 public universities active in the Czech Republic (including schools focusing on the arts and economics), and research projects with issues in nanotechnology are being implemented at 18 of them. From this we can conclude that all of the public universities in the Czech Republic with a natural–technical focus are involved to a greater or lesser degree in nanotechnology research and development. The largest institute in the Czech Republic which is investigating various aspects of nanotechnologies is still the Institute of Physics of the Academy of Sciences of the Czech Republic.

The Research Centres programme administered by the Ministry of Education, Youth and Sports of the Czech Republic, research proposals of MEYS and most of all the "Nanotechnology for Society" programme managed by the Academy of Sciences of the Czech Republic helped significantly in the development of nanotechnology research in the Czech Republic from 2005–2011. Thirty–eight projects were chosen in three public procurement rounds. The projects were gradually implemented from July2006 until December 2012, and their budgeted costs equalled CZK 1.75 billion (and they were 87% financed on average from the Czech budget). Smaller scale research projects, related to basic research, were primarily implemented within the Grant Agency of the Czech Republic in the stated period. These included projects such as the Intelligent nanofibre composite carriers with liposomes for bone regeneration (Institute of Experimental Medicine AS CR) or Nanotechnology in functional diagnostics of apoptotic and tumour cells (Institute of Analytical Chemistry AS CR).

Applied research and development of specific nanomaterials, instruments and nanotechnologies was supported from the T.I.P. programme. This involved projects such as studying paints with long–term antimicrobial effects on a nanomaterial base (SYNPO a.s.), new generation of barrier nonwoven textiles on a nanofibre base (PEGAS NONWOVENS s.r.o.) or the development of grafts with an antibacterial coating on a base of nanostructured surfaces (ProSpon spol. s r.o.). After the end of the T.I.P. programme (the last public tender for project selection was announced in 2011) one of the main sources of public support for applied nanotechnology and nanomaterial research in the Czech Republic will be the Alfa programme, administered by the Technology Agency of the Czech Republic (TACR), whose first call to tender was announced in 2010.

In the upcoming period it can be expected that the centre of nanotechnology research and development in the Czech Republic will shift to the **centres of excellence** and regional research centres, i.e. to the newly built research infrastructure financed from European Union structural funds (from the Operational Programme Research and Development for Innovation) and the government budget of the Czech Republic.This involves primarily the ELI centre (Extreme Light Infrastructure), which is being built in the Central Bohemian town of Dolní Břežany, the Institute of Physics AS CR, CEITEC (Central European Institute of Technology) – a project of four Brno universities and two research institutes – in Brno, the Biotechnology and Biomedicine Centre of the Academy of Sciences CR and Charles University in Vestec (BIOCEV). Nanotechnology research should be also conducted at other centres of excellence – Sustainable Energy (SUSEN), the IT4Innovations Centre of Excellence at the Mining University – Technical University of Ostrava and the Telč Centre of Excellence at the Institute of Theoretical and Applied Mechanics AS CR. By 2015 roughly CZK 19 billion from the government budget and EU funds should have been invested in centres of this type, mainly for construction and equipment.

Regional research centres in the Czech Republic should generate specific nanotechnology applications.In addition considerable financial investment is directed at them.A total of eleven **regional research centres**, which should specialise in applied nanotechnology research, should be supported from the EU and Czech Republic by at least CZK 5 billion. This is:

- The Centre for Nanomaterials, Advanced Technologies and Innovation at the Technical University of Liberec
- The Regional Centre of Advanced Technologies and Materials at the Palacký University Olomouc/Faculty of Science
- The Centre of Material Research at the at the Brno University of Technology/Faculty of Chemistry
- The Centre for Low–cost Plasma and Nanotechnology Surface Treatments at the Masaryk University in Brno/Faculty of Sciences
- ALISI – Application Laboratories of Advanced Microtechnologies and Nanotechnologies at the Institute of Scientific Instruments AS CR
- NTIS – New Technologies for the Information Society at the University of West Bohemia in Pilsen/Faculty of Applied Sciences
- Polymer System Centre at Tomas Bata University in Zlín
- The University Centre of Energy Efficient Buildings at Czech Technical University in Prague/Faculty of Electrical Engineering
- The West–Bohemian Materials and Metallurgical Centre of COMTES FHT a.s. in Dobřany by Pilsen
- The Regional Technology Institute at the Faculty of Mechanical Engineering at the University of West Bohemia in Pilsen
- The Regional Material Technological Research Centre at the Mining University–Technical University Ostrava/Faculty of Metallurgy and Material Engineering

There are great expectations for specific applications and cooperation of research institutions with industry for the new **Centres of Competence**, which are being established in the Czech Republic starting in 2012 (on the basis of the results of the first call of the Centre of Competence programme managed by TA CR). At least 6 of the total of 22 recommended projects concern nanotechnologies.Specifically this concerns the following centres:

- Platform of advanced microscopic and spectroscopic techniques for nano and microtechnologies, whose coordinator is Brno University of Technology/Faculty of Mechanical Engineering
- Environmentally friendly nanotechnologies and biotechnologies for treating water and soil, the coordinator of the Centre is Palacký University Olomouc/Faculty of Science
- The Centre for Development and Application of Graphene–Based Nanocomposites, the coordinator is the Institute of Inorganic Chemistry AS CR
- The Centre for the Development of Original Drugs, the coordinator is the Institute of Organic Chemistry and Biochemistry AS CR
- Electron Microscopy, the coordinator of the centre is FEI Czech Republic s.r.o.
- The Centre of Advanced Polymer and Composite Materials, the coordinator of the centre is Tomas Bata University in Zlín/University Institute

Major changes and progress have been made in the Czech Republic, not only in research, but also in **education in nanotechnologies**.In 2007/2008 the Mining University – Technical University in Ostrava was the first in the Czech Republic to start teaching future undergraduate and graduate students in its "Nanotechnologies" study programme. And in the 2001/2012 academic year it sent its first two masters' studies graduates to work.In the following years more universities – the Technical University of Liberec, the Brno University of Technology/Faculty of Mechanical Engineering, and Charles University/Faculty of Mathematics and Physics – received accreditation for respective study programmes focused on nanotechnologies and nanomaterials. In the 2012/2013 academic year teaching of this multidisciplinary programme should start also at Palacký University Olomouc/Faculty of Science, the Institute of Chemical Technology, Prague, the Jan Evangelista University Purkyně in Ústí nad Labem/Faculty of Science, the Brno University of Technology/Faculty of Chemistry and Masaryk University in Brno/Faculty of Sciences. At other universities at least partial courses focused on nanotechnologies are taught, e.g. the “Nanotechnologies” course at the CTU/Faculty of Electrical Engineering.

The Czech Republic is involved in solving problems of nanotechnology standardisation, a necessary step for the successful commercialisation of research and development results. Standard creation activity in the Czech Republic proceeds from standards adopted in the European Union and on the global scale. For now in the Czech Republic primarily the EN, ISO or IEC standards are adopted as national. A positive development is the fact that the Czech Republic has representatives on international standardisation commissions.

The need for a **national programme for nanotechnology development** is all the more pressing given the continuous increase in the Czech Republic in the number of research institutes and companies involved in nanotechnologies. Most of the Member States of the European Union and mature nations outside of the EU have a similar programme. This type of programme does not exist in the Czech Republic. It should define a development strategy for this interdisciplinary field in the Czech Republic and the necessary research infrastructure for nanotechnology development. It should further outline how the training of new experts and standardisation will be ensured, and how possible social, health or environmental risks of nanotechnology implementation will be treated.

NANOTECHNOLOGIES IN THE CZECH REPUBLIC 2012

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