RCPTM NEWSLETTER

1/2018

REGIONAL CENTRE OF ADVANCED TECHNOLOGIES AND MATERIALS
Regionální centrum pokročilých technologií a materiálů

Palacký University Olomouc

Dear Ladies and Gentlemen,
You are reading the fourth edition of our quarterly newsletter ending the year 2017 – a very successful year for RCPTM in which the OP RDE Excellent Teams project started and the new Photoelectrochemistry research group came into being. It was the year in which scientists from the Centre were published in the Nature family of journals and in Science journal. Some of the products and technologies developed here entered the industrial sphere. At the end of the year, the long-term effort of the whole Centre was then rewarded by being given a grant from the OP RDE program Excellent Research.

Here, I would like to thank our scientists, domestic as well as foreign, and the implementation team for all their work. I wish them and also our readers good health, lots of energy and ideas in the new year and I hope that you will continue your goodwill towards us in 2018.

Radek Zbořil
General Director

Czech–Hong Kong cooperation has produced new nanomaterials with a number of applications

The collaboration between scientists from RCPTM and City University of Hong Kong produced exceptionally interesting results last year. The common denominator of the two groups is the use of small pieces of matter in the order of thousandths of micrometers, which emit light of different colors depending on their size and chemical structure. These objects are called carbon quantum dots, copper nanoparticles, and the so-called inorganic-organic perovskites. This work has led to the publication of papers in prestigious specialist journals including ACS Nano and Nature Communications.

Two joint papers published in the American Chemical Society journal ACS Nano have highlighted the great application potential of carbon nanoparticles in medical diagnostics. These studies concern the carbon nanoparticles that serve as thermometers in living cells and can thus point to diseased cells in living organisms (Kalytchuk S. et al. *ACS Nano* 11, 1432–1442, 2017), and a new technology for the preparation of so-called red carbon dots, which may yield a breakthrough in imaging methods (Holá K. et al. *ACS Nano* 11, 12402–12410, 2017). Extremely sensitive nanosensors capable of detecting even very small amounts of highly explosive trinitrotoluene, new types of quantum dots for applications in LEDs (Kalytchuk S. et al. *ACS Photonics* 4, 1459–1465, 2017; Tian Z. et al. *Adv. Opt. Mater.* 5, 1700416, 2017), and the development of inorganic-organic perovskite-based nanocrystals applicable in solar cells (Huang H. et al. *Nat. Commun.* 8, 996, 2017) are also exciting developments.

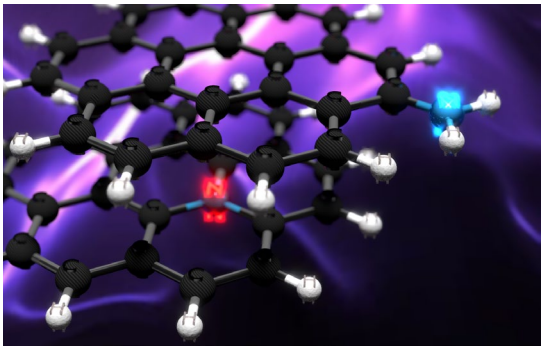
The collaboration began seven years ago when Radek Zbořil, the Director of RCPTM, met the head of the Hong Kong team, Andrey Rogach. It was then that the idea was born to link the knowledge of the Olomouc scientists, studying the field of carbon nanostructures and their applications, to the description of the optical properties of quantum dots that the Hong Kong group had been studying for 20 years. "In the past, we have published many joint papers on the development and applications of materials with interesting features for use in optoelectronics and medicine, but year 2017 was extraordinary. All projects have great application potential and we will follow up on them in the coming year. Therefore, we are planning to hire new employees to our joint team," said Zbořil.

Scientific Results

How to tune the optical characteristics of carbon quantum dots

Carbon dots are a very young class of stable, easily prepared and highly biocompatible nanomaterials with great application potential in cell labeling technologies and cell temperature measurement, optical imaging in medicine, LEDs and optoelectronic applications (e.g. Georgakilas V. et al. *Chem. Rev.* 115, 4744–4822, 2015; Hola K. et al. *Nano Today* 9, 590–603, 2014; Kalytchuk S. et al. *ACS Nano* 11, 1432–1442, 2017). Unlike metal-based quantum dots, the control of photoluminescence properties of these materials is not only through the size of the nanoparticles but also through the different chemical properties of the graphitic core and the surface functional groups. Developing an elegant method of managing optical properties and separating individual color fractions has thus been a major challenge for the scientific community for many years.

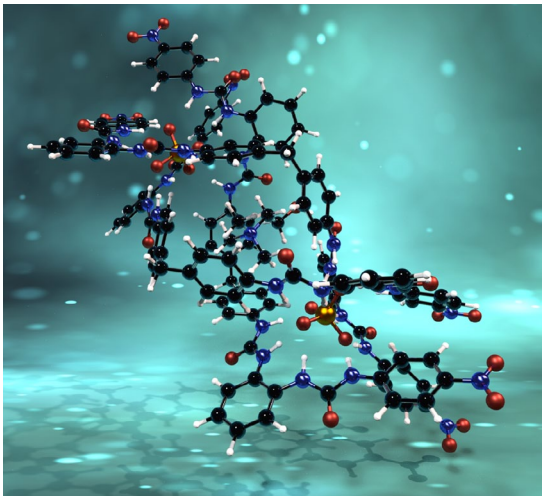
In a study, published at the end of 2017 in the ACS Nano journal, the RCPTM team of scientists developed a two-stage method for the preparation of carbon dots with fluorescence in the blue, green, yellow and red range of the light spectrum. The precursors for the synthesis of carbon dots under elevated pressure and temperature are citric acid and urea, and individual color fractions are separated using column chromatography thanks to the different charge of the obtained fractions. Researchers at our Centre have also shown that the key parameter that shifts optical properties towards the red wavelength is the increasing content of graphite nitrogen in the structure of carbon quantum dots. The ability to prepare "red" quantum dots easily is very encouraging in terms of their application for *in vivo* optical imaging technologies, as red light has the best tissue penetration. The RCPTM team is already intensively working on this application with the group of Luděk Šefc, Head of the Center for Advanced Preclinical Imaging of the First Medical Faculty, Charles University in Prague.



Holá K., Sudolská M., Kalytchuk S., Nachtigallová D., Rogach A.L., Otyepka M., Zbořil R.: Graphitic Nitrogen Triggers Red Fluorescence in Carbon Dots, *ACS Nano* 2017, 11 (12), 12402–12410. IF = 13.942

Scientists caged the choline molecule to understand its interactions with receptors

Proteins are among the basic building blocks of all known organisms. Their interactions with smaller molecules take place in sophisticated cavities that are capable of accurate drug recognition between molecules of similar size, shape and charge. The basic principles of these processes are still not fully understood. One of the approaches to study them is the development of artificial receptors. An important step towards understanding the recognition of choline, which is a building block of cell membranes, by both natural and artificial receptors was achieved through the collaboration of Pavel Hobza from RCPTM and the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences, along with colleagues from Beersheba (Israel), Oak Ridge (USA) and Xi'an (China). The key role here is played by a cage-shaped binding site formed by the aromatic nuclei of benzene derivatives. They are in intimate contact with the substrate, choline, through nonbonded cation–π interactions. A new investigation of this arrangement came from computations of a self-aligned cage that pointed to the possible role of a second binding site and the role of entropy. The choline molecule contains a hydroxyl functional group that forms a hydrogen bond with the cage and is therefore favored despite the increased cavity size and reorganization requirements. Due to the fluorescence properties of the substances used to construct the aromatic cage, there are potential applications in cell imaging, membrane transport monitoring, and the recognition of proteins and their activities.



Jia C., Zuo W., Yang D., Chen Y., Cao L., Custelcean R., Hostaš J., Hobza P., Glaser R., Wang Y.-Y., Yang X.-J., Wu B.: Selective binding of choline by a phosphate-coordination-based triple helicate featuring an aromatic box, *Nature Communications* 2017, 8 (1), 938. IF = 12.124

Photoluminescent nanocrystals for developing a new generation of displays and LEDs

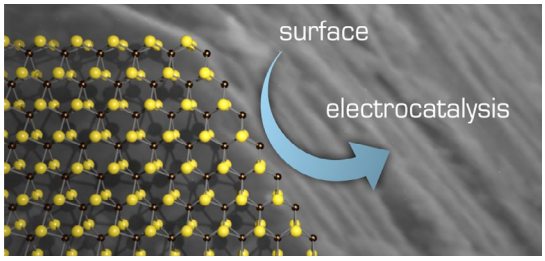
Inorganic metal halide crystals with the so-called perovskite structure and the general chemical formula ABX_3 (where A is a monovalent cation, B is a divalent cation and X is a halide anion) are very promising materials with a wide range of applications, including LEDs, solar cells, and photodetectors. Only a few years ago, in 2014, the first colloidal synthesis of nanocrystals of the so-called organic–inorganic perovskites with the chemical composition $CH_3NH_3PbX_3$ (X = Cl, Br, I) and a huge photoluminescence yield that approached 100% was described. In order to transfer these materials to real technologies, it is extremely important to be able to control the chemical composition and size of nanoparticles precisely, as these parameters fundamentally affect the resulting optical properties. In a joint publication from RCPTM authors with Hong Kong colleagues published in Nature Communications, the research team described their development of a synthetic pathway allowing such controlled growth of crystals by changing the reaction components and their concentration. In addition, for the first time, the mechanism of nucleation and growth control of these ultra-small crystals and the influence of ligands on the chemical form of lead in the structure of such strongly photoluminescent materials was explained in detail.

This knowledge can be used specifically in the further development of new types of displays and LEDs. Last year, the joint Czech–Hong Kong team also developed other promising nanosystems for use in LED technologies, namely carbon dots and metal quantum dots of the CdHgTe type (Tian Z. et al. *Adv. Opt. Mater.* 5, 1700416, 2017; Kalytchuk S. et al. *ACS Photonics* 4, 1459–1465, 2017).

Huang H., Raith J., Kershaw S.V., Kalytchuk S., Tomanec O., Jing L., Susha A.S., Zboril R., Rogach A.L.: Growth mechanism of strongly emitting $CH_3NH_3PbBr_3$ perovskite nanocrystals with a tunable bandgap, *Nature Communications* 2017, 8 (1), 996. IF = 12.124

Layered transition-metal ditellurides are suitable electrocatalysts for hydrogen evolution

Hydrogen is considered to be the fuel of the future. However, it is essential to ensure its sustainable production. One of the options to produce it is using (photo)electrocatalysis of water. Platinum is one of the most efficient catalysts for this process, but its high price is an obstacle. Thanks to their applications for electrocatalysis during water splitting, the layered materials known as transition-metal dichalcogenides (TMD) have become the objects of intense scientific interest. A typical efficient catalyst from this class of substances is MoS_2. Scientists from RCPTM, together with colleagues from the University of Chemistry and Technology Prague and Nanyang Technological University in Singapore, prepared new telluride TMDs, $MoTe_2$ and WT_2. They exfoliated them with the help of n-Butyllithium and sodium naphthalene. More precisely, they separated them into individual layers and explored their possible use in electrocatalysis. Both materials catalyze the electrochemical reaction for hydrogen release efficiently; the best performance comes when they are in an exfoliated state. $MoTe_2$ exhibits excellent electrocatalytic properties, which predisposes it for use in electrocatalytic water splitting.



In our study, we showed that the correct structure of its edges is the key for catalysis by MoS_2 (Lazar P., Otyepka M. *Chem. - Eur. J.* 23, 4863–4869, 2017). Also, the edges of individual layers make MoS_2 sensitive to oxidation in the atmosphere (Martincová J. et al. *Chem. - Eur. J.* 23, 13233–13239, 2017).

Luxa J., Vosecký P., Mazánek V., Sedmidubský D., Pumera M., Lazar P., Sofer Z.: Layered Transition-Metal Ditellurides in Electrocatalytic Applications—Contrasting Properties, *ACS Catalysis* 2017, 7 (9), 5706–5716. IF = 10.614

Other publications from RCPTM

Colmenares J.C., Varma R.S., Nair V.: Selective photocatalysis of lignin-inspired chemicals by integrating hybrid nanocatalysis in microfluidic reactors, *Chemical Society Reviews* 2017, 46 (22), 6675–6686. IF = 38.618

Otyepková E., Lazar P., Luxa J., Berka K., Čépe K., Sofer Z., Pumera M., Otyepka M.: Surface properties of MoS_2 probed by inverse gas chromatography and their impact on electrocatalytic properties, *Nanoscale* 2017, 9 (48), 19236–19244. IF = 7.367

Sofer Z., Luxa J., Bouša D., Sedmidubský D., Lazar P., Hartman T., Hardtdegen H., Pumera M.: The Covalent Functionalization of Layered Black Phosphorus by Nucleophilic Reagents, *Angewandte Chemie International Edition* 2017, 56 (33), 9891–9896. IF = 11.994

Konté N.D.D., Krepl M., Damberger F.F., Ripin N., Duss O., Šponer J., Allain F.H.-T.: Aromatic side-chain conformational switch on the surface of the RNA Recognition Motif enables RNA discrimination, *Nature Communications* 2017, 8 (1), 654. IF = 12.124

Di Donato M., Lerch M.M., Lapini A., Laurent A.D., Iagatti A., Bussotti L., Ihrig S.P., Medved' M., Jacquemin D., Szymański W., Buma W.J., Foggi P., Feringa B.L.: Shedding Light on the Photoisomerization Pathway of Donor–Acceptor Stenhouse Adducts, *Journal of the American Chemical Society* 2017, 139 (44), 15596–15599. IF = 13.858

RCPTM Scientific Board

RCPTM has a new Scientific Board, whose members will meet for the first time in March 2018. This advisory body of the General Director of RCPTM monitors and proposes the main research directions and the transfer of research results into applications.

Jiří Čejka

Charles University, J. Heyrovský Institute of Physical Chemistry of the Czech Academy of Sciences

He focuses on heterogeneous catalysis, synthesis of microporous and mesoporous molecular materials mainly based on zeolites. He is the head of the Zeolite Group Committee at the Czech Chemical Society and, in 2014, he received the Award of the President of the Grant Agency of the Czech Republic for his research on zeolites.

Antonín Fejfar

Institute of Physics of the Czech Academy of Sciences

He specializes in the physics of thin films of nanostructured semiconductors with applications mainly in photovoltaics and photonics. He is a member of the Committee on Energy of the Czech Academy of Sciences, Scientific Board of CEITEC Nano at Brno University of Technology, and Nanometer Structures Division of the International Union for Vacuum Science, Technique and Applications (IUVSTA).

Roland A. Fischer

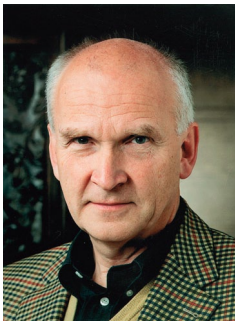
Technical University of Munich

He is a world-renowned expert in inorganic chemistry and metal–organic materials, mainly based on metal–organic frameworks (MOF). His research deals with the development of functional molecular materials with possible applications in energy conversion, catalysis, gas storage and separation, sensing, photonics, and microelectronics. He had been a member of an editorial board of Angewandte Chemie for many years.

Paolo Fornasiero

University of Trieste

He is a Professor of Inorganic Chemistry who focuses on materials chemistry with an emphasis on the design and development of multifunctional metal-oxide nanosystems for advanced applications in energy and environmental heterogeneous catalysis. He is an Associate Editor of ACS Catalysis and a laureate of the Heinz Heinemann Award awarded by International Association of Catalysis Societies (IACS).



Wolfgang Lindner

University of Vienna

He is a Professor of Analytical Chemistry and an expert in the field of chromatography and chirality research. He works on the interface between organic, analytical, and biological chemistry. He has been an editor of major international journals, including Chirality, and Chromatographia. He has received, among others, the Chirality Medal, the ACS Award in Chromatography, and the AGP Martin Medal.

Arben Merkoçi

Catalan Institute of Nanoscience and Nanotechnology

He specializes in research into the use of nanomaterials mainly in biosensor applications in medicine, environmental protection, and electronics. He was awarded the IAAM Medal in 2011 and the Nano Award in 2013 by the International Association of Advanced Materials, for outstanding research in the field of nanoscience and nanotechnology. He is an editor of Biosensors & Bioelectronics.

Marián Valko

Slovak University of Technology in Bratislava

He is a specialist in physical chemistry and molecular spectroscopy and has greatly contributed to clarifying the role of free radicals in biosystems. His significant achievements include the description of the role of redox metals in the origin of oxidative stress in living systems. He is a member of the Learned Society of the Slovak Republic. In 2016, he received a prize from the Minister of Education, Science, Research and Sport of the Slovak Republic.

Ladislav Kavan

J. Heyrovský Institute of Physical Chemistry of the Czech Academy of Sciences

He is a pioneer in the study of electrochemical nanomaterials. He contributed to the development of a new type of a highly efficient high-voltage solar cell. He is a member of an editorial board of Carbon journal and a laureate of the Award of the Czech Academy of Sciences for excellent results of great scientific impact. He received the František Běhounek Award for the promotion and popularization of Czech science and the spread of the good name of the Czech Republic in the European research area.

Our Grants

RCPTM has succeeded in the Excellent Research grant competition

RCPTM will receive CZK 335 million over the next five years from the Operational Programme Research, Development and Education. In its application to the "Excellent Research" project, the Centre succeeded against 130 domestic research teams with the "Nanotechnology for the Future" project. This project aims at the development of nanotechnologies with a major social impact in the following areas: improvement of the quality of the environment, human health, and renewable energy resources.

The key topics include, for example, the development of new two-dimensional materials with unique magnetic and catalytic properties, nanolayers for advanced optical applications, hybrid nanomaterials for use in the production and storage of hydrogen, biomedical technologies for the detection and regulation of processes at single-cell level, and the use of waste materials for the production of nanomaterials applicable in water treatment and environmental protection technologies.

"The success in this grant application confirms RCPTM's position as of one of the leading European nanomaterial research institutes with the expected intense involvement in European projects. At the same time, the project will strengthen our position in already existing large scientific collaborations, such as the European Particle Physics Laboratory CERN and the Pierre Auger Observatory in Argentina. The research programs will be led by experts not only from the Czech Republic but also from the USA, Hong Kong, and Italy. In addition, the project will involve 12 new top scientists mainly from abroad," disclosed the RCPTM Director Radek Zbořil.

To meet the project's objectives, RCPTM will use the already existing infrastructure, which will be extended using some unique techniques. There is, for example, a high-resolution scanning electron microscope with a focused ion beam, which will allow the study of the internal structure of materials in detail. "RCPTM, which already has the most powerful transmission electron microscope in the Czech Republic, can become the leading European microscopy center," added Zbořil.

Twenty-four strategic foreign partners, including Tokyo University, Technical University of Munich, Cornell University in the USA, along with others, have all promised to participate in the project.

Interview

"Quantum dots are extremely versatile materials"

Andrey Rogach, a scientist with Belarusian roots who currently works at City University of Hong Kong, has researchers from more than a dozen of countries in his team. He collaborates with a number of scientific institutions worldwide. He has also found common ground with researchers from RCPTM. Ultra-small objects with dimensions in the order of thousandths of micrometers – quantum dots, copper nanoparticles, or the so-called inorganic–organic perovskites – are the focus of their attention. To the delight of both sides, the long-term cooperation has borne fruit, with last year's fruit especially sweet.

For about two decades, your team has worked on so-called quantum dots. How did these materials attract your attention? What are the key areas of applications of these materials that you would like to address?

Indeed, we have worked on semiconductor quantum dots for more than two decades now. The nice point about quantum dots is that these are extremely versatile materials, which we synthesize in solution and can modify on demand for a lot of potential applications. We design and develop them for applications such as light-emitting devices (LEDs) and displays. We also pay a lot of attention to quantum dots able to absorb and emit light over the broad near-infrared and mid-infrared spectral range, with a view to using them for gas sensors and photodetectors. Our most recent kind of light-emitting quantum dots, which were the focus of our research, are lead halide perovskite nanocrystals, which turned out to be very bright emitting materials. We do collaborate with RCPTM in this field of research as well.

You have mentioned collaboration with RCPTM. Nevertheless, your research team collaborates with a number of institutes abroad. What is the position of RCPTM in comparison to these other institutes? What do you think are the main benefits of this collaboration?

There are several particular aspects of our collaboration that I would like to emphasize in this respect. First, several of my previous Ph.D. students and postdocs used to be employed or are still employed by this Centre. Second, RCPTM offers us very efficient support on the wide range of structural characterization techniques of nanomaterials, such as high resolution transmission electron microscopy with the possibility of chemical mapping of crystals. For many of our nanomaterial systems, availability of this kind of data is of immense importance. Third, we also rely on the expert support from the computational team at RCPTM led by Michal Otyepka in our projects related to carbon dots. As a result, there are multiple benefits from our collaboration with RCPTM, ranging from our ability to produce high quality joint papers on nanotechnologies, to the employment of international students and postdocs.

Your partnership with RCPTM resulted in several great publications in 2017. They were published in prestigious journals including ACS Nano and Nature Communications. Which one of the papers do you value the most?

I particularly liked our joint paper entitled "Carbon Dots Nanothermometry: Intracellular Photoluminescence Lifetime Thermal Sensing," which we had published in ACS Nano at the end of 2017. The first author on this publication is my former postdoctoral fellow Sergii Kalytchuk, a very skilled spectroscopist. The paper itself is a perfect combination of work by chemists, biologists, and physicists; we show how non-toxic carbon dots can be employed for remote optical measurements of the temperature inside the cells. This technique has a lot of potential implications. Any time I present this work at international conferences and seminars, it receives a lot of interest and attention.

Which direction will the Olomouc–Hong Kong collaboration follow in the near future?

We will definitely continue our joint studies on carbon dots; this is an extremely versatile platform to achieve eventual breakthroughs in several research areas, in particular those related to luminescence labeling of biological systems. The RCPTM team is one of the most reputed in the world for carbon-based nanomaterials, and I see our collaboration on carbon dots flourishing. We also plan to extend our collaborative efforts in this area by involving other teams from China and Russia. Moreover, we also plan to involve both spectroscopy and the theory team of RCPTM in our ongoing research on infrared quantum dot materials.

Awards

The Alfred Bader Prize heading to Olomouc

Pavel Štarha from the research group Biologically active complexes and molecular magnets and from the Department of Inorganic chemistry of the Faculty of Science, Palacký University, received the prestigious Alfred Bader Prize for young Czech bioorganic and bioinorganic chemists in 2017. The prize is awarded annually by the Czech Chemical Society. Štarha and his colleagues specialize mainly in the study of complexes of selected transition metals and their possible use in antitumor therapy.

The prestigious Czech prize for chemists under 35 years of age was awarded to the young scientist for his work in the field of bioinorganic chemistry. He received the award at the beginning of November at the conference Advances in organic, bioorganic, and pharmaceutical chemistry—Liblice 2017, where he gave a plenary lecture.

"I see the award as an award not only for my work but mainly as an appreciation of the results of the whole research team under the guidance of Professor Zdeněk Trávníček. After the initial feeling of joy, a feeling of great responsibility emerged immediately after. I am aware that I should not rest on my laurels and that it is necessary to regard it as a commitment to further professional life," said Štarha, who also received the Dean's prize for prestigious scientific publications last year.

Czech-French student won in Kraków

French student Benjamin Chantemargue, who is a student in a double-degree Ph.D. program in Olomouc, received a prize from the Professor Zygmunt Wasylewski Foundation for the best lecture at the Fifth European Joint Theoretical/Experimental Meeting on Membranes (EJTEMM 2017). It was organized by the Jagiellonian University in Kraków at the beginning of December.

Benjamin Chantemargue studies in Olomouc under the physical chemist Michal Otyepka and at the University of Limoges under Patrick Trouillas. At the interdisciplinary international meeting, he successfully gave a lecture entitled "Exploration of landscapes of ABC membrane exporter". Both institutions have collaborated for more than seven years and, during this time, the authors have published ten research studies.

Introducing a Scientific Infrastructure

Mössbauer spectrometers (MS) are part of the basic infrastructure of RCPTM. The method is a specific form of gamma-ray spectroscopy, which is used to analyze solid iron-bearing materials. It enables the study of so-called hyperfine interactions between atomic nuclei and their surroundings. Hyperfine parameters provide information about structural, electronic, and magnetic properties of materials. This element-selective technique makes it possible to distinguish and quantify reliably nonequivalent valence states of iron in solid patterns, and differentiate between amorphous and crystalline phases or isomorphic structures. The scientists make use of this mainly in environmental or catalysis research (e.g. Rathi A. K. et al. *Green Chem.* 18, 2363–2373, 2016; Sharma V. K. et al. *Acc. Chem. Res.* 48, 182–191, 2015). Mössbauer spectroscopy is also often used for advanced magnetic characterization of nanomaterials, mainly for applications in targeted drug delivery or magnetic resonance imaging (e.g. Tuček J. et al. *Nat. Commun.* 7, 12879, 2016; Sarigiannis Y. et al. *Biomaterials* 91, 128–139, 2016). Measurements of a wide range of temperatures allow the study of

molecular systems such as molecular magnets or spin transitions of complex compounds (e.g. Zoppellaro G. et al. *Chem. Mater.* 29, 8875–8883, 2017; Zoppellaro G. et al. *Inorg. Chem.* 52, 8144–8150, 2013). Last but not least, it is possible to study the course of chemical reactions in the solid state including identification of intermediate products or texture of surface layers with the help of so-called conversion electron Mössbauer spectroscopy – CEMS (e.g. Kment S. et al. *ACS Nano* 9, 7113–7123, 2015).

The MS laboratory is equipped with a number of additional instruments that enable analyses in a temperature range from 1 K to 1,200 K, in specialized atmospheres, and in an external magnetic field of up to 7 T. Use of low temperatures also makes it possible to analyze frozen solutions and dispersions.

Happened Recently...

Visit of the chairwoman of the Academy of Sciences

Eva Zažímalová, the Chairwoman of the Czech Academy of Sciences (CAS), honored RCPTM with a visit in the autumn. The President of the Learned Society of the Czech Republic and former director of the Institute of Organic Chemistry and Biochemistry of the CAS, Zdeněk Havlas, accompanied her. They discussed with the management of the research center, among others, the support of young scientists in the form of junior grants. Another topic of discussion was the formation and support of joint laboratories of CAS and university workplaces. The new Chairwoman of the CAS declared, shortly after taking up her position, an interest in greater cooperation with the universities and to involve the doctoral students at the institutes of CAS more. Therefore, she signed an Agreement for cooperation in the implementation of doctoral study programs with Palacký University in August. So far, it has linked doctoral students from both institutions in the field of history of art. In the future, it should also touch upon other disciplines, including chemistry. The CAS management representatives then visited several unique RCPTM laboratories.

Science and Technology Week

Just as last year, RCPTM joined the Science and Technology Week, which was organized by the Czech Academy of Sciences at the beginning of November. Over three days, the research center was open to high school students and to interested members of the general public. About 150 people used the opportunity to take a close look at the nanoworld. They visited the laboratories where excellent science is carried out. Interesting experiments were prepared as well. The aim was to acquaint the visitors with the rapidly developing area of nanoparticles and nanotechnologies, and with the research fields which RCPTM focuses on.

Michal Otyepka took the high school students to the world of two-dimensional chemistry during his lecture in the Fort Science. He introduced them to the nanoworld, how to study it, and what properties nanomaterials have. He talked not only about graphene but also about its young "siblings" including fluorographene. "The students learn somewhat old information in high schools. I think that they should get to know the current trends in science and new technologies too. They should know where the limits of knowledge are today. All this can inspire them towards their future careers," said Otyepka. RCPTM Director Radek Zbořil spoke at the Institute of Physics of the Czech Academy of Sciences about nanomaterials as aids in treatment of the environment and in new medical technologies in a lecture entitled "Nanomaterials – Little Helpers with a Great Future".

Annual conference

The seventh annual RCPTM conference, which took place in Mikulov at the beginning of November, summarized the most prominent scientific results of the last year. As is the custom, the management of the Centre rewarded employees for outstanding scientific work. The annual RCPTM prize was awarded to the chemist Aristeidis Bakandritsos from the Magnetic nanostructures group, who is a holder of a prestigious IAAM Scientist Medal for 2017. The second laureate of the RCPTM prize is Aleš Panáček from the Nanomaterials in biomedicine group. Mainly colloid silver is in the focus of his attention – its preparation, modification, studies of stability and biological activity, including the mechanism of antibacterial and antifungal properties.

As in previous years, the research groups told each other of their work over the past year in basic and applied research. "In addition to group leaders, new or young colleagues had the opportunity to present their results. There were talks about, for example, the magnetism of 2D systems, experimental counterfeiting of quantum money, or multiplex analysis of tumor markers in human blood using Raman spectroscopy. Considerable attention has been paid to advances in the field of graphene derivatives. The new Photoelectrochemical group lead by Professor Schmuki presented their results for the first time," stated Ondřej Haderka, the Scientific Director of RCPTM. The researchers have also demonstrated to their colleagues, through the so-called tutorials, the techniques they work with, and the potential for their use.

Coming Next...

The US–Czech Conference will determine the direction of collaboration in nanotechnology and chemistry

The outline of possible projects for mutual collaboration between Czech and American scientists as well as the strategy for their financing should be the result of the US–Czech Conference on Advanced Nanotechnology and Chemistry. The conference, which takes place on January 17th and 18th in Prague, is organized by the U.S. Embassy in the Czech Republic, the Office of Naval Research (ONR), and the RCPTM. The Science Forum will launch the celebrations of the centenary of diplomatic relations between both countries. The hosting of the conference was taken over by the chairwoman of the Czech Academy of Sciences (CAS) Eva Zažímalová.

"We have agreed with the US co-organizers that chemistry and nanotechnology are areas in which scientists from both countries achieve unique results and have something to offer for mutual collaboration. The idea is that similar events could be repeated over a two-year cycle focusing on other disciplines," said RCPTM Director and Conference President Radek Zbořil.

http://conference.rcptm.com/

The American Center will invite approximately 80 participants who can attend more than 30 lectures and who will evaluate the abilities of both countries in the fields of nanotechnologies and chemistry. The aim of the panel discussion with the representatives of the grant support providers from both countries will be the identification of the possible support of collaboration in the fields of nanotechnology and chemistry and to outline the feasible research projects and propose their funding sources.

At the conference, RCPTM will also be represented by Pavel Hobza, Michal Otyepka, Pavel Jelínek, and Jiří Šponer. The Czech nanoscience and chemistry will be presented by, among others, Josef Michl and Zdeněk Havlas from the Institute of Organic Chemistry and Biochemistry of the CAS, Tomáš Jungwirth from the Institute of Physics of the CAS, Jana Roithová from the Charles University, Jiří Čejka from the J. Heyrovský Institute of Physical Chemistry of the CAS, and Jiří Homola from the Institute of Photonics and Electronics of the CAS. Of the Americans, participation was confirmed by, among others, David Bell from Harvard University, Mark Reed from Yale University, Julia Geer from California Institute of Technology, Emmanuel Giannelis from Cornell University, Alexander Kabanov from the University of North Carolina, and Rajender Varma from the United States Environmental Protection Agency collaborating with RCPTM.

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Palacký University Olomouc

REGIONAL CENTRE OF ADVANCED TECHNOLOGIES AND MATERIALS

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