



CHEMISTRY & NON-METAL MATERIALS

TABLE OF CONTENTS

AUSTRIAN RESEARCH INSTITUTE FOR CHEMISTRY AND TECHNOLOGY (OFI) / SURFACE TECHNOLOGY & MATERIAL ANALYSIS (AT)	60
BIOCOLLOIDS (CZ)	60
DEPARTMENT OF BIOANALYTICAL INSTRUMENTATION (CZ)	60
HOLZFORSCHUNG AUSTRIA, RESEARCH INSTITUTE AND ACCREDITED TESTING AND INSPECTION BODY OF THE AUSTRIAN SOCIETY FOR WOOD RESEARCH (ÖGH) (AT)	60
INSTITUTE OF ADVANCED MATERIALS (CZ)	60
POLYMER GROUP (CZ)	60
RESEARCH GROUP OF SMART MATERIALS FOR ORGANIC ELECTRONICS, PHOTONICS AND SENSORS (CZ)	60
SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA / FACULTY OF CHEMICAL AND FOOD TECHNOLOGY (FCHFT STU) / INSTITUTE OF ANALYTICAL CHEMISTRY (SK)	60
SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA / FACULTY OF CHEMICAL AND FOOD TECHNOLOGY (FCHFT STU) / INSTITUTE OF CHEMICAL AND ENVIRONMENTAL ENGINEERING (SK)	60
SLOVAK UNIVERSITY OF TECHNOLOGY / FACULTY OF CHEMICAL AND FOOD TECHNOLOGY / INSTITUTE OF ORGANIC CHEMISTRY, CATALYSIS AND PETROCHEMISTRY / DEPARTMENT OF ORGANIC TECHNOLOGY (SK)	60
SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA / FACULTY OF CHEMICAL AND FOOD TECHNOLOGY (FCHFT STU) / INSTITUTE OF POLYMER MATERIALS / DEPARTMENT OF CHEMICAL TECHNOLOGY OF WOOD, PULP AND PAPER (SK)	60
SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA / FACULTY OF MECHANICAL ENGINEERING / INSTITUTE OF PROCESS AND FLUID ENGINEERING (SK)	60





AUSTRIAN RESEARCH INSTITUTE FOR CHEMISTRY AND TECHNOLOGY (OFI)

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

- Coatings / paints / varnishes, adhesives, corrosion protection, lifetime prediction, ageing & environmental simulation, material characterization & analysis (with focus on organic materials)
- Destructive and non-destructive testing
- Material testing in the photovoltaic industry
- Analysis of emissions and immissions, leachables and extractables of materials

EXCELLENCE

Adhesives, environmental simulation, material testing

MISSION

Enabling & accompanying application- a/o product-specific (industrial) R&D-processes with focus on SME's.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Lifetime assessment, Ageing and long-term-behaviour of polymeric materials
- Investigation of interfacial phenomena within multi-material-structures
- Non destructive material testing and material analysis
- Optimisation of adhesive bonding technologies and their application in innovative processes
- Trace analysis in emission, immission and migration

MAIN CAPABILITIES

Applied research

- Compatibility and ageing behaviour of polymeric materials in laminated safety glass and photovoltaic modules
- Structural adhesive bonding of light metals and fiber-reinforced plastics for the automotive Industry
- Development of innovative and non destructive testing methods for internal surface

characterization and corrosion protection

- Industrial On-demand R&D in surface technology, corrosion protection and in adhesives/ adhesive bonding
- Emission and immission behaviour of materials, identification of leachables and extractables in packing materials

FIELDS OF RESEARCH RESULTS APPLICATION

- Paint & Coating industry
- Metal working industry
- Automotive industry
- Glass industry, Photovoltaic industry
- Polymer and Chemical Industry

ALUMNI PROFILE

Our educational activities focus on trainings according to EWF (European Federation for welding, joining and cutting)- schemes for

- EAB – European Adhesive Bonder
- EAS – European Adhesive Specialist
- EAE – European Adhesive Engineer

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

6/18

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

2/18

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- chemiluminescence equipment
- ultrasonic acoustic microscopy,
- ion permeation testing of anticorrosive coatings
- active [pulsed] and ultrasonic induced thermography
- artificial weathering instrumentation (with fluorescent / Xenon-arc / metal halogenide lamps) & climatic chambers
- corrosion testers (e.g. salt spray test, Kesternich test, ion permeability, electrochemical ageing)

THIS SME INNOVATION GUIDE HAS BEEN DEVELOPED WITHIN THE CENTROPE TT PROJECT AND WAS FUNDED BY THE CENTRAL EUROPE PROGRAMME (EUROPEAN REGIONAL DEVELOPMENT FUND).

- Acoustic-Induced Nano Particle Emission and Analysis Unit for Paper, Foils, Textiles and Surfaces
- FTIR-microscopy (incl. surface- and imaging-techniques)
- GC/MS-chromatography (incl. Cryo-injection, thermodesorption, pyrolysis, headspace)
- SEM/EDX

MAIN PROJECTS

- **2010 – 2013:** Development of innovative environmental simulation test procedures for shortening of product development cycles within surface technology by the factor 1:10 ('OptiSurf'), federal state of NÖ, EFRE
- **2010-2011:** Functional Multi-Material-Composites, Federal Ministry of Traffic, Innovation and Technology
- **2011-2014:** Long-run Performance of Photovoltaic-Modules: System Optimization by use of innovative processes in Ageing and Analysis, FFG
- **2008-2010:** Improvement of long-Term Ageing resistance in Adhesive Bonding of Alumina, FFG
- **2006-2007:** Corrosion protection of parts made of cast-Mg-Alloys in Automotive applications, FFG

ACHIEVEMENTS

- (In)Kompatibilität polymerer Werkstoffe – Ein Beitrag zum Verstehen der Zusammenhänge: G. Eder, W. Preusser, J. Kammerer, Adhäsion 2008.
- Alterung von Klebeverbindungen im Fensterbau unter verschiedenen Umweltsimulationsbedingungen Gabriele Eder, Jochen Kammerer, Werner Preusser, Bernd Bodiselitsch
- Lecture, Jahrestagung der GUS März 2009, Karlsruhe
- Kleben Drylube-beschichteter Aluminium-bleche, Gabriele Eder, Jochen Kammerer

- Fachvortrag bei der 5. Internationalen Klebetagung, Mai 2009 (In)Kompatibilität polymerer Werkstoffe im Fenster- und Glasfassadenbau: Gabriele Eder, Jochen Kammerer und Werner Preusser, Glas 4, 2010.
- Vergleichende Messungen von Emissionen polymerer Materialien mit Thermodesorption- GC/MS Systemen unterschiedlicher Bauweise: Gabriele Eder, Monika Zoder; Fachvortrag beim 12.Workshop „Geruch und Emissionen bei Kunststoffen“ Kassel, März 2010
- Spectroscopic Characterisation of the Oligomeric Surface Structures on Polyamide Materials Formed During Accelerated Ageing: Boril Chernev and Gabriele C. Eder; accepted J.Applied Spectroscopy 2011.
- Visualisierung alterungsbedingter Änderungen an Kunststoffoberflächen mit spektroskopischen Imaging-Techniken: Gabriele Eder, Lidija Spoljaric-Lukacic und Boril Chernev, Lecture at the Solid State Analytics Symposium Vienna July, 2011; proceedings to be published in Analytical and Bioanalytical Chemistry.
- Effects of weathering on the ionic permeability of coated metal substrates Volker Uhl, Eduard Pohle; lecture accepted for the 5th European Weathering Symposium, Lisbon Sept. 2011.

MAIN COLLABORATING PARTNERS

COLLABORATION WITH ACADEMIC PARTNERS

- AC²T – Austrian Center of Competence for Tribology, TFZ Wiener Neustadt
- CEST – Austrian Center of Competence for Electrochemical Surface Technology, TFZ Wiener Neustadt
- ÖGI – Austrian Foundry Research Institute, Leoben
- FELMI-ZFE – Austrian Centre for Electron Microscopy and Nanoanalysis, Graz
- SZA – Schweißtechnische Zentralanstalt, Wien
- Technical University of Vienna, Vienna

COLLABORATION WITH COMPANIES

- Different companies within Austria and European Union

EXPECTATIONS

OFFERS

- Lifetime assessment and ageing testing of materials and products
- Mechanical, physical and chemical material characterization, identification and optimization of properties
- Partnership in projects at the field of coating technology, Adhesives and corrosion protection
- Partnership in Photovoltaic projects
- Expertise in ageing, failure and damage assessment of polymer based materials // material improvement and damage prevention
- Expertise in non-destructive testing of adhesive bonding
- Expertise in the analysis of emissions, imissions, leachables and extractables, analysis of migration processes

REQUIREMENTS

We are looking for academic institutions with one or more of the following equipment:

- confocal Raman microscopy
- confocal white light microscopy
- eddy current imaging
- polymer additive analytical instrumentation
- nano-indentation
- high end UV-VIS spectroscopy
- LC-MS
- GPC

We are looking for partners (companies) with the following equipment for research partnerships:

- Laboratory module laminator
- laboratory film casting equipment

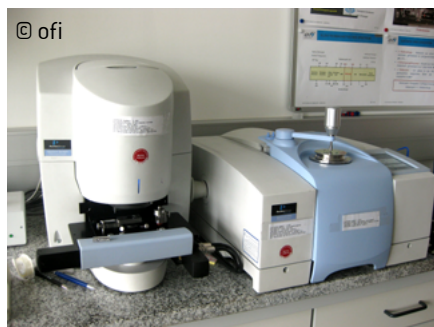
We would be interested in customers in the following fields:

- Partners looking for weathering/ accelerated ageing facilities (esp. in Automotive, Construction, Photovoltaic)
- Companies looking for expertise in material characterisation and evaluation of incompatibilities of polymeric material combinations
- Partners with industrial or R&D-topics in adhesive technology and adhesive bonding
- Commercial partners looking for services in instrumental analytics.

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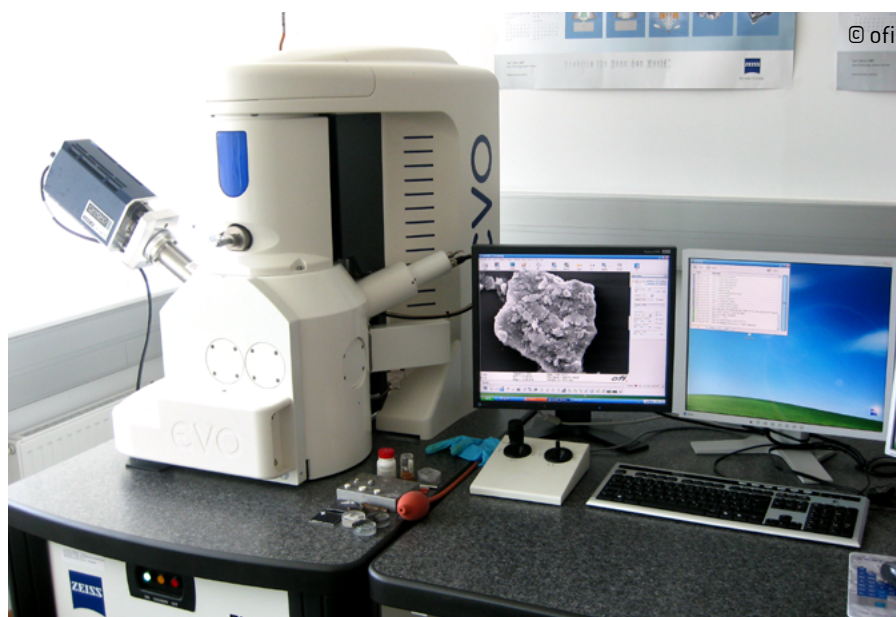
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BIOCOLLOIDS

/ CENTRE FOR MATERIALS RESEARCH & INSTITUTE OF PHYSICAL AND APPLIED CHEMISTRY

/ FACULTY OF CHEMISTRY / BRNO UNIVERSITY OF TECHNOLOGY

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

Physical chemistry of colloid and macromolecular systems

EXCELLENCE

Applied physical chemistry (3 researchers are in the world's top 10 %)

MISSION

- To look towards the European excellence in research of physical chemistry of biocolloids
- To be attractive partner for industrial R&D
- To provide a high quality educational process (for students and employees of industrial partners)

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Biocolloid transport systems for biomedical and environmental technologies, nanomedicine and other nanotechnologies
- Research on biomaterials for medical applications / applications of lignite and humic acids (e.g. sorbents)

MAIN CAPABILITIES

- Physicochemical characterization of delivery systems for (nano) medicine, cosmetics and agriculture
- Physicochemical characterization of humic substances and new humic materials for applications in agriculture and environmental technologies
- Diffusion in gels

FIELDS OF RESEARCH RESULTS APPLICATION

- Biomedicine
- Agriculture and food biotechnology
- Plastics industry
- Environmental protection technology

ALUMNI PROFILE

Alumni are specialists in applied physical and colloid chemistry in the production of specialty or consumer chemical products or for smallscale chemical and biotechnological industry in general.

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

3

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

15

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- Ultrasonic spectrometer (Ultrasonic Scientific, HR-US 102) - unique in the Czech Republic
- Rheometry (TA Instruments, AR G2)
- Thermal analysis (TA Instruments, DSC Q200 and TG Q5000IR)
- Tensiometry (KSV, Sigma 701 and bubble pressure BPO 800 P)
- Densitometry (Anton Paar DMA 4500)
- Fluorescence (Aminco Bowman Series 2)
- UV/VIS (Hitachi U-3900H, Varian Cary 50)
- IR spectroscopy (Nicolet Impact 400)
- Diffusion cells

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BUDGET**TOTAL (MIL. CZK/MIL. EUR)**

11/0.44

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

5

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

0

MAIN PROJECTS

2010-2013: Centres for materials research at FCH BUT (project ED0012/01/01 financed by the Operational Programme Research and Development for Innovation, Ministry of Education, Youth and Sports)

2008-2011: Self-assembling colloids hyaluronan-surfactant, hyaluronan-amino acid for nanomedical applications (project OC08004 financed by programme OC – COST, Ministry of Education, Youth and Sports)

2005-2008: Structural effects of humic substances and some plant alkaloids on the degradation and detoxification of persistent organic pollutants in soils (project 04-82-7271 INTAS financed by the Sixth Framework Programme)

2005-2007: Progressive and efficient non-energy applications of lignite (project GA105/05/0404 financed by the Czech Science Foundation)

MAIN COLLABORATING PARTNERS**COLLABORATION WITH ACADEMIC PARTNERS**

- Mendel University (Brno, CZ)
- Academy of Sciences of the Czech Republic, Institute of Biophysics - Nanomedic cluster (CZ)
- University of Poitiers (FR)
- NTNU Trondheim (NO)
- University College Dublin (IE)

COLLABORATION WITH COMPANIES

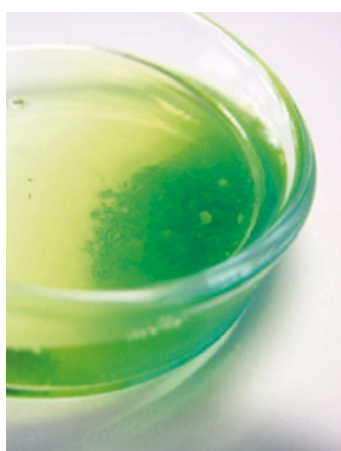
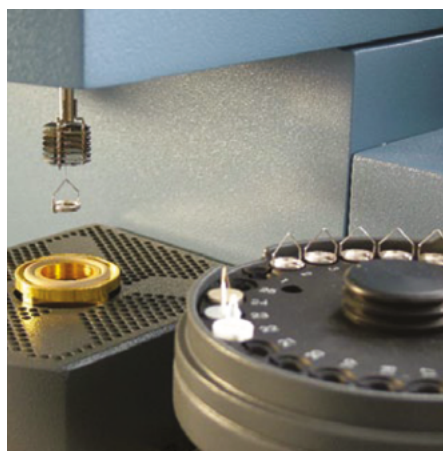
- CPN (CZ)
- Generi Biotech (Hradec Králové, CZ)
- Nanomedic (cluster) (CZ)
- Amagro (CZ)

EXPECTATIONS**REQUIREMENTS**

- Cooperation with interesting subjects and companies – cooperation with potential for further academic work
- Cooperation based on clearly defined research and development tasks
- from the field of colloids or nanocolloids

OFFERS

- Experience and facility in physical chemistry of colloids, including soft and macromolecular matter applicable in wide range of specific subjects or technologies
- Ideas for development of application activities



04/2011

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DEPARTMENT OF BIOANALYTICAL INSTRUMENTATION

/INSTITUTE OF ANALYTICAL CHEMISTRY
/ACADEMY OF SCIENCES OF THE CZECH REPUBLIC



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THEMATIC RESEARCH FOCUS

RESEARCH AREA

Research of methods and their combinations and development of their applications especially for bioanalytical objects.

EXCELLENCE

Microcolumn separations – mass spectrometry coupling

MISSION

Exploring the world of Capillary Separations - Mass Spectrometry Coupling, Microfluidics and Single Cell Analysis.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Capillary separations
- Mass spectrometry coupling
- Enzymatic microreactors
- Microfabrication – Microfluidics
- Single cell analysis

MAIN CAPABILITIES

Electrospray interface for coupled column ITP system – presentment of application for patenting, others are in preparation. Capillary fraction collector, thermostat box for DNA analysis.

- International patents are granted together with Ing. Klepárník in cooperation with Barnett Institute in Boston

Miniaturized multidetector for conductivity, absorbance and fluorescence detection at a single site capillary.

- Presentment of application in Ireland in cooperation with Dublin City University (prof. Macka)

FIELDS OF RESEARCH RESULTS APPLICATION

- Biomedicine
- Biotechnology (diagnostic, medical equipment)
- Waste water treatment
- Chemical industry

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

3

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

8

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- Laser lithograph
- Laser detection systems
- 3 electrospray mass
- Spectrometers
- CE and HPLC instruments

BUDGET

TOTAL (MIL. CZK/MIL. EUR)

5/0.2

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

10

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

2

MAIN PROJECTS

2006-2010: Integrated bioanalytical technologies for microanalyses and diagnostics with laser induced fluorescence and mass spectrometry coupling (project LC06023 financed by the Ministry of Education, Youth and Sports)

2006-2010: Nanotechnologies for protein and gene diagnostics (project KAN400310651 financed by the Academy of Sciences of the Czech Republic)

2006-2008: Microfluidic instrumentation for analyses of biopolymers modified by structural

probes (project GA203/06/1685 financed by the Czech Science Foundation)

ACHIEVEMENTS

Selected high impact publications:

- Editing of yearly special issues of Electrophoresis on Miniaturization since 2000.
- Lazar, I.M., Grym, J., Foret, F. Microfabricated devices: a new sample introduction
- approach to mass spectrometry. Mass Spectrometry Reviews, 2006, 25, 573–594.
- Křenková, J., Foret, F. Immobilized microfluidic enzymatic reactors. Electrophoresis, 2004. 25, 3550-3563.

Patents:

- Karger, B. L., Kotler, L., Foret, F., Minarik, M., Kleparnik, K. Multichannel microscale system for high throughput preparative separation with comprehensive collection and analysis. US Patent # 7,578,915, 2009.
- Foret, F.; Karger, B. L. Parallel array of independent thermostats for column separations. U.S. Patent # 6,929,731, 2005.
- Foret, F.; Rejtar, T.; Zhang, B.; Karger, B. L. Parallel sample loading and injection device for multichannel microfluidic devices. U.S. Patent #6,939,452, 2005.
- Karger, B.L., Foret, F., Preisler, J. On-line and off-line deposition of liquid samples for matrix assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectrometry. U.S. Patent # 6,825,463, 2004.

Organization of international conferences:

- Founders and organizers of the international interdisciplinary symposium on bioanalysis CECE 2004 - 2011.
- Organization of the prestigious international conference MicroScale Bioseparations - MSB2010.

Membership in editorial boards of international journals:

- Electrophoresis
- Journal of Chromatography
- Journal of Separation Science
- Biomacromolecular Mass Spectrometry
- Current Analytical Chemistry
- The Open Proteomics Journal

MAIN COLLABORATING PARTNERS

COLLABORATIONS WITH ACADEMIC PARTNERS

- Institute of Biophysics, Academy of Sciences of the Czech Republic (Brno, CZ)
- Faculty of Science, Masaryk University (Brno, CZ)
- University Hospital (Brno, CZ)
- Masaryk Memorial Cancer Institute (Brno, CZ)
- DCU (Dublin, IE)
- CNR (Rome, IT)
- Barnett Institute (Boston, US)
- IFI CISC (Madrid, ES)
- University of Debrecen (Debrecen, HU)

COLLABORATION WITH COMPANIES

- BVT (Brno, CZ)
- Villa Labeco (SK)
- Genomac, Watrex (Prague, CZ)
- Applied Biosystems (US)
- Gyros (SE)

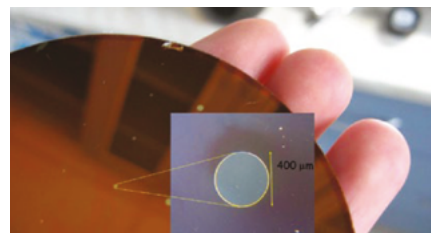
EXPECTATIONS

REQUIREMENT

We are looking for industrial partners in the Czech Republic as well as abroad.

OFFERS

Capacity in designing and fabrication of microdevices, preparation of surface modified quantum dots, bioanalytical method development



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THEMATIC RESEARCH FOCUS

RESEARCH AREA

- Timber Products: Solid timber as well as composites (glulam, WPC, ...), bio energy
- Timber Technology: Grading of timber, optimisation of the production processes within the wood chain (using the right raw material for the right purpose)
- Chemistry: Wood preservation, pulp and paper, wood surface and furniture, molecular biology
- Timber Construction: building physics, development of structural engineered solutions (e.g. integrated photo voltaics), use of wood in outdoor areas (e.g. terraces, facades), VOC in wooden houses, life cycle assessment, carbon footprint

EXCELLENCE

- Detection of grain deviation using microwave transition
- Load bearing timber-glass composites

MISSION

Holzforschung Austria (HFA) is the leading research and testing institute for wood and wood products in Austria. HFA is a fully-owned subsidiary of the Austrian Society for Wood Research founded in 1948 and is organized as a non-profit organisation. The institute works frequently for its customers as their external research and development department. Our specialists cover a wide range of technical fields. Topics spanning over several fields are addressed in an interdisciplinary way. Our customers are mainly small and medium sized enterprises of the Austrian wood industry for whom HFA provides solutions for practical questions and problems. Consequently, HFA focusses on industry near applied research. HFA also addresses basic research and applied research (COMET K project "HFA-TIMBER") to be able to provide state of the art solutions for our customers.

DEVELOPED TECHNOLOGIES

Holzforschung Austria provides research in various fields. This holistic approach enables

us to work on complex research projects with intertwined in-house divisions. The USP of HFA is its capability to perform research along the whole wood supply chain including associated sciences like e.g. molecular biology.

Within the K project HFA-TIMBER, there are foci on the physical process of microwave transition through structural timber, image processing of different surfaces or materials, material measurements based on the emission, adsorption, desorption and diffusion behaviour of VOCs as well as advanced research in buildings physics in our new full scale research building.

MAIN CAPABILITIES

Timber and timber products research focus division: Properties of structural timber (characteristic properties i.e. strength, modulus of elasticity and density; image processing; microwave technology), rheological properties of wood and wood composites, classification and modification of renewable energy materials

Chemistry research focus division: Wood related emissions (e.g. VOC, formaldehyde), wood preservatives, surface coatings and new maintenance concepts for in-door and out-door application

Timber construction research focus division: modified design for safe utilization of wood, safety of windows and doors, buildings physics, life cycle assessment, carbon footprint

FIELDS OF RESEARCH RESULTS APPLICATION

The results can be used in an as diversified industry as the research areas indicate. Annex 1 holds a comprehensive overview.

ALUMNI PROFILE

Holzforschung Austria is not included in the lectural system although several employees do give lectures at universities / universities of applied sciences in Austria and Germany. Therefore, no graduates in the strict sense are trained at HFA.

Our staff is well versed in using a wide range of scientific equipment, e.g. mechanical, chemical and biological testing as well as in utilizing different software on expert level for the analysis of the data.

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF/POSITIONS (FTE/HC): 4/11

JUNIOR RESEARCH STAFF/POSITIONS, INCL. PH.D. STUDENTS (FTE/HC): 6/17

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- Holzforschung Austria is well equipped with testing gear (e.g. ICP, GC-MS, climate chambers, testing machines up to 1.200 kN) and relevant software bundles (e.g. for LCA).

BUDGET

TOTAL: 6.400.000 EUR

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%): 50 %

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%): 10 %

MAIN PROJECTS

- **2002-2008:** Wood Technology (Industrial Competence Centers, BMWFJ GZ 98.366/0011-C1/10/2006)
- **2007-2009:** HFA-XL (prokis 04/2, FFG 813493)
- **2009-2014:** HFA-TiMBER - Timber in Material, Building and Environmental Research (COMET, FFG 820501)

ACHIEVEMENTS

- utilization of microwaves for the detection of microwaves

- load bearing timber glass composites (patent granted)

MAIN COLLABORATING PARTNERS

COLLABORATIONS WITH ACADEMIC PARTNERS

- University of Natural Resources and Life Sciences, Vienna, AUT
- Vienna Technical University, AUT
- Technische Universität München, Holzforschung München, GER
- University of Applied Science Salzburg, AUT

COLLABORATIONS WITH COMPANIES

- Binderholz GmbH, Fügen, AUT
- MiCROTEC srl, Brixen, ITA
- Hasslacher Norica Timber, Sachsenburg, AUT
- Stora Enso Timber, international
- Donausäge Rumplmayr, Enns, AUT
- DOKA Industrie GmbH, Amstetten, AUT
- Association of the Austrian Prefabricated Houses, Vienna, AUT
- Association of the Austrian Wood Industry, Vienna, AUT
- Österreichische Vereinigung der Zellstoff- und Papiertechniker und -chemiker, Vienna, AUT
- Akzo Nobel, international
- Rütgers, GER

EXPECTATIONS

OFFERS

Holzforschung Austria is a specialist in applied science and experimental development. Our vast network of SMEs as well as our different research foci make us an excellent partner. We can provide the necessary knowledge for a successful implementation of basic research results in applicable products and processes. We are also interested in participating in international research projects as well as cooperation in basic research.

REQUIREMENTS

Holzforschung Austria has a strong emphasis on the various aspects of wood. Potential partners might want to note that we can partake in a lot of different scientific settings, although not in a leading role since we are a medium sized non-profit organization.



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INSTITUTE OF ADVANCED MATERIALS

/ CENTRAL EUROPEAN INSTITUTE OF TECHNOLOGY OF
BRNO UNIVERSITY OF TECHNOLOGY
/ BRNO UNIVERSITY OF TECHNOLOGY



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THEMATIC RESEARCH FOCUS

RESEARCH AREA

- Advanced ceramic, polymer materials and composites,
- Advanced metallic materials and metal based composites,
- Structure and phase analysis,
- Research and diagnostics of electrical properties of advanced materials

EXCELLENCE

- Advanced ceramic, polymer materials for bioapplications and electronic and structural applications

MISSION

To establish equipment and personnel infrastructure further enhancing excellence in research of advanced (polymeric, ceramic, metallic and building) materials and their applications in various industrial segments, medicine and services

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

Biomaterials

development of novel composite biomaterials which can induce the growth of connective tissue on the surface of implants and therefore accelerate healing and improve the strength and biological stability of the implant-tissue connection (ceramic and metallic materials for replacement of soft and hard tissues, materials for orthopaedic devices).

Materials for energetics, communication and ecology

development of novel composite materials with a functionally graded structure for the improvement of the efficiency and lifetime of components and devices for energetics, communication and control technologies (conductive ceramic and polymer materials for electrodes, novel actuators, sensor components, control and instrumentation systems for technological processes, catalysts for the decomposition of gaseous pollutants, biopolymers and precursors from plants and plant residues).

Structural materials

development of novel polymeric, metallic and ceramic composites with excellent mechanical and thermal properties for structural applications (transparent ceramic materials; thermally and chemically resistant ceramic composite materials; impact-resistant ceramic composites; polymer multifunctional composites for high-tech engineering applications).

MAIN CAPABILITIES

Basic research

The results are published in high impact international journals in the mentioned fields, presented and communicated to the research and industrial community at workshops and conferences.

Application research + protection forms

- Transparent ceramics, ceramic armour, toughened engineering ceramics and composites
- New materials from easily renewable raw sources (low energy materials, green materials), intelligent materials (materials with additional „smart“ properties, for example – materials with high surface activity), nanomaterials.
- Innovative solutions of solar panels and diagnostics of their properties
- Application achievements in the innovation of electrode materials for NiCd batteries.
- Polymer materials: scratch-resistant materials based on nano fillers, intelligent enamels based on the application of nano fillers, soft polyurethane foams with controlled life-time
- Metallic materials for gas turbines and turbochargers (superalloys and intermetallics), metallic biomaterials for surgical implants (stainless steels, Ti-alloys, NiTi alloys) and new steels for railway traffic.
- Patent application dealing with hydrogen storage in metallic materials.

This is a result of long term basic and applied research in the field of diffusion in metals. The results obtained (new materials, methodologies) create excellent conditions for expanding collaboration with hi-tech companies in the area of

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multilevel, multifunctional heterogeneous advanced materials.

FIELDS OF RESEARCH RESULTS APPLICATION

- Advanced materials – biomaterials, materials for energetics, communication and ecology, structural materials
- Electronic industry
- Chemical industry
- Automotive industry
- Alternative energy
- Non ferrous materials
- Plastics, polymers
- Glass, ceramics
- IT Security

Multifunctional homogeneous and heterogeneous advanced polymeric, ceramic, metallic and composite materials are expected to target a broad area of industrial segments ranging from technical sectors such as engineering, automotive industry, energetics, communication technology and medical electronics to the food industry, ecology and biomedicine. Besides traditional technical industries, the exploitation potential of multi-disciplinary scientific interactions is expected to result in novel application areas (e.g. unique mechanical characteristics of biomaterials finding applications in medicine as heart tissue substitutes in orthopaedics and dentistry, excellent mechanical and thermal properties of novel polymeric, metallic and ceramic composites exploitable in structural applications, materials originated from natural sources and environmentally compatible materials finding application in agriculture and forestry, etc.)

ALUMNI PROFILE

Doctoral graduates are on a very high technical level, provided with both the knowledge of the latest advances in the fields of materials sciences (inclusive of experimental methods for studying the structure and properties of materials) and the knowledge necessary for playing the

role of a „bridge“ between designers and technologists. Graduates are thus well prepared for science and research activities as members of materials science teams, for teaching activities at technical universities as well as for working in teams that, within the contemporary trend towards concurrent engineering, participate in the development of new products in manufacturing plants.

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

29

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

87

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- Multi-channel equipment Potentionstat/ Galvanostat with multichannel input / output for measuring very low frequency, voltage compliance 100V, current compliance 1nA - 10A. The measuring system is fully computerized and controlled by the programmable software.
- Multi-channel equipment for analyzing and data storage with fast sampling pulse generator (10Mvz/s) and scan rate 250kV/s. Usage of a broad range of electrochemical methods for analysing of material properties. The measuring system is fully computerized and controlled by the programmable software.
- Precision measurement system for dielectric and electrochemical impedance spectroscopy covers a frequency range from 3μHz to 3 GHz, a temperature range - 160 °C - 1 400 °C and voltage range up to kV. The system consists of several frequency analyzers and potentionstats.
- Sensitive measurement system for spectroscopic measurements in the time domain for very small currents (below 1 fA).

- AC voltage module system – workplace for measurement breakdown voltage of electro insulating materials up to 200 kV
- Measuring bridges method covering both high and low voltage applications - workplace for precision measurement of capacity and dissipation factor (voltage up to 2 kV, frequency about 50 Hz)
- Set of climatic chambers – apparatus for exposing samples to different climatic condition (temperature range -70 – 200 °C, humidity range 10– 99 %, solar and UV radiation, thermal shock chamber)
- Thermal analyser TG/DTA for thermoanalysis of ceramic particulate materials in the temp. range of 25-2000 °C and in driven atmosphere; sample mass 25 mg; mass spectrometric detection of evaluated gasses
- Device for the study of ionic permeability of ceramic high temperature membranes in the temp. range of 0-1200 °C and pressure range of 0-0.2 Mpa
- Equipment for testing of SOFC in the temperature range 0-1200 °C and pressure range of 0-0.2 Mpa
- Attrition mills for dispersion and homogenisation of fine and nanometre-sized ceramic powders, especially in liquid medium
- Heated kneading machine for mixing ceramic suspensions based on ceramic powders and liquids solvent or polymer melts
- Isostatic press with a pressure of liquid medium up to 1 GPa
- Machine for casting of ceramic green bodies of thin-wall sheets
- Milling machine for machining of complex ceramic green bodies
- Furnace for catalytic debinding of polymer binder
- Climatic chamber with temperature and humidity control
- Debinding muffle furnace for temperatures up to 1100 °C with controlled gas atmosphere

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- Device for mercury porosimetry of porous bodies
- Capillary rheometer for rheological evaluation of plastic materials
- Thermogravimetric analyzer with controlled gas atmosphere or with vacuum up to temperature of 1600°C and sample mass up to 100 g
- Equipment for solvothermal microwave synthesis of advanced ceramic particulate materials at max. temp. 300°C and pressure 20 Mpa
- Device for high-temperature synthesis of ceramic particles in the temp. range of 0-1200 °C and pressure range of 0-0.2 Mpa
- Device for deposition of thick films and flat objects by means of ceramic colloidal dispersions. Maximum size of objects : 250x250 mm
- Device for deposition of thin films by means of liquid and gaseous precursors. Maximum size of objects : 50x50 mm
- Device for drying of g-l spray of ceramic particles and collection in cyclone separator. The volume of drying box is about 1 m³.
- Box for chemical experiments with reactive chemicals under inert conditions. The volume of chamber is 1,5 m³, contents of oxygen and water about 1 ppm
- Hot press used for pressing of inorganic powder materials at elevated temperature
- High-temperature dilatometer used for heating the sample and at the same time monitoring its length changes
- High-temperature furnace intended for large samples
- High-temperature furnace working with vacuum or inert atmosphere
- High-temperature furnace working with pure hydrogen atmosphere
- Low-temperature furnaces with air atmosphere
- Catalytic reactor, with mass spectrometric product detection; capable of temperature programmed oxidation (TPO), temperature programmed reduction (TPR) and temperature programmed desorption (TPD) of ceramic catalytic materials
- Weather-Ometer Ci4000 + accessories
- Q-Sun Xe-1 desktop
- Weather station, type C
- HV Flame chamber HVUL2
- Melt-flow indexer
- Air-draft ageing chamber
- DMTA with low temperature chamber
- Servohydraulic tensile testing machine with temperature chamber
- High resolution SEM
- Confocal laser microscope
- Micro-rheological analyzer
- Nano CT Scan
- SAXS (small-angle X-ray scattering)
- High resolution TGA
- High temperature GPC
- Regular GPC
- Dynamic light scattering with MWD
- Modulated DSC
- Rheoviscosimeter
- FTIR microscope
- Lyophilizer
- Vacuum drying oven
- UV spectrophotometer
- GPC
- High performance dry box
- Micro twin-screw continuous reactor 15ml
- Bench top injection moulding machine
- 19 mm twin screw co-rotating split barrel extruder with accessories
- Gravimetric dosing system
- Axial-torsional servo-all-electric test system
- Multiaxial fatigue test stand
- Linear-Torsion All-Electric Test Instrument
- FEG -SEM High/Low vacuum + analytical attachments (EDS + WDS + EBSD)
- X-Ray Diffractometer + Goebble mirror for HR spectra acquisition + JCPDS database + high temperature chamber
- High resolution (sub nanometer) FEG scanning electron microscope + analytical attachments (EDS + WDS + EBSD)
- High resolution 300 keV FEG TEM/STEM with aberration correctors + analytical systems (EDS + EELS)
- Materialographic sample preparation unit - coarse (materialographic saw with equipment and materialographic press with equipment).
- Automatic grinder and polisher with equipment.
- TEM and SEM sample preparation unit (ion polisher for TEM foils, ion polisher for bulk SEM specimens and Electrolytical polisher for TEM foils).
- Oscilloscopes DSA9000 or equivalent
- Active measurement equipment for DSA
- Measurement stand for embedded systems and communication systems
- Pulse pattern generator
- Circuit board rapid prototyping system
- 3-ph programmable power supply 21kVA
- Oscilloscope + advanced functionality modules + probes
- Precise spatial measurement system
- Navigation unit
- Mobile calibration anechoic chamber
- PXI measurement system
- Set of acoustic sensors
- Reference vibration exciter with accessories
- Measurement and test workplace with dynamometers set

BUDGET

TOTAL (MIL. CZK/ MIL. EUR)
40 / 1.6

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)
5

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)
10

MAIN PROJECTS

2007-2010: Heterogenous catalysts for oxidation of organic compounds based on composite perovskite oxides (Project OC 180

financed by the Ministry of Education, Youth and Sports]

2010-2012: Effect of nanoparticles on the chain mobility and crystallization kinetics in polyolefin nanocomposites [Project GAP205/10/2259 financed by the Czech Science Foundation]

2009-2011: Rheological behaviour of polymer melts and solutions loaded with nanoparticle fillers [project Project OC09040 financed by the Ministry of Education, Youth and Sports]

ACHIEVEMENTS

VOJTOVÁ, L.; JANČÁŘ, J.: Method of preparation of thermodegradable polyurethane foams. World Intellectual Property, Geneva, Patent no.: WO/2010/066211 [appl. no: PCT/CZ2009/000153], 2010-17-06.
TRUNEC, M., CHLUP, Z.: Higher fracture toughness through nanocrystalline structure, Scripta Materialia, 61, 2009, 56-59.
MACA, K., POUCHLY, V., ŽALUD, P.: Two-step sintering of oxide ceramics with various crystal structures, J. Eur. Ceram. Soc., 30, 2009, 583-589.
BARTONCKOVA, E., WIJK, K., MACA, K., LEIN, H. L., RUDBERG, E. A.: Synthesis and oxygen transport properties of $\text{La}_{0.2}\text{Sr}_{0.8}\text{Fe}_{1-x}\text{Ti}_x\text{O}_3$ ($x=0.2, 0.4$) intended for syn-gas production, J. Eur. Ceram. Soc., 30, 2009, 605-611.
JANCAR, J., DOUGLAS, J. F., STARR, F. W., et al.: Current issues in research on structure-property relationships in polymer nanocomposites, POLYMER, 51 (15), 2010, 3321-3343
JANCAR, J., RECMAN, L.: Particle size dependence of the elastic modulus of particulate filled PMMA near its T-g, POLYMER, 51 (17), 2010, 3826-3828.

MAIN COLLABORATING PARTNERS

COLLABORATION WITH ACADEMIC PARTNERS

- Arrhenius Laboratory, Stockholm University [prof. Zhijian Shen, SE],

- Department of Materials Engineering, University of Novi Sad [prof. VI. Srdic, RS]
- National Institute for Materials Science [Dr. Taras Kolodiaznyi, JP]
- University Duisburg-Essen [Prof. Markus Winterer, DE]
- National Centre for Scientific Research "Demokritos" [Dr. Evagelia Moshopoulou, GR]
- Institute of Materials Research, Slovak Academy of Science [Prof. Jan Dusza, SK]
- Institute of Materials Science, University of Connecticut [Prof. R.A.Weiss, US]
- S.A. Conte Polymer Engineering Center, University of Massachusetts [Prof. A. Lesser, US]
- Institut für Energietechnik, Technische Universität Dresden [Prof. Dr. Ing. Uwe Gampe, DE]
- Dipartimento di Meccanica, Politecnico di Milano [Assoc. Prof. Dr. Mauro Fillipini, IT]

COLLABORATION WITH COMPANIES

- Walter [Ing. František Denk, Prague, CZ]
- Saint-Gobain Advanced Ceramics [Ing. Vladimír Šída, Turnov, CZ]
- Lasak [Ing. Zdeněk Strnad, Prague, CZ]
- mTec [Ing. Erik Elmer, Prague, CZ]
- Synpo [Dr. J. Zelenka, Pardubice, CZ]
- Rhodia [Dr. G. Mignani, Lyon, FR]
- Volkswagen AG [Dr. W. Kramer, Wolfsburg, DE]
- Metallchemie [Vrútky, SK]
- Daneher Motion [Modřice, CZ]
- Ingersoll-Rand Czech Republic [Uničov, CZ]
- Timken Česká Republika [Bystrovany, CZ]
- BOSCH Diesel [Jihlava, CZ]
- Brisk Tabor [Tábor, CZ]
- Bochemie [Bohumín, CZ]
- Solartec [Rožnov pod Radhoštěm, CZ]
- Gumotex [Břeclav, CZ]

EXPECTATIONS

REQUIREMENTS

We are looking for both academic and industrial partners in basic and applied

research in the areas of biomaterials, structural materials and materials for energetics, communication and ecology.

OFFERS

- Competitive applied research
- Specialized services on top-class instruments in the area of transmission microscopy, scanning electron microscopy, microanalysis and X-ray diffraction analysis



Photo 1 Electroceramics – Oxygen tubular membranes, material: La-Ca-Fe-Co perovskite



Photo 1 Bioceramics – Femoral component of knee joint

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POLYMER GROUP

/ INSTITUTE OF MATERIALS CHEMISTRY / FACULTY OF CHEMISTRY
/ BRNO UNIVERSITY OF TECHNOLOGY

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

The relationship between structure and properties of polymers, biopolymers, composites and nanocomposites and their fracture mechanics and technology of production.

EXCELLENCE

Our group has achieved world recognized results in the synthesis of amphiphile block copolymers for a wide range of biomedical applications and drug delivery, in understanding the mechanisms and kinetics of thermodynamic transitions in polymer nanocomposites and in their viscoelasticity and deformation behaviour. In addition, excellent results have been obtained in reactive compounding, polymer stability and in computer simulations of complex heterogeneous polymers and polymer composites including bio-nano-composites.

MISSION

- An excellent institute, which is one of the wider world leaders in basic and applied research

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Basic research in the physics of polymer nanocomposites
- Development of new polymer or composite materials for applications in electrical engineering, mechanical engineering, civil engineering and medicine
- Assessing the interaction of biological and synthetic materials with elements of the environment in terms of material life and its impact on the environment

MAIN CAPABILITIES

Basic Research:

- Fibre composite materials
- Optical microscopy
- Confocal microscopy
- Deposition and characterization of plasma polymers

- Simulation and Modelling
- Geopolymers
- MDF Composites
- Non-traditional binders and composites
- Corrosion and Protection of metallic materials
- Synthesis of organometallic compounds

Application research + protection forms

- Polymer nanocomposites
- Biomaterials for tissue engineering
- Sol-gel process

FIELDS OF RESEARCH RESULTS APPLICATION

- Advanced mechanical engineering, aerospace and automotive industries
- Biomedical technology
- Microelectronics
- Coatings, sensors

ALUMNI PROFILE

Our graduates are fluent in using a wide range of experimental devices in FTIR and UV VIS spectroscopies, SEM, OM and CLSM microscopies, thermoanalysis (DSC, TGA, DMA), mechanical testing (tensile testers, impact pendulums, rheoviscosimeters) and master a range of specific synthetic techniques (ROMP, ATRP). In addition, theoretical knowledge of the natural laws governing thermodynamic transitions in polymer based systems as well as morphology formation in polymer composites is also part of the skills acquired by our graduates in the course of their Ph.D. studies.

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

25

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

47

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- TGA 6 thermogravimetric analyzer PERKIN ELMER
- TGA Q500 thermogravimetric analyzer TA

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- DSC Pyris I Differential Scanning Calorimetry PERKIN ELMER
- DMTA 2980 Dynamic mechanical thermal analyser, TA
- RSA-III dynamic mechanical analyser, TA
- AR-G2 rheoviscosimeter, TA
- DSC 2920 Differential Scanning Calorimetry TA INSTRUMENTS
- ZWICK Z 010 Universal test equipment ZWICK – Roell
- Resil Junior, instrumented impact pendulum, CEAST
- Fractovis, biaxial instrumented impactor, CEAST
- LEXT 3000, Confocal laser scanning microscope, Olympus
- iSpeed-3, ultrafast digital camera, Olympus
- hot-stage, Linkam
- Isothermal 16 - digit calorimeter
- TGA + DTA SETERAM
- GPC - Gel permeation chromatography + RI detector
- Image analysis, optical microscope (Olympus BX 50 with an additional light source (Olympus TH 400-200) with a digital camera (Olympus Camedia C-4040Zoom)
- Scanning probe microscopy Ntegra Prima (NT-MDT)
- High-shear mixer TWINROLL
- Gravimetric spectrometer HIDEN ANALYTICAL
- Chembet - 3000 (Fa Quantachrome)
- Zetasizer 3000HSA (Fa MALVERN)
- Elipsometr Jobin – Yvon UVISEL
- Chamber electric furnaces CLASIC
- Diffractometer Siemens D500

BUDGET

TOTAL (MIL. CZK/MIL. EUR)

30 / 1.2

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

10

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

5

MAIN PROJECTS

2005–2011: Multifunctional heterogeneous materials based on synthetic polymers and biopolymers (project MSM0021630501 financed by the Ministry of Education, Youth and Sports)

2010–2012: Effect of nanoparticles on the chain mobility and crystallization kinetics in polyolefin nanocomposites (project GAP205/10/2259 financed by the Czech Science Foundation),

2006–2011: Synthesis of new biomaterials and preparation of stem cell derived cells, and their applications in the treatment of diseases affecting human tissues derived from mesoderm: cartilage, bone, ligament and meniscus (Project 2B06130 financed by the Ministry of Education, Youth and Sports)

ACHIEVEMENTS

- J. Jancar, J.F.Douglas, F.W. Starr, S.K. Kumar, P. Cassagnau, A.J.Lesser, S.S. Sternstein, M.J. Buehler; Current issues in research on structure–property relationships in polymer nanocomposites. Review Article, Polymer, Volume 51, Issue 15, 8 July 2010, Pages 3321-3343
- Jancar, J.; Jancarova, E.; Zidek, J. Combining Reptation Dynamics and Percolation in Modelling Viscoelastic Response of Collagen Based Nanocomposites. Journal of Computational and Theoretical Nanoscience, Volume 7, Number 7, July 2010, pp. 1257-1264
- Jancar J., Hynstova K., Pavelka V., Toughening of denture base resin with short deformable fibres, Composites Science and Technology, Volume 69, Issues 3-4, March 2009, Pages 457-462

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- Kalfus, J.; Jancar, J., Effect of Particle Size on the Thermal Stability and Flammability of Mg(OH)₂/EVA Nanocomposites, Composite Interfaces, Volume 17, Numbers 5-7, 2010, pp. 689-703(15)
- Jancar J, Interphase phenomena in polymer micro- and nanocomposites, in Nano- and Micro-mechanics of polymer blends and composites, Karger-Kocsis J, Fakirov S, Eds., Hanser, Munich 2009, Ch. 7, pp.241-267
- Jancar J, Use of reptation dynamics in modelling molecular interphase in polymer nanocomposites, in Modelling Nanomaterials and Nanosystems, Pyrz R, Rauhe JC, Eds., Springer, Heidelberg, 2009, pp.293-301
- Kalfus J., Jancar J., Theoretical Modelling and Simulation of Rubber Nanocomposites, in Thomas S., Stephen R. (Eds.), Rubber Nanocomposites: Preparation, Properties and Applications, J.Wiley, New York, 2010, ISBN: 978-0-470-82345-3
- Vojtova L, Jancar J, PCT/CZ2009/000153, Degradable polyurethane foams (granted 2011)
- Vojtova L, Jancar J, Blends for thermodegradable polyurethane foams, application CZ 2007-007, (Czech)
- Kučera F, Jancar J, Blend for preparation of ITA grafted PP, application 2007-19026 18837, awarded 28.8.2008, (Czech)

MAIN COLLABORATING PARTNERS

COLLABORATION WITH ACADEMIC PARTNERS

- Polymer Science and Engineering Center, University of Massachusetts (US)
- Institute of Materials Science, University of Connecticut (US)

- University of Veterinary and Pharmaceutical Sciences Brno (Brno, CZ)
- Institute of Experimental Medicine, Academy of Sciences of the Czech Republic (Prague, CZ)
- Faculty of Medicine, Masaryk University (Brno, CZ)

COLLABORATION WITH COMPANIES

- Škoda (Mladá Boleslav, CZ)
- VW (Wolfsburg, DE)
- PPG Industries (Pittsburgh, US)
- Ivoclar (Schaan, LT)
- ADM (Brno, CZ)
- Gumotex (Břeclav, CZ)
- Fatra (Napajedla, CZ)
- VÚP (Brno, CZ)

EXPECTATIONS

REQUIREMENTS

- Cooperation with research institutions as well as companies in the field

OFFERS

- Tailor made polymer based materials
- Troubleshooting



Photo 1 Polymer group leader, Professor Jancar, with Nobel Price laureate in chemistry, Professor Alan Heeger, during his visit in the Polymer Group synthetic laboratory

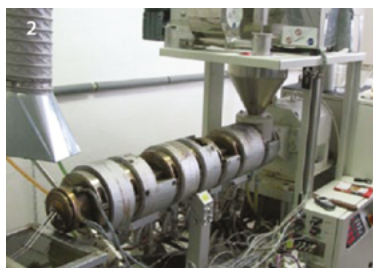


Photo 2 Versatile, 25mm twin-screw extruder with L/D=36 and many adds on in the Polymer Group polymer processing and modification laboratory

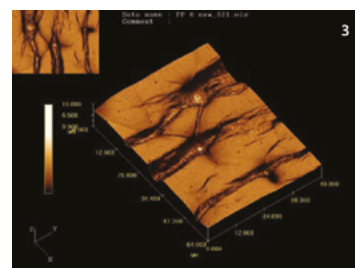


Photo 3 Morphology of reactor ICPP copolymer deformed in the view area of the Polymer Group Confocal Laser Scanning Microscope

04 / 2011

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RESEARCH GROUP OF SMART MATERIALS FOR ORGANIC ELECTRONICS, PHOTONICS AND SENSORS

/CENTRE FOR MATERIALS RESEARCH / FACULTY OF CHEMISTRY /
BRNO UNIVERSITY OF TECHNOLOGY

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

- Organic electronics, photonics, sensors
- Small molecules, polymers and biomaterials
- Preparation of organic thin multilayered systems

EXCELLENCE

Preparation of thin organic multi-layered structures; synchronous characterization of optical and electrical properties and parameters of organic materials.

MISSION

To be excellent in Europe, be flexible in the needs of companies; development of our Centre for material research.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Research of advanced organic materials for organic electronics, bioelectronics, photonics and sensors
- Research of biomaterials for diagnostics / applications of biomaterials
- Deposition of multilayered thin organic systems for a broad range of applications

MAIN CAPABILITIES

The potential for application is also in the use of specific properties of organic semiconductors allowing not only expensive ones to exchange inorganic semiconductors with cheaper organic ones, but also allowing the creation of fundamentally new electronic components for molecular electronics and nanotechnology.

The successful application of research results is based on wide cooperation with many industrial partners from Europe and the Czech Republic.

FIELDS OF RESEARCH RESULTS APPLICATION

Organic electronics and photonics

OTHERS:

Automotive industry, Textile industry, Construction - civil engineering, Construction - residential building, Measuring instruments, Chemical industry, Hazard management, Renewable energy, Energy savings, Plastics, Polymers, Diagnostic, Biotechnology, Clothing, Power supply – alternative resources

ALUMNI PROFILE

Alumni are experts in:

- Material engineering
- Physics and chemistry of advanced organic materials
- Nanotechnology
- Small-scale and special chemistry

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

12

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

25

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- Clean room and glove boxes for the preparation of organic multilayered systems, sensors and other devices
- Complex equipment for the characterization of optical and electrical properties and parameters of organic materials

BUDGET

TOTAL (MIL. CZK/ MIL. EUR)

10 / 0.4

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

10

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

40

MAIN PROJECTS

2009–2013: Multicomponent electronic systems based on organic materials (project FR-TI1/144, Ministry of Industry and Trade, CZ)

2008–2011: Development of Photovoltaic Textiles based on novel Fibres (project 7E09061, Ministry of Education, Youth and Sports, FP7 – NMT – SME, EU)

2006–2010: Molecular nanosystems and nanodevices: electric transport properties (project KAN401770651, Academy of Sciences of the Czech Republic)

MAIN COLLABORATING PARTNERS**COLLABORATION WITH ACADEMIC PARTNERS**

- Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic (Prague, CZ)
- Institute of Physics, Academy of Science of the Czech Republic (Prague, CZ)
- Julius-Maximilians-Universität Würzburg (Würzburg, DE)

COLLABORATION WITH COMPANIES

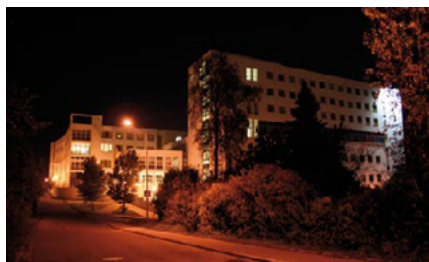
- Generi Biotech (Hradec Králové, CZ)
- Centre of Organic Chemistry (Pardubice, CZ)
- Prefa Nanocomposites (Brno, CZ)
- Centro Ricerche Fiat S.C.p.A., (IT)
- Wetenschappelijk en technisch centrum van de Belgische textielindustrie (CENTEXBEL), (BE)
- Greatcell Solar, S.A. (CH)

EXPECTATIONS**REQUIREMENTS**

We appreciate a clear vision of the potential collaboration including time scales, output, IPR and other relevant circumstances.

OFFERS

We offer our substantive experience in the development of different applications based on organic advanced materials. This experience allows us to effectively utilize the Centre's up-to-date complex equipment for materials research for the preparation, characterization and application of different organic systems.



04/2011

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INSTITUTE OF ANALYTICAL CHEMISTRY

/ FACULTY OF CHEMICAL AND FOOD TECHNOLOGY

RESEARCH GROUP CONTACT

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

Analysis of complex biological and food samples. The research concentrates on the following areas:

- Development and implantation of new high-resolution NMR methods, their application to determine the structure of complex organic molecules.
- Development and implementation of modern methods for in-vivo NMR imaging and in-vivo spectroscopy.
- Development of modern GCxGC TOF MS methods for screening of biological, food and environmental samples, determination of food origin and target analysis of multi-component pollutants in complicated matrices.

EXCELLENCE

New concepts and protocols for the analysis of complex biological and food samples.

MISSION

We will conduct an interdisciplinary approach for the analysis of complex biological, environmental and food samples in collaboration with other groups in basic biological, medical and applied industrial (food) researches in order to clarify relevant metabolic changes, and/or identify the origin and quality of food samples.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Structure and interaction of natural and synthetic organic compounds.
- Study of in-vivo metabolism on experimental animals using different animal models of brain diseases. Analysis of body fluids and tissue extracts using high resolution NMR and statistical methods. Application of GCxGC methods for the analysis of volatile organic compounds in biological, environmental and food samples.

Application of modern separation methods to determine food origin.

MAIN CAPABILITIES

Expertise in NMR and various applications of it, including in-vivo NMR imaging and spectroscopy. Expertise in advanced GC-MS methods and their application in analysis of complex food and biological samples.

FIELDS OF RESEARCH RESULTS APPLICATION

Chemical, biological and medicine research, food industry and environmental pollution.

ALUMNI PROFILE

Graduate has knowledge of modern powerful research and state of the art analytical methods and their application in structure determination, metabolic study and food analysis.

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

4

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

6

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- 600 MHz NMR spectrometer, 300 MHz NMR spectrometer, GCxGC-TOF MS spectrometer

MAIN PROJECTS

State Program ŠP 06K0A02, Project n. 2003SP20028020, "Establishment of the Top-Class Nuclear Magnetic Resonance Laboratory"

MAIN COLLABORATING PARTNERS

COLLABORATION WITH ACADEMIC PARTNERS

- University of Edinburgh, Department of Chemistry, UK
- Université Blaise Pascal, Clermont Ferrand, France

- Università di Bari, Istituto di Clinica Chirurgica, Italy

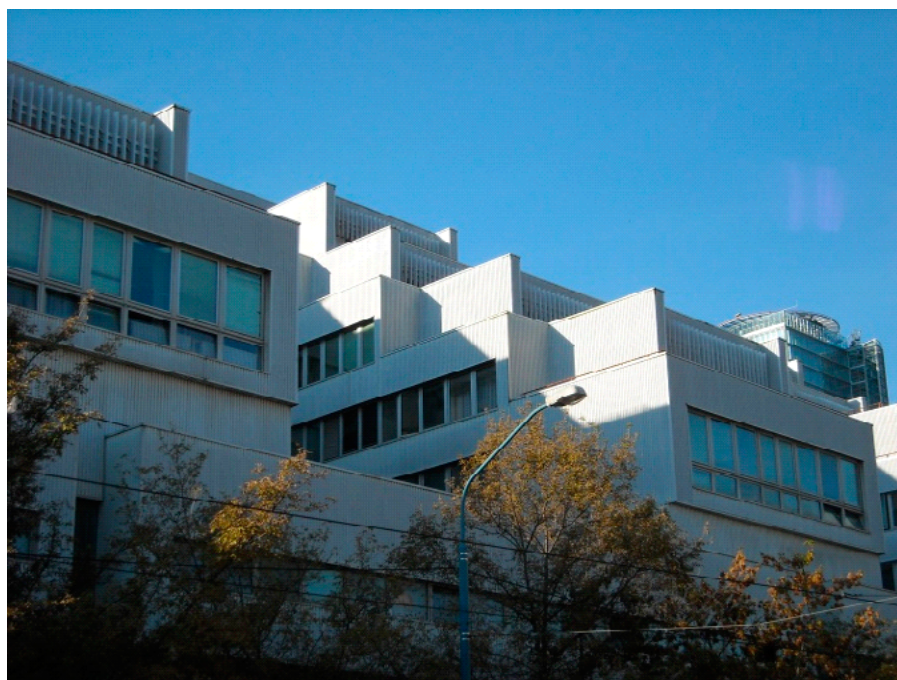
COLLABORATION WITH COMPANIES

- Jesenius Faculty of Medicine, Martin
- Institute of Preventive and Clinical Medicine, Bratislava
- Pharmacobiochem. Lab., Medical faculty of Comenius Univ., Bratislava
- Slovak Academy Sciences, Chemical Institute, Bratislava
- Faculty of Natural Sciences, Comenius University, Bratislava
- Derer Hospital, Bratislava
- Faculty of Natural Sciences UPJS, Košice
- Faculty of Pharmacy, Comenius University, Bratislava
- Research Institute of Animal Production, Nitra
- Slovnaft, Bratislava
- Duslo Šal'a
- Slovakofarma(Zentiva) Hlohovec
- Institute of Polymers, Slovak Academy Sciences, Bratislava
- Soil Sciences and Conservation Research Institute, Prešov

EXPECTATIONS

REQUIREMENTS

Internationalisation of the research team through foreign post doctoral positions and Ph.D.s





INSTITUTE OF CHEMICAL AND ENVIRONMENTAL ENGINEERING

/ FACULTY OF CHEMICAL AND FOOD TECHNOLOGY

RESEARCH GROUP CONTACT

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

The research is carried out within six research groups: Bioprocess Engineering, Diffusional and Separation Processes, Reactor and Safety Engineering, Membrane Processes, Wastewater and Water Treatment, Biogas Production, Chemical Waste Disposal and Removal.

EXCELLENCE

Strong academic research in various fields of reaction engineering, separation processes, industrial biotechnology, environmental engineering and safety engineering combined with co-operations with industrial partners enabling application of many developed methods and technologies.

MISSION

Our objective is to build and maintain a strong educational research centre that would be competitive with other chemical and environmental engineering departments in the region. In the field of education, we have fully implemented the Bologna system for bachelor, master and doctoral levels with a curriculum compatible with the recommendation guidelines of the European Federation of Chemical Engineering. In the field of research, our research groups have been integrated in three interdisciplinary centres of excellence that are very good platforms for carrying out competitive research results that can be applied in practice.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Biotechnological production of prebiotic compounds - fructooligosaccharides
- Characterization of membrane and particular chromatographic adsorbents used for separation of monoclonal antibodies and other therapeutic proteins
- Stabilization and stability of biocatalysts
- Adsorption and chromatographic processes for the recovery of product of biotechnological production processes

- Renewable Energy Sources - pyrolysis and gassification of biomass
- Experimental and mathematical modeling of hybrid reaction - membrane separation systems
- Ionic liquids in extractive separations of organic acids
- Pertraction through liquid membranes and membrane-based solvent extraction
- Formation of hybrid systems with membranes and membrane reactors combining adsorption or extraction into microparticles and microfiltration.
- Microfiltration of suspensions, mainly through ceramic membranes and in submerged modules. Flux decline mechanism and fouling of membranes.
- Vapour-liquid and liquid-liquid equilibria of multicomponent mixtures: experimental determination and prediction, application in separation equipment design
- Wastewater / water treatment: nutrients removal, new reactor and technologies, granulated biomass, membrane sludge filtration, ozonization, Fenton reaction
- Biogas production: biogas from sludge, organic waste and organic material, co-fermentation
- Chemical Waste Disposal and Removal: advanced oxidation methods, photochemical reactions.

MAIN CAPABILITIES

Educated and skilled research team consisting of both experienced and dynamic young researchers with numerous research outputs and practical applications.

FIELDS OF RESEARCH RESULTS APPLICATION

- Chemical industry
- Pulp and paper industry
- Food and beverages industry
- Energetics
- Biotechnology
- Feed production
- Waste/biomass for renewable resources
- Energy audits

- Environmental protection
- Water and wastewater treatment technology
- Waste removal.

ALUMNI PROFILE

Based on the complex knowledge of the field of chemical engineering, our graduates can carry out applied research, design and optimization of chemical and food production processes and environmental technologies. They can integrate knowledge of chemistry and biochemistry with theory of reactors and separation processes and evaluate process economics and safety. They are well qualified to the positions of process engineers and technical managers in chemical, food, and pharmaceutical industries and water/wastewater treatment plants.

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

26

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

25

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- Set of mechanically stirred bioreactors from 2 to 100 litres
- High pressure cell homogenizer
- HPLC, LC/MS, FPLC, GC
- Set of chromatographic columns from 1 ml to 1 l and accessories
- Equipment for membrane extraction (hollow fibre membrane modules)
- Air lift bioreactors of different size (12, 40, 200 litres)
- Continuous equipment for biomass pyrolysis/gasification (5 kg of biomass/hr)
- Continuous catalytic reactor for waste organic liquids pyrolysis/gasification
- Continuous catalytic tubular reactor for solid biomass/plastics pyrolysis/gasification
- GCM Micro Box III, SLS Micro Technology GmbH
- FTIR Microscope, Bruker
- FTIR Tensor 27, Bruker
- Calorimetric bomb, Fire Testing Technology
- CHNSO Analyzer, ELEMENTAR
- BACCHUS II fy Microdon
- TGA/DSC Netzsch STA409 PC
- GC Agilent 6890N
- GC Agilent 7890A
- POROSIMETER P2000
- SORPTOMATIC 1900
- Stand for the membrane based solvent extraction and simultaneous regeneration of the solvent by stripping in hollow fiber contactors.
- Stand with module with spiral channels for testing of supported liquid membranes.
- Microfiltration and ultrafiltration equipment with a tubular ceramic membrane module.
- Ultrafiltration and microfiltration equipment with multichannel membrane element of industrial size.
- Microfiltration equipment with submerged hollow fiber element.
- Reverse osmosis and nanofiltration for testing flat membranes.
- Isotachophoretic and electrophoretic analyser EA 100 (Villa, SK).
- Spektrophotometer (Unicam).
- Density meter Paar DMA 5000
- Titrator with a microprocessor (Mettler) with K. Fischer accessory.
- Rheometer Kinexus (Malvern)
- Mastersizer 2000 (Malvern)
- Zetasizer Nano ZS (Malvern)
- Circulation apparatus for the measurement of binary adsorption data of gases and vapours at ambient temperature
- Differential semimicrostill for the measurement of isothermal equilibrium V-L data for liquids having a low vapour pressure
- Modified static still for the measurement of isothermal and isobaric equilibrium V-L data in systems with very different boiling point
- Modified Gillespie still for the measurement of isothermal and isobaric equilibrium V-L data in systems with close boiling points
- Modified saturation still for the measurement of isothermal and isobaric equilibrium V-L data by the measurement of the concentration of the liquid phase.
- Laboratory models with equipment (pumps, mixers etc.)
- Pilot scale reactors (70 - 200 l reactors; UASB, activation with nitrification-prednitrification, anaerobic digester)
- TOC analyser; Isotachophoretic analyser; HPLC;
- Ozonizator; Respirometers / oximeters

BUDGET

TOTAL (MIL. CZK/MIL. EUR)

500 000 euro

MAIN COLLABORATING PARTNERS

COLLABORATION WITH ACADEMIC PARTNERS

- Institute of Chemical Technology Prague, Czech Republic
- Institute of Chemical Process Fundamentals, Academy of Sciences of Czech Republic, Prague, Czech Republic
- Institute of Chemistry, Slovak Academy of Sciences, Bratislava, Slovakia
- Faculty of Civil Engineering, Slovak University of Technology Bratislava
- Brno University of Technology, Czech Republic
- Wrocław University of Technology, Wrocław, Poland
- University of Minho, Braga, Portugal
- Strathclyde University, Glasgow, U.K.

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- University of Aix-Marseille I,II, and III, Marseille, France.

COLLABORATION WITH COMPANIES

- Slovnaft, Bratislava
- Novácke chemické závody, Nováky
- VUCHT, Bratislava
- Duslo, Šal'a
- Mondi SCP, Ružomberok
- Heineken Slovensko, Hurbanovo
- Euromilk, Veľ'ký Meder
- Fermas Evonik, Slovenská L'upča
- Biotika Slovenská L'upča
- Amylum Slovakia, Boleráz
- Enviral Leopoldov
- Noving, Nováky
- Grucon, Bratislava
- Tauchem, Bratislava
- LiAxx, Bratislava
- Monoprix, Bratislava
- de Miclén, Levice
- LEAF, Levice
- Water Research Institute ,Bratislava
- Veolia, Zvolen
- ČOVSPOL, Bratislava
- K&H Kinetic, Slovenská L'upča
- HYDROTECH, Vinosady
- ASIO-SK Bytča
- Ekoservis Slovensko, Veľ'ký Slavkov
- WTW, meracia a analytická technika, Banská Bystrica
- Hach Lange, Bratislava
- CIBA Spezialitätenchemie Basel, Switzerland.
- Sartorius Stedim Biotech, Goettingen, Germany

EXPECTATIONS

REQUIREMENTS

- Interest in process optimization using the tools of chemical engineering
- Mutual trust and reliable cooperation

OFFERS

R&D common projects and services in the following fields:

- chemical reaction kinetics and reactor design
- safety audits
- optimization of distillation, absorption and extraction processes
- design and optimizations of liquid phase adsorption and chromatography separations in biotechnology
- optimization of stirred-tank and air-lift bioreactor cultivations
- design and optimization of enzymatic reactors
- biocatalyst operational stability testing
- energy audits
- optimization of membrane separations and membrane hybrid processes
- process development for renewable energy from biomass
- waste pyrolysis analyses
- solution of operational problems in water/ wastewater treatment and biogas plants
- design and optimization of environmental technologies
- laboratory and pilot-scale modelling of processes and technologies
- environmental monitoring and analyses



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INSTITUTE OF ORGANIC CHEMISTRY, CATALYSIS AND PETROCHEMISTRY / DEPARTMENT OF ORGANIC TECHNOLOGY / FACULTY OF CHEMICAL AND FOOD TECHNOLOGY

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

Utilisation of biorenewable polyols, as glycerol from vegetable oils and sacharides from lignocelulosic materials, development of green and greening technologies based on selectively catalysed processes, preparation, characterisation and testing of catalyst, selective oxidation of methane to formaldehyde and methanol, propene to methyloxiran, cyclohexylamine to cyclohexanone oxime, alkylation by shape selective catalysts, etc.

EXCELLENCE

Greening of processes by selective catalysis

MISSION

Development of green technologies.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

Utilisation of biorenewable polyols, as glycerol from vegetable oils and sacharides from lignocelulosic materials, development of green and greening technologies based on selectively catalysed processes, preparation, characterisation and testing of catalyst, selective oxidation of methane to formaldehyde and methanol, propene to methyloxiran, cyclohexylamine to cyclohexanone oxime, alkylation by shape selective catalysts, etc.

MAIN CAPABILITIES

BASIC RESEARCH

- Catalyst preparation and characterisation
- Study of mechanisms of various types of chemical reactions by spectrometric methods
- Study of processes in terms of dynamic in-situ experiments

APPLICATION RESEARCH

- New environmentally friendly processes for products preparation, e.g. preparation

of sulfenamides by catalytic oxidation with molecular oxygen, diphenyl based antioxidants

- Utilization of renewable feedstock for product preparations, e.g. glycerol ethers and glycerol carbonate,
- Bulk and supported catalysts with defined active sites
- Etching agent for making permanent safety marks on vehicle glass; etching agent for marking cars and other goods by safety marks visible only under UV light

FIELDS OF RESEARCH RESULTS APPLICATION

- Material science (study of some special samples)
- Specialty chemicals
- Chemical industry
- Pharmaceutical industry
- Fuel additives
- Measuring instruments
- Renewable energy
- Plastics, polymers

ALUMNI PROFILE

Alumni of Chemical Technology Master of Science Program are chemical engineers, who are able to analyze technical problems and suggest appropriate solutions, develop new technological processes, simulate processes in the technological units and optimize them. Graduates are holders of knowledge of manufacturing of chemical compounds and materials, are able to develop and control manufacturing processes and solve technological, safety and ecological problems. They may find employment in chemical production, the petroleum industry, technical sales, environmental protection, commercial and industrial laboratories and R&D of modern environmentally friendly technologies.

The graduates of the 3rd degree have acquired knowledge and skills commensurate with their graduation degree. The graduate is well acquainted with the methods of scientific research and development aimed at streamlining technologies and development of new manufacturing processes for basic chemicals, antioxidants, phar-

maceuticals, pesticides and other chemical specialties. The third degree graduate has reached the level of specialist in their area of activity. They have been groomed for independent work on difficult solutions in the area of development and manufacturing of organic compounds.

Our graduates are fluent in using a wide range of experimental devices, different types of chemical reactors, physico-chemical operations equipment, FTIR and UV VIS spectroscopies, SEM, thermoanalysis (TPD, TPR, DSC, TGA, DMA) and have mastered a range of specific synthetic techniques.

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

5

JUNIOR RESEARCH POSITIONS (INCL . PH.D. STUDENTS)

9

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

In the laboratories of our department we have the required experimental equipment for carrying out the research. This includes high pressure reactors and autoclaves and tubular reactors operating up to temperatures of 600°C applicable for carrying out both liquid phase and gas phase reactions using heterogeneous and homogeneous catalytic systems. We have also temperature programmed calcination ovens operating up to temperatures of 1200°C for the thermal treatment of the catalysts. Analytical equipment for reaction and catalyst analysis includes several gas chromatographs with FID or TCD, high pressure liquid chromatographs with UV-VIS diode array detector or RI detector, a gas chromatograph with a mass spectrometer, an UV-VIS and FT IR spectrometers, TPD

and TPR equipment, equipment from Micromeritics for the measurement of catalyst surface area. In addition, there is interdepartmental instrumentation such as X-ray diffractometer, an atomic absorption spectrometer, EPR and NMR spectrometer equipped with search unit for the measurement of solid materials, fraction collector and flow-cell enable to detect compounds separated by liquid chromatography.

BUDGET

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%): 50 %

MAIN PROJECTS

- Catalysts for specialty chemicals
- Intermediates for fine chemicals
- Chemical and biochemical transformations of glycerol from renewable sources to fine chemicals and fuel components
- without sulfur
- Research of chemical specialties production based on home-made raw materials
- Highly-effective catalysts for polyurethanes

ACHIEVEMENTS

E.g. No. of patents >100

Scientific results of the team members are regularly published in high profile scientific journals

MAIN COLLABORATING PARTNERS

COLLABORATION WITH ACADEMIC PARTNERS

- VŠCHT Praha (CZ)
- UTZCHT ČAV Praha (CZ)
- Institut für Physikalische und Theoretische Chemie TU Wien (AT)

COLLABORATION WITH COMPANIES

- Chemko Strážske
- Slovnaft Bratislava
- NCHZ Nováky
- PCHZ Žilina
- DUSLO, a.s. Šal'a
- UTZCHT ČAV Praha (CZ)
- Università di Padova (IT)
- ENSCM Montpellier (FR)

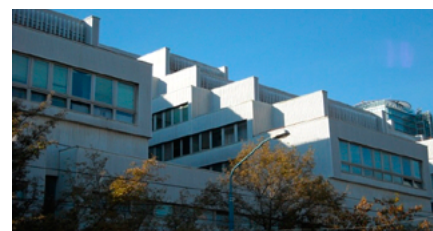
EXPECTATIONS

REQUIREMENTS

- Partners for FP7 research project in the field of catalysis
- Collaboration with industrial partners in common projects dedicated to applied science
- New complementary technologies
- New techniques suitable for analyses of catalysts and processes by in-situ techniques

OFFERS

- Partnership in international projects
- Testing of functional properties of catalysts
- Expertise in chemical processes, greening technologies



09/2011



DEPARTMENT OF CHEMICAL TECHNOLOGY OF WOOD, PULP AND PAPER

/ FACULTY OF CHEMICAL AND FOOD TECHNOLOGY (FCHFT STU)

RESEARCH GROUP CONTACT

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

- Chemical treatment of plant raw materials (biomass, wood)
- Chemical technology of pulp and paper production
- Thermal degradation of natural and synthetic polymers
- Lignocellulosic feedstock bio refinery
- Protection of cultural and material heritage
- Surface treatment of lignocellulosic materials

RESEARCH TARGETS

- Basic and applied research: Biomass, mono- and polysaccharides, lignin, extractives
- Development and application of biofuels and new biomaterials
- New methods and technologies of pulp and paper production
- Protection and surface treatment of wooden-based materials
- New methods and technologies for protection of cultural heritage materials and objects

EXCELLENCE

Centre of Excellence of STU in Bratislava:
National Centre for Research and Application of
Renewable Energy Sources:

- basic and applied research in the field of renewable material and energy sources
- Technological laboratory for conservation of materials and objects of cultural heritage
- Technological laboratory for activation of solid surfaces in atmospheric plasma

HIGH-TECHNOLOGIES

- Thermochemical liquefaction of natural and synthetic materials and waste
- Methods for conservation of cultural heritage materials and objects
- Surface treatment of wooden-based (lignocellulosic) materials by the application of atmospheric plasma technology

MISSION

Main mission of our department is based on

the 68 years long experience [the department was established in 1943] in the education of specialists (M.Sc., Diploma) for the area of chemical treatment of wood (biomass-based materials), for example, for the pulp and paper industry, woodwork industry, and other related areas.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

Department research findings are as follows:

- new processes and substances for technology of conservation historical books and archive documents
- activation of lignocellulosic surfaces in diffuse coplanar surface barrier discharge at atmospheric pressure
- transformation of pulp and paper industry to the Lingo Cellulosic Feedstock Bio refinery

We try to discover:

- system for better application of water-based lacquers used for protection of exterior wood
- increase efficiency of paper recycling

MAIN CAPABILITIES

The main capabilities gained through our research process are as follows:

- work in interdisciplinary groups and their co-ordination
- ability to use scientific tools and methods for analysis and processing of renewable resources
- ability to transfer gained knowledge into practice

FIELDS OF RESEARCH RESULTS APPLICATION

Fields of our research results application are described in attachment no. 1. We can add the following applications of our research results which are not described in this attachment.

ALUMNI PROFILE

The capabilities of our alumni are as follows:

- attention to details
- analytical ability

- knowledge and application of scientific methods
- lateral thinking
- Alumni (graduates of our department) are specialised mainly in:
 - technology of pulp and paper production
 - chemical treatment and utilisation of biomass and renewable raw materials
 - conservation of materials and objects of cultural heritage
 - novel methods in changing surface properties of lignocellulosic materials

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

8

JUNIOR RESEARCH POSITIONS

(INCL. PH.D. STUDENTS)

10

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

- Gas chromatography equipment (FID, TCD, ECD, Headspace Sampler, Purge and Trap, Thermal desorption, SPME applications): several devices and combined with MS detection
- GC-MS – several devices
- Liquid chromatography - various configurations (LC), combination of HPLC-MS - several devices;
- UV/VIS/NIR spectrophotometers - several devices
- FTIR spectrophotometer with a FTIR microscope
- TOC and Elemental analyzer (CHNOS): elemental composition of non-homogenous materials
- Thermal analysis - various equipments (TG, DTA, DSC),
- Calorimetric bomb (determination of gross calorific value), in accordance with the requirements of standard methods (ISO, EN, ASTM, DIN)

- Reactor for the preparation and adjustment of biofuels at high pressures and temperatures
- Equipment for evaluation of oxidative stability
- Gasification reactor with a floating layer and counterflow arrangement
- Analytical determination of qualitative and quantitative composition of prepared biofuels by sophisticated combined methods, such as GC/MS and HPLC/MS
- Laboratory autoclaves for pulping
- Test equipments for evaluation of physical and mechanical properties of pulp and paper
- Testing laboratory for evaluation of deacidification and strengthening of archive documents and books
- Laboratory equipped with Diffuse Coplanar Surface Barrier Discharge device and Surface Energy Evaluation System
- Technological centre for research and development of traditional and new systems for conservation of lignocellulosic carriers of information

BUDGET

TOTAL (MIL. CZK/ MIL. EUR)

2 mil. Eur

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

50 %

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

20 %

MAIN PROJECTS

- **State Programme of Research and Development:** KnihaSK – Preservation, stabilization and conservation of traditional carriers of information in Slovak Republic

- **FP7 Durawood:** - Development of Novel Solvent-free Coating Process for Wooden Facades
- **NCRARES:** National Centre for Research and Application of Renewable Energy Sources

ACHIEVEMENTS

- Technology for the production of liquid biofuels
- Technology for the surface treatment by application of atmospheric plasma discharge
- Technology for conservation of lignocellulosic carriers of information in organic systems
- Technology for conservation of lignocellulosic carriers of information on the basis of water-based systems
- Mobile apparatus for the production of charcoal

MAIN COLLABORATING PARTNERS

COLLABORATION WITH ACADEMIC PARTNERS

- Technical University Zvolen (SK)
- Slovak Academy of Science (SK)
- University of Pardubice (CZ)
- Institute of Chemistry and Technology of Macromolecular Materials (CZ)
- Masaryk University in Brno (CZ)
- Johannes Kepler University Linz (AT)
- EFPG Grenoble (FR)
- University of Catallunya, Castelldefels (ES)
- McGill University Montreal (CA)
- Library of Congress, Michigan State University in Kalamazoo (USA)

COLLABORATION WITH COMPANIES

- Mondi SCP a.s. Ružomberok, (SK)
- BelNovaman International s.r.o, Bratislava (SK)
- Bukoza Holding a.s., Vranov nad Topľou, (SK)

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- SHP Group a.s. Harmanec, (SK),
- Biocel a.s. Paskov, (CZ)
- Plasma Technologic s.r.o (CZ)
- PAM s.r.o. (SK)
- VAS Dolný Kubín, (SK)
- Slovak National Archive
- Slovak National Library
- Slovak National Museum
- TTZ Bremerhaven (DE),
- IRIS - Innovació i Recerca Industrial i Sostenible, Castelldefels (ES)
- Aryecla (ES)
- Electrodynamic Systems and Technologies, Tomsk (RU)
- Setas Kimya (TR)
- Kartas Kontrplak Sanayi (TR)

EXPECTATIONS

REQUIREMENTS

Different companies from the area of woodwork industry and from other sectors are welcome for co-operation. Any potential partners, whether an established company, a start-up, an industry association, research institute or public/government department, should promote credible plan for exploiting research results for social, environmental or economic benefit from the proposed common project. The partner should also show that it has the expertise and resources to put the plan into the effect, or the means, as well as the intention to acquire this capacity.

OFFERS

- Education, courses, training, research, consultancy and expertise
- Analytical services in the field of plant raw materials (biomass, wood)
- Applications and technological development in the field of plant raw materials (biomass, wood)
- Applications of chemical treatment of different kinds of organic waste



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INSTITUTE OF PROCESS AND FLUID ENGINEERING

/ FACULTY OF MECHANICAL ENGINEERING

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THEMATIC RESEARCH FOCUS

RESEARCH AREA

Mechanics of Particulate Materials, Hydraulic and Pneumatic Processes, Filtration and Membrane Processes, Thermal Processes, Bioreactors, Hydro Power Systems, Pumping Systems, Hydro-Mechanical Gears

EXCELLENCE

Center of Excellence for Research and Development of Composite Construction Materials for Machinery, Building and Medical Applications CEKOMAT.

MISSION

We want to offer high standard of education in process and fluid engineering and research in branche mechanics of particulate matter and hydrodynamics and hydrostatics systems.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Mixing, Granulation, Compaction of Particulate Matters
- Extrusion of Pastes
- Pneumatical Classifiers for Powder Materials
- Calculation of Separation Efficiency and Energy Consumption of Cyclone Apparatus
- Computer Simulation of an Expansion of the Pressure and Velocity Waves
- Measurement of Permeability Characteristics in Clogged Fiber Layers
- Heat Transfer in Helicoidal Fluid Flow
- Heat Exchangers with Rotating Heat Exchanger Area
- Hydromechanical Properties of Bioreactors
- Research and development of turbines for Small Hydro Power Plants i.e. simpler design and lower weight
- Research and development of non-conventional hydro equipment
- Pumping systems safety in Nuclear Power Plants
- Proposals of static and dynamic characteristics of hydraulic elements and systems and their experimental verification

- Theoretical and experimental research of characteristics of hydrostatic elements and systems
- Theoretical and experimental formulation of mathematical simulation models and their solutions of unsteady and non-isothermal systems of liquid transport

MAIN CAPABILITIES

- Excellent background with laboratory equipment for collaboration with industry
- Participation in an international research teams
- Experienced researchers team
- Solving of a wide range of research tasks

FIELDS OF RESEARCH RESULTS APPLICATION

- Process engineering
- Machines and apparatus construction
- Devices for energy transfer, waste and biomass processing
- Plants engineering
- Chemical and food industry
- Hydro power plants
- Pipelines design

ALUMNI PROFILE

Our alumni have the knowledge which may be applied in various industrial branche - power, chemical and food industry, industrial practice, research and business.

NUMBER OF RESEARCH POSITIONS

SENIOR RESEARCH STAFF

9

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

12

KEY RESEARCH EQUIPMENT

LIST OF DEVICES

Laboratory of mechanics of the particulate materials - device for measurement of coefficient of internal friction of the particulate materials, Laboratory packing granulator and cylindrical

compactor for pressure granulation. Screw extruder with separated drives of the screw and rotor. Laboratory of filtration - Photo-sedimentograph Analysette 20 of Fritsch Co, Sedimentation scales SARTORIUS 4600, The particle counter with analyzer MEDICOR PSL-1, Analyzer PSA-1, Diffraction Laser-Particle-Sizer "Analysette 22", Laboratory of Laser - Doppler anemometer for 2-D non-intrusive measurement of velocity fields Dantec 60X with processor FVA 58 N 40 and source Ar - Ion. Laboratory of bioreactors - Fermenter Esedra 6,0M Solaris Biotechnology, Laboratory of water turbines - Maximum input power: 100 kW, Speed range: 500 – 5000 1/min, Flow rate range: 0,07 – 0,72 m³/s, Head range: 2 – 12 m., Power: sensor HBM, Pressure difference: differential manometers ROSEMOUNT, Laboratory of pumps - Maximum input: 28 kW at speed 3000 1/min, Stand has 5 circuits, MotionPro Y-3 high speed camera IDT-REDLAKE, High-frequency arc illumination source (pulse light source for visualization of high-dynamic physical processes).

BUDGET

TOTAL: 2,47 mil. EUR

MAIN PROJECTS

Research of interactions in carbon systems for bearing and sealing applications, Development of actual methods and technologies for efficient energy consumption in pump devices, Hydrostatic drive's optimization of mobile working machinery out of aspect of their minimal weight and the minimal power consumptions of transmission performance by fulfilment of kinematic and force requirements, Research of selected processes of the particulate solids matter, Estimation of characteristic curves of an emission quantification and air quality

indicators in terms of European legislation, Modernization of inflow object's hydrostatic power of lock chamber - Waterwork Gabčíkovo.

MAIN COLLABORATING PARTNERS

COLLABORATION WITH ACADEMIC PARTNERS

- TU Darmstadt, Germany,
- TU Karlsruhe (TH) Germany,
- TU Wien, Austria,
- ETH Zürich, Switzerland,
- VUT Brno, Czech Republic,
- CVUT Praha, Czech Republic

COLLABORATION WITH COMPANIES

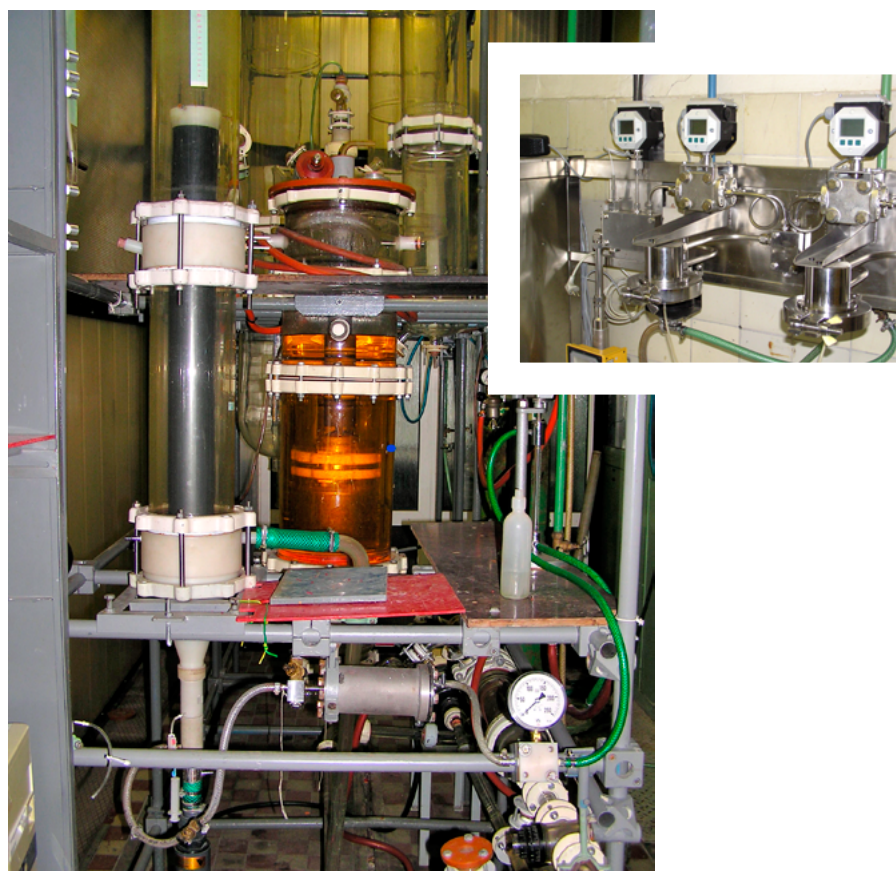
- Elementa Group Inc. St. Catherines, Ontario, Canada,

- HUNTSMAN (Thailand) Limited, Tambol Banghoh, Thailand,
- Lučební závody Draslovka Kolín (CZ),
- Fosfa Brěclav-Poštoná (CZ)
- SPP - distribution a.s., Bratislava (SK),
- eustream a.s., Bratislava (SK),
- TÜV SÜD Slovakia s.r.o., Bratislava (SK),
- Vodohospodárska výstavba Bratislava (SK)

EXPECTATIONS

REQUIREMENTS

- Professional collaboration on research and industrial projects
- Cooperation based on profitability for all partners



09/2011

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