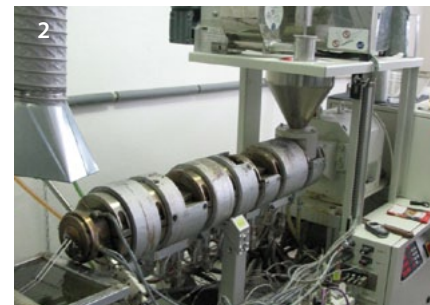


## RESEARCH GROUP CONTACT >>

Purkyňova 118, 612 00 Brno  
<http://www.fch.vutbr.cz/cs/fakulta/ustav-chemie-materialu.html>

HEAD Prof. Josef Jančář  
PHONE + 420 541 149 310  
E-MAIL [jancar@fch.vutbr.cz](mailto:jancar@fch.vutbr.cz)



## 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
- » 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 Calorimetr 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
- » Isoperibolic 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 MALUERN)
- » 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
- » Jancar J., Recman L., Particle size dependence of the elastic modulus of particulate filled PMMA near its Tg, Polymer, Volume 51, Issue 17, 4 August 2010, Pages 3826-3828
- » Kalfus, J.; Jancar, J., Effect of Particle Size on the Thermal Stability and Flammability of Mg(OH)<sub>2</sub>/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

