

KOLOKVIUM 2019

**Ústav makromolekulární
chemie AV ČR, v. v. i.**

Heyrovského náměstí 2
162 06 Praha 6

4. 2. – 7. 2. 2019

28. KOLOKVIUM



K O L O K V I U M

Kolokvia jsou od roku 1992 výroční interní konferencí Ústavu makromolekulární chemie AV ČR, v. v. i.

Reflektují celosvětové trendy základního a aplikovaného výzkumu v oboru makromolekulární chemie a hlavní směry výzkumu ÚMCH AV ČR.

Nabízejí zaměstnancům ústavu a dalším hostům prostor pro odbornou diskuzi nad aktuálními výsledky řešených výzkumných projektů s možností rozvíjet vzájemnou spolupráci.

Součástí Kolokvií jsou také přednášky pracovníků ústavu oceněných v uplynulém roce a hostů z jiných výzkumných institucí a soukromého sektoru v rámci sekce „Jak se dělá věda jinde“.

Panelová diskuze, která tradičně probíhá na závěr Kolokvia, přináší příležitost pro zamyšlení se nad určitým problémem naší práce či celospolečenským tématem. V letošním ročníku budeme diskutovat na téma „Proč i věda potřebuje PR“.

Těšíme se na Vás na našem 28. Kolokviu

P R O G R A M

Pondělí 4. 2.

9:00 **Jiří Kotek, Petr Šálek**
Zahájení

9:10

9:10 **C1 Jiří Brus**

Domain-edited NMR crystallography: An efficient strategy for describing the atomic-resolution structure of nanocomposite solids

9:45 **C2 David Rais**

Femtosecond laser ablation manufacturing: From metal nanoparticle colloids to micromachined parts

10:10 **C3 Elena Tomšík**

Semiconducting polymers as solid contacts for biomedical sensors

Michal Babič

10:35 **PŘESTÁVKA** Občerstvení a diskuze u posterů v klubu B a C

11:00 **C4 Ivana Šeděnková**

The effect of dosage-form formulation on API studied by vibrational and ssNMR spectroscopy

11:25 **C5 Michal Pechar**

Polymer cancerostatics targeted by recombinant antibody fragments to GD2-positive tumor cells

Jiří Brus

11:50 **PŘESTÁVKA** Oběd

13:20

13:20 **C6 Marina Tavares**

HPMA copolymer conjugates for the active targeting to human galectins: The architecture matters

13:45 **C7 Petr Toman**

Charge transport in lamellar structure of linear conjugated polymers

Elena Tomšík

14:10 **PŘESTÁVKA** Občerstvení a diskuze u posterů v klubu B a C

14:40 **C8 Alexander Zhigunov**

Advantages and limitations of the new approach of molecular weight determination using Small-Angle X-ray Scattering

15:05 **C9 Bohumila Podhorská**

Macroporous hydrogel scaffolds for tissue engineering: Study of morphology and biocompatibility

Michal Pechar



P R O G R A M

Úterý 5. 2.

9:00

9:00 **C10** **Libor Matějka**
Smart and self-healing polymers

9:40 **C11** **Miroslav Menšík**
Pump intensity dependent time evolution of diffusion coefficient of excited state in thin films of thiophene-bridged terpyridine ligands

10:05 **C12** **Uliana Kostiv**
Advanced polymer-coated upconversion nanoparticles for biomedical application: Design and characterization

Adam Strachota

10:30 **PŘESTÁVKA** Občerstvení a diskuze u posterů v klubu B a C

11:00 **C13** **Adam Strachota**
Monolithic intercalated PNIPAm/starch hydrogels with very fast and extensive one-way volume and swelling response to temperature and pH: Prospective actuators and drug release systems

11:25 **C14** **Johanka Kučerová**
Fibrin coating for cardiovascular implants

Libor Matějka

11:50 **PŘESTÁVKA** Oběd

13:20

13:20 **C15** **Lenka Kotrchová**
Synthesis of biodegradable water-soluble star-like polymer carriers

13:45 **C16** **Dana Kubies**
Polysaccharide-based polyelectrolyte LbL coatings as carriers for growth factor delivery

14:10 **C17** **Miroslava Dušková Smrčková, Karel Dušek**
How to force polymer gel to show volume phase transition aneb skrytý fázový přechod v gelech

Hynek Beneš

P R O G R A M

Středa 6. 2.

9:00

9:00 **C18** **Miroslav Šlouf**
Micromechanical properties of polymers: Recent progress

9:25 **C19** **Hynek Beneš**
Využití mikrovlnných reaktorů pro bulk polymerace / depolymerace

9:50 **C20** **Petr Šálek**
Development of poly(amino acid)-based nanogel – How the story goes

Ivana Šeděnková

10:15 **PŘESTÁVKA** Občerstvení a diskuze u posterů v klubu B a C

10:45 **C21** **Andrés de los Santos Pereira**
Polymer brushes as bioactive interfaces for contacting biological fluids

11:10 **C22** **Larysa Janisova**
NMR spectroscopy of polymers

Miroslav Šlouf

11:35 **PŘESTÁVKA** Oběd

13:05

13:05 **C23** **Volodymyr Lobaz**
The *in situ in vivo* radiolabeling of polymer-coated hydroxyapatite nanoparticles allows tracking their biodistribution in mice

13:30 **C24** **Ognen Pop-Georgievski**
Conformation in ultrathin polymer brushes resolved by infrared nanoscopy

Andrés de los Santos Pereira

13:55 **PŘESTÁVKA** Občerstvení a diskuze u posterů v klubu B a C

14:25 **C25** **Jan Kučka**
Aspekty testování *in vivo*

14:50 **C26** **Kristýna Venclíková**
Study of immunomodulatory and antibacterial characteristics of nanomaterials

Ognen Pop-Georgievski



P R O G R A M

Čtvrtek 7. 2.

9:00		
9:00	C27 Jiří Pflieger Electronic memory based on solution processable polymers	Miroslava Dušková Smrčková
9:25	C28 Miloš Netopilík Plate-model applied on concentration effects in size exclusion chromatography	
9:50	C29 Jakub Širc Laboratoř čistých prostor ÚMCH	
10:15	PŘESTÁVKA Občerstvení a diskuze u posterů v klubu B a C	
10:45	Přednášky oceněných pracovníků	
10:45	01 Miroslava Trchová Why to use advanced vibrational spectroscopic methods in materials science?	Petr Šálek
11:15	02 Martin Hrubý Samouspořádané polymerní materiály pro biomedicínské aplikace	
11:45	03 Patrycja Bober Polypyrrole - enhancement of conductivity	
12:15	PŘESTÁVKA Oběd	
13:45	Jak se dělá věda jinde	
13:45	G1 Mária Omastová, ÚSTAV POLYMÉROV SAV Smart 2D nanoplatforms for advanced application	Petr Šálek
14:15	G2 Petr Špalek, ŠKODA TRANSPORTATION a.s. Kolejová vozidla a anizotropní materiály	
14:45	Předání ceny za juniorskou prezentaci	
15:00	Panelová diskuze	
15:00	Moderuje Michal Babič Zuzana Plecítá Proč i věda potřebuje PR	
16:30	ZÁVĚREČNÉ OBČERSTVENÍ v klubu B a C	

Seznam posterových prezentací

- P1 Ladislav Androvič**
Synthesis and structure optimization of biocompatible star co-polymers used as effective nanoparticle platform for vaccine delivery
- P2 Markéta Bláhová**
Synthesis of PCL-pHPMA graft copolymers for efficient tumor drug delivery
- P3 Ana-Irina Cocârță**
Methacrylate-based hydrogels for trans-scleral administration of topotecan and vincristine in retinoblastoma therapy
- P4 Sabina Horodecka**
Vitrimers and reversible elastomers non-covalently crosslinked by inorganic nano-building blocks and by orientation-able liquid-crystalline units
- P5 Iryna Ivanko**
Hydrophobic Poly (3,4- ethylenedioxythiophene) (PEDOT)-based solid contact like ion-electron transducer for sensing application
- P6 Leonid Kaberov**
Synthesis and self-assembly behavior of fluorine containing poly-2-oxazolines
- P7 Zhansaya Kaberova**
Theoretical approach for calculation of modulus of hydrogels with interpenetrating network structure
- P8 Jana Kousalová**
Preparation of HPMA copolymers by RAFT polymerization with redox initiation in the water
- P9 Konstantin Milakin**
Conducting composite cryogels based on copolymers of aniline with phenylenediamines
- P10 Islam Minisy**
Carbonized polypyrrole nanotubes covered with globular, nanofibrillar or nanotubular polypyrrole
- P11 Maksym Moskvin**
Temperature-sensitive magnetic solid-lipid particles containing 4-thiazolidinedione-based anticancer drug
- P12 Monika Paúrová**
Synthesis and characterization of polypyrrole nanoparticles
- P13 Jaroslav Štefuš**
Polydopamine coated maghemite $\gamma\text{-Fe}_2\text{O}_3$ nanoparticles
- P14 Nadiia Velychkivska**
Physicochemical study of water soluble porphyrin derivatives
- P15 Guang Wang**
Towards an advanced monolithic template precursor from hexagonal lyotropic liquid crystals



Vzdělávací a informační středisko
ÚMCH AV ČR, v. v. i., pořádá ve dnech
4. – 7. února 2019 vnitroústavní konferenci
KOLOKVIUM 2019

**Setkání se uskuteční v přednáškovém sále A a v klubu B
v budově Ústavu makromolekulární chemie AV ČR, v. v. i.,
Heyrovského náměstí 2, Praha 6-Petřiny.**

Významné přednášky:

Přednášky oceněných pracovníků ÚMCH v roce 2018

čtvrtek 7. 2. 2019

10:30 Miroslava Trchová

Why to use advanced vibrational spectroscopic methods in materials science?

11:15 Martin Hrubý

Samouspořádané polymerní materiály pro biomedicínské aplikace

11:45 Patrycja Bober

Polypyrrole - enhancement of conductivity

Jak se dělá věda jinde

čtvrtek 7. 2. 2019

13:45 Mária Omastová, ÚSTAV POLYMÉROV SAV

Smart 2D nanoplatforms for advanced application

14:15 Petr Špalek, ŠKODA TRANSPORTATION a.s.

Kolejová vozidla a anizotropní materiály

Na závěr konference proběhne **panelová diskuze** na téma: **Proč i věda
potřebuje PR.** Moderuje Michal Babič

Informace o konání Kolokvia 2019 a případné změny v programu lze nalézt na:
<http://www.imc.cas.cz/kolok/kolok19/>



Abstrakty přednášek

C1 Jiří Brus

Domain-edited NMR crystallography: An efficient strategy for describing the atomic-resolution structure of nanocomposite solids

This contribution addresses our attempt to formulate a combined strategy for obtaining the atomic-resolution structure of multicomponent polymeric solids with nano-domain architecture. The potential of this strategy is demonstrated on injectable polyanhydride microbeads consisting of a mixture of microcrystalline decitabine and nanocrystalline sebacic acid, both incorporated in the semicrystalline matrix of poly(sebacic acid). Through the synergistic interplay between the measurements and calculations the statistical analysis, we have developed an integrated approach that enables one to determine structural arrangements in situations which are not tractable by conventional techniques.

C2 David Rais

Femtosecond laser ablation manufacturing: From metal nanoparticle colloids to micromachined parts

Femtosecond laser pulses are much shorter than the typical period of molecular vibration (~ 1 ps). When used for laser ablation, this feature prevents the target from the laser-induced heating, because the whole volume of irradiated material immediately evaporates. This method has unique property that allows us to obtain metal nanoparticles directly in organic medium, which could easily ignite when using longer pulses. In case of micromachining, the apparatus allows us to gently cut fine parts out of polymer foil. Particularly, we are able to dissect living cell culture implants from larger polymer membranes immersed in an aqueous medium.

C3 Elena Tomšík

Semiconducting polymers as solid contacts for biomedical sensors

The chemical sensing is part of the information process in which an insight is obtained about the chemical composition of the system in real-time. In such process, an electrical signal results from the interaction between some chemical species and the sensor. Different types of biomedical sensors will be discussed where semiconducting polymers plays either sensing part or is a transducer (solid contact).

C4 Ivana Šeděnková

The effect of dosage-form formulation on API studied by vibrational and ssNMR spectroscopy

As the active pharmaceutical ingredients (APIs) are predominantly accompanied by excipients in the pharmaceutical dosage forms, the interaction between API and excipient, API and API or between different excipients is of imminent interest. The excipients and their interactions affect the bioavailability of API and as such have to be control during formulation and storage of the dosage form. Three different dosage forms were studied by vibrational and ssNMR spectroscopy: 1) The degradation of pellets for detection of nerve agents; 2) stability of films with benzydamine hydrochloride and 3) silicone dosage forms with prostaglandine.

C5 Michal Pechar

Polymer cancerostatics targeted by recombinant antibody fragments to GD2-positive tumor cells

A polymer conjugate of an anti-tumor drug doxorubicin with a N-(2-hydroxypropyl)methacrylamide-based copolymer was targeted against GD2-positive tumor cells using a single chain fragment (scFv) of an anti-GD2 monoclonal antibody. The targeting protein was attached to the polymer either via a covalent bond between the amino groups of the protein or via a non-covalent but highly specific interaction between bungarotoxin covalently linked to the polymer and the recombinant scFv modified with a bungarotoxin-binding peptide. The GD2 antigen binding activity and GD2-specific cytotoxicity of the targeted non-covalent polymer-scFv complex proved to be superior to the covalent polymer-scFv conjugate.

C6 Marina Tavares

HPMA copolymer conjugates for the active targeting to human galectins: The architecture matters

In the present study we describe the synthesis and the structure-affinity relationship study of Galectine-3-targeted glycoconjugates, based on hydrophilic N-(2-hydroxypropyl) methacrylamide (HPMA) copolymers.

C7 Petr Toman

Charge transport in lamellar structure of linear conjugated polymers

Many polymers (e.g. PPV, P3HT) used in organic electronic devices possess a linear backbone composed of conjugated repeat units interconnected by single bonds. Strong dispersion forces between repeat units of adjacent chains lead to a chain packing into a lamella and subsequent ordering of lamellas into nanofibers. Unlike various charge transport models previously used for organic materials, our approach is combination of the quantum mechanical description of the on-chain charge states with a semi-classical Marcus solution of the inter-chain hopping. The proposed charge transport model was used for calculation of the charge mobility in an active layer of the organic field-effect transistor.

C8 Alexander Zhigunov

Advantages and limitations of the new approach of molecular weight determination using Small-Angle X-ray Scattering

One of the parameters which are usually obtained during small-angle X-ray scattering (SAXS) data treatment is the molecular weight of moieties. The new approach of molecular weight determination from a single scattering curve on a relative scale is proposed. Measurements on an absolute scale will bring additional benefits, including evaluation of the correctness of the chosen form factor. Several examples of successful application of the suggested approach on modeled data show accuracy within 5%. With the data obtained using laboratory SAXS instrument, the average error was ~10%. Method's advantages and limitations will be disclosed during the lecture.

C9 Bohumila Podhorská

Macroporous hydrogel scaffolds for tissue engineering: Study of morphology and biocompatibility

The aim of the project was the detailed study of morphology of hydrogel scaffolds based on copolymer of N-(2-hydroxypropyl)methacrylamide (HPMA) and in vitro characterization of these scaffolds seeded by rat mesenchymal stem cells (rMSC). The scaffold morphology was analyzed by laser scanning confocal microscopy (LSCM) and compared with scanning electron microscopy (SEM) images. The viability of rMSC seeded on the scaffolds and cytotoxicity of prepared materials were also determined.

C10 Libor Matějka

Smart and self-healing polymers

Two types of self-healing (SH) polymers will be discussed - those containing (i) physical supramolecular structure and (ii) chemical covalent reversible network, as a stimuli sensitive unit. (i) The polycarbonate based polyurethanes show a high degree of ordering, strong physical superstructures and entanglements. Two structural motifs are present: the sensitive structure generating SH properties and the entanglement network preventing the irreversible deformation. (ii) The reversible covalent network based on the Diels-Alder reaction is a transient network. The furan-maleimide systems were prepared and the network formation/breaking, as well as dynamics of the transitions were studied.

C11 Miroslav Menšík

Pump intensity dependent time evolution of diffusion coefficient of excited state in thin films of thiophene-bridged terpyridine ligands.

Time evolution of the diffusion coefficient of the excited state in thin films of ditopic ligand bis(terpyridine-40-yl)terthiophene was determined from the transient absorption spectroscopy. It was shown that the diffusion coefficient of excited states, which controls their mutual collision, decreases in time more rapidly with increasing energy of the pump pulse. It was explained that the excited state diffusion decreases due to the excimer formation, which is faster for higher energy of the pump pulse.

C12 Uliana Kostiv

Advanced polymer-coated upconversion nanoparticles for biomedical application: Design and characterization

Considerable attention has been devoted to the development of novel lanthanide-based upconversion nanoparticles (UCNPs) that are promising for both therapy and diagnostics. The current work was focused on synthesis of UCNPs with controllable morphology, i. e., size, its distribution, and high upconversion yield, and on suitable surface modification by biocompatible inorganic or organic polymers. Moreover, UCNPs were decorated with targeting cell-adhesive or cell-penetrating peptides. With the aim to kill cancer cells by photodynamic therapy, phthalocyanine was conjugated to the particles and their in vitro and in vivo biodistribution were monitored by confocal microscopy and SPECT/CT imaging.

C13 Adam Strachota

Monolithic intercalated PNIPAm/starch hydrogels with very fast and extensive one-way volume and swelling response to temperature and pH: Prospective actuators and drug release systems

Centimeter-sized monolithic (non-porous) hydrogels based on poly(NIPAm-co-sodium methacrylate) intercalated by starch were prepared, and were found to display very fast (response times down to 4 min) and extensive (shrinking ratios up to 15) one-way deswelling, induced by both pH and temperature. The unique intercalated structure and the temperature-dependent hydrogen bridging between the intercalated phases, as well as between these phases and water, was found to play the key role in the rapid stimuli-responsiveness. The hydrogels are of interest as soft actuators, but also as chemical- or drug release systems. The latter application was successfully tested with theophylline as drug.

C14 Johanka Kučerová

Fibrin coating for cardiovascular implants

Cardiovascular diseases are one of the main causes of death in the world. Damaged or blocked vessels must be replaced by either by an autologous or synthetic graft. However, due to the high thrombogenicity of the artificial surface, the main challenge faced by many researchers is to decrease the acute thrombosis on the artificial surface. To improve the biocompatibility, we have coated the surface of synthetic grafts with fibrin network and additionally with bioactive molecules such as heparin, growth factors, inhibitors of fibrinolysis etc. Based on the obtained results it seems that fibrin network can be considered as one of the most versatile coating for the cardiovascular implants.

C15 Lenka Kotrčová

Synthesis of biodegradable water-soluble star-like polymer carriers

The star-like copolymers based on *N*-(2-hydroxypropyl)methacrylamide (HPMA) represent one of the most intensively studied and most promising systems for efficient passive tumor accumulation and drug delivery. Therefore we designed, synthesized and characterized highly defined biodegradable water-soluble star-like polymer carriers with polyester core. The molar mass of these star-like carriers can be well controlled in range of 150 to 600 kDa by the changing the ration core to polymers, concentration and time.

C16 Dana Kubies

Polysaccharide-based polyelectrolyte LbL coatings as carriers for growth factor delivery

The layer-by-layer (LbL) assembly of polyelectrolytes is a technique for formation of multilayer films providing release of bioactive components that can be used as functionalized coatings of biomaterial surfaces in tissue engineering applications. Here we present several types of LbL coatings deposited on 3D microporous polylactide-based scaffolds, characterization of their physico-chemical properties, stability and ability to deliver growth factors or cytokines with biological affinity to heparin or eventually ability to enhance cell ingrowth and formation of a new vasculature when implanted in vivo.

C17 Miroslava Dušková Smrčková, Karel Dušek

How to force polymer gel to show volume phase transition aneb skrytý fázový přechod v gelech

Fifty years have elapsed from the prediction of existence of volume phase transition (VPT) in swollen polymer gels and forty years from its experimental discovery. The number of published papers dealing with this phenomenon reached the order of 10^4 . Yet, relatively few polymer gels are known to show VPT. Here, we show that some gels characterized by continuous change of the degree of swelling with temperature (χ -induced transition) transform into ones who show (VPT) under effect of deformation. Strains can also make the VPT wider and more robust in those gels where transition is already observed under free swelling condition.

C18 Miroslav Šlouf

Micromechanical properties of polymers: Recent progress

Morphology of most polymer systems strongly influences their mechanical performance. In the Polymer Morphology Department, we have recently introduced new method – instrumented microindentation hardness testing – which enables us to study both microstructure and micromechanical properties of polymer samples. Important advantage of the method is the fact that the same specimen, even if it is quite small, can be used both for microscopic and micromechanical characterization. Moreover, the local mechanical properties (indentation hardness, modulus, creep etc.) show interesting correlations with bulk mechanical properties. In this contribution we will show several interesting recent examples.

C19 Hynek Beněš

Využití mikrovlnných reaktorů pro bulk polymerace / depolymerace

Přednáška ukáže možnosti využití mikrovlnné techniky pro přípravu polymerních materiálů a kompozitů, popř. pro jejich degradaci/depolymeraci. Bude představen nový monomodální mikrovlnný reaktor, který byl pořízen na odd. 209 v listopadu 2018.

C20 Petr Šálek

Development of poly(amino acid)-based nanogel – How the story goes

Nanogels represent an intensively studied class of soft and hydrophilic nanoparticles, also called nanohydrogels or hydrogel nanoparticles. In my lecture, I will talk about our progress in the development of poly(glutamine)-based nanogels by horseradish peroxidase-induced crosslinking in inverse miniemulsion. The talk will include results from electrochemical measurement of the enzyme kinetics, a study of an effect of emulsifier type and concentration on size, dispersity and morphology of the nanoparticles, an enzymatic degradation of the nanogels, and an application of artificial enzyme (nanozyme) in the nanogel preparation.

C21 Andrés de los Santos Pereira

Polymer brushes as bioactive interfaces for contacting biological fluids

Application of blood-contacting medical devices such as biosensors and implants requires control of surface protein deposition, thrombogenicity, and other associated complications, while displaying specific functionality in the form of immobilized bioreceptors. To tackle this challenge, we created bioactive interfaces based on state-of-the-art antifouling polymer brushes and studied their resistance to non-specific adsorption of blood plasma proteins and platelet adhesion from whole blood. We introduced novel surfaces biofunctionalization strategies to incorporate bioactive molecules while preserving the surface fouling resistance, allowing use of the surface in a label-free biosensor.

C22 Larysa Janisova

NMR spectroscopy of polymers

NMR is considered to be one of the most effective tools for characterizing the microstructures of polymers and enables to provide successful structure determination (including homopolymer and copolymer systems), study a inter- and intro-molecular interactions (for example, Saturation Transfer Difference and Nuclear Overhauser Effect experiments). Diffusion and relaxation NMR experiments measured can be useful tools for the investigation of the local mobility and dynamics of polymer segments and solvent molecules separately. The capabilities and limits of our NMR equipment for investigation of the polymers will be presented.

C23 Volodymyr Lobaz

The *in situ in vivo* radiolabeling of polymer-coated hydroxyapatite nanoparticles allows tracking their biodistribution in mice

We have developed a two-stage diagnostic system for monitoring of long-lasting targeting effects with short-lived radioactive labels using bone-mimicking polymer-coated hydroxyapatite nanoparticles (HAP Nps) and bone-seeking radiopharmaceuticals. Within the pretargeting stage, the non-labeled nanoparticles are allowed to circulate in the blood. Afterwards the ^{99m}Tc -HEDP is administered intravenous for the *in situ* labeling of the nanoparticles and subsequent SPECT/CT visualization. The polymer coating prolongs the circulation of HAP Nps in blood. The nanoparticles were successfully *in vivo* labeled with ^{99m}Tc -HEDP 1 and 24 h after injection and visualized by SPECT/CT over time in healthy mice.

C24 Ognen Pop-Georgievski

Conformation in ultrathin polymer brushes resolved by infrared nanoscopy

Polymer brush coatings are effective in preventing protein fouling, blood coagulation, and bacterial attachment. While their chain conformation is vital for this, it was never characterized in high spatial resolution. We report mid-infrared spectroscopic nanoscopy studies of few-nm poly(ethylene oxide) films of various molecular weight where we find surprising spectral variations at 100 nm length scale along the surface. Theoretical derivation of spectra and comparison with experiment lets us conclude that the polymer grafting density is non-uniform and thus causes distinct variations of both chain conformation and orientation.

C25 Jan Kučka

Aspekty testování *in vivo*

Biologické testování nově připravených polymerních a nanočásticových systémů pro biomedicínu je nedílnou součástí jejich charakterizace. Nové techniky zobrazování *in vivo* (SPECT/CT, MRI, UZ atd.) jsou nyní prakticky dostupné při dodržení vybraných podmínek. V příspěvku jsou uvedeny biologické, legislativní a ekonomické aspekty experimentů na zvířatech.

C26 Kristýna Vencíliková

Study of immunomodulatory and antibacterial characteristics of nanomaterials

This short introduction to immunological and microbiological methods available in BIOLAB will explain their principle and show their potential use on specific experiments already done in our laboratory. These methods can illuminate the effect of nanomaterials and their active compounds on immune cells (stimulatory or inhibitory) and bacteria (bacteriostatic or bactericidal) in *in vitro* systems.

C27 Jiří Pflieger

Electronic memory based on solution processable polymers

For some applications simple electronic memory elements are required, produced by cheap printing technology. We focus on resistor-type memory (ReRAM) made from soluble polymer materials, in which data are stored as different electrical conductivity states. Electrical bistability arises from charge transfer, phase change, conformation changes or local redox reactions, in response to an applied voltage. We show a simple organic memory based on thin films of molecularly-doped polymer based on a soluble derivative of poly(diketopyrrolopyrrole) mixed with a soluble derivative of perylene. We document its functionality on repeated read-write cycles and a retention time exceeding several hours.

C28 Miloš Netopilík

Plate-model applied on concentration effects in size exclusion chromatography

A universal procedure of modeling chromatography separation, based on the plate model, has been developed. On each plate, the equilibrium between the analyte in the mobile and stationary phases is established. This equilibrium may be described by the concentration-dependent partition coefficient. The establishment of the equilibrium on each plate is followed by the displacement of the of the analyte in the mobile phase by one plate, establishment of new equilibrium etc. The result is a series of elution curves with positions of maxima dependent on injected mass of the polymer. The procedure has been tested on the basis of dependences of the partition coefficient.

C29 Jakub Širc

Laboratoř čistých prostor ÚMCH

Představení Laboratoře čistých prostor ÚMCH.

Přednášky oceněných pracovníků

01 Miroslava Trchová

Why to use advanced vibrational spectroscopic methods in materials science?

Interesting examples of the using of the vibration spectroscopic facilities in Department of vibrational spectroscopy and their advantage for other scientists of the Institute will be demonstrated. Advanced spectroscopic methods of FTIR spectroscopy were used to detect in-situ time evolution of the spectra during aniline oxidation or temperature dependent spectra of samples in temperature controlled cell. Resonance Raman scattering of light from lasers emitting in various visible or near-infrared regions were used for study of molecular structure of polypyrrole nanotubes or of carbonized polyaniline aerogels. SERS effect allowed detection of aniline oligomers on gold support.

02 Martin Hrubý

Samouspořádané polymerní materiály pro biomedicínské aplikace

Na samovolném uspořádání makromolekul v prostoru na základě nekovalentních mezimolekulových přitažlivých a odpudivých sil je založeno mnoho jevů v přírodě, především sám život. Samouspořádané polymerní nanosystémy proto nalézají mnohé potenciální aplikace v biomedicíně. Přednáška je přehledem biomedicínsky směřovaných samouspořádaných polymerních nanosystémů studovaných na oddělení Nadmolekulárních polymerních systémů.

03 Patrycja Bober

Polypyrrole - enhancement of conductivity

Emerging electronics and energy applications require new materials combining original electrical properties. Such are conducting polymers, e.g. polypyrrole, having a mixed electron and ion conductivity. Their conductivity can be further modified by introducing to the polymerization mixture the structure-guiding additives. Resulting polypyrroles can be obtained in various forms. Powders are typically produced by the polymerization of monomer with oxidant. Colloidal dispersions are obtained if a stabilizer is present during the polymerization. When the polymerization is conducted in the presence of water-soluble polymers in a frozen reaction mixture, hydrogels are obtained after thawing.

Jak se dělá věda jinde

G1 **Mária Omastová, ÚSTAV POLYMÉROV SAV**

Smart 2D nanoplatforms for advanced application

Last years promoted the generation of novel organic/inorganic nanosystems for biomedical applications. Graphene derivatives, such as graphene oxide (GO) and reduced GO, have been recently demonstrated as attractive candidates for biomedical applications, like cancer detection or drug delivery. Since the discovery of graphene and its derivatives, various biocompatible two-dimensional (2D) materials have been investigated. In the presentation GO functionalized with magnetic nanoparticles and the monoclonal antibody specific for the CA IX marker for cancer targeting will be introduced, and in the second part modified exfoliated MoS₂ nanoplatform for the same aim will be presented.

G2 **Petr Špalek, ŠKODA TRANSPORTATION a.s.**

Kolejová vozidla a anizotropní materiály

Využití vláknových kompozitních materiálů na bázi skla nebo uhlíkových vláken ve stavbě kolejových vozidel. Možnosti spojení nekovové součásti s kovovými/ocelovými součástmi konstrukce. Představení příkladů použití.
