Programme & The Book of Abstracts

Seventeenth Annual Conference

YUCOMAT 2015

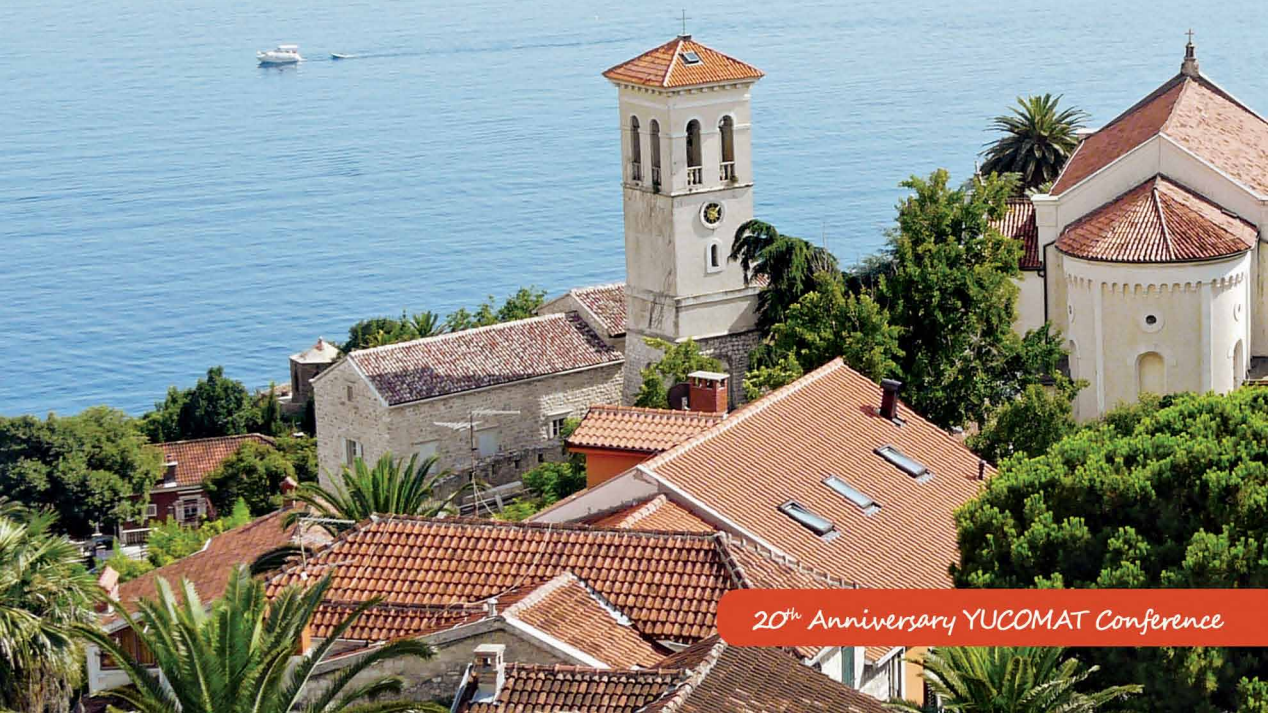
Herceg Novi, Montenegro, August 31 – September 4, 2015

Organised by

MATERIALS RESEARCH SOCIETY OF SERBIA

endorsed by

MRS E-MRS FEMS



20th Anniversary YUCOMAT Conference

SEVENTEENTH ANNUAL CONFERENCE

YUCOMAT 2015

Hunguest Hotel Sun Resort Herceg Novi, Montenegro,
August 31-September 4, 2015
http://www.mrs-serbia.org.rs

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and
The Book of Abstracts

Organised by:
Materials Research Society of Serbia

Endorsed by:
Materials Research Society,
European Materials Research Society
and
Federation of European Material Societies

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WELCOME SPEECH BY THE PRESIDENT OF MRS-SERBIA:

IN STEP WITH THE GOLIATHS

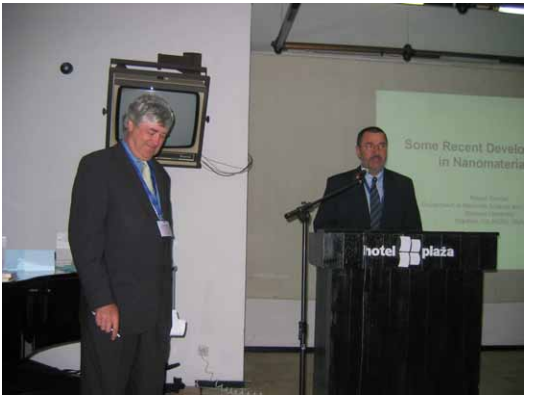
My Esteemed Colleagues,

Learning timely from the developed world is a vital requirement for the continued progress of the developing countries. The story behind the founding of the Materials Research Society – Serbia (MRS – Serbia) nicely illustrates this. Namely, not too long after the American and the European Materials Research Societies were founded in mid-1970s and mid-1980s, respectively, did we decide to follow up on these extraordinary efforts. YUCOMAT conferences, organized by MRS – Serbia and having taken place first biannually and then annually on the first weeks of September in this scenic Adriatic town of Herceg-Novi, have served as the best illustration of our success in this endeavor. Moreover, this particular conference, marking twenty years since the founding of MRS – Serbia and the first YUCOMAT conference, is supposed to present the culmination of our effort to create a Society that will not lag behind its developed world counterparts in absolutely anything, from the quality and contemporariness of science that it promotes to its involvement in regional educational efforts in materials science and beyond.

However, to properly understand the history of our MRS, a step back in time needs to be made. In the early nineties of the 20th Century, Yugoslavia was a relatively developed country, with its GDP being higher than that of many European Union (EU) countries. The country practically stood at the doorstep of EU, ready to join it in no time. A fruitful scientific and technological collaboration was in place with entire Europe as well as with Americas and countries from the eastern hemisphere. Our scientists, at the same time, earned the epithet of reputable partners, embodying an ideal middle ground between the eastern excellence in theoretical studies and the western interest in practicality. As was the case a few decades earlier, during the Cold War era, our country was practically a paradise for cooperation, having enabled the scientists from both East and West to meet, present their findings, engage in unrestrained debates about their ideas and establish vital contacts as nods on today's network of a connected and globalized world.

Countless stories are shared to this very day about the first encounters between the renowned Soviet scientists with their western colleagues. As ever, science and art have acted as territories freed from political divisions and animosities that tore their real-life counterparts apart. Many of us still remember the gatherings of distinguished names from materials science and engineering in this very venue between 1969 and 1989 at conferences known as the Round Table Meetings on Sintering, later renamed to World Conference on Sintering. Unfortunately, this role as a bridge between the East and the West was erased in a heartbeat owing to a string of irrational strategic decisions of our political leaders in the early 1990s. It resulted in the breakup of a beautiful country that Yugoslavia was, a decade of civil wars, staggering social strife and horrible crimes before whose victims every intellectual should have kept his head bowed. Following the economic sanctions installed by the United Nations in June 1992 the country was plunged into a deep isolation; the Serbian scientists were left to themselves only, with only a few sporadic contacts here and there with their foreign colleagues and former collaborators being maintained. Even publications in international journals were prohibited in the years that followed. At the same time, while our country was shattered by real bombs and ammunition, materials science worldwide experienced an explosion of new knowledge and its technological potentials. Biomaterials, energy materials and nanomaterials are only some of the types of materials which underwent a small renaissance in this period of time. Yet, like a prisoner watching carnival outside the rusty prison bars, so were we pushed into ever deeper scientific, cultural and

socioeconomic isolation while the outside world was getting ever more connected and prospective, the devastating consequences of which are reaped in every domain of our society to this very day.

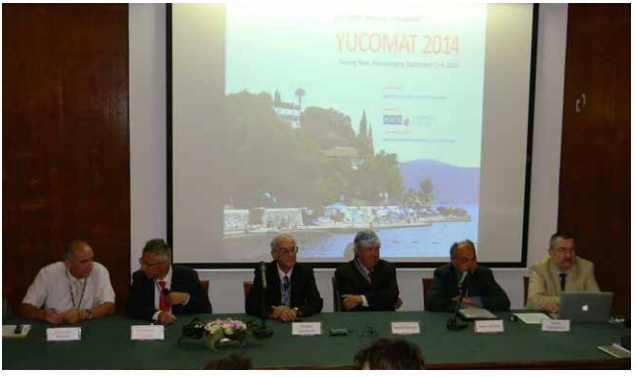


What is important to notice is that this phenomenal moment in the evolution of materials science and engineering partially came forth as a result of the impetus given by the American scientists through their forming the first MRS in 1973. Ten years later, in 1983, the European MRS was founded, which was followed by the founding of other materials research societies all over the world – Japanese and Indian in 1989, Mexican and Singaporean in 1990, and eventually Serbian in 1997, a few years before the Brazilian in 2001 and the Ukrainian in 2003. The American MRS conferences with the unprecedentedly large numbers of symposia demonstrated the then unthinkable scale at which materials science congregations could be organized. Seeing this, a group of our scientists, who had worked in diverse fields of materials science and engineering - from physics to physical chemistry to chemistry to ceramics to metals to polymers to fine powders to thin films to monocrystals and beyond - felt inspired and came to an idea to organize the first conference on new materials, in September 1995, at which mainly reviews of their own and global research in the field would be presented and shared among the participants. The idea was unequivocally embraced and resulted in the formation of the embryo for a professional society that MRS – Serbia was to become two years later. This very seaside town, Herceg-Novi, was chosen as the conference site because of its long tradition in hosting the aforementioned conferences on sintering and other domestic and international events of scientific and cultural significance.

The agreement reached during this inaugural conference on materials in September 1995 was respected and, as a result, months before the second such conference was to be held, in July 1997 our MRS was registered as the Yugoslav Materials Research Society (Yu-MRS) and our conferences became known as YUCOMAT, being the acronym for YUgoslav COnference on MATerials. The organization scheme was established so that 19 of the individual founders of the Society became the members of the Presidential Board. The President, the Vice President and the General Secretary who were elected then have remained acting in those roles to this very day. Although a few members of the Presidential Board voluntarily stepped down, they were replaced and its membership count remained the same: 19. It must be added that a significant moral support was received from the Serbian Ministry of Science and the Serbian Academy of Sciences and Arts (SASA), as well as from a few other institutions. The then President of SASA, late Aleksandar Despić, welcomed the participants at the first four YUCOMAT conferences (1995-2001) and was actively involved in the workings of the Society. Logically, the most prominent sponsor was the Institute of Technical Sciences of the

SASA, given that from the very first day a complete organizational logistics has been executed by its staff members and using its financial resources. The Institute for Chemistry, Inorganic Technologies and New Materials in Padua, Italy must be acknowledged here for offering us a helping hand when it was the hardest; the Proceedings for conferences held in 1999 and 2001 were published with their financial aid.

Initially we were driven by the idea that memories of even the most memorable presentations fade away with time and that, therefore, it would be useful to capture them in the form of Conference Proceedings. Starting with the first YUCOMAT, we published the Conference proceedings in English and with relatively large publishers, which distributed them globally. The first eight proceedings were published in the Materials Science Forum edition of the Swiss publisher, Trans Tech Publications. Each of the first four proceedings was a single volume, containing about 40 papers per volume, whereas the following four proceedings were published as two combined volumes with about 20 papers per volume. By that time, the global trend of diminished interest in releasing scientific results in low-impact conference proceedings had already taken over the entire scientific community and we were not spared by it by any means. Therefore, the first YUCOMAT that went on without being accompanied by published proceedings was the one held in 2007. Instead, the small number of papers chosen, as ever, through rigorous peer review, went on to be published in special issues of *Materials and Manufacturing Processes* published by Taylor and Francis, and of S*urface Engineering* published by Maney. Journals that published the selected works from subsequent YUCOMAT conferences were also *Materials and Manufacturing Processes*, *Acta Physica Polonica A* and *International Journal on Modern Physics B*. Despite the diminishing interest in the submission of papers, we continue to encourage the Conference participants to share their work in a written format and contribute to the impression of a memory of this event in a lasting form.



To complement the efforts to create a world-class scientific event for our community through YUCOMAT conferences, MRS – Serbia began to hold the complementary annual conferences for young researchers in the field of materials science and engineering. The success of the first such meeting held in Belgrade in 2002 prompted us to continue to organize them annually. Participants include undergraduate and graduate students as well as PhD graduates younger than 35; they are being given a valuable opportunity to orally present their works to peers, professors and professional researchers who could guide them in their further research. This was meant to be a part of their training for presentations at larger international meetings which are to be an integral part of their scientific careers. The interest in participating at these meetings has been continually increasing over the years: the first conference numbered 27 participants, whereas the few previous ones had about 80 of them. The conference is now being held in Belgrade each December and, in view of the interest of many younger international participants of YUCOMAT for it, as of 2010 the official language of it was switched from Serbian to English.

Were we to look back at where we started from and where we find ourselves now, I believe that we could be satisfied. We succeeded in uniting the majority of human potential in the field of materials science and engineering in this country around a common core and associating it with the work of peers

from abroad. Working with very limited and modest resources we have succeeded in conforming the outlook of MRS - Serbia to the major European and worldwide trends. None speaks better in favor of this than the programs of all the previously held YUCOMAT conferences. Since the times of the first YUCOMAT conference in 1995, almost purely local in character, with no foreign participants, it has transformed into a truly international meeting, whereat two-thirds of all participants are affiliated with foreign scientific institutions. From the first YUCOMAT conference, whose focus was on review presentations of our most renowned materials scientists, to this one, twenty years later, the selection of invited, plenary lecturers was made meticulously. Their total number at this point exceeds 300, which is one-tenth of the overall number of participants at all YUCOMAT conferences up to now – over 3000. They have come from around 60 different countries and all five continents of the world. After the biannually held conferences in the first 8 years, after the fifth one, held in 2003, we transitioned to the annually held ones. This transition invoked a plenty of insecurities and disbelief at first, but they were swiftly overcome by our faith in the immense latent potentials in our scientific milieu. The interest in the participation did not diminish and we have maintained a steady number of 200 - 250 presentations per conference. In 2006, as a result of the breakup of the state union between Serbia and Montenegro, the Yugoslav MRS changed its name to MRS – Serbia, the sole successor of the Yu-MRS. Countless prolific contacts have been established at these conferences, even during the times of our deepest international isolation, and have resulted in many official and unofficial research collaborations wherefrom equally many joint research projects were born. The broader recognition of our activities came in 2008 when MRS – Serbia became one of the 27 members of the Federation of the European Societies for Materials, which gathers around 20,000 researchers working in the field of materials science and engineering under its umbrella. Numerous renowned colleagues originally from Serbia and the neighboring countries have also been attracted and they have widely accepted this conference as a forum for the presentation of their freshest research findings and for learning about the research accomplishments in their countries of origin too. Such is, we believe, the best way for the arrival at intimate interfaces between their research programs and the locally performed research, hoping that a fruitful cross-fertilization between the two will be initiated. We have given a substantial support for young researchers through the promotion of the best doctoral and masters theses and the best oral and poster presentations at YUCOMAT conferences, as well as through holding the Conference for Young Researchers in the winter period. As of this year we will be also giving the annual award for the exceptional and lasting contribution to the field of materials science and engineering. There is a plenty of locally and internationally based scientists who deserve this award. The endowment committee has decided that the first of these awards will go to Dr. Ivan Božović for his vast contribution to science and engineering of superconductive materials and atomically thin films. Ivan began his career in Belgrade, but its fruition came in the United States, specifically in the Brookhaven National Laboratory and at Yale University. His 18 articles published in Science and Nature magazines, along with a myriad of other accomplishments, speak well enough about his great contribution to this field.

The essential task for MRS – Serbia in the future should be continued maintenance of the ascending path of progress and furthering of the internationalization of its YUCOMAT conference. With an increasing number of new conferences on materials science taking place all over the globe, many of which are as predatory in nature as the largest percentage of open-source journals in existence today,

the retention of the status and the "brand", so to speak, that YUCOMAT has secured over the years will be challenging. Still, we must secure its permanent place on the calendar of world events in this field, while not straying from its main purpose, which is to gather materials science researchers from Serbia, from the Balkans and from the rest of the world, and provide a fruitful forum for the exchange of ideas, know-how and the initiation of collaborations from which everyone would benefit. More than anything, the continued emission of positive energy in the promotion of this wondrous field of science locally and globally must remain our central aim.

Still, MRS – Serbia is relatively young, maybe not so much when compared to other materials research societies in the world, but certainly when compared to many other prestigious scientific societies, both within the country and abroad, the most renowned of which have been in existence for over a century. Regardless of that, a series of successes from 1995 to this date, twenty years later, gives us a hope that bright future stands before our MRS. We wish to see both our local community and the planet as a whole benefit from our growth and the efforts to elevate the quality of materials science and engineering to ever higher levels. Countless individuals and institutions contributed to this two decades long walk along a long and winding road made by MRS – Serbia and its repeated arrival at this idyllic coast. They deserve unreserved credit and respect for their persistence, for their hard work and for their faith that in a small and materially impoverished country such as ours materials science could still flourish and bring fruit oftentimes sweeter and more refreshing for the body and spirit than that produced in the already developed parts of the world. What we celebrate today is the immense spiritual strength and the unfathomable intellectual potential of all of you who have been a part of this journey. We have proven that we could make it – we could build a research society following the model set by the bigger and more influential materials research societies, while at the same time enrich it with the flavor that is authentic to this region of the world and its culture.

I wish you yet another happy YUCOMAT!

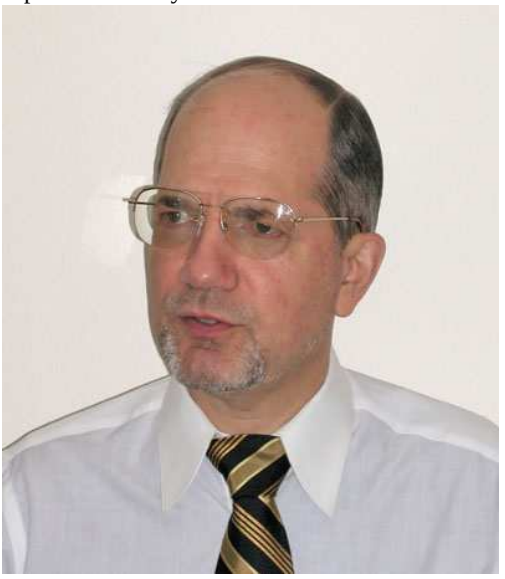
Cordially Yours,

Dragan Uskoković,

President of MRS-Serbia

MRS-SERBIA AWARD FOR A LASTING AND OUTSTANDING CONTRIBUTION TO MATERIALS SCIENCE AND ENGINEERING

We are pleased to announce that the recipient of the first MRS-Serbia Award for a Lasting and Outstanding Contribution to Materials Science and Engineering is Dr. Ivan Božović of Brookhaven National Laboratory (Condensed Matter and Materials Science, Upton, New York, USA). He is awarded for his achievements in the field of new quantum materials with a special emphasis on his seminal work in cuprates physics, artificial heteroepitaxial materials and interface superconductivity.



This is the decision of the MRS-Serbia Executive Board:

"**T**he Executive Board of the MRS-Serbia Presidency, on their meeting on February 19, 2015, considered submitted candidates for the MRS-Serbia's Award for a Lasting and Outstanding Contribution to Materials Science and Engineering and concluded that the procedure was conducted in accordance with the Awarding Rulebook, that the Call was announced on the MRS-Serbia's website on January 1, 2015, and that in the stipulated period of 45 days only one candidacy was submitted, that for Dr. Ivan Bozovic, submitted by Prof. Dr. Davor Pavuna. This submission was supported by Prof. Dr. Laszlo Forro, Prof. Dr. Zoran Radović, Prof. Dr. Zoran Petrović, Prof. Dr. Velimir Radmilović and Prof. Dr. Dejan Raković. Having received the opinion from the Expert Committee Members, Prof. Dr. Robert Sinclair and Prof. Dr. Danilo Suvorov, the Executive Board of the MRS-Serbia Presidency took the decision that Dr. Ivan Božovic be granted the MRS-Serbia Award for a Lasting and Outstanding Contribution to Materials Science and Engineering.

President of MRS-Serbia, Prof. Dr. Dragan Uskokovic
Vice-President of MRS-Serbia, Dr. Slobodan Milonjić
Vice-President of MRS-Serbia, Prof. Dr. Velimir Radmilović
Vice-President of MRS-Serbia, Prof. Dr. Dejan Raković"

Dr. Božović's invited plenary lecture will be a part of the Opening Ceremony of the Seventeenth Materials Research Society of Serbia Annual Conference YUCOMAT 2015, which will be held in a beautiful little place at the Adriatic coast, Herceg Novi, Montenegro, August 31 - September 4, 2015.

MRS-Serbia

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Conference Technical Committee

Milica Ševkušić, Ana Stanković, Vuk Radmilović, Nemanja Aničić, Ivana Jevremović, Jovana Zvicer

HISTORY:

Materials science and engineering incorporate acquiring of knowledge on synthesis and processing of materials, their composition and structure, properties and behaviour, functions and potentialities as well as application of that knowledge to various final products. Economic prosperity, life quality, and healthy environment are tightly connected with the improvements in the existing and the development of new materials and processing technologies. These improvements and development can contribute greatly to the national priorities: energy saving, environment and health protection, information and communication, infrastructure, transportation, etc.

The First Conference on materials science and engineering, including physics, physical chemistry, condensed matter chemistry, and technology in general, was held in September 1995, in Herceg Novi. An initiative to establish Yugoslav Materials Research Society was born at the conference and, similar to other MR societies in the world, the programme was made and objectives determined. The Yugoslav Materials Research Society (Yu-MRS), a non-government and non-profit scientific association, was founded in 1997 to promote multidisciplinary goal-oriented research in materials science and engineering. Main task and objective of the Society is to encourage creativity in materials research and engineering to reach a harmonic coordination between achievements in this field in our country and analogous activities in the world with an aim to include our country into the global international

projects. Until 2003, Conferences were held every second year and then they grew into Annual Conferences that were traditionally held in Herceg Novi in September of every year. Following the political separation between Serbia and Montenegro, in 2007 Yu-MRS formed two new MRS: MRS-Serbia (official successor of Yu-MRS) and MRS-Montenegro (in founding). In 2008 MRS-Serbia became a member of FEMS (Federation of European Materials Societies).

GENERAL INFORMATION

DATE AND VENUE: The conference will be held on August 31-September 4, 2015, at the Hunguest Hotel Sun Resort, in Herceg Novi, Montenegro. Participants will also be accommodated there. The conference will begin on Monday, August 31st, at 09.00 and end on Friday, September 4th, 2015, at 12.30.

REGISTRATION: Registration, registration fee payment, conference materials distribution, etc, will take place at the conference desk (Conference Secretariat) open on Sunday, August 30, Monday, August 31, and Tuesday, September 1, from 8.00 to 19.00, on Wednesday and Thursday 8.00-13.00 and 19.00-20.00, and on Friday from 8.00 to 12.00. At registration, the participants are requested to submit a proof of their advance registration fee payment and their registration form.

INSTRUCTION FOR AUTHORS: The conference will feature plenary sessions, oral sessions, poster sessions, and an Exhibition of synthesis and characterization equipment.
Time of papers' presentations to be given in ORAL SESSIONS is limited. Time available for delivery is 30 min for plenary and 15 min for other papers including discussion (5-10 min). Video-beam is available. PowerPoint presentations, recorded on CD or USB flash-memory, should be given at registration, specifying the name of the speaker and the day and session number.
In POSTER SESSIONS, the authors are requested to display their papers minimum one hour before the session and to be present beside their posters during the session. Poster sessions venue will be open from Tuesday to Thursday, from 18.00-22.00.

CONFERENCE AWARDS: Materials Research Society of Serbia will award the authors (preferable young members under 35) of the best oral and poster presentation at the conference, and also the authors of highly rated PhD theses defended between two conferences. Awarded researchers are granted free registration at the next YUCOMAT Conference.

ADDITIONAL ACTIVITIES: An Exhibition of synthesis and characterization equipment will be held during the Conference. Traditional Cocktail Party on Monday evening and excursions on Wednesday afternoon to Dubrovnik (Croatia) and Thursday afternoon (boat trip around Boka Kotorska Bay) will be organized again.

Programme

GENERAL CONFERENCE PROGRAMME

SYMPOSIUM A: Advanced Methods in Synthesis and Processing of Materials
SYMPOSIUM B: Advanced Materials for High-Technology Application
SYMPOSIUM C: Nanostructured Materials
SYMPOSIUM D: Eco-materials and Eco-technologies
SYMPOSIUM E: Biomaterials

Sunday, August 30, 2015
08^{00}-19^{00} **Registration**

Monday, August 31, 2015
08^{00}-09^{00} **Registration**
09^{00} -10^{00} **OPENING CEREMONY**
- Introduction and Welcome
10^{15}-13^{15} **First Plenary Session**
13^{15} **Photo Session**
15^{00}-18^{45} **Symposium A, Conference Hall**
15^{00}-18^{30} **Symposium B, Small Hall**
19^{30}-21^{00} **Cocktail Party**

Tuesday, September 1, 2015
09^{00}-13^{00} **Second Plenary Session**
15^{00}-16^{45} **Symposium C, Conference Hall**
15^{00}-16^{45} **Symposium E, Small Hall**
Symposium B, Small Hall
20^{00}-22^{00} **Poster Session I** (Symposium A)

Wednesday, September 2, 2015
09^{00}-12^{45} **Third Plenary Session**
14^{00}-19^{00} **Excursion to Dubrovnik, Croatia**
20^{00}-22^{00} **Poster Session II** (Symposium B)

Thursday, September 3, 2015
09^{00}-12^{30} **Fourth Plenary Session**
14^{00}-19^{00} **Boat-trip around Boka Kotorska Bay**
20^{00}-22^{00} **Poster Session III** (Symposiums C, D and E)

Friday, September 4, 2015
09^{00}-12^{30} **Fifth Plenary Session**
12^{30}-13^{00} **Awards and Closing of the Conference**

OPENING CEREMONY

Monday, August 31, 2015

09^{00}-10^{00}

20 Years of YUCOMAT Conferences
Dragan Uskoković
President of MRS-Serbia, Belgrade, Serbia

MRS-Serbia 2015 Award for a Lasting and Outstanding Contribution to Materials Science and Engineering
Atomic-Layer Engineering and High-Tc Superconductivity in Cuprates
Ivan Božović
Brookhaven National Laboratory, Yale University, Upton, New York, USA

Break: 10^{00}-10^{15}

FIRST PLENARY SESSION

Monday, August 31, 2015

Session I: 10^{15}-11^{45}
Chairmen: Robert Sinclair and Velimir Radmilović

10^{15}-10^{45} **Quantum Dot Formation on Nanowires**
Q. Zhang[1], S.H. Davis[1], J.-N. Aqua[2], Peter W. Voorhees[3]
[1]Engineering Sciences and Applied Mathematics, Northwestern University, USA,
[2]Institut des Nanosciences de Paris, Université Pierre et Marie Curie Paris 6, France,
[3]Materials Science and Engineering, Northwestern University, USA

10^{45}-11^{15} **Electromagnetic Field Mapping at the Nanoscale in the Transmission Electron Microscope**
Rafal E. Dunin-Borkowski, Jan Caron, Andras Kovacs, Patrick Diehle, Vadim Migunov
Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons and Peter Grünberg Institute, Forschungszentrum Jülich, Germany

11^{15}-11^{45} **Electron Holography for Structures and Fields in Nanomaterials**
Hannes Lichte, Felix Börrnert, Bernd Einenkel, Andreas Lenk, Axel Lubk, Falk Röder, Jan Sickmann, Sebastian Sturm, Karin Vogel, Daniel Wolf
Triebenberg Laboratory, Institute of Structure Physics, Technische Universität Dresden, Germany

Break: 11^{45}-12^{15}

Session II: 12^{15}-13^{15}
Chairmen: Peter W. Voorhees and Rafal E. Dunin-Borkowski

12^{15}-12^{45} **An Up-date on In Situ and Environmental High Resolution Electron Microscopy of Material Reactions**
Robert Sinclair[1], Sang Chul Lee[1], Ai Leen Koh[2]
[1]Department of Materials Science and Engineering, Stanford University, Stanford, USA, [2]Stanford Nano Shared Facilities, Stanford University, Stanford, USA

12^{45}-13^{15} **Zigzag Inversion Domain Boundaries in Functional Oxide Nanowires**
Velimir Radmilović
Nanotechnology and Functional Materials Center, Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia; Serbian Academy of Sciences and Arts, Knez Mihailova 35, 11000 Belgrade, Serbia

Break: 13^{15}-15^{00}

SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

Conference Hall

Session I: 15^{00}-17^{00}
Chairmen: Jan Dutkievicz and Smilja Markovic

15^{00}-15^{15} **High Resolution Materials Characterisation using Aberration Corrected Scanning Transmission Electron Microscopy**
David R.G. Mitchell, Gilberto Casillas, Elena Pereloma
UOW Electron Microscopy Centre, University of Wollongong, Australia

15^{15}-15^{30} **Lead Free Piezoelectric Materials for Transducer Applications**
Mai Pham Thi
Thales Research Technology France, 1 Avenue A. Fresnel, 91676 Palaiseau Cedex, France

15^{30}-15^{45} **Silver Matrix Graphene Strengthened Composites with High Electrical Conductivity**
Jan Dutkiewicz, Piotr Ozga, Janusz Pstruś, Justyna Stolarska, Wojciech Maziarz, Institute of Metallurgy and Materials Science of the Polish Academy of Sciences, 25, Reymonta Str., 30-059 Kraków, Poland

15^{45}-16^{00} **Tailoring Microstructure of Thermoelectric Oxides**
Boštjan Jančar[1], Damjan Vengust[1], Tilen Sever[1], Goran Dražić[2], Ioannis Petousis[3]
[1]Advanced Materials Department, Jozef Stefan Institute, Ljubljana, Slovenia, [2]Laboratory for Materials Chemistry, National Institute of Chemistry, Ljubljana, Slovenia, [3]Department of Mechanical Engineering, Stanford University, Stanford CA, USA

16^{00}-16^{15} **Acrobatics of N'-2-propylidene-4-hydroxybenzohydrazide Crystals**
Igor Djerdj[1], Jasminka Popović[1], Željko Skoko[2]
[1]Ruđer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia, [2]Department of Physics, Faculty of Science, University of Zagreb, Bijenička c. 32, HR-10000 Zagreb, Croatia

16^{15}-16^{30} **Towards Rotational Molding of Ultra Low Density Cellular Polymeric Composites**
Remon Pop-Iliev
UOIT-University of Ontario Institute of Technology, Canada

16^{30}-16^{45} **On PolyHIPE Based Separators for Thin Film Lithium-Ion Batteries**
Werner Paschinger, Alexander Bismarck
Institute for Materials Chemistry & Research, University of Vienna, Waehringer Straße 42, A-1090 Wien, Austria

16^{45}-17^{00} **Fluorine Doping of Layered Na_xCoO_2 Structure**
Dragana Jugović[1], Miloš Milović[1], Miodrag Mitrić[2], Nikola Cvjetićanin[3], Max Avdeev[4], Bojan Jokić[5], Dragan Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia, [3]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, [4]Bragg Institute, Australian Nuclear Science and Technology Organisation, Locked Bag 2001, Kirrawee DC, NSW 2232, Australia, [5]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

Break: 17^{00}-17^{30}

Session II: 17^{30}-18^{45}
Chairmen: Mai Pham Thi and Boštjan Jančar

17^{30}-17^{45} **Advances in Improvement of Pb-based Thin Layers Deposited on Nb Substrate**
Anna Kosinska[1], Marek Barlak[1], Jerzy Lorkiewicz[1], Jacek Sekutowicz[2], Robert Nietubyć[1], Lukasz Kurpaska[1], Katarzyna Nowakowska – Langier[1]
[1]National Center for Nuclear Research, st. A. Soltana 7, 05-400 Swierk, Poland, [2]Deutsches Elektronen Synchrotron (DESY), 85 Notkestrasse, D-22-607 Hamburg, Germany

17^{45}-18^{00} **Photoluminescence Properties of YAG:Dy and YAG:Dy:Er Thermographic Phosphors Synthesized by Solid State, Co-precipitation and Solvothermal Methods**
Liudmyla M. Chepyga [1], Gordana Jovicic [1,2], Andreas Vetter [1,2], Miroslaw Batentschuk[2], Christoph J. Brabec[2]
[1]Energie Campus Nürnberg, Fürther Str. 250, 90429 Nürnberg, [2]Lehrstuhl für Materialien der Elektronik und Energietechnologie, Friedrich-Alexander-Universität, Erlangen-Nürnberg, Martensstrasse 7, 91058 Erlangen

18^{00}-18^{15} **Influence of Sintering Atmosphere on the Crystal Structure, Microstructure, Dielectic and Optical Properties of $BaTi_{1-x}Sn_xO_3$ (x = 0, 0.05 and 0.1) Ceramics**
Smilja Marković[1], Ljiljana Veselinović[1], Andrej Garaj[2], Nikola Cvjetićanin[2], Srečo D. Škapin[3], Dragan Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, [3]Jožef Stefan Institute, Ljubljana, Slovenia

18^{15}-18^{30} **The Effect of D,L-lactide-based Linker on the Hydrolytic Stability of Polyurethane Films**
Milena Špírková, Magdalena Serkis, Rafal Poreba, Jana Kredatusová, Luďka Machová, Jiří Hodan
Institute of Macromolecular Chemistry AS CR, Prague, Czech Republic

18^{30}-18^{45} **Temperature Dependencies of Thermo-Physical Properties of Selected Foundry Sands**
Paweł K. Krajewski
AGH University ofd Science and Technology, Faculty of Foundry Engineering, 23 Reymonta Street, 30-059 Krakow, Poland

SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

Small Hall

Session I: 15^{00}-18^{30}
Chairpersons: Dragana Jugović and Irena Nikolić

15^{00}-15^{15} **Silver Nanowire Based Networks for Transparent Electrode Applications**
Vuk Radmilović[1], Manuela Göbelt[2], Silke Christiansen[2,3], Erdmann Spiecker[4], Velimir Radmilović[5,6]
[1]Innovation Center, University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11120 Belgrade, Serbia, [2]Max Planck Institute for the Science of Light, Günther-Scharowsky-Str. 1, 91058 Erlangen, Germany, [3]Helmholtz Centre Berlin for Materials and Energy, Hahn-Meitner Platz 1, 14109 Berlin, Germany, [4]Center for Nanoanalysis and Electron Microscopy (CENEM), Friedrich-Alexander University Erlangen-Nürnberg, Cauerstrasse 6, 91058 Erlangen, Germany, [5]University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11120 Belgrade, Serbia, [6]Serbian Academy of Sciences and Arts, Knez Mihailova 35, 11000 Belgrade, Serbia

15^{15}-15^{30} **Direct Observation of the Magneto Crystal Anisotropy Axis in $Fe_{3-x}O_4$ Nanoparticles by MFM**
Carlos Moya[1], Óscar Iglesias-Freire[2,3], Nicolás Pérez[1], Xavier Batlle[1], Amilcar Labarta[1], Agustina Asenjo[2]
[1]Departament de Física Fonamental, Institut de Nanociència i Nanotecnologia, Universitat de Barcelona, Barcelona, Spain, [2]Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC), Cantoblanco, Madrid, 28049 Spain, 3Department of Physics, McGill University, Montreal, Canada

15^{30}-15^{45} **Smart Hydrogels of Thermoresponsive Interpenetrating Networks of Poly(N-isopropylacrylamide) and Polyacrylamide**
Jiri Spevacek, Marek Radecki, Lenka Hanykova, Alexander Zhigunov, Zdenka Sedlakova
Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Prague, Czech Republic; Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic

15^{45}-16^{00} **Methodology of Formation of New Generation Multilayer Coatings for Cutting Tools**
Alexey Vereschaka[1], Anatoly Vereschaka[1], Boris Mokritskii[2], Andre Batako[3]
[1]Moscow State Technological University STANKIN, [2]Komsomolsk-na-Amure State Technical University, [3]Liverpool John Moores University

16^{00}-16^{15} **Design of Phase Percolated Composites for Military Application**
Paulina Chabera, Anna Boczkowska
Warsaw University of Technology, Faculty of Materials Science and Engineering, Woloska St 141, 02-507 Warsaw

16^{15}-16^{30} **Green's Functions Analysis of Microcracking in a Brittle Material**
Hillal Ayas, Mohamed Chabaat
Buyilt Environmental research Lab., Civil Engineering Faculty, University of Sciences and Technology Houari Boumediene, B.P. 32 El Alia Bab Ezzouar, 16111 Algiers, Algeria.

16^{30}-16^{45} **The Influence of Thermal Treatment on Microstructural and Magnetic Properties of Electrical Steel**
Branko Koprivica[1], Ioan Dumitru[2], Alenka Milovanović[1], Ovidiu Caltun[2]
[1]Faculty of Technical Sciences, University of Kragujevac, Čačak, Serbia
[2]Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Romania

16^{45}-17^{00} **Spin Hall Effect in (111)-Oriented Thin Films of SnSe and SnTe Topological Crystalline Insulators**
Shiva Safaei, Marta Galicka, Perla Kacman, Ryszard Buczko
Institute of Physics Polish Academy of Science, Warsaw, Poland

Break: 17^{00}-17^{30}

17^{30}-17^{45} **Influence of Degradation Process on Composite Performance with Eembedded Fibre Optical Sensors**
Rafal Kozera, Stefan F. Awietjan, Przemyslaw D. Gacia, Anna Boczkowska
Warsaw University of Technology, Faculty of Materials Science and Engineering, ul. Woloska 141, 02-507 Warszawa, Poland

17^{45}-18^{00} **Femtosecond Laser Interaction with Nickel Based Superalloy M-252**
Predrag Drobnjak[1], Andjelka Milosavljević[2], Sanja Petronić[3], Suzana Polić[4], Strain Posavljak[5]
[1]TEHNIKUM-TAURUNUM, Belgrade, [2]Faculty of Mechanical Engineering, University of Belgrade, [3]Innovation Centre, Faculty of Mechanical Engineering, [4]Central Institute for Conservation in Belgrade, [5]Faculty of Mechanical Engineering, University of Banja Luka, BiH

18^{00}-18^{15} **Thermal Resistance of Alkali Activated Binders Synthesized Using the Fly Ash and Steel Slag**

Irena Nikolić[1], Smilja Marković[2], Ljiljana Karanović[3], Vuk Radmilović[4], Velimir Radmilović[4]

[1]University of Montenegro, Faculty of Metallurgy and Technology, Džordža Vašingtona bb, 81 000 Podgorica, Montenegro, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]University of Belgrade, Faculty of Mining and Geology, Laboratory of Crystallography, Đušina 7, 11000 Belgrade, Serbia, [4]University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11120 Belgrade, Serbia

18^{15}-18^{30} **Determination of the Temperature Transfer Function of Building Constructions Based on Measurement Data**

Zorana Petojević[1], Milica Mirković[1], Željko Jovanović[2], Radovan Gospavić[1], Goran Todorović[1]

[1]Civil Engineering Faculty of University of Belgrade, [2]Orion Telecom Company Belgrade

SECOND PLENARY SESSION

Tuesday, September 1, 2015

Session I: 09^{00}-11^{00}
Chairmen: Hannes Lichte and Wolfgang Jäger

09^{00}-09^{30} **20 Years of Nanostructured Materials: Enabling Nanotechnology to Benefit Society**
Richard W. Siegel
Materials Science and Engineering Department, Rensselaer Polytechnic Institute, Troy, New York 12180, USA

09^{30}-10^{00} **Solving Problems in Nanodimensions by Aberration-corrected Transmission Electron Microscopy with Picometer Precision**
Knut W. Urban
Research Center Juelich, PGI-5, D52425 Juelich, Germany

10^{00}-10^{30} **Holographic Imaging and Optical Sectioning in the Aberration-corrected STEM**
Harald Rose
University of Ulm, Albert-Einstein-Allee 11, 89069 Ulm, Germany

10^{30}-11^{00} **Instrumentation for High Resolution EM and Its Limitations**
Max. Haider, Peter Hartel, Stephan Uhlemann, Heiko Müller, Joachim Zach
CEOS GmbH, Englerstr. 28, D-69126 Heidelberg, Germany

Break: 11^{00}-11^{30}

Session II: 11^{30}-13^{00}
Chairmen: Knut Urban and Richard Siegel

11^{30}-12^{00} **Advanced and In Situ Transmission Electron Microscopy of Growth and Interface Phenomena of Oxide Semiconductor Nanowires**
Yanicet Ortega[1,2], David Maestre[1,2], Christel Dieker[1], Dietrich Häussler[1], Ana Cremades[2], Paloma Fernández[2], Javier Piqueras[2], Wolfgang Jaeger[1]
[1]Institute of Materials Science, Christian-Albrechts-University of Kiel, 24143 Kiel, Germany EU, [2]Dept. Materials Physics, University Complutense of Madrid, 28040 Madrid, Spain EU

12^{00}-12^{30} **Technology Transfer, Especially in Materials Science**
Kyung-Ho Shin
Korea Institute of Science and Technology, Seoul, Korea

12^{30}-13^{00} **Alumina-dispersed Cu Alloy of High Mechanical Strength and Electric Conductivity beyond Conventional Limit by Interfacial Design between Alumina Particle/Cu Matrix**

Kwang Ho Kim[1], Seung Zeon Han[2]
[1]School of Materials Science and Engineering, Pusan National University, Busan 609-735, Korea, [2]Structural Materials Division, Korea Institute of Materials Science, Changwon 642-831, Korea

Break: 13^{00}-15^{00}

SYMPOSIUM C: NANOSTRUCTURED MATERIALS

Conference Hall

Session I: 15^{00}-16^{45}
Chairpersons: Gerda Rogl and Natalia Kamanina

15^{00}-15^{15} **The Origin of Exceptional Activity of $Pt_3Ni(111)$ Catalyst in CO Oxidation Reaction**

Dušan Tripković[1,2], Vladimir Tripković[3], Amalija Tripković[2], Vladislava Jovanović[2], Vojislav Stamenković[1], Nenad Marković[1]
[1]Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439, USA, [2]ICTM, Center of Electrochemistry, University of Belgrade, 11000 Belgrade, Serbia, [3]Center for Atomic-scale Materials Design, Department of Physics, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark.

15^{15}-15^{30} **Monocarboxylic Acid-modified CeO_2 Nanoparticles Synthesized under Hydrothermal Conditions Using Supercritical Water**

Minori Taguchi, Takashi Naka, Toshitaka Funazukuri
Department of Applied Chemistry, Faculty of Science and Engineering, Chuo University, 1-13-27 Kasuga, Japan; National Institute for Materials Science

15^{30}-15^{45} **Role of the Nano- and Bio-structuration Process in Change of the Laser-induced Refractive Index and Other Related Optical Effects**

Natalia V. Kamanina
Vavilov State Optical Institute, Kadetskaya Liniya V.O., dom.5, korpus 2, St.-Petersburg, 199053, Russia; Saint-Petersburg Electrotechical University ("LETI"), St. Petersburg, Russia,

15^{45}-16^{00} **New High ZT p- and n-type Skutterudites**
Gerda Rogl, Andriy Grytsiv, Ernst Bauer, Peter Rogl
[1]Christian Doppler Laboratory for Thermoelectrics, Austria
[2]Institute of Physical Chemistry, University of Vienna, Austria
[3]Institute of Solid State Physics, Vienna University of Technology, Austria

16^{00}-16^{15} **Universal One-pot and Scalable Synthesis of SERS Encoded Nanoparticles**
Bernat Mir-Simon[1,4], Irene Reche-Perez[1,2], Luca Guerrini[1,2], Nicolas Pazos-Perez[1,2,#], Ramon Alvarez-Puebla[2,3]
[1]Medcom Advance, Spain, [2]Department of Physical Chemistry and Inorganic, Universitat Rovira i Virgili, Spain, [3]Institució Catalana de Recerca i Estudis Avançats, Spain, [4]Department of Surgery, UD-Vall d'Hebron School of Medicine, Universitat Autònoma de Barcelona, 08035 Barcelona, Spain

16^{15}-16^{30} **Photocatalytic Properties of 1D Nanostructured Vanadium Pentoxide Compounds**
Nemanja Aničić, Marija Vukomanović, Danilo Suvorov
Insitute Jožef Štefan, Ljubljana, Slovenia

16^{30}-16^{45} **A Novel Method to Measure Dynamic Contact Angle Hysteresis on Nanostructured Surfaces**
Daniel Pawlak[1], Maciej Psarski[1], Grzegorz Sobieraj[2], Michał Remer[2], Krzysztof Gumowski[2], Jacek Rokicki[2], Grzegorz Celichowski[1]
[1]Department of Materials Technology and Chemistry, University of Lodz, Pomorska 163, 90-236 Lodz, Poland, [2]Institute of Aeronautics and Applied Mechanics, Warsaw University of Technology, Nowowiejska 24, 00-665 Warsaw, Poland

SYMPOSIUM E: BIOMATERIALS
SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

Small Hall

Session I: 15^{00}-16^{45}
Chairmen: Nenad Ignjatović and Wieslaw A. Swiatnicki

15^{00}-15^{15} **A Facile Determination Method for an Androstane-based Lung Cancer Inhibitor Loaded in Nano/micro Particles Based on Hydroxyapatite by Means of DTA/TGA Coupled with On-line Mass Spectrometry**

Nenad Ignjatović[1], Maja Kuzmanović[1], Katarina Penov-Gaši[2], Jovana Ajduković[2], Vesna Kojić[3], Dragan Uskoković[1]
[1]Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, P.O. Box 377, 11000 Belgrade, Serbia, [2]Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, [3]Oncology Institute of Vojvodina, Institutski put 4, 21204 Sremska Kamenica, Serbia

15^{15}-15^{30} **Polymer/ceramic Composite Scaffold for the Regeneration of Bone Defect after Cancer Treatment in Dog Distal Radius**

Barbara Ostrowska[1], Igor Bissenik[2], Wojciech Swieszkowski[1]
[1]Division of Materials Design, Faculty of Materials Science and Engineering, Warsaw University of Technology, 02-507, Warsaw, Poland, [2]Veterinary Clinic "Pulawska" 02-844, Warsaw, Poland

15^{30}-15^{45} **Magnetic Chitosan-g-acrylate/styrene Composites for Hybrid Coatings with Nanostructured Morphology**

Doina Hritcu, Gianina Dodi, Mirabela L. Iordache, Dan Draganescu, Marcel I. Popa ''Gheorghe Asachi'' Technical University of Iasi, Romania

15^{45}-16^{00} **Transition Metal Trichalcogenides Dispersed as Precursors for Preparation of Film Materials**

Sofya Artemkina, Pavel Poltarak, Tatyana Podlipskaya, Alexander Bulavchenko, Vladimir Fedorov
Nikolaev Institute of Inorganic Chemistry SB RAS, Novosibirsk, Russia, Novosibirsk State University, Novosibirsk, Russia

16^{00}-16^{15} **Composite Materials Based on Highly-dispersed Inorganic 1D and 2D Materials and Metal Nanoparticles**

Mariia N. Kozlova[1], Ekaterina D. Grayfer[1], Lidiya S. Kibis[2], Andrei I. Boronin[2], Vladimir E. Fedorov[1]
[1]Nikolaev Institute of Inorganic Chemistry SB RAS, 3, Acad. Lavrentiev Ave., Novosibirsk, Russia, [2]Boreskov Institute of Catalysis SB RAS

16^{15}-16^{30} **Electroactive Nanocomposites Based on Thermoplastic Elastomers**

Paulina Latko[1], Mateusz Bielecki[1], Wojciech Konior[2], Rafał Kozera[1], Anna Boczkowska[1], Jerzy Grygorczuk[2]
[1]Department of Materials Science and Engineering, Warsaw University of Technology Wołoska 141, 02-507 Warsaw, Poland, [2]Space Research Centre Polish Academy of Sciences, Bartycka 18, 00-716 Warsaw, Poland

16^{30}-16^{45} **Formation of Nanocrystalline Structure in Steels and Iron Alloys through the Heat Treatment Process**

Wieslaw A. Swiatnicki
Faculty of Materials Science and Engineering, Warsaw, University of Technology, ul. Wołoska 141, 02507 Warszawa, Poland

THIRD PLENARY SESSION

Wednesday, September 2, 2015

Session I: 09^{00}-11^{00}
Chairmen: Maximilian Haider and Davor Pavuna

09^{00}-09^{30} **Scanning Transmission Electron Microscopy at Atomic Resolution**
Ferdinand Hofer, Gerald Kothleitner
Institute for Electron Microscopy and Nanoanalysis, Graz University of Technology, A-8010 Graz, Austria

09^{30}-10^{00} **Defects in the TEM**
C. Barry Carter
Dept of Chem. & Biomolec. Engng, U. of Connecticut, 191 Auditorium Rd, Storrs, CT USA; Dept of Mats Sci & Engng, U. of Connecticut, 97 North Eagleville Road, Storrs, CT USA; Institute of Materials Science, U. of Connecticut, 97 North Eagleville Road, Storrs, CT USA

10^{00}-10^{30} **Structure and Properties of Dislocations in Bilayer Graphene**
Erdmann Spiecker
Institute of Micro- and Nanostructure Research & Center for Nanoanalysis and Electron Microscopy (CENEM), University of Erlangen-Nürnberg, Cauerstrasse 6, D-91058 Erlangen, Germany

10^{30}-11^{00} **Advances in Focused Ion Beam Imaging, Spectroscopy and Fabrication**
Robert Hull
Rensselaer Polytechnic Institute, Troy NY, USA

Break: 11^{00}-11^{30}

Session II: 11^{30}-12^{45}
Chairmen: Ivan Božović and C. Barry Carter

11^{30}-12^{00} **Electric Field Effect Studies in High-Tc Cuprates and Related Mater**ials
Guy Dubuis[1,2], A. T. Bollinger[1], Davor Pavuna[2], Ivan Božović[1,3]
[1]Brookhaven National Laboratory, Upton, NY 11973, USA
[2]Physics of Complex Matter, EPFL, CH-1015 Lausanne, Switzerland
[3]Applied Physics Department, Yale University, New Haven CT 06250, USA

12^{00}-12^{30} **Revised Phase Diagram of the Cuprates**
Neven Barišić
Institute of Solid State Physics, Vienna University of Technology, 1040 Vienna, Austria

12^{30}-12^{45} **In Situ TEM**
Dominique Delille
FEI Company, Eindhoven, Netherlands

FOURTH PLENARY SESSION

Thursday, September 3, 2015

Session I: 09^{00}-11^{00}
Chairmen: Peter Franz Rogl and Mamoru Senna

09^{00}-09^{30} **Application of Experimental and Computational Approaches to Explore Non-conventional Transformation Pathways Resulting in Refined Microstructures in Beta-stabilized Titanium Alloys**
Hamish L Fraser
The Ohio State University, Columbus, Ohio, USA

09^{30}-10^{00} **Deformation Mechanisms in Superalloys: New Insights from STEM-based Imaging and Spectroscopy**
Tim Smith, Connor Slone, G. Babu Viswanathan, Michael J. Mills
The Ohio State University, Center for Electron Microscopy and Analysis (CEMAS), Columbus, OH, USA

10^{00}-10^{30} **Characterization of the Deformation Mechanisms in High-Mn Austenitic Steels**
James E. Wittig
Materials Science and Engineering, Vanderbilt University, Nashville, Tennessee, USA

10^{30}-11^{00} **Nanotwinned Structures in Nanomaterials: Preparation, Properties and Application**
Rostislav A, Andrievski
Institute of Problems of Chemical Physics, Russian Academy of Sciences, Chernogolovka, Moscow Region, Russia

Break: 11^{00}-11^{30}

Session II: 11^{30}-12^{30}
Chairmen: Hamish L. Fraser and Michael Mills

11^{30}-12^{00} **Thermoelectric Materials for Automotive Applications**
Peter Rogl[1,2], Gerda Rogl[1,2,3], Andriy Grytsiv[1,2,3], Ernst Bauer[1,3]
[1]Christian Doppler Laboratory for Thermoelectricity, Wien, Austria, [2]Institute of Physical Chemistry, University of Vienna, Währingerstrasse 42, A-1090 Wien, Austria, [3]Institute of Solid State Physics, Vienna University of Technology, Wiedner Hauptstrasse 8-10, A-1060 Wien, Austria

12^{00}-12^{30} **Alkali Metal-containing Complex Oxide Nanoparticles for Advanced Materials**
Mamoru Senna
Faculty of Science and Technology, Keio University, Yokohama, Japan

FIFTH PLENARY SESSION

Friday, September 4, 2015

Session I: 09^{00}-10^{30}
Chairmen: Ai Leen Koh and Gyula Eres

09^{00}-09^{30} **The On-site Analysis of Cultural Heritage Materials and Artefacts**
Philippe Colomban
[1]Sorbonne Universités, UPMC Univ Paris 06, UMR 8233, MONARIS, c49, 4 Place Jussieu, F-75005, Paris, France, [2]CNRS, IP2CT, UMR 8233, MONARIS, 4 Place Jussieu, F-75005, Paris, France

09^{30}-10^{00} **Plasmonic Diagnostic in Biological Fluids**
Ramon A. Alvarez-Puebla
Institució Catalana de Recerca i Estudis Avançats (ICREA), Passeig Lluís Companys 23, 08010, Barcelona, Spain; Universitat Rovira i Virgili and Centro de Tecnologia Quimica de Cataluña, Carrer de Marcel•lí Domingo s/n 43007, Tarragona, Spain; Medcom Advance SA, Viladecans Business Park - Edificio Brasil, Bertran i Musitu 83-85 08840, Viladecans – Barcelona, Spain

10^{00}-10^{30} **Identifying Active Nanostructures by In Situ Electron Microscopy for Design of Tailored Materials**
Eva Olsson
Department of Applied Physics, Chalmers University of Technology, Gothenburg, Sweden

Break: 10^{30}-11^{00}

Session II: 11^{00}-12^{30}
Chairpersons: Eva Olsson and Philippe Colomban

11^{00}-11^{30} **The Role of Cooperativity in Two-dimensional Crystal Growth**
Gyula Eres
Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA

11^{30}-12^{00} **Applications of Environmental (Scanning) Transmission Electron Microscopy to Study Oxidation and Hydrogenation Phenomena in Nanomaterials**
Ai Leen Koh
Stanford Nanocharacterization Laboratory, Stanford University, CA, USA

12^{00}-12^{30} **The Half of Millennium Since Publishing of the First Exact Contribution to the Elastomer Concept – Some Lessons of Epistemology and Some Prospect for the Future**

Milenko B. Plavšić, Milanka M. Plavšić
Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia

12^{30}-13^{00} **CLOSING CEREMONY**

POSTER SESSION I

Tuesday, September 1, 2015, 20^{00}-22^{00}

SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

P.S.A.1. **Production of Nanomaterials for Physical/Chemical Methods of Fluid Filtering**
Suzana Gotovac Atlagić[1], Marko Čađo[1], Siniša M. Vučenović[2], Igor J. Šetrajčić[3], Jovan P. Šetrajčić[3]
[1]University of Banja Luka, Faculty of Technology, Banja Luka, Republic of Srpska, BiH, [2]University of Banja Luka, Faculty of Natural Sciences, Banja Luka, Republic of Srpska, BiH, [3]University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina, Serbia

P.S.A.2. **Doped Calcium Cobaltites: The Synthesis Approach**
Eva Bartonickova, Alzbeta Jebava, Jiri Masilko, Lukas Kalina, Jakub Tkacz, Jaromir Havlica
Materials Research Centre, Faculty of Chemistry, Brno University of Technology, Brno Czech Republic

P.S.A.3. **Alternative Synthesis of Certain Compounds of Perovskite-type for Piezoelectric Transducers**
Piotr Dulian[1], Wojciech Bąk[2], Krystyna Wieczorek-Ciurowa[1], Czesław Kajtoch[2]
[1]Faculty of Chemical Engineering and Technology, Cracow University of Technology, 24, Warszawska Str., 31-155 Cracow, Poland, [2]Institute of Physics, Pedagogical University, 2, Podchorążych Str., 30-084 Cracow, Poland

P.S.A.4. **Evaluation of Inhibition Efficiency of Talloil Diethylenetriamine Imidazoline as Corrosion Inhibitor for Top of the Line Corrosion of Mild Steel in Multiphase Flow Environment**
Ivana Jevremović[1], Marc Singer[2], Srdjan Nešić[2], Vesna Mišković-Stanković[1]
[1]Faculty of Technology and Metallurgy, Belgrade, Serbia,
[2]Institute for Corrosion and Multiphase Technology, Ohio University, Athens, USA

P.S.A.5. **Effect of Thermal Aging of Ethylene-Vinyl Acetate Copolymer (EVA) on Adhesive Properties for Optical Fibers Fixation**
Nataša Z. Tomić[1], Bojan I. Međo[2], Kata Trifković[1], Dušica B. Stojanović[2], Vesna J. Radojević[2], Marko P. Rakin[2], Radmila M. Jančić-Heinemann[2], Radoslav R. Aleksić[2†]
[1]University of Belgrade, Innovation Center of Faculty of Technology and Metallurgy, Karnegijeva 4, 11120 Belgrade, Serbia, [2]University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11120 Belgrade, Serbia

P.S.A.6. **Synthesis and Structure of Cobalt(III) Complex with Pyridoxylideneaminoguanidine**
Marko V. Rodić, Mirjana M. Radanović, Ljiljana S. Vojinović-Ješić, Vukadin M. Leovac
Faculty of Sciences, University of Novi Sad, Serbia

P.S.A.7. **The Kinetic Energy Dependence of Association Reactions for Alkali Metal Ions with Dimethoxyethane**
Milica Petrović, Martina Gilić, Vladimir Stojanović, Željka Nikitović, Zoran Raspopović, Nebojša Romčević
Institute of Physics, University of Belgrade, Serbia

P.S.A.8. **Electroless Deposition of Ni-P Coating on Wrought Mg-3Al-1Zn Magnesium Alloys**
Jaromir Wasserbauer[1], P. Kosár[1], M. Buchtík[1], Pavel Doležal[1,2]
[1]Brno University of Technology, Faculty of Chemistry, Materials Research Centre, Purkynova 118, 612 00 Brno, Czech Republic, [2]Brno University of Technology, Faculty of Mechanical Engineering, Institute of Material Science and Engineering, Technicka 2, 616 69 Brno, Czech Republic

P.S.A.9. **Preparation of Cordierite Ceramic Materials Starting from Natural Raw Materials**
Khaled Boumchedda, Said Debbakh, Bahia Rebahi, Tahar Aouroun
UR-MPE, FSI, University of Boumerdes, 35000 Boumerdes, Algeria

P.S.A.10. **Complexes of Ru(II) with N-alkylphenothiazines – biological Assay**
Milena P. Krstić[1], Sunčica M. Borozan[1], Sofija P. Sovilj[2], Sanja Grgurić-Šipka[2]
[1]Faculty of Veterinary Medicine, University of Belgrade, Belgrade, Serbia, [2]Faculty of Chemistry, University of Belgrade, P.O. Box 158, 11001 Belgrade, Serbia

P.S.A.11. **Transport Parameters of Ne+ in CF_4 for Technological Applications**
Željka Nikitović, Zoran Raspopović, Vladimir Stojanović
Institute of Physics, University of Belgrade, Belgrade, Serbia

P.S.A.12. **Influence of Point Defects Concentration on Densification Process and Optical Properties of Sintered ZnO Ceramics**
Smilja Marković[1], Ana Stanković[1], Ljiljana Veselinović[1], J. Belošević-Čavor[2], Srečo Škapin[3], S. Stojadinović[4], V. Rac[5], S. Lević[5], I. Janković-Častvan[6], Dragan Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]The Vinča Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia, [3]Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia, [4]Faculty of Physics, University of Belgrade, Belgrade, Serbia, [5]Faculty of Agriculture, University of Belgrade, Zemun, Serbia, 6Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.A.13. **Synthesis and Characterisation of Powder Metallurgy Bulk Magnesium**
Matěj Březina[1], Pavel Doležal[1,2], Josef Zapletal[2], Jaromír Wasserbauer[1], Veronika Ruttkayová[1]
[1]Brno University of Technology, Faculty of Chemistry, Materials Research Centre, Purkynova 118, 612 00 Brno, Czech Republic, [2]Brno University of Technology, Faculty of Mechanical Engineering, Institute of Material Science and Engineering, Technicka 2, 616 69 Brno, Czech Republic

P.S.A.14. **The Gamma-irradiation Effect on Sintering and Properties of Zirconia Ceramics**
Olga S. Antonova[1], Valeriy V. Smirnov[1], German P. Kochanov[1], Ludmila I. Shvorneva[1], Alexey A. Zanin[2], Sergey M. Barinov[1]
[1]Baikov' Institute of Metallurgy and Material Science RAS, Moscow, Russia
[2]D. Mendeleev Univercity of Chemical Technology of Russia, Moscow, Russia

P.S.A.15. **Modeling the Influence of Synthesis Parameters and Thermal Effects on Magnetic Properties of Pressed Powder System $Fe_xO_yBaTiO_3$**
Dejan Vujičić[1], Dušan Marković[2], Danijela Milošević[1], Slobodan Djukić[1], Siniša Randjić[1]
[1]Faculty of Technical Sciences Čačak, [2]Faculty of Agronomy Čačak, Serbia

P.S.A.16. **Analysis of Stress Distribution in the Case of Scarf Joint of Two Composite Materials**
Abdurrahman O. Houssein[1], Mohamed Mokhter Omar Abukhres[2]
[1]Aljabel Algharbi University, Al Zentan engineering Faculty, Lybia
[2]Aljabel Algharbi University, Lybia

P.S.A.17. **Application of New Composites for Fused Deposition Modeling (FDM) Technology in Wood Industry**
Nenad Grujović[1], Milan Šljivić[2], Miroslav Živković[1], Fatima Živić[1], Andreja Radovanović[1], Miloš Mladenović[1]
[1]Faculty of Engineering, University of Kragujevac, Serbia
[2]Faculty of Mechanical Engineering, University of Banja Luka, RS-BIH

P.S.A.18. **Tuning Electronic Properties of Transition Metal Dichalcogenides by a Heterovalent Doping in Metal Sublattice**
Alexandra Yu. Ledneva, Sofya B. Artemkina, Mariia N. Kozlova, Anatoly I. Romanenko, Vladimir E. Fedorov
[1]Nikolaev Institute of Inorganic Chemistry SB RAS, Novosibirsk, Russia,
[2]Novosibirsk State University, Novosibirsk, Russia

POSTER SESSION II

Wednesday, September 2, 2015, 20^{00}-22^{00}

SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

P.S.B.1. **Valence State Ce(Yb), Electron Structure and Physical Properties of New Ternary Intermetallic Compounds**
Ivan D. Shcherba[1,3], Dragan Uskoković[2] , M. V. Kovalska[3]
[1]Institute of Technology, the Pedagogical University of Cracow, Podchorozych st. 2 Cracow 30-084 Poland, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Ivan Franko National University of Lviv, Ukraine

P.S.B.2. **Preparation of NdFeB Magnetic Nanoparticles by Surfactant-assisted High Energy Ball Milling**
Jelena Lamovec, Vesna Jović, Filip Radovanović, Danijela Randjelović, Katarina Radulović, Zoran Jakšić, Dana Vasiljević-Radović
Centre of Microelectronic Technologies, Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Njegoseva 12, 11000 Belgrade, Serbia

P.S.B.3. **Thermodynamic Characteristics of Graphene**
Stevan Jaćimovski[1], Dejan Raković[2]
[1]Academy of Criminalistic and Police Studies, Belgrade, Serbia
[2]University of Belgrade, Faculty of Electrical Engineering, Belgrade, Serbia

P.S.B.4. **Investigation of Optoelectronic and Heat Transport Properties of Graphene Modified with Boron Atoms**
Stevan Armaković[1], Sanja J. Armaković[2]
[1]University of Novi Sad, Faculty of Sciences, Department of Physics, Trg Dositeja Obradovića 4, 21000, Novi Sad, Serbia, [2]University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000, Novi Sad, Serbia,

P.S.B.5. **Self-Healing Fiber-Reinforced Composite**
Ivana Radović, Vesna Radojević, Petar S. Uskoković, Dušica B. Stojanović, Miloš Petrović and Radoslav Aleksić
University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.B.6. **Synthesis and Consolidation of Ni_3B by Spark Plasma Sintering**
Dina V. Dudina[1,2], Arina V. Ukhina[1], Yuliya G. Mateyshina[1], Vyacheslav I. Mali[2], Alexander G. Anisimov[2], Michail A.Korchagin[1,3]
[1]Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russian Federation
[2]Lavrentyev Institute of Hydrodynamics SB RAS, Novosibirsk, Russian Federation
[3]Tomsk State University, Tomsk, Russian Federation

P.S.B.7. **Magnetoimpedance Effect of Metastable $Fe_{72}Cu_1V_4Si_{15}B_8$ Alloy Ribbons**
Nebojša Mitrović[1], Radoslav Surla[1], Aleksandra Kalezić -Glišović[1], Maja Kićanović[1], Dragica Minić[2]
[1]Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia, [2]Faculty of Physical Chemistry, University of Belgrade, Serbia

P.S.B.8. **Voltammetric Determination of an Antipsyhotic Agent Trifluoperazine at Boron-Doped Diamond Electrode**
Dalibor Stanković[1], Teodora Dimitrijević[2], Darko Kuzmanović[2], Milena P. Krstić[3], Branka B. Petković[4]
[1]ICTM, Department of Electrochemistry, University of Belgrade, Belgrade, Serbia, [2]Faculty of Chemistry, University of Belgrade, Belgrade, Serbia, [3]Faculty of Veterinary Medicine, University of Belgrade, Belgrade, Serbia, [4]Faculty of Natural Science and Mathematics, University of Priština, Kosovska Mitrovica, Serbia

P.S.B.9. **Mechanism of Increasing the Capacitance of Li-Ion Bettery with Nano-Coated Electrodes**
Igor J. Šetrajčić[1], Ana J. Šetrajčić – Tomić[2], Jovan P. Šetrajčić[1]
[1]University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina – Serbia; [2]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Novi Sad, Vojvodina – Serbia

P.S.B.10. **Modern Technologies to Be Applied into Ballistic Vests**
Elżbieta Maklewska, Grażyna Grabowska, Joanna Blaszczyk, Agata Pawlowska
Institute of Security Technologies "MORATEX", M.Sklodowskiej-Curie 3, Polska

P.S.B.11. **Protection of Personal and Biometric Data of Individuals from the Measurements with a 3D Scanner**
Grazyna Grabowska, Elzbieta Maklewska, Joanna Blaszczyk, Agata Pawlowska
Institute of Security Technologies "MORATEX", M.Sklodowskiej-Curie 3, Polska

P.S.B.12. **Optical and Mechanical Properties of PMMA Film Doped with QD**
Hana Ibrahim Elswie[1], Ivana Radović[1], Dragutin Sević[2], Dušica B. Stojanović[1], Petar Uskoković[1], Vesna Radojević[1], Radoslav Aleksić[1]
[1]Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11120 Belgrade, Serbia, [2]Insitute of Physics, University of Belgrade, Belgrade, Serbia

P.S.B.13. **Investigation on Fracture Mechanics for Steel, Cast Iron and Bronze Materials**
Miranda Vidhaj[1], Mariglen Kurti[1], Fatjon Boçi[2]
[1]"Ismail Qemali" University of Vlora, Vlore, Albania, [2]Private sector, Industrial production and management Vlora, Albania

P.S.B.14. **Low-cycle Fatigue Behaviour of 6061 Aluminium Alloy Plated with Multi-layered Coatings**
Ya. B. Unigovski, Emmanuel M. Gutman, A. Grinberg
Ben-Gurion University of the Negev, Department of Materials Engineering, Beer-Sheva 84105, Israel

P.S.B.15. **Spectroscopical Analyses of Laboratory Produced ODS Steels**.
Jarmila Degmova, Julius Dekan, Jana Simeg Veterníkova, Veronika Sabelova, Vladimir Slugen
Institute of Nuclear and Physical Engineering, Slovak University of Technology, Ilkovičova 3, 812 19 Bratislava, Slovakia

P.S.B.16. **The Pore Structure of Hydrated Portland Cement Paste**
Irida Markja[1], Thomas Bier[2], Ylli Shehu[1]
[1]Polytechnic University Tirana, Department of Production Management, Sq. Nene Teresa nr. 4, Tirana, Albania, [2]TU Bergakademie, Institute für Keramik, Glas und Baustofftechnik, Leipziger Str.28, 09599 Freiberg, Germany

P.S.B.17. **The Influence of Nano-Silica and Barite Aggregate on Properties of Ultra High Performance Concrete**
Ksenija Janković[1], Srboljub Stanković[2,3], Dragan Bojović[1], Marko Stojanović[1], Ljiljana Miličić[1]
[1]Institute for Materials Testing - IMS, Belgrade, Serbia
[2]Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia
[3]School of Electrical Engineering, University of Belgrade, Belgrade, Serbia

POSTER SESSION III

Thursday, September 3, 2015, 20^{00}-22^{00}

SYMPOSIUM C: NANOSTRUCTURED MATERIALS

P.S.C.1. **Tailoring Surface Plasmon Resonance (SPR) of Bimetallic Ag/Au Nanoparticles through their Composition and Assembly**
Manca Logar[1], Tilen Sever[2], Boštjan Jančar[2]
[1]Laboratory for chemistry of materials, National Institute of Chemistry, Slovenia, [2]Advanced Materials Department, Jozef Stefan Institute, Slovenia

P.S.C.2. **Alignment of MoS_2 Nanotubes in a Photopolymerizable Liquid–crystalline Material**
Aleš Mrzel[1], Blaž Tasič[1], Miro Huskič[2], Irena Drevenšek-Olenik[1,3]
[1]Jozef. Stefan Institute, Jamova 39, SI 1000 Ljubljana, Slovenia, [2]National Institute for Chemistry, Hajdrihova 19, SI 1001, Ljubljana, Slovenia, [3]Faculty of Mathematics and Physics, University of Ljubljana, Jadranska 19, SI 1000 Ljubljana, Slovenia

P.S.C.3. **Platinum Nanocatalysts at Titanium Oxide Based Supports for Low Temperature Fuel Cell Applications**
Ljiljana M. Gajić Krstajić[1], Nevenka R. Elezović[2], Biljana M. Babić[3], Velimir R. Radmilović[4], Nedeljko V. Krstajić[4]
[1]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35, Belgrade, Serbia, [2]Institute for Multidisciplinary Research, University of Belgrade, Belgrade, Serbia, [3]Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia, [4]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.C.4. **Shape Evolution of Carbon Supported Pt Catalyst for PEMFC**
Mila N. Krstajić[1], Sanja I. Stevanović[1], Vuk V. Radmilović[2], Aleksandra Gavrilović-Wohlmuther[3], Velimir R. Radmilović[4,5], Snežana Lj. Gojković[4], Vladislava M. Jovanović[1]
[1]ICTM, Department of Electrochemistry, University of Belgrade, Njegoševa 12, 11000 Belgrade, Serbia, [2]Innovation Center, Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia, [3]CEST Centre of Electrochemical Surface Technology, Viktor-Kaplan Strasse 2, 2700 Wiener Neustadt, Vienna, Austria, [4]Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia, [5]Serbian Academy of Sciences and Arts, Knez Mihailova 35, 11000 Belgrade, Serbia

P.S.C.5. **Photocatalytic Degradation of the Propranolol Hydrochloride in Natural Water Using Titania-based Nanoparticles**
Sanja J. Armaković[1], Daniela V. Šojić[1], Marija Radoičić[2], Mirjana I. Čomor[2], Biljana F. Abramović[1]
[1]University of Novi Sad, Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia; [2]Institute for Nuclear Sciences Vinča, 11001 Belgrade, PO Box 522, Serbia

P.S.C.6. **Synthesis, Characterisation and Photocatalytic Properties of Two Novel Nanocomposites: TiO_2 Hombikat with Fullerene nC_{60} and with Fullerenol $C_{60}(OH)_{24}$ Nanoparticles**
Ivana Borišev[1], Igor Medić[1], Daniela Šojić[1], Biljana Abramović[1], Marina Lazarević[1], Marina Delić[1], Danica Jović[1], Vladimir Srdić[2], Aleksandar Djordjević[1]
[1]University of Novi Sad, Faculty of Sciences, Department for Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, Novi Sad, Serbia, [2]University of Novi Sad, Faculty of Technology, Bulevar Cara Lazara 1, Novi Sad, Serbia

P.S.C.7. **Synthesis of Sulphur Nanoparticles by Mechanochemical Route in the System $Na_2S_2O_3$−$H_2(C_4H_4O_4)$−Na_2SO_3**
Dinar Zharlyrkasimova[1], Mukhambetkali Burkitbayev[1], Bolat Uralbekov[1], Farit Urakaev[2]
[1]al-Farabi Kazakh National University, Almaty, Kazakhstan, [2]V.S. Sobolev Institute of Geology and Mineralogy SB RAS, Novosibirsk, Russia

P.S.C.8. **Hydrolytic Stability of Nanosilica-based Urea-formaldehyde Composite with Different Coumarine Derivates as Scavengers of the Formaldehyde**
Vojislav Jovanović[1], Branka Petković[1], Suzana Samaržija-Jovanović[1], Biljana Dekić[1], Vidoslav Dekić[1], Gordana Marković[2], Milena Marinović-Cincović[3]
[1]Faculty of Natural Science and Mathematics, University of Priština, Kosovska Mitrovica, Serbia, [2]Tigar, Pirot, Serbia; [3]Institute of Nuclear Science Vinča, University of Belgrade, Belgrade, Serbia

SYMPOSIUM D: ECO-MATERIALS AND ECO-TECHNOLOGIES

P.S.D.1. **Investigation of Adsorption of Copper Ions by Poplar Wood Sawdust and Lignin**
Marina Šćiban, Dragana Kukić, Jelena Prodanović, Vesna Vasić
University of Novi Sad, Faculty of Technology Novi Sad, Bul. Cara Lazara 1, 21000 Novi Sad, Serbia

P.S.D.2. **Friction and Aerodynamic Offset of Cup Anemometer**
Miodrag Zlatanović[1], Ivan Popović[2]
[1]Wind Electricity doo, Belgrade, Serbia, [2]School of Electrical Engineering, Belgrade, Serbia

P.S.D.3. **Newer Methods of Waste Disposal from Thermal Power Plants**
Jelena Mitić[1], Oliver Dimitrijević[2], Miodrag Smelcerović[1], Dragan Djordjević[3]
[1]Higher School of Textile Studies, Leskovac, Serbia
[2]Higher School of Medical Studies 'Hipokrat', Bujanovac, Serbia
[3]Faculty of Technology, Leskovac, Serbia

SYMPOSIUM E: BIOMATERIALS

P.S.E.1. **Bone Cements Based on Calcium Phosphate-Magnesium Phosphate System with (Ca+Mg)/P = 2**
M.A. Goldberg, Sergey V. Smirnov, V.V. Smirnov, O.S. Antonova, L.I. Shvorneva, S.V. Kutsev, S.M. Barinov
Baikov' Institute of Metallurgy and Materials Science RAS, Moscow, Russia

P.S.E.2. **Synthesis, Characterization and Antimicrobial Activity of Ni(II) Complexes with Condensation Product of 2-(Diphenylphosphino)Benzaldehyde and Girard's T Reagent**
Božidar Čobeljić[1], Milica Milenković[1], Gabrijela Bradjan[1], Dušan Sladić[1], Marina Milenković[2], Katarina Andjelković[1]
[1]Faculty of Chemistry, University of Belgrade, Studentski trg 12–16, 11000 Belgrade, Serbia, [2]Department of Microbiology and Immunology, Faculty of Pharmacy, University of Belgrade, Vojvode Stepe 450, Serbia

P.S.E.3. **Crosslinked Electrospun Chitosan/PEO Nanofibers for Wound Healing Application**
Mirjana Grković[1], Andjela Radisavljević[1], Dušica B. Stojanović[2], Aleksandar Kojović[2], Mirjana Rajilić-Stojanović[2], Igor Balać[3], Vladimir Pavlović[5], Miloš Bjelović[4], Petar S.Uskoković[2]
[1]University of Belgrade, Innovation Centre Faculty of Technology and Metallurgy, Belgrade, Serbia, [2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia, [3]University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia, [4]University of Belgrade, Faculty of Medicine, Belgrade, Serbia, [5]University of Belgrade, Faculty of Agriculture, Belgrade, Serbia

P.S.E.4. **Development of Multifunctional Oxaprozin/poly(2-hydroxypropyl acrylate/itaconic Acid) Delivery System**
Marija M. Babić, Bojan Dj. Božić, Katarina M. Antić, Jovana S. Vuković, Marija D. Perišić, Jovanka M. Filipović, Simonida Lj. Tomić
Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia

P.S.E.5. **The Influence of Gradient Copolymerisation Poly(oligo(propylene glycol) methacrylate) Hydrogels with 2-hydroxyethyl methacrylate on Thermoresponsive Properties**
Maja Mićić, Zorana Rogić Miladinović, Dejan Miličević, Edin Suljovrujić
Vinča Institute of Nuclear Sciences, University of Belgrade, PO Box 522, 11001 Belgrade, Serbia

P.S.E.6. **Evaluation of Nano-particulate Bioactive-glass Reinforced Gellan-gum Hydrogel Regarding the Formation of Hydroxyapatite under Shear Stress**
Jovana Zvicer[1], Ana Gantar[2,3], Djordje Veljović[1], Saša Novak[2,3], Bojana Obradović[1]
[1]Faculty of Technology and Metallurgy, University of Belgrade, Serbia
[2]Department for Nanostructured Materials, Jožef Stefan Institute, Ljubljana, Slovenia
[3]Jožef Stefan International Postgraduate School, Ljubljana, Slovenia

P.S.E.7. **Formation Mechanism of Biocompatible Fluoride Conversion Coating on AZ31 Magnesium Alloy**
Juliána Drábiková, Jaromír Wasserbauer, Martin Zmrzlý
Brno University of Technology, Faculty of Chemistry, Materials Research Centre, Purkynova 118, 612 00 Brno, Czech Republic

P.S.E.8. **Squeeze Cast AZ31 Magnesium Alloy Long Term Degradation Analysis in Hanks' Solutions**
Pavel Doležal[1,2], Helena Doležalová Weissmannová[1], Jaromír Wasserbauer[1], Sylvia Dundeková[3], Branislav Hadzima[3], Ivana Modráčková[1]
[1]Brno University of Technology, Faculty of Chemistry, Materials Research Centre, Purkynova 118, 612 00 Brno, Czech Republic, [2]Brno University of Technology, Faculty of Mechanical Engineering, Institute of Material Science and Engineering, Technicka 2, 616 69 Brno, Czech Republic, [3]Research Centre of the University of Zilina, Univerzitná 1, 010 26 Zilina, Slovak Republic

P.S.E.9. **Influence of Coefficient of Friction and Contact Area on Prostheses-implant Retention Force**
Igor Balać[1], V. Buljak[1], S. Pandey[1], V. Lojpur[2]
[1]The Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia,
[2]Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

Abstracts

Oral Presentation

MRS-Serbia Award for 2015

Atomic-Layer Engineering and High-Tc Superconductivity in Cuprates

Ivan Božović
Brookhaven National Laboratory, Yale University, Upton, New York, USA

Superconductivity in cuprates has many mysterious facets, but the central question is why the critical temperature (Tc) is so high. It remained open for so long largely because of Materials science problems — these are very complex compounds.
The results will be presented of a comprehensive study that took nine years and encompassed thousands of cuprate samples — probably without precedence in the history of Condensed matter physics. The large statistics enables us to identify clear trends and unravel intrinsic properties; this is essential when dealing with complex materials such as cuprates. We use atomic-layer-by-layer molecular beam epitaxy to synthesize atomically perfect thin films, multilayers and superlattices of cuprates and other complex oxides. By atomic-layer engineering, we customize the samples for the particular experiment. Using a continuous spread in composition we tune the doping level in steps of 0.01%. We have measured accurately the key physical parameters of the superconducting state and established their dependence on doping, temperature, and external fields. The findings bring in some great surprises and hint at the answer to our initial question.

PL.S.I.1.

Quantum Dot Formation on Nanowires

Q. Zhang[1], S.H. Davis[1], J.-N. Aqua[2], Peter W. Voorhees[3]
[1]Engineering Sciences and Applied Mathematics, Northwestern University, USA, [2]Institut des Nanosciences de Paris, Université Pierre et Marie Curie Paris 6, France, [3]Materials Science and Engineering, Northwestern University, USA

Quantum dots embedded within nanowires hold great promise in quantum photonics applications. However, controlling the formation of these dots remains a challenge. Recently, GaAs nanowires have been used as substrates to create novel optoelectronic devices by growing an AlGaAs alloy shell on a GaAs nanowire. The deposition of the AlGaAs layer leads to the spontaneous formation of stripes of Al along certain crystallographic directions and quantum dots near the apex of the shell. A model has been developed for the motion of the faceted AlGaAs-vapor interfaces that accounts for capillarity, deposition, and surface diffusion. We find that for certain combinations of these effects, facets can be present during growth that are not present on the Wulff shape. These small facets can have a slowly time-dependent size that can lead stripes and quantum dot formation. The effects of surface diffusion, deposition, and surface energy on the development of stripe of Al and quantum dots will be discussed.

PL.S.I.2.

Electromagnetic Field Mapping at the Nanoscale in the Transmission Electron Microscope

Rafal E. Dunin-Borkowski, Jan Caron, Andras Kovacs, Patrick Diehle, Vadim Migunov
Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons and Peter Grünberg Institute, Forschungszentrum Jülich, Germany

Off-axis electron holography is a powerful technique for recording the phase shift of a high-energy electron wave that passes through an electron-transparent specimen in the transmission electron microscope. The phase shift is, in turn, sensitive to the electrostatic potential and magnetic induction in the specimen. Recent developments in the technique have included the use of advanced specimen holders with multiple electrical contacts to study nanoscale working devices and the use of ultra-stable transmission electron microscopes to achieve sub-$2\pi/1000$-radian phase sensitivity.

We are currently working on the application of off-axis electron holography to the measurement of electrostatic potentials and electric fields around electrically-biased atom probe tomography needles. Each experiment involves applying a voltage between a needle and a counter-electrode. The recorded phase shift can be analyzed either by fitting the phase distribution to a simulation or by using a model-independent approach that involves contour integration of the phase gradient to determine the charge enclosed within the integration contour. Both approaches require evaluation of the difference between phase images acquired for two applied voltages, in order to subtract the mean inner potential (and sometimes also the magnetic) contribution to the phase. On the assumption of cylindrical symmetry, the three-dimensional potential and field around such a needle can be determined from the results.

We are also working on a model-based approach that can be used to reconstruct the three-dimensional magnetization distribution in a specimen from a series of phase images recorded using electron holography. We generate simulated magnetic induction maps by projecting a best guess for the three-dimensional magnetization distribution onto a two-dimensional Cartesian grid. We simulate phase images of arbitrary three-dimensional objects from any projection direction by making use of known analytical solutions for the phase shifts of simple geometrical objects, with numerical discretization performed in real space to avoid artifacts generated by discretization in Fourier space, without a significant increase in computation time. This forward simulation approach is then used in an iterative model-based algorithm to solve the inverse problem of reconstructing the three-dimensional magnetization distribution in the specimen from a tomographic tilt series of two-dimensional phase images. This approach avoids many of the artifacts that result from using classical tomographic techniques such as filtered backprojection, as well as allowing additional constraints and known physical laws to be incorporated. When recording weak phase shifts, it is important to remember that the sample must remain clean and undamaged for the time required to acquire images with a sufficient signal to noise ratio, that electron-beam-induced charging can affect the measured phase shift and that for crystalline specimens careful comparisons with dynamical simulations may be required even for a thickness of only a few atoms.

PL.S.I.3.

Electron Holography for Structures and Fields in Nanomaterials

Hannes Lichte, Felix Börrnert, Bernd Einenkel, Andreas Lenk, Axel Lubk,
Falk Röder, Jan Sickmann, Sebastian Sturm, Karin Vogel, Daniel Wolf
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TEM is the method of choice for analysis of materials at atomic scale at point resolution below 0.1nm allowing interpretation of positions of atoms e.g. at interfaces. However, a conventional TEM-image reflects only the intensity, i.e. the amplitude squared of the electron wave, whereas the phases are lost, and hence the signal of electric and magnetic fields in the object. Phase-loss is overcome by electron holography allowing the reconstruction of the complete object exit wave. This allows access to, for example:

• Inner Potentials in solids
• Functional potentials such as pn-junctions
• Electric fields controlling growth in biominerals
• Magnetic fields in magnetic structures
• Difference of atomic numbers
• Number of atoms in an atomic column
• Coherence of inelastically scattered electrons.

Lateral resolution of 0.1nm is reached in the holographically reconstructed wave. Phase resolution presently is about 2pi/200, allowing detection of the electric field around the nucleus of single heavy atoms.

PL.S.I.4.

An Up-date on In Situ and Environmental High Resolution Electron Microscopy of Material Reactions

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There has been a steady growth in the applications and breadth of in situ transmission electron microscopy (TEM) since the 1980's [1]. At that time, the procedures to carry out meaningful experiments were described (e.g. [2]) but it was thought that high voltage TEM and thick specimens were required to reproduce bulk behavior. However, in a series of studies, we established that this was not necessarily the case and that high resolution TEM recordings could be made in real time, in situ and that the atomic behavior associated with materials reactions at interfaces could be deduced (e.g. [3]-[5]). Moreover, with the advent of thin film and nanotechnology, the investigation of thin and nano-scale materials became a necessity (e.g. [6]). In recent years, there has been an additional proliferation, most notably from in situ TEM in controlled environments such as in gases and liquids (e.g. [1], [7]).

This paper gives an up-date of the application of in situ TEM to investigate material reactions, particularly those associated with interfaces important in electronic applications. An overarching theme of our work has been to ensure that the in situ studies are truly representative of the real behavior of the material system, and we have advanced a number of guidelines to ensure this. Moreover, we have also expanded our approach to environmental material-gas reactions such as carbon nanotube oxidation [8], magnesium hydrogenation and the hydrogen reduction of amorphous molybdenum sulfide for water splitting reactions. The influence of the imaging electron beam is more important for the gaseous reactions, as it ionizes the reacting gas species, and it is necessary to develop protocols to take this into account. The procedures we have adopted to do this will be carefully described.

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PL.S.I.5.

Zigzag Inversion Domain Boundaries in Functional Oxide Nanowires

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Due to the decoupling of certain electrical and thermal properties, M2O3(ZnO)n polytypoid nanowires (MZO, where M could be various elements, such as In, Ga, Fe), which contain nanometer-scale periodic compositional and structural features, are promising materials for a variety of applications. This new concept of structure control at atomic level is in agreement with the theoretical prediction that it is possible to increase the material-dependent figure of merit by using low dimensional materials, attributed to electronic band structure changes and enhanced interface phonon scattering. It appeared that control of lattice phonon transport contribution is essential to improve thermoelectric properties of ZnO based nanowires. Atomic resolution high angle annular dark field (HAADF) imaging and high resolution phase contrast imaging (HREM) in tandem with firs principles calculations are used to perform a detailed structural analysis on the M2O3(ZnO)n nanowires, unambiguously determined the location of indium within the structure and to evaluate lattice strain and the presence of defects. Existing models for the crystal structure of indium zinc oxide (IZO) and indium iron zinc oxide (IFZO) conflict with transmission electron microscopy data. We propose a model based on imaging and spectroscopy of IZO and IFZO nanowires and verify it using density functional theory. The model features a $\{1\bar{2}1\ell\}$ "zigzag" layer, which is an inversion domain boundary containing 5-coordinate indium and/or iron atoms. Higher ℓ values are observed for greater proportion of iron. We suggest a mechanism of formation in which the basal inclusion and the zigzag diffuse inward together from the surface of the nanowire. This will enable future studies on structure-dependent thermoelectric properties and possibly lead to further enhancements in thermoelectric efficiency.

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O.S.A.1.

High Resolution Materials Characterisation using Aberration Corrected Scanning Transmission Electron Microscopy

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Development of new advanced materials requires understanding of the precise arrangements and local chemistry of the material's constituent atoms. The state-of-the-art atomic resolution imaging and microanalysis capabilities of aberration corrected scanning transmission electron microscope JEOL ARM200F equipped with a cold field emission gun, energy filtered transmission electron microscopy, electron energy loss spectroscopy, a large area energy dispersive x-ray spectrometer, with a solid angle of 0.98sr, will be demonstrated for a range of materials. The examples will include (i) characterisation of interface structure of nanoparticles and segregation in Ni-Fe-Nb-C and metastable beta Ti alloys, (ii) HAADF imaging of titanium dioxide porous nanoparticles; and (iii) atomic resolution imaging and EELS of beam sensitive materials at 80 kV.

O.S.A.2.

Lead Free Piezoelectric Materials for Transducer Applications

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Lead Zirconia Titanate (PZT) is high efficiency, very precise, electromagnetic noise free, non-conductive and non-inflammable. Therefore piezoelectric devices could be miniaturized, while staying stable in frequency and safer in the case of overload and short circuit. The devices cover diverse equipment, from consumer electronics & automotive to medical & underwater imaging. However, the PZT contains lead (typically above 60 wt% in commercial products) and has been known to raise various health and environmental concerns. Therefore efforts have been devoted to the development of competitive lead-free counterparts such as derivatives of $BaTiO_3$, or $KNbO_{31-3}$.

The status of lead free piezoelectric materials from ceramics to textured ceramics and single crystal investigating in national French projects will be presented. Some examples of the applications potential, LF Langevin transducer and medical HF transducer, will be presented. This work reinvestigates the well known $BaTiO_3$ (BT) and the more popular $(K,Na,LI)(NbTaSn)O_3$ (KNL-NTS) materials in the form of ceramics, textured ceramics. Nanopowders were obtained by attrition milling and calcining at low temperature. Very dense conventional ceramics, 99% of theoretic density, were sintered using different densification techniques as solid state reaction, hot forging and spark plasma sintering. BT and KNL NTS ceramics were poled using field cooling and room temperature poling processes. Ceramics poled under field cooling exhibit high thickness coupling efficiency. Engineering ferroelectric domains of lead free ceramics piezoelectric materials was explored though textured ceramics and single crystals. Dense $BaTiO_3$ and KNL NTS textured ceramics exhibiting 90% of orientation degree were sintered using “Template Grain Growth” with $NaNbO_3$ platelets seeds synthesized via molten salt or flux method.

A transducer based on KNL NTS textured ceramic sample has been fabricated and functional characterised. Finally, in a single element transducer was made with textured ceramic and compared with a current PZT transducer.

O.S.A.3.

Silver Matrix Graphene Strengthened Composites with High Electrical Conductivity

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Silver matrix composites were prepared from ball milled powders of silver and graphene in vacuum by hot pressing. Two types of graphene platelets of different platelet thickness were applied; the first one of thickness of 2-4 nm and another of 10-20 nm in the amount of 1 and 2 wt.%. The obtained composites showed similar hardness, but only about 20% higher electrical resistivity of composites with 2 % of fine graphene platelets, compared with pure silver. SEM studies of composites revealed slightly more homogeneous microstructure of samples with fine graphene additions, contrary to the coarse graphene platelets locating at the silver particle boundaries. TEM studies indicated insignificant change of the structure of both kinds of graphene platelets after hot pressing. High dislocation density within platelets and the crystallographic correspondence of graphene and silver leading to a good match at atomic scale was observed with the use of high resolution TEM. Raman spectra confirmed nonhomogeneity of graphene platelets in bulk composites, although the composites with fine graphene additions had more homogeneous microstructure. Analysis of Raman spectra of composites with coarser graphene showed that lateral size of graphene platelets was significantly smaller than that of initial one in opposite to graphene with finer platelets. The increase of number of layers and increase of lateral size of finer graphene platelets could be the result of ordering of graphene sheets in nanoplatelets during formation of composites at high pressure and high temperature. It could be connected with synthesis (top-down) of such graphene nanoplatelets, which disturbed the ordering of graphene layers in initial substrate (graphite) by processes of oxidation, sonication and reduction. Preliminary experiments indicated better resistance of composites to multiple (up to 50 000) electrical contact experiments as compared to conventional contact materials.

O.S.A.4.

Tailoring Microstructure of Thermoelectric Oxides

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Several conductive oxides have recently been identified as candidate materials for high-temperature thermoelectrics, mostly due to non toxicity, chemical stability and abundance of constituent elements. The literature and our research point to layered cobaltates, doped perovskite manganates and doped zinc oxide as currently the most prominent thermoelectric oxides. There are, however, several issues, which the limit usefulness of these materials. In the case of layered cobaltetaes the $NaxCoO_2$ (x~0.75) exhibits the highest zT values (above 0.6 at 800ºC), however the reactivity of interlayer sodium ions causes this material to react with atmospheric H_2O and CO_2 which results in deterioration of material with time. The similar material $Ca_3Co_4O_9$ with the rock salt layer between CoO_2 sheets is resistant to atmospheric influences, however its properties are lesser, part of which can be attributed to lower degree of spontaneous texturing during processing. We synthesized coherently grown materials $Ca_{3-x}Na_xCo_4O_9$ that exhibit a high degree of spontaneous texturing and improved resistance to atmospheric degradation. Several structural anomalies that form during coherent intergrowth will be presented and their influence on thermoelectric properties will be discussed. In the case of perovskite manganates, based on donor doped $CaMnO_3$, we investigated possibility of tailoring properties by introducing electrically insulating Ruddlesden-Popper faults into the perovskite grains. These planar faults crucially influence development of microstructure and consequently influence thermal and electrical properties of the system. The properties of Al-doped ZnO are influenced by segregation of Al-rich secondary phase upon exceeding solid solubility. The Al-rich inclusions first tend to form as amorphous layers along the grain boundaries of ZnO matrix grains and subsequently in the form of spinel-phase inclusions, which strongly influences transport properties.

O.S.A.5.

Acrobatics of N'-2-propylidene-4-hydroxybenzohydrazide Crystals

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Targeted design of new actuating materials which are capable of fast, reversible and controllable mechanical motion in response to external stimuli (thermal or light) is at the frontier of the contemporary materials science research. Among these, the few serendipitiously discovered examples of crystals that sudenly jump while heated, to distances several thousand times larger than their own dimension in less than 1 ms, provide the most impressive display of the conversion of thermal energy into mechanical work. These thermosalient crystals are biomimetic, nonpolymeric self-actuators par excellance.

It was reported that N'-2-propylidene-4-hydroxybenzohydrazide shows behaviour somewhat similar to that of jumping crystal. This system was found in three polymorphic modifications (I, II and III), all having the same polar space group Pna21, with the phase transitions I to II, and III to II reported as topotactic (single crystal to single crystal). It was also reported that during irreversible phase transition from I to II, the polar axis undergoes a strong compression (approximately 15%) and single crystals of phase I are violently shuttered into single crystal fragments of the phase II (without jumping), while in the reversible phase transition III to II the polar axis expands (approximately 14%) and the integrity of the single crystals is preserved – and no movement of crystals is observed.

Our investigation shows somewhat different behaviour – during the irreversible phase transition from I to II some of the crystals did indeed shutter into smaller fragments, but a large number remained intact and showed a typical jumping crystals behaviour – jumping all around over the large distances (several cm). This is typical of other thermosalient materials. Also, during the reversible phase transition II <-> III (both ways) crystals exhibited jumping behaviour, alas somewhat weaker than during the phase transition I to II. This is in contrast to previously reported behaviour and the new model for jumping crystals phenomenon in this system has to be proposed. Especially interesting is that the negative thermal expansion was observed during heat treatment prior to each thermosalient phase transition.

We acknowledge financial support from the Croatian Science Foundation (HRRZ) project entitled: “Acrobatics of molecular crystals – thermosalient materials for new generation of actuators”.

O.S.A.6.

Towards Rotational Molding of Ultra Low Density Cellular Polymeric Composites

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Rotational molding is a plastic processing technology particularly useful for manufacturing large-sized and complex-shaped single-piece hollow articles. Rotomolded foam-reinforced integral-skin cellular polymeric composites form a very desirable class of rotational molding articles because they can satisfy severe service requirements while demonstrating very high strength-to-weight ratios. However, it is intrinsically very difficult to effectively control the process so to retain fine-celled foam morphology and skin thickness uniformity. In order to address these disadvantages, an extrusion-assisted rotational foam molding technology has been designed, developed, and recently patented. It is refereed to as Rapid Rotational Foam Molding. By further developing this innovative synergy between the traditional rotational molding and the extrusion foaming process it would become feasible to explore the implementation of physical blowing agents in rotational foam molding for the first time.

O.S.A.7.

On PolyHIPE Based Separators for Thin Film Lithium-Ion Batteries

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Thin film lithium ion batteries are in the focus of investigation because they offer improved performance such like having higher average output voltage, lighter weights thus higher energy density and longer cycling life than typical rechargeable batteries. Up to now mostly solid electrolytes are used in thin film cell setups, having rather low electrical conductivities and modest current densities. High internal phase emulsion (HIPE) templating now offers the possibility to produce highly porous in situ Li+-electrolyte filled separators that are printable as films with thicknesses fare beyond 100µm. For investigations, new systems on the basis of Lauryl methacrylate and 1,12-Dodecanediol dimethacrylate with different amount of emulsifier as external minority phase have been prepared. Solutions of various Li-salts in classical carbonates and room temperature ionic liquids were used as internal phase. The polymerized systems (polyHIPEs) were then characterized in terms of microstructure, rheology, electrical conductivity and mechanical and thermal stability.

O.S.A.8.

Fluorine Doping of Layered Na_xCoO_2 Structure

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The room temperature Na-ion secondary battery has been under focus lately due to its feasibility to compete against the already well-established Li-ion secondary battery. Transition metal oxides of general formula Na_xMO_2 have been investigated as potential cathode materials for sodium batteries. Layered Na_xCoO_2 is synthesized via solid-state method at 900 ºC in air atmosphere. Fluorine doping of the as-prepared powder is established by the use of ammonium hydrogen difluoride (NH_4HF_2) as a fluorinating agent. The fluorination takes place only at low temperature (200 ºC), while the treatment at higher temperatures (≥ 400 ºC) facilitates the formation of NaF. It is shown that various and controllable amounts of fluorine can be successfully incorporated into the structure. Finally, the effects of fluorine doping on both structural and electrochemical properties are examined.

O.S.A.9.

Advances in Improvement of Pb-Based Thin Layers Deposited on Nb Substrate

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Improvement of adhesion between deposited lead thin layer on niobium substrate is a challenging task due to their highly different physical and chemical characteristics. The fundamental problem is that niobium and lead tend to oxidize which cause poor deposition of the applied layers. In this study we use the Rod Plasma Injector (RPI) technique (operating in PID and DPE regimes) to solve the problem of insufficient adhesion between Pb layer deposited on Nb substrate with or without additional Ti or Sn layers. In order to assess thickness of thin layer we use Calotester device and SEM/EDX techniques. Finally, nanoindentation technique was implemented to evaluate mechanical properties of studied system. Reported results revealed that melting of the substrate occurs above certain energy threshold. Moreover, the Ti layer unlike the Pb layer is continuous, smooth and homogeneous. The goal of this study is to improve adhesion of deposited Pb thin layer.

O.S.A.10.

Photoluminescence Properties of YAG:Dy and YAG:Dy:Er Thermographic Phosphors Synthesized by Solid State, Co-precipitation and Solvothermal Methods

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Thermographic phosphors help to study local thermal gradients and thermal stress in the solar thermal absorbers, as well as gas flow and thermal gradients in internal combustion engines. Yttrium aluminum garnet ($Y_3Al_5O_{12}$, YAG) doped with rare-earth ions have good thermal stability (melting point ~ 1950ºC), excellent optical and mechanical properties which makes it suitable for thermographic applications. By using metal nitrates and oxides as a starting materials YAG:Dy and YAG:Dy:Er powder phosphors were synthesized by solid state (SS), co-precipitation (CP) and solvothermal (ST) methods, respectively. The resulting YAG based phosphors were characterized by XRD, SEM and photoluminescent excitation and emission spectra. The doping concentration and method of synthesis on the structure and optical properties were investigated. The thermoluminescent properties of powder phosphors were investigated by using an intensity ratio technique comparing phosphorescence intensity at 455 nm, 482 nm and 493 nm emission lines.

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O.S.A.11.

Influence of Sintering Atmosphere on the Crystal Structure, Microstructure, Dielectic and Optical Properties of $BaTi_{1-x}Sn_xO_3$ (x = 0, 0.05 and 0.1) Ceramics

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Due to specific dielectric and ferroelectric properties, functional ceramics based on barium titanate ($BaTiO_3$) have found application in semiconductor industries. Appropriate electrical properties of barium titanate-based materials, such as magnitude of relative dielectric permittivity and the Curie temperature, can be achieved by varying sintering conditions (which influenced ceramics' microstructure) and/or by doping with various cations.
In this study, we investigated the influence of sintering atmosphere (air and argon) on the crystal structure, microstructure, dielectric and optical properties of barium titanate-stannate (BTS; $BaTi_{1-x}Sn_xO_3$) ceramics. The BTS powders (with x = 0, 0.05 and 0.1; denoted BT, BTS5 and BTS 10, respectively) were synthesized by the solid-state reaction technique. The powders were subsequently uniaxially pressed (P = 240 MPa) into cylindrical compacts (ø 6 mm and h ≈ 2 mm) and sintered in SETSYS TMA (Setaram Instrumentation, Caluire, France). Sintering experiments were performed at a heating rate of 10 °/min up 1420 °C and with a dwell time of 2 hours; to determine the influence of sintering atmosphere, two sets of experiments were performed: (1) in air, and (2) in Ar. During sintering, the shrinkage was recorded in the axial (h) direction. The crystal structure of the BTS ceramics was studied at room temperature by X-ray diffractometry and Raman spectroscopy. The microstructure and chemical (Ti/Sn) composition were examined by SEM–EDS methods. The electrical measurements were made in air, at 1 kHz using a Wayne Kerr Universal Bridge B224; the measurements were done in cooling, from 160 to 20 °C. For optical characterization UV-Vis diffusive reflectance and photoluminescence spectroscopy were employed. A profound effect of an argon atmosphere on the examined properties of the sintered BTS ceramics has been found; the mostly important is an increase of the magnitude of relative dielectric permittivity.

O.S.A.12.

The Effect of D,L-lactide-based Linker on the Hydrolytic Stability of Polyurethane Films

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All aliphatic (PU) films made from polycarbonate-based macrodiol, hexamethylene-1,6-diisocyanate and butane-1,4-diol tested in physiologically simulated conditions (37 °C in PBS = Phosphate-Buffered Saline at pH = 7.4) for a period up to 12 months are distinguished by excellent functional properties, hydrolytic stability included. On condition that PU chain contains in the backbone relatively low content of D,L-lactide-based oligomer (8 wt%), strong PU materials can be prepared as well. However, these PU films became hydrolytically degradable at identical experimental conditions for the period exceeding 6 months. The set of methods covering sample analysis from segmental up to macroscopic levels (e.g. FTIR, AFM, SEM, DSC, TGA, tensile characteristics) was used for the estimation of extent of hydrolysis being expressed as material changes vs. time of PBS immersion.

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O.S.A.13.

Temperature Dependencies of Thermo-Physical Properties of Selected Foundry Sands

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Modern foundry engineering requires implementation of numerical aiding when designing the casting and solidification processes. One of the key input data to the numerical algorithms are thermo-physical properties of the mould materials. It is well known that they depend strongly on temperature changes of the sand which take place during casting, pouring and solidification. Moisture, its vaporization, transport inside the mould and condensation strongly influence thermal conductivity. That is why measurements of wet sand are required. The only method suitable to perform investigation in real casting conditions is the so called "Casting Method", previously described in detail in. The other commonly used methods, e.g. Hot-Disk or Laser Flash Analysis, require special preparation of the samples whose state during the experiment is far from the state of the real mould.

The present paper summarizes results of the examinations of two typical foundry sands, i.e. the silica quartz bounded with bentonite (green sand) and silica quartz cured with water glass. During these experiments plate-shape copper castings were poured into the mentioned moulds. The measured temperature field of the system casting-mould-ambient allowed to obtain temperature dependencies of the main thermo-physical properties, i.e. the thermal conductivity, heat diffusivity and heat capacity. It was stated that moisture vaporization strongly influences thermal conductivity during the first period of the mould heating by the cast copper. The thermal conductivity reaches even value close to 10 W/(mK) in inner mould parts directly after pouring the casting. Than this value significantly drops to about 0.5-0.8 W/(mK). However, in higher temperatures of about 700 ºC it again increases above 1.2 W/(mK), which is due to inter-granular radiation.

Basing on mentioned results it should be concluded that only real temperature dependencies of sand thermo-physical properties, especially the thermal conductivity coefficient, should be implemented to the mathematical algorithms to ensure high accuracy of the numerical calculations.

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O.S.B.1.

Silver Nanowire Based Networks for Transparent Electrode Applications

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An essential part of optoelectronic devices such as flat-panel displays (FPD), light emitting diodes (LEDs) or solar cells are highly transparent electrodes with low electrical resistivity. In this work we demonstrate the phenomenology behind welding of silver nanowires (Ag NWs), for the use as an alternative transparent electrode to conventional solutions in energy applications. These nanowires are coated with an aluminum doped zinc oxide layer (AZO) formed by atomic layer deposition (ALD), assuring a conformal coating of the AgNWs with a homogeneous thickness. During the thermally induced welding, prior to AZO deposition, we observe, using scanning electron microscopy (SEM), local sintering at the junctions of the monodisperse Ag NWs, due to the solid state wetting and homoepitaxial growth that is taking place. A wetting angle of 4.8° is observed, which denotes complete wetting, an expected result since it is the same material. High resolution scanning transmission electron microscopy (HRSTEM) reveals the presence of significant strain in the pentagonal twinned Ag NW, as well as stacking faults. The developed AgNW/AZO nanolayers are a technologically relevant cheap alternative transparent electrodes with a high potential for energy related applications.

O.S.B.2.

Direct Observation of the Magneto Crystal Anisotropy Axis in $Fe_{3-x}O_4$ Nanoparticles by MFM

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Magnetic nanoparticles have broad potential implications in fundamental magnetism, biomedical applications and ultra-high density magnetic recording. Thermal stability of the particle magnetization is a crucial issue in most of those applications, so that direct observation of the magnetization reversal becomes of great interest to check the validity of models and theoretical assumptions. Despite several attempts found in the literature, unambiguous correlation of the magnetic domain orientation to the crystalline structure is yet to be achieved.

In our work, we present direct experimental imaging by variable-field magnetic force microscopy of the magnetic domain configuration in individual, cubic $Fe_{3-x}O_4$ nanoparticles of about 27 nm in size and high crystal quality. Single domain structures have been shown, whose orientation and polarity result from both the magnetocrystalline easy axes of the particles and previous magnetic history. As the main result, we report on the direct observation of the easy axes in individual ferrimagnetic nanoparticles. Furthermore, the changes in the domain orientation with an external magnetic field have given evidence of a particle magnetization reversal mediated by a coherent rotation of the particle spins that has also been supported by micromagnetic calculations.

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O.S.B.3.

Smart Hydrogels of Thermoresponsive Interpenetrating Networks of Poly(N-isopropylacrylamide) and Polyacrylamide

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It is well known that hydrogels of thermoresponsive polymer networks show a temperature-induced volume phase transition (collapse). Recently we studied hydrogels of interpenetrating networks (IPN) of thermoresponsive poly(N-isopropylacrylamide) (PNIPAm) and hydrophilic polyacrylamide (PAAm) by a combination of NMR, small-angle neutron scattering (SANS) and DSC. The influence of IPNs composition and preparation on the phase transition and collapsed structures was examined with respect to possible application of these materials for drug delivery and molecular separation. The increasing content of PAAm component in IPNs shifts the transition towards higher temperatures. Reversed order of adding components during IPNs preparation also affects phase transition and collapsed structures. Existence of compact globular structures was revealed in collapsed IPN hydrogels by SANS. A certain portion of water bound in globular structures was established by NMR. The fraction of bound water slowly decreases with time.
Acknowledgment: Support by the Czech Science Foundation (Project 13-23392S) is gratefully acknowledged.

O.S.B.4.

Methodology of Formation of New Generation Multilayer Coatings for Cutting Tools

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The study considers the improvement of efficiency of multilayer coatings through development of their architecture and directed choice of composition and properties of individual layers. For coating deposition, a vacuum-arc VIT-2 unit was used, which was designed for the synthesis of coatings on substrates of various tool materials. The study used the methods to control coating properties by changing the composition of gaseous medium, the assisting high energy exposure, the formation of adhesive layers, and the ion assisting during the deposition process. The study has examined improvement of the efficiency of the cutting tool (for turning and milling) due to the choice of rational composition and thickness of intermediate adhesive layers in multilayer coating. The use of multilayer TiN-TiAlN, TiN-TiZrN and TiN-TiCN-TiZrN coatings considerably increases tool life till formation of transverse cracks in the area of plastic contact between chips and rake face of the tool as compared with TiN-TiCN coating.The study also considers application of multilayer coatings with intermediate TiFeN layer, which significantly increases tool life.

O.S.B.5.

Design of Phase Percolated Composites for Military Application

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The military industry is the one of the most developing branch in the world. High expectations to the novel military equipment require low weight protective panels to be mounted on various vehicles and mobile machinery. This in turn calls new materials and technologies. Ceramic- elastomer composites were fabricated via infiltration of porous Al_2O_3 preforms. As a result of the ceramics infiltration by elastomer, composites of two interpenetrating phases were obtained.
Observations of ceramic's surface were conducted with the scanning electron microscopy (SEM) and their microstructure was quantitatively characterized using image analysis methods. Also static and dynamic tests were conducted.
The obtained microstructure with percolation of ceramic and elastomer phases gives the composites high mechanical properties together with the ability to absorb the strain energy.

O.S.B.6.

Green's Functions Analysis of Microcracking in a Brittle Material

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It is well known that in many materials crack propagation is accompanied by the formation of a damage surrounding the crack tip. This damage develops in a nearby tip-zone called Fracture Process Zone (FPZ). In this study, interaction between a macrocrack and a microcrack represented by a distribution of dislocations dipole is considered. Explicit expressions for the Stress Intensity Factor (SIF) are derived using a semi empirical approach where the effects of microcracking are quantified on experimentally measured crack opening displacements. A stress field distribution induced during these interactions is obtained using Muskhelshvili's complex variables formalism which relies on the Green's functions, solution to the multiple crack interaction problems. Contours of equal level of normalized SIF are determined for different orientations and positions of the dislocation-dipole with respect to the main crack. Obtained results are discussed for a variety of geometrical configurations, with the intent of developing an understanding of the effects of position and orientation of the microcrack on the crack-tip shielding and amplification. Besides, different energy release rates which arise from the interaction are computed. Obtained results are compared and agreed with those of other researchers.

O.S.B.7.

The Influence of Thermal Treatment on Microstructural and Magnetic Properties of Electrical Steel

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Paper is focused on the influence of thermal treatment on microstructure and magnetic properties of different sort of electrical steels used as transformer cores. The analysis refers to the materials with different compositions of Fe-Si. The changes in the average grain size of the material before and after thermal treatment were observed by using scanning electron microscopy and X-ray diffraction. The magnetic properties were measured by using a vibrating sample magnetometer and the hysteresis graph method. In the last method different amplitudes and frequencies of the excitation magnetic field were used. A variation of the obtained results was analysed and related to the microstructural changes in the material.

O.S.B.8.

Spin Hall Effect in (111)-oriented Thin Films of SnSe and SnTe Topological Crystalline Insulators

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The Quantum Spin Hall Effect in (111)-oriented thin films of IV-VI topological crystalline insulators (SnSe and SnTe) is predicted. Using a tight-binding approach supported by first-principles calculations of the band structures we demonstrate that in these films the energy gaps in the two-dimensional band spectrum depend in an oscillatory fashion on the layer thickness. The calculated topological invariant indexes and edge state spin polarizations show that for ca 20–40 monolayers thick films a Quantum Spin Hall phase appears. In this range of thicknesses in both, SnSe and SnTe, (111)-oriented films edge states with Dirac cones with opposite spin polarization in their two branches are obtained. While in the SnTe layers a single Dirac cone appears at the projection of the Γ point of the two-dimensional Brillouin zone, in the SnSe (111)-oriented layers three Dirac cones at M points projections are predicted.

O.S.B.9.

Influence of Degradation Process on Composite Performance with Embedded Fibre Optical Sensors

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Research all over the world is carried out by manufacturers to provide access to low-priced but quality reliable composite products. With the growing use of high performance composite materials in critical structures, it has become increasingly important to monitor these materials. Optical fibre sensors embedded into the weave structure of carbon fibre epoxy composites offer the capability to "on-line" monitoring of these composites during manufacture, cure and damage. In present work such photonic composite material composed of a composite with embedded optical fibre sensors has been subjected to aging process in climatic chamber. The purpose was to evaluate an influence of degradation process into composite mechanical performance, its morphology and thermal characteristics. Sensitivity of sensors after aging process was also taken into consideration. Observations of the composite morphology and cross sections were carried out using Scanning Electron Microscope while thermal characteristics were evaluated using Dynamic Mechanical Analysis and Thermogravimetric Analysis.
Project supported by National Centre for Research and Development: „Fotoniczne materiały kompozytowe do monitorowania struktur lotniczych” no. PBS1/B5/20/2012.

O.S.B.10.

Femtosecond Laser Interaction with Nickel Based Superalloy M-252

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Nickel-base superalloys are an important class of engineering materials designed for high - temperature applications such as aero-engine components. Good corrosion resistance, optimal thermal properties, strength coupled with ductility, creep and fatigue resistance, as well as optimal impact and wear resistance are the main requirements for a satisfactory function in such severe environments at high temperatures.

Lasers have been used for high precision material processing in micro- and nanomanufacturing operations due to the specific nature of the light that they emit, such as the high intensity and the possibility of controlled surface modification. In the last few decades a lot of attention was paid to surface modifications of different metals and their alloys by various types of laser light. Treatment of superalloys' surfaces with laser light can induce the changes in the microstructure which result in improved mechanical properties of the material.

In this work, the process of interaction is related to exposure of nickel superalloy M-252 to femtosecond laser beam. The effect of the laser beams on the surface of the multicomponent alloys is performed by different pulse energies and different exposition time. The changes in the microstructure, depending on the parameters of the laser beam, are identified by the scanning electron microscope (SEM) and energy-dispersive spectrometry (EDS), and the mean grain size was measured by the method of the circle. The aim of the study was to optimize the parameters of laser treatment to reach the microstructure with the favourably affects for the surface quality.

O.S.B.11.

Thermal Resistance of Alkali Activated Binders Synthesized Using the Fly Ash and Steel Slag

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The thermal resistance of alkali-activated binders based on fly ash (FA), electric arc furnace slag (EAFS) and their FA/EAFS blends was assessed. Compressive strengths of samples before and after firing were measured. The samples were characterized by X-ray powder diffraction (XRPD), scanning electron microscopy (SEM), energydispersive X-ray spectra (EDS), thermal (TG/DTA) analysis. Besides, the sintering shrinkage were recorded by thermomechanical analyzer (TMA) during non-isothermal sintering up to 900 ºC with heating rate of 15 º/min, in an air atmosphere.
The main reaction products in FA and EAFS based alkali activated binders are the sodium-alumino-silicate-hydrate (N–A–S–H) and calcium-alumino-silicate-hydrate (C-A-S-H) type gels, respectively. FA/EAFS based binders are characterized by the presence of N-A-S-H gel with the high content of Ca. The EAFS based binders exhibited superior performances in terms of compressive strength than FA based binders. Thermal resistance of FA based binders was improved by the slag addition.
This research was supported by a Ministry of Science of Montenegro under the contract No. 01-460.

O.S.B.12.

Determination of the Temperature Transfer Function of Building Constructions Based on Measurement Data

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In this paper a method of determination of transfer function for temperature measured inside and outside residential building in Belgrade is presented. The instantaneous measurements of indoor temperature inside a living room of the second floor flat of the five store building and outdoor temperature at close vicinity of the building facade were made. The external air temperature was also collected from nearby meteorological station few hundred meters apart of the building at the same moments. The measurements have lasted more than three months in period from 22th April till the 2th August, 2014. The data have been collected by data loggers every 5 minutes. Using a digital processing the periodical daily and seasonal variations have been extracted from indoor and outdoor temperature measurements. These variations for indoor and outdoor temperature are considered as excitation and response functions respectively. The periodic outdoor temperature variations could be considered as complex periodic excitation. The Z transformation has been adopted to obtain temperature variations in frequent domain and temperature transfer function for the considered building construction.

PL.S.II.1.

20 Years of Nanostructured Materials: Enabling Nanotechnology to Benefit Society

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Over the two decades (1995-2015), since the beginning of the YUCOMAT conference series, developments worldwide have continually increased our ability to synthesize and assemble nanoscale building blocks of various sizes and morphologies to create advanced nanostructured materials and devices with novel properties and functionalities. These materials and devices, based firmly upon the pioneering research of two earlier decades (1975-1995), have enabled the continued development of nanotechnology for the increasing benefit of society. The special properties of nanostructured materials are derived from the unique atomic structures, confined sizes, and very large surface-to-volume ratios of their nanoscale constituents. Nanostructured surfaces exhibit specific functions through their nanoscale topography and the controlled dispersion of high surface area nanoscale fillers with precise surface modification in conventional matrices also enable novel multifunctional nanocomposites. These emerging nanoscale attributes continue to create new opportunities for solutions to important societal problems. A brief retrospective of this exciting and ever-developing field, with highlighted examples from our research at Rensselaer, will be presented that focuses on some of the seminal contributions that have made it possible, as well as a number of current advances in our understanding that indicate a bright and impactful future.

PL.S.II.2.

Solving Problems in Nanodimensions by Aberration-corrected Transmission Electron Microscopy with Picometer Precision

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To be able to observe atoms in solids and to measure their individual positions and displacements has been an old dream in materials science. Modern aberration-corrected transmission electron microscopy combined with computer-based numerical absolute contrast matching techniques allows to determine accurately local atom concentrations and permits to measure atom-by-atom displacements at interfaces and boundaries in the picometer range. This extraordinary potential for nanosciences is demonstrated discussing examples of the elucidation of the local structure and stoichiometry of dislocations in perowskites, of interfaces in oxide heterostructures, of domain wall arrangements in ferroic materials as well as the determination of the three-dimensional atomic surface structure of a nanoparticle.

PL.S.II.3.

Holographic Imaging and Optical Sectioning in the Aberration-Corrected STEM

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The correction of spherical aberration enables efficient holographic imaging in the scanning transmission electron microscope (STEM) if the energy width of the incident electron beam is sufficiently reduced. Holographic imaging implies that the Fourier transform of the image is linearly related with the elastic scattering amplitude of the object. Effective optical sectioning can be realized in the aberration-corrected STEM by employing "holographic" phase-contrast imaging. This imaging mode requires a segmented bright-field detector and a Fresnel phase plate which can be formed with a sufficient degree of accuracy by adjusting appropriately the third-order spherical aberration and the defocus of the corrected objective lens. By subtracting the signals of the annular detector segments covering the region of destructive interference of the scattered wave with the non-scattered wave from that recorded by the annular segments covering the regions of constructive interference, we obtain a pure phase contrast image which may be conceived as a holographic image because the terms of the intensity which depend quadratic on the scattering amplitude cancel out. Theoretical results will be presented which demonstrate the feasibility of the proposed method. In particular, the method enables the transfer of spatial frequencies over a large range which exceeds significantly that of conventional phase contrast imaging. Image simulations show that by correcting the aperture aberrations up to the fifth order inclusively, it will be possible to detect the three-dimensional position of substitute atoms in crystalline materials.

PL.S.II.4.

Instrumentation for High Resolution EM and Its Limitations

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After the proof of the advantages of the compensation of the spherical aberration by means of a hardware corrector this type of equipment became almost mandatory for high resolution microscopy in materials science. Just after the introduction of commercially available Cs-corrected TEM/STEM the discussion started how far one can compensate the resolution limiting aberrations and if one can achieve a new landmark of resolution in the range of d = 50 pm. The chromatic aberration Cc was the resolution limiting parameter and, hence, had to be cancelled. The benefits of Cc-correction are highest at low energies where the relative energy width DE/E is largest (E < 100 keV). Such a Cc-corrected system has been developed and installed. The requirements on the stability of the power supplies needed for the compensation of the chromatic aberrations are about one order of magnitude higher than for other strong focusing elements like the objective lens. These aberration corrected instruments are now rather tools for measurements of structures and compositions at the atomic level than just imaging devices. Meanwhile many variants of Cs-correctors have been developed and installed. Those advanced hexapole correctors for ultra high resolution are used for various voltages from 20 kV up to 300 kV and, for one project, even up to 1.2 MeV.

PL.S.II.5.

Advanced and In Situ Transmission Electron Microscopy of Growth and Interface Phenomena of Oxide Semiconductor Nanowires

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Knowledge of the microstructure-property relationships of oxide semiconductor nanomaterials are indispensable for assessing their potential for applications in nanoelectronics, nanoscale electromechanical systems, spintronics, or solar cells. High-resolution imaging and spectroscopic techniques of advanced and in situ transmission electron microscopy (TEM) have been used to investigate growth and interface phenomena of ZnO and In_2O_3 semiconductor nanowires (NWs) that are grown by thermal methods from different precursor materials (dopants) containing Sn, Al, or Ga.[1-5].

For Sn as dopant, ZnO NWs (dimensions $\leq$ 100nm) are formed whose core regions contain various types of lattice defects and whose surfaces are often covered by thin layers of a spinel phase indicating that interface reactions occur during growth. Cathodoluminescence from such NWs with larger dimensions reveal a blue-shifted ZnO band gap luminescence and a spatially varying light emission. Furthermore, ZnO nanotubes are formed whose cores are partially or completely filled with Sn or a Sn-rich material. In situ TEM experiments reveal reversibly melting, thermal expansion and contraction of the core material when choosing alternatingly low and high electron beam fluxes (thus applying locally variable thermal loads to the NWs). These results confirm the presence of a material of low melting temperature. For Al and for Ga as dopant, ZnO NWs exhibit growth inhomogeneities that can be attributed to the incorporation of the dopant elements into the lattice.

Characteristic for In_2O_3 NWs is the presence of a tubular cavity of constant diameter extending along the total length of the NWs. Also, NWs with core regions containing defects, such as precipitates, dislocation loops, and voids, are observed when Sn is used as precursor dopant. Both observations can be interpreted as result of a dislocation-driven growth mechanism.

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PL.S.II.6.

Technology Transfer, Especially in Materials Science

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The future success of a nation's economy has been linked to the success of translating a world class technology base to generate new business providing new jobs and wealth. Most of countries, however, suffer from a valley of death that prevents the progress of technology from the laboratory bench to the market. A greater part of the valley of death is ascribed to the chasm between promising benchwork and investable prototype. The challenge lies in creating a bridge between the researchers and the experts who know to crystallize technologies on the shelves of the research entities. You will see how KIST has met the challenge these days.

PL.S.II.7.

Alumina-Dispersed Cu Alloy of High Mechanical Strength and Electric Conductivity beyond Conventional Limit by Interfacial Design between Alumina Particle/Cu Matrix

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Al_2O_3 dispersed copper matrix composites has excellent thermal stability and high conductivity, and it has widely applied to electric or electronic parts as a backup alloy, although it has low mechanical strength. The forming Al_2O_3 as a dispersion in copper matrix by internal oxidation has been intensively studied to increase their strength in recent years. Why alumina dispersed copper alloy has comparatively lower strength than precipitation hardening copper alloys was known to the lower oxide content, larger dispersed particles size and inter-distance between particles. Therefore, to solve the problem how to distribute small sized Al_2O_3 evenly in copper matrix by internal oxidation has been investigated in recent years.

In the present work, the alumina and Ti substituted alumina dispersed copper matrix composite were fabricated by internal oxidation as a simulation experiment prior to conventional powder metallurgy process. The two types of raw alloy, copper-aluminum with and without Ti were prepared and oxidized at 980ºC at ambient atmosphere. The fine (~30nm) and evenly distributed sphere type alumina were obtained during the oxidation of copper-aluminum with Ti, because, Ti atom was substituted to alumina and it leads decreasing the interface energy difference of each interface between alumina and copper matrix. Successively, it introduced extra stable interface between alumina and matrix with decreasing average particle size and inter-distance between particles in the matrix, and it leads simultaneous increasing strength and conductivity, although these properties have trade-off relation. The microstructure of Ti substituted alumina dispersed copper composite was investigated by HRTEM and why size of alumina in the copper matrix was decreased was predicted by the first principle calculation.

O.S.C.1.

The Origin of Exceptional Activity of $Pt_3Ni(111)$ Catalyst in CO Oxidation Reaction

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Bulk CO oxidation was studied at the $Pt_3Ni(111)$ single crystal alloy using electrochemical (EC), scanning tunneling microscopy (STM), infrared adsorption spectroscopy (IRAS) techniques and density functional theory (DFT) calculations. Polarization curves revealed that $Pt_3Ni(111)$ is much more active for CO oxidation than Pt(111). The results obtained by IRAS and STM demonstrated that the high $Pt_3Ni(111)$ activity for CO oxidation is not primary caused by an electronic effect induced by Ni from the subsurface layer but by a distinct surface morphology. Adislands, composed of highly undercoordinated Pt atoms, detected at the surfaces of both catalysts, are assigned as the active sites for CO oxidation in a preignition potential region. The enhanced activity of $Pt_3Ni(111)$ compared to Pt is explained through a larger number of adislands present on the $Pt_3Ni(111)$ surface and an earlier OH formation potential on the $Pt_3Ni(111)$ adislands.

O.S.C.2.

Monocarboxylic Acid-Modified CeO2 Nanoparticles Synthesized under Hydrothermal Conditions Using Supercritical Water

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Monocarboxylic acid-modified CeO_2 nanoparticles are simply and rapidly prepared from $Ce(OH)_4$ as the precursor under hydrothermal conditions using supercritical water in the presence of monocarboxylic acids with systematic carbon number (C6–18) in alkyl chain as surface modifiers. The precursor and surface modifiers are heat-treated in a batch reactor at 400 °C for 30 min. The carboxylic acids attach to the surface of products by the coordination bond between carboxylate and Ce ions. The amount of attached surface modifiers on the surface of nanoparticles tends to increase with increasing carbon number of alkyl chain. The morphology and particle size are a cubic and approximately 10 nm, respectively, which are also controlled by the surface modifiers. The surface modification also controls the band gap of nanoparticles, suggesting the possibility of tuning the electronic and optical properties by organic surface modifiers.

O.S.C.3.

Role of the Nano- and Bio-Structuration Process in Change of the Laser-Induced Refractive Index and Other Related Optical Effects

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At present time the basic knowledge collected from complicated area of the structuration process of the organic materials (including the liquid crystal (LC) ones) as well as of the inorganic composites useful for the optoelectronics and biomedicine, requires extending the types of the novel model materials and the class of the effects realized in these materials. Our own steps in these directions have been shown in the papers on last five years. In the current paper the effect of the introduction of the nano-objects (based on fullerenes, quantum dots, carbon nanotubes, shungites, graphenes, and modern dyes) and of the bio-objects (based on DNA) in the organic conjugated materials has been discussed. The influence of this process on the laser-induced refractive index as well as on the rotation of the polarization plane of light has been studied. Moreover, increase of the transparency and wetting angle has been shown using the nano-structured surfaces between solid substrate and materials mesophace.
The presented results are coincided with the main research direction of the Lab for Photophysics of media with nanoobjects and they are the part of a work supported partially by Russian Foundation for Basic Research, grants No.10-03-00916 (2010-2012), No.13-03-00044 (2013-2015) as well as by FP7 Marie Curie International researchers exchange proposal "BIOMOLEC" (2011-2015).

O.S.C.4.

New High ZT p- and n-type Skutterudites

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Thermoelectric (TE) conversion of waste heat into useful electricity demands optimized thermal and electrical transport in the leg material over a wide temperature range. Filled skutterudites are excellent candidates because they provide excellent TE and mechanical properties, the starting material is cheap and abundant and they can be produced easily and fast and already in large scale. This paper will outline the preparation and optimization via nanostructuring of Sb-substituted didymium-filled p-type and multi-filled n-type skutterudites with ZT values approaching 1.3 and 1.8 with thermal-electric conversion efficiencies of $\eta > 14\%$ and $\eta > 17\%$, respectively, resulting in a ZT(modul) = 1.55. In addition a review will be given on mechanical properties essential for TE device engineering.

O.S.C.5.

Universal One-Pot and Scalable Synthesis of SERS Encoded Nanoparticles

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Encoded nanoparticles are one of the most powerful approaches for multiplex high-throughput screening in diagnosis and bioimaging.
Unfortunately, methods for the synthetic preparation of these particles are tedious; with low reproducibility and, limited to a small amount of molecules.
In this work, we report a universal, one-pot, inexpensive, and scalable synthetic protocol for the fabrication of SERS-encoded nanoparticles. This synthetic strategy is highly reproducible, independent of the chemical nature and size of the Raman code used (31 different codes were tested) and scalable in the liter range without affecting the final properties of the encoded structures.
Furthermore, the SERS efficiency of the fabricated encoded nanoparticles is superior to that of the materials produced by conventional methods, while showing a remarkable reproducibility from batch to batch. This encoding strategy can easily be applied to nanoparticles of different materials (like Au or Ag) and shapes (such as spheres, rods, or stars).

O.S.C.6.

Photocatalytic Properties of 1D Nanostructured Vanadium Pentoxide Compounds

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The aim of this study was to find a relationship between the structural characteristics of 1D nanostructured vanadium pentoxide-related compounds and their photocatalytic activity. Long V_2O_5 nanowires with an orthorhombic unit cell were obtained from a peroxovanadate precursor solution, monoclinic $K_{0.33}V_2O_5$ nanoribbons were synthetized from V_2O_5 gel prepared in a KOH solution and monoclinic $V_2O_5{\cdot}xH_2O$ nanoribbons were produced from an ammonium metavanadate solution. Thermo-gravimetric analyses indicate the presence of structure-bonded water in $V_2O_5{\cdot}xH_2O$, while V_2O_5 and $K_{0.33}V_2O_5$ are thermally stable up to 500 °C. The photocatalytic activity of the compounds was determined via the degradation of organic dyes, rhodamine B, methylene blue and caffeine. The experiments were performed in the visible and ultraviolet parts of the spectrum. The results indicate the clear relation between the structural peculiarities with the photocatalytic properties, which will be discussed in detail in this contribution. Furthermore, possible carrier systems for applications in aqueous systems will be addressed, due to the water solubility of the vanadium pentoxide.

O.S.C.7.

A Novel Method to Measure Dynamic Contact Angle Hysteresis on Nanostructured Surfaces

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Wetting is an important phenomenon in chemistry, physics, biology, medicine, and materials science. One of the key measures of wettability is contact angle hysteresis (CAH).
Surface wetting is a dynamic process in many daily situations (e.g., raindrops hitting the surface). Standard CAH measurement methods are static or quasi-static, so they don't fully correspond to natural conditions. Here we presented a novel method to measure CAH in dynamic conditions.
Dynamic CAH is determined by analysis of video sequences of impacting droplets, recorded with a high-speed camera. The procedure is demonstrated using gold and gold modified with self-assembled monolayers of alkyl- and perfluoroalkyl thiols as model substrates, as well as epoxy nanocomposite as a superhydrophobic substrate with hierarchical topography. Results are compared with CAH values obtained using established techniques (tilting table, sessile drop, Wilhelmy plate).
This work was supported by the National Science Centre of Poland through project No. UMO-2012/05/B/ST8/02876.

O.S.E.B.1.

A Facile Determination Method for an Androstane-based Lung Cancer Inhibitor Loaded in Nano/Micro Particles Based on Hydroxyapatite by Means of DTA/TGA Coupled with On-line Mass Spectrometry

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In our study, we examined the possibilities for the application of Thermo-Gravimetric Analysis/Differential-Thermal Analysis (DTA/TGA) coupled on-line with mass spectrometry (MS) as a fingerprint for identification purposes in drug loading processes. Androstane derivative 17β-hydroxy-17α-picolyl-androst-5-en-3β-yl acetate (2-OAc) with antitumor activity was loaded in nano hydroxyapatite (HAp) coated with chitosan-poly(D,L)-lactide-co-glycolide (Ch-PLGA) by emulsification and finally freeze-dried. By means of DTA/TGA-MS, it was quickly determined that the form of 2-OAc was the same before and after loading. The observed exothermic and endothermic processes due to the transformation of material with simultaneous analysis of gas products have proven to be successful in the analysis of drug loading processes in multi-component ceramic-polymer carriers. The loading efficiency of 74.7% was determined using the Differential Scanning Calorimetry (DSC) technique. A FT-IR analysis confirmed the qualitative composition of the synthesized 2-OAc-loaded HAp/Ch-PLGA.
The in vitro antiproliferative activity was evaluated against human cell lines: lung adenocarcinoma (A549), as well as healthy fetal lung fibroblasts (MRC-5). The results of DET and MTT tests have revealed a high viability of healthy cells MRC-5 (82%) and the death of cancer cells A549 (46%) after a treatment with 2-OAc-loaded HAp/Ch-PLGA.

O.S.E.B.2.

Polymer/Ceramic Composite Scaffold for the Regeneration of Bone Defect After Cancer Treatment in Dog Distal Radius

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The aim of the study was to reconstruct a radius bone loss after cancer treatment in a 8 year-old, male Labrador (69.2 kg) presented for progressive lameness of 3 weeks duration. A polymer/ceramic composite (PCL/TCP, 10%wt.) was used to fabricate scaffold by using rapid prototyping technique. Radiographs of the affected limb revealed proliferative changes and lysis of the radial metaphysical cortex with an irregular periosteal reaction in the distal radius. Limb-sparing surgery was offered because the owner refused limb amputation. In this study a 10cm of radius bone region was removed and the defect was reconstructed with the composite scaffold. For scaffold fixation a titanium locking plate was used. After scaffold implantation a significant improvement of the dog movement have been obtained. Every month implanted scaffold using radiographs was evaluated. After 3 months of implantation, we observed that sufficient tissue formation can be induced in segmental bone defect in combination with a well-designed composite scaffold was used.

O.S.E.B.3.

Magnetic Chitosan-g-acrylate/styrene Composites for Hybrid Coatings with Nanostructured Morphology

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This study aims to evaluate novel hybrid materials as potential candidates for producing coatings with hierarchical roughness and controlled wetting behaviour.
Magnetite (Fe_3O_4) nanoparticles obtained by co-precipitation were embedded in matrices synthesized by solution radical co-polymerization of butyl acrylate (BA), butyl methacrylate (BMA), hexyl acrylate (HA) or styrene (ST) with ethylene glycol di-methacrylate (EGDMA) onto previously modified chitosan bearing surface vinyl groups. The resulting composite particles were characterized regarding their average size (dynamic light scattering), composition (FTIR) and magnetic properties.
Hybrid thin films containing ethanolic suspension of composite particles and pre-hydrolysed alkoxysilane as a coupling/crosslinking agent were deposited by spin coating. The films were cured by heating and subsequently characterized regarding their morphology (scanning electron microscopy) and contact angle with water. The structure-property relationship is discussed.
Acknowledgement: This work was supported by a grant of the Ministry of National Education, CNCS-UEFISCDI, project number PN-II-ID-PCE-2012-4-0433.

O.S.E.B.4.

Transition Metal Trichalcogenides Dispersed as Precursors for Preparation of Film Materials

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Transition metal trichalcogenides MQ_3 are called quasi-one-dimensional compounds due to their anisotropic properties (superconductivity, Peierls instability, and charge density wave transport). Topologically these compounds are considered as layered ones.
These compounds are regarded as possible materials in solar cell elements, electrodes in lithium batteries, effective catalysts, materials with charge density waves, and others. In order to prepare MQ_3 film materials we studied their ability to dispergation in liquid media. Here we report dispergation of NbQ_3 (Q = S, Se) and TaS_3 and stable colloidal dispersions of the MQ_3 in different organic media. According to the DLS and AFM data the particles resembles thin pellets with the mean sizes of particles in different solutions are in range 150 – 200 nm, and thicknesses from 1-2 to tens of molecular polymeric layers MQ_3.
Acknowledgements: The work is supported by Russian Scientific Foundation (Project 14-13-00674).

O.S.E.B.5.

Composite Materials Based on Highly-Dispersed Inorganic 1D and 2D Materials and Metal Nanoparticles

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In the last few years preparation of nanosized one- and two-dimensional inorganic materials attracted wide attention due to their improved electronic, optical, catalytic properties etc. Decorating the surface with nanoparticles of different types is an effective way to functionalize a material and to bring new and enhanced properties for many areas such as energy storage, catalysis and surface enhanced Raman spectroscopy devices. Composites based on highly-dispersed compounds can be prepared by so called in situ process where the deposition of nanoparticles occurs in the presence of the dispersed compound. Using this approach, we prepared a number of composites based on 2D materials, such as few-layer graphene, graphene oxide, transition metal dichalcogenides (MoS_2, $MoSe_2$, WS_2, WSe_2, etc), and 1D VS_4 with metal nanoparticles (Ag, Au, Pt, Pd, Co, Fe, Ni), and investigated the prepared composites by a set of methods.
Acknowledgements: The work is supported by Russian Scientific Foundation (Project 14-13-00674).

O.S.E.B.6.

Electroactive Nanocomposites Based on Thermoplastic Elastomers

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Electroconductive nanocomposites able to respond to electrical stimulation with a significant shape or size change are the object of the presented work. This type of material is tested due to their potential application in aerospace industry. Instead of nowadays used acrylic polymers and carbon black styrene block copolymers doped with multi-walled carbon nanotubes are more promising. Nanocomposites were produced in a twin screw extrusion process using three commercial poly (styrene-b-ethylbutylene-b-styrene) and grafted with maleic anhydride (SEBS-MA). The relationship between electrical conductivity and the extrusion conditions as well as type of used polymer was found. Microscopic characterization of nanocomposites confirmed good distribution of nanotubes in polymer matrix. Electromechanical test and FEM analysis were performed to see whether this material can be utilized as a construction material for aerospace industry.
The research leading to these results has received funding from the European Space Agency (ESA) under Grant Agreement n° 4000107904/13/NL/KML.

O.S.E.B.7.

Formation of Nanocrystalline Structure in Steels and Iron Alloys through the Heat Treatment Process

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This paper describes the heat treatment methods that allow producing a nanocrystalline structure in medium alloyed steels and in iron alloys. Different variants of the nanostructuring processes, leading to various phase compositions have been presented. The mechanical properties of selected steels and iron alloys after various nanostructuring processes have been determined. It was shown, that alloys with nanocrystalline structure exhibit higher strength and ductility as compared to the same material subjected to the conventional heat treatment. It was concluded, that by use of properly designed heat treatment parameters it is possible to produce steels and iron alloys with nanocrystalline structure and improved mechanical properties. The possible areas of implementation of the developed nanostructuring methods in the industry have been presented.

PL.S.III.1.

Scanning Transmission Electron Microscopy at Atomic Resolution

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Scanning transmission electron microscopy (STEM) has proven to be an indispensable method for mapping the location and identity of atoms in various complex materials. Aberration-corrected STEM images at atomic resolution are now routinely measured using the high-angular annular dark field detector (HAADF). Additionally, atomic-resolution mapping of the individual elements in a material (elemental mapping) can be achieved using either electron energy-loss spectroscopy (EELS) or energy-dispersive X-ray spectroscopy (EDS). Several examples of atomic resolution elemental maps using the STEM have been already published, but to date these "coloured" maps could only been interpreted qualitatively. Using a novel simultaneous EELS and EDS spectrum image acquisition approach with fast scanning rates and advanced data reduction methods, it is now possible to explore elemental quantification in terms of volumetric densities. Absolute scale quantification comparisons between experiment and quantum mechanical calculations will be presented and show that it is principally possible to determine the number of atoms in the individual atom columns, but only if all scattering effects are fully considered. Here we will highlight recent progress in elemental mapping at atomic resolution and practical consequences for solving materials problems will be discussed.

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PL.S.III.2.

Defects in the TEM

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Today one of the most exciting features of transmission electron microscopy concerns the increasing flexibility for in-situ experimentation. While all TEM imaging is, by definition, in-situ, the term has come to imply carrying out an experiment inside the TEM while observing the specimen and is now referred to as operando, following the spectroscopists' lead. Until recently, almost all such experiments were undertaken in the ambient vacuum of the TEM. The oxygen partial pressure was thus invariably extremely low. Even oxides that are generally thought of as being stable can be reduced during observation in the TEM—the extent of this reduction might not be appreciated without careful analysis of EELS data. This talk will present an overview of why in-situ studies are now becoming so widespread, what the future may hold, and how we can now learn so much more about defects in materials. One challenge encountered in all TEM studies is knowing if, and if so how and how much, the electron beam has changed the specimen. Recently, advances in the design of the specimen holder have allowed specimens to be examined when in a different environment, such as a less-reducing atmosphere or even inside a liquid. It should not be a surprise that the electron beam will then interact with the gas or liquid that then surrounds the specimen, so all the lessons learnt about beam/specimen interactions must still be applied and, in fact, may become even more important. The principal references providing the background to this talk are two textbooks, namely one on transmission electron microscopy (1) and the other on ceramic materials (2). The importance and potential for in-situ experiments will be illustrated by examples from the author and his colleagues including simple heating experiments, solid-state reactions, and reactions involving a liquid. The possibilities are exciting but the challenges will also be significant, particularly because the variables and precise conditions are often so difficult to determine. This determination is so important if the rigorous scientific approach is to be followed wherein an experiment must be reproducible! Finally, the ambiguity in the title is not unintentional.

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PL.S.III.3.

Structure and Properties of Dislocations in Bilayer Graphene

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Dislocations represent one of the most fascinating and fundamental concepts in materials science. First and foremost, they are the main carriers of plastic deformation in crystalline materials. Furthermore, they can strongly affect the local electronic and optical properties of semiconductors and ionic crystals. In materials with small dimensions they experience extensive image forces, which attract them to the surface in order to release strain energy. However, in layered crystals like graphite dislocation movement is mainly restricted to the basal plane. Thus the dislocations cannot escape enabling their confinement in crystals as thin as only two monolayers. To explore the nature of dislocations under such extreme boundary conditions, the material of choice is bilayer graphene, the thinnest imaginable quasi-2D crystal, in which such linear defects can be confined. Homogeneous and robust graphene membranes derived from high-quality epitaxial graphene on SiC [1] provide an ideal platform for their investigation.

Here we report on the direct observation by transmission electron microscopy of basal-plane dislocations in freestanding bilayer graphene and their detailed investigation by diffraction contrast analysis and atomistic simulations [2]. Our investigation reveals striking size effects. First, the absence of stacking fault energy, a unique property of bilayer graphene, leads to a characteristic dislocation pattern which corresponds to an alternating AB ↔ BA change of the stacking order. Moreover, our experiments in combination with atomistic simulations reveal a pronounced buckling of the bilayer graphene membrane, which directly results from accommodation of strain.

Since bilayer graphene is a quasi-two-dimensional material dislocations have a profound effect on the transport properties. Our recent transport measurements revealed a linear magnetoresistance which is characteristic for a mosaic-like conductor [3]. The partial dislocation network is assumed to play a key role for the segmentation of the electronic structure leading to this characteristic transport behavior.

This work has been performed within the frameworks of the Collaborative Research Center CRC 953 “Synthetic carbon allotropes” and the Cluster of Excellence EXC 315 “Engineering of Advanced Materials” which are both funded by the German Research Foundation (DFG).

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PL.S.III.4.

Advances in Focused Ion Beam Imaging, Spectroscopy and Fabrication

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I will describe advances in imaging, spectroscopy and fabrication used focused ion beams (FIB) that have been developed in my group. These include combined FIB / transmission electron microscopy (TEM) techniques that enable imaging of doping distributions in semiconductors at four orders of magnitude greater sensitivity than from conventional image contrast mechanisms, the use of focused ion beams to template surfaces to program nanostructure assembly in arrays of arbitrary complexity, the use of the FIB for creation of core shell nanostructures, and very recent results on ion-induced Auger electron spectroscopy. I will also discuss instrumentation advances that enable separation of multiple ion species (As, B, Si, Ge. Mn etc) from alloy sources, creation of isotopically pure beams, and nanoscale doping / chemical surface modification with beam pulses ranging from 1 (statistically!) to 109 ions. Together these capabilities provide new avenues for nanoscale tomographic imaging and spectroscopy, fabrication, doping and local surface chemical modification.
Work in collaboration with Jerry Floro (University of Virginia), Jeremy Graham (FEI), Li He (U. Wisconsin), Jonas Jonasson (U. Lund), Hamed Parvaneh (RPI), Frances Ross (IBM).

PL.S.III.5.

Electric Field Effect Studies in High-Tc Cuprates and Related Materials

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We overview our systematic studies on electric field effect with ionic liquid gating applied to a range of electronic materials, including high-Tc cuprates. Such an approach may be crucial to modulate the carrier concentration in systems where chemical doping proved itself unpractical or failed. Initially we studied thin film devices that were made in an electrical double layer gating (EDLG) configuration on gated LSCO-214 monolayers grown by Molecular Beam Epitaxy. The shifts in Tc of up to 30 K were induced in films by an external electric field, reversibly driving the insulator-to-superconductor quantum phase transition. We have mesured the critical resistance, and it turned out to be precisely equal to the quantum resistance for pairs, $RQ = h/(2e)2 = 6.5\ k\Omega$. This is suggestive of a phase transition driven by quantum phase fluctuations. It implies the existence of 2D (interface) superconductivity, as well as of the 'Bose' insulator state with localized pairs. Furthermore, we have extended our studies to other related materials, including $Sr_{0.9}La_{0.1}CuO_2$, $SrCuO_2$, $SrFeO_3$, $SrRuO_3$, WO_3, FeTe, highly ordered pyrolytic graphite and grapheme. So far, we have observed field-induced metallicity only in WO_3. We have also developed a method to apply Coherent Bragg Rod Analysis (COBRA) to LSCO-214 samples while they are exposed to the EDLG. We discuss the implications of our results in light of emerging physics of high-Tc cuprates and related quantum materials.

PL.S.III.6.

Revised Phase Diagram of the Cuprates

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The superconducting state of the cuprates evolves upon cooling from an enigmatic metallic phase that is characterized near optimal hole doping by a planar resistivity with large magnitude and extended linear temperature dependence. Below optimal doping, at temperatures below T*, there exists an intermediate pseudogap phase with a partially gapped Fermi surface. These unusual properties have motivated proposals to consider unconventional electronic scattering mechanisms and even to abandon the Landau quasiparticle paradigm entirely.
$HgBa_2CuO_{4+\delta}$(Hg1201) may be viewed a model cuprate system due to its relative structural simplicity, minimal disorder effects, and large optimal Tc of nearly 100 K (1). We have found that the planar resistivity of Hg1201 exhibits quadratic temperature dependence, the behavior characteristic of a Fermi liquid, at temperatures below T** (T** <T*) (2). This result motivated optical conductivity measurements that yielded the quadratic frequency dependence and the temperature-frequency scaling of the optical scattering rate expected for a Fermi liquid (3). Furthermore, we demonstrated for Hg1201 (and for $YBa_2Cu_3O_{6+\delta}$) that the magnetoresistance obeys Kohler's rule at temperatures below T** (4). By combining our dc resistivity results for Hg1201 with published data for three structurally more complex cuprates, we obtained the universal sheet resistance throughout most of the temperature-doping phase diagram and arrived at the unexpected conclusion that Fermi-liquid behavior extends to very low doping, close to the Mott-insulating state (2). In contrast to previous approaches that extended ideas developed for the strange metal phase (T>T*) to the pseudogap phase (T<T*), we will discuss the former in the context of the now well-documented pseudogap Fermi-liquid state. A combined analysis of the planar dc-resistivity and Hall-effect measurements demonstrate that the transport scattering rate remains quadratic in temperature across T** and T*, and moreover doping and compound independent. This universal behavior implies an underlying conventional scattering mechanism throughout the entire phase diagram [5].

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PL.S.IV.1.

Application of Experimental and Computational Approaches to Explore Non-Conventional Transformation Pathways Resulting in Refined Microstructures in Beta-Stabilized Titanium Alloys

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This research has investigated the mechanisms, involving non-conventional transformation pathways, underscoring the formation of refined of the alpha phase in metastable beta titanium alloys. This investigation has studied nucleation either in the absence, or presence, of heterogeneous nucleating agents. In the case of the former, it has been shown that the pseudo-spinodal mechanism is activated. In the case of the latter, the role of the omega phase on the nucleation of the alpha phase has been established experimentally and also computationally (phase field modeling), where the relative contributions of stress and compositional changes associated with omega to the driving force for nucleation have been assessed. The mechanisms of formation of various types of distributions will be presented, and the accuracy of the phase field model developed in this research to predict the evolution of microstructures in these alloys will be described. This research has been supported by the NSF-DMR.

PL.S.IV.2.

Deformation Mechanisms in Superalloys: New Insights from STEM-Based Imaging and Spectroscopy

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The international initiative on Integrated Computational Materials Engineering holds great promise for accelerating the insertion of new materials in high performance structural applications. Achieving this aim relies upon the fidelity of materials models and their ability to capture the connectivity between processing, microstructure and performance. This presentation will focus on advancements in our ability to characterize deformation mechanisms at finer length-scales – from atomic to grain-level behavior. In the Ni-base superalloys, a surprising variety of governing mechanisms are observed as a function of microstructure and deformation condition. In particular, at elevated temperature, the strain rate and temperature dependence of deformation depends on the onset of several deformation mechanisms that are quite distinct from the “classic” APB shearing process that dominates at lower temperature. Using electron-microscopy-based techniques, new insights into the governing deformation mechanisms in several important structural materials are being developed. The important interplay between characterization and modeling at several length-scales (atomistic, phase field and crystal plasticity) in elucidating rate-limiting processes will also be discussed.

PL.S.IV.3.

Characterization of the Deformation Mechanisms in High-Mn Austenitic Steels

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The influence of the strain rate, temperature, and changes in stacking fault energy (SFE) on the deformation mechanisms in high-Mn austenitic steels has been investigated using electron backscattered diffraction (EBSD) and both conventional and aberration corrected transmission electron microscopy (TEM). Secondary deformation mechanisms such as twinning-induced plasticity (TWIP) and transformation-induced plasticity (TRIP) are related to the low SFE exhibited in these materials. Experimentally measured SFE from weak-beam-dark-field imaging provides the basis to understand how changes in SFE influence mechanical twinning versus transformation induced martensite. However, adiabatic heating during deformation at high strain rates (100 -10,000 s^{-1}) increases the SFE. Quantifying the twin or martensite density by EBSD allows for comparison of the secondary deformation at different SFE, strain rates, and total elongation, but to study the details of the deformation mechanisms requires imaging at atomic resolution using aberration corrected TEM.

PL.S.IV.4.

Nanotwinned Structures in Nanomaterials: Preparation, Properties and Application

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It is well known that the specific feature of nanomaterials is their non-equilibrium state. Thus, the nanomaterials stability in extreme environments, such as high temperatures, irradiation as well as deformation and corrosion actions, is very crucial problem. In this connection, the development of optimal nanostructures able to withstand to extreme actions very important [1, 2]. Here, this overview mainly discusses current researches into the key role of nanotwinned interfaces in the stability increase at extremes. Methods of preparation nanotwinned structures by pulsed electrodeposition, magnetron sputtering and severe plastic deformation are described in detail with discussion of structure and physical/mechanical properties. The special attention is taken to the key role of nanomaterials with nanotwinned gradient surface structure and possibilities of their application. Some unresolved and insufficiently studied problems are discussed and pointed.

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PL.S.IV.5.

Thermoelectric Materials for Automotive Applications

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To efficiently convert waste exhaust heat of internal combustion engines into electricity, thermoelectric generators (TEGs) are designed for automotive applications. Among the various types of TE materials for this energy conversion, recently developed skutterudite materials have shown to be cost-efficient with long term stability at high operation temperatures (<600°C) and maximised energy yields above 10 % operating at temperature gradients < 600 K.
The current presentation will cover a detailed description of the state of art on skutterudite research leading to optimised >98% dense bulk TE-material with ZT-values (ZT = figure of merit) reaching ZT = 1.4 for p-type grades and ZT = 1.8 for n-type grades. Via severe plastic deformation on selected skutterudites we were able to enhance these ZT-values to 1.5 for p-type and reach ZT ~ 1.9 for n-type skutterudite material. Although these data refer to bulk specimens prepared in the laboratory it should be emphasized that our synthesis methods and technology have been successfully transferred to large scale production at Treibacher Industrie AG, which warrants ZT > 1.1 also for large amounts (up to tons) of both p- and n-type skutterudite powders ready to be hot-compacted into customer-designed shapes. The presentation will also cover the state of the art concerning thermal expansion coefficients and elastic moduli of skutterudites, fracture toughness, hardness and internal maximal stresses.
Long term stability tests (up to 10 000 hrs) on both our p- and n-type material showed only marginal degradation of the TE-properties. It was furthermore shown that highly efficient skutterudites (h > 12 %) may be also prepared from low-grade starting materials (purity less than 99.9 wt.%) resulting in a significant reduction of the manufacturing costs.

PL.S.IV.6.

Alkali Metal-Containing Complex Oxide Nanoparticles for Advanced Materials

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Based on the author's recent experimental works, the roles of alkali metals (AM) on the preparation and properties of representative phase pure complex oxide nanocrystals (CON) are discussed. Three CONs are selected, i.e. (1) spinel $Li_4Ti_5O_{12}$ (LTO), (2) garnet $Li_7La_3Zr_2O_{12}$ (LLZO) and (3) perovskite $K_{0.5}Na_{0.5}NbO_3$ (KNN). A common feature during the preparation process is that AM is always a diffusing species into the host oxide components with a cation of higher atomic numbers, i.e. TiO_2 for LTO, La_2O_3, ZrO_2 or $La_2Zr_2O_7$ for LLZO, and Nb_2O_5 for KNN. Therefore, the precursor with a core (host) -shell (AM) structure is always beneficial for low temperature, quick solid state synthesis. Homogeneity of the starting mixture, together with the well-dispersed smallest possible host particles, is another prerequisite. The position, states and degree of ordering of AM in CON are also discussed since they are decisive for their functional properties.

In the case studies dealing with three compounds given above, new features of (a) precursor preparation, (b) consolidation or sintering and (c) resultant electrical or electrochemical properties are discussed. CONs are seldom used as free powders. Instead, they are assembled in 1D, 2D or 3D, depending on the purposes or devises. When they are prepared via a solid state route at temperatures lower than conventional processes, the resulting high surface energy is beneficial for sintering. The functions of CON also depend on those particulate assemblies, so that the sintering process and the structure of the sintered bodies are also discussed in conjunction with their functional properties.

PL.S.V.1.

The on-site Analysis of Cultural Heritage Materials and Artefacts

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The reduction in size of instruments enables their use outside the laboratory. Nevertheless, since performances of portable devices are lower than those of fixed ones, appropriate procedures and models must be developed. Here we present the results of nearly 15 years of non-destructive analysis using Raman/Infrared (micro)spectroscopy and X-ray fluorescence on a wide variety of objects and materials. The non-destructive on-site analysis was used to study artefacts never tested before due to their high value and / or weakness (many of them were Advanced Materials at their time of production). It allowed significant contributions to be made to the history of art and techniques: e.g. to distinguish between original productions and non-documented restorations, to identify false or copies or erroneous attributions, but also to better understand the manufacturing techniques and state of conservation. It can be anticipated that the use of portable instruments should rapidly spread to many other fields.

PL.S.V.2.

Plasmonic Diagnostic in Biological Fluids

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Plasmonic nanostructures present unique optical properties due to the generation of strong electric fields caused by the excitation of the localized surface plasmon resonances (LSPRs). One of the main applications of such LSPRs are the so-called surface enhanced spectroscopies, mainly the surface enhanced Raman scattering (SERS). These spectroscopies have potential for the detection of single molecules under the natural environmental conditions of the analyte and thus, present a broad potential application in different (bio)fields including medicine,[1] the development of new diagnostic tools,[2, 3] multiplex detection and bioimaging[4, 5] and high-throughput screening[6] applications for drug discovery.[7] Herein we will disuse about the application of these technologies to the high-throughput screening multiplex identification and recounting of microorganism in biological samples in real time.

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PL.S.V.3.

Identifying Active Nanostructures by In Situ Electron Microscopy for Design of Tailored Materials

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Nanostructured materials are complex structures consisting of interfaces, defects and sometimes of several crystal phases. The morphology, atomic ordering, defects and composition of the different constituents are examples of factors that influence the material properties. The knowledge of the interplay between local structure and properties enables the tailoring and optimization of the properties of nanostructured materials and devices.

In situ electron microscopy and manipulation can be used to directly correlate the local atomic structure to the corresponding properties with high spatial resolution. This is of particular interest for nanostructured materials that can exhibit different properties compared to the bulk materials due to the reduced dimensions.

This talk addresses different aspects of quantitative in situ electron microscopy for studies of transport properties of charges and matter and also light induced effects. Examples from experiments with different in situ holders for scanning electron microscopy and transmission electron microscopy will be discussed. Coatings for controlled drug release, graphene, organic solar cells and nano particle systems are among the examples that will be covered.

PL.S.V.4.

The Role of Cooperativity in Two-Dimensional Crystal Growth

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One of the most remarkable aspects of cooperative processes is that complex and intricate behavior emerges as a result of interplay between inherently simple steps that in principle can be fully quantified. Multicomponent complex oxides, artificial oxide heterostructures, and the rapidly emerging class of two-dimensional (2D) oxide nanosheets can all be envisioned to be formed by stacking of 2D building blocks (2D-BB) of single atomic or molecular layers. In this talk I show that the crystalline perfection of such 2D-BBs is governed by a length scale that emerges from the interplay of two atomic scale surface processes, random nucleation and interlayer transport. The key factors that control the perfection of 2D crystallization, the perpendicular growth rate for adding new layers and the lateral growth rate that controls the island size and their spatial distribution are measured directly using time resolved surface x-ray diffraction (SXRD). Pulsed laser deposition of a prototype perovskite, $SrTiO_3$ was used to enable probing the crystallization of layers across multiple time scales and multiple length scales. Specifically, the interlayer transport rates are obtained from time-dependent coverages extracted from the perpendicular growth rates measured by the specular SXRD intensity, and the random nucleation density is extracted from island size distributions measured by the diffuse scattering intensity. The sigmoidal shape of the growth curves obtained by solution to a differential equation that combines the time dependent steps of random nucleation and interlayer transport suggests that 2D crystallization involves cooperative behavior of growth species facilitated by interlayer transport. A direct experimental evidence of such cooperative behavior is observation of a growth regime in which atomic surface transport processes are totally frozen on the time scale of the dwell time between successive laser shots. The interpretation of this observation is that island growth is driven by and occurs only in the presence of the PLD plume that delivers the growth species. The most important consequence of the transition from random nucleation to cooperative island growth is the emergence of a quasi-step flow growth mode. Unlike step flow in quasi-step flow nucleation still must occur, but at a vanishing level that is compatible with the lateral growth of single domain, large-area 2D crystals that avoid the formation of grain boundaries that can be detrimental to the properties. The extension of this simple kinetic picture to heteroepitaxy will be discussed to show that the interface width has a finite value that is determined by the interaction of the impinging growth species with the potential energy surface that is described by the sticking coefficient for random nucleation and the rate of interlayer transport.

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PL.S.V.5.

Applications of Environmental (Scanning) Transmission Electron Microscopy to Study Oxidation and Hydrogenation Phenomena in Nanomaterials

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Environmental (scanning) transmission electron microscopy (E(S)TEM) is a method to investigate the behavior of nanomaterials in gases at atomic resolution. In the first part of this talk, I will describe the basic setup of the E(S)TEM. Then, I will discuss its applications relating to oxidation of carbon nanotubes (CNTs) and hydrogenation of individual palladium nanocrystals. Since their discovery in 1991 carbon nanotubes (CNTs) [1] have found an increasing number of applications, most notably as field emission electron sources in X-ray tubes for medical applications [2, 3]. In a laboratory setting, field emission measurements of CNTs are usually carried out in an ultra-high vacuum system with base pressure of about 10^{-7} mbar or better. Under less stringent vacuum conditions, CNTs are found to exhibit lower emission currents and reduced lifetimes [4, 5]. Recently, we reported the direct study on the structural changes in CNTs as we heated and oxidized them in-situ using an aberration-corrected E(S)TEM [6]. We established a protocol whereby heating and oxidation were performed without an imaging beam, and the changes on identifiable nanotubes were documented after purging the gas from the chamber, to ensure that they were due to the effect of gaseous oxygen molecules on the nanotubes, rather than the ionized gas species [6]. Contrary to earlier reports that CNT oxidation initiates at the end of the tube and proceeds along its length, our findings show that only the outside graphene layer is being removed and, on occasion, the interior inner wall is oxidized, presumably due to oxygen infiltrating into the hollow nanotube through an open end or breaks in the tube [6]. The CNT caps are not observed to oxidize preferentially [7].
We also report the first direct measurement of hydrogen absorption and desorption in individual palladium nanocrystals on a SiO2 substrate using electron energy loss spectroscopy (EELS) in the E(S)TEM [8]. We measured the shift in the bulk plasmon resonance modes of Pd, as it transforms into PdH_x during hydrogen absorption, and constructed pressure – energy-loss isotherms of individual Pd nanocrystals to obtain insight into the hydrogen intercalation in nanostructured metals. The examples described highlight the strengths of the E(S)TEM as a tool which enables us to understand the behavior of nanomaterials in reactive gas environments.

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PL.S.V.6.

The Half of Millennium since Publishing of the First Exact Contribution to the Elastomer Concept – Some Lessons of Epistemology and Some Prospect for the Future

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Elastomers are the class of materials of unique characteristics, in all (now very sophisticated) approaches to material classifications, of modern Materials Science. It has been clear (by intuition, since the ancient times but, also in exact terms since the Peter Martys d'Anghiera report on 'Caoutchouc'), to the people whose knowledge has been based on empirical research. But for theoreticians, elastomers have been being a hard problem in balancing basic principles of material structure-property relations. Some distinguished scientist (e.g. Lord Kelvin, Wilhelm Ostwald, Peter Debye and some others as well!) in their very straight breakthrough into formulation of basic principles, at the new level of understanding the physical reality, tripped on the (apparently) simple issues of rubber elasticity (being very obvious to common mind, due to broad polymer industry goods production now, and the early personal experiences from childhood, as well!). In that way it is quite interesting to compare empirical and theoretical conclusions (in- between and on -across from the one approach to another) on such common subject, but being developed in parallel to developing the concepts of modern Material Science, in the long period of time!
The first who provided theoretical background for our understanding of the principles how elastomers succeed in connecting solid state structure with gaseous properties, building in that way a special state of matter, that can be described in terms of ideal systems of thermodynamics , was P.J. Flory. Moreover, it seems now that Flory's model of phonon fluctuations (that some people now call also fractons but, some describe as conformon features) is extremely useful for understanding some essential processes in molecular biology. For example Debye-Weller coefficient for globular proteins can be calculated directly using programs made for Flory model of rubber network fluctuations. In the lecture, will be presented also the other examples of that new direction in biophysics research, and some author prospects for the future, as well.

Poster Presentation

P.S.A.1.

Production of Nanomaterials for Physical/Chemical Methods of Fluid Filtering

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The raw materials such as cellulose waste and low-quality wool waste, widely available but mostly unexploited in Western Balkans, have great potential for production of applicable nanomaterials. Production methods of such raw materials are being analyzed together with their availability in the field. The largest potential lies in the waste containing cellulose (sawdust, wooden waste, the fruit stones, corn waste etc.). By means of standard procedures, it is possible to produce nanoporous carbon, a filter material for water and air, from these raw materials. There is also a possibility for application of wool, as a raw material for production of nanofibers, which could be an effective filter material for elimination of the organic pollutants and allergens. The production of nanomaterials from domestic raw materials has a great potential to induce a local economic activity and resolve problems with air pollution from thermal plants or waste water from the growing textile industry.

P.S.A.2.

Doped Calcium Cobaltites: The Synthesis Approach

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Thermoelectric (TE) oxide ceramics is for decades in researchers' interest due their biosafety, biocompatibility and mainly abundance instead of conventionally used TE materials based on Bi, Pb, Sb, or Te. CoO_2 based structures are p type semiconductors with wide band gap, high electron mobility and layered structure possess adequately low thermal conductivity. Cobaltites based on calcium, sodium or strontium were prepared in this study. Less conventional wet citric and glycine/nitrate combustion syntheses were compared with conventional solid state reaction. Investigation of morphology (SEM), phase composition (XRD, XPS and Raman study) of prepared cobaltites were discussed as key parameters for understanding of relation between type of synthesis of the particles and required properties of prepared dense ceramic counterparts.
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P.S.A.3.

Alternative Synthesis of Certain Compounds of Perovskite-type for Piezoelectric Transducers

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The effects of the high-energy ball milling process affecting the quality of the formed perovskite-type structure products (such as A'A"B'B"O3, where A', A"= Ba, Na, K and B',B"= Ti, Zr, Nb) were studied. It is known, that this kind of materials is used for sensors and piezoelectric transducers, therefore mechanochemical treatment, which is simple, energy efficient and waste-free method of synthesis is very interesting. As an example, the K-Nb-O system was considered in details. The properties of samples, such as purity, particle size, surface morphology and dielectric parameters, were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), X-ray fluorescence spectroscopy (XRF) and dielectric spectroscopy. The results are presented.
The study was supported by the National Science Centre Poland (NCN), Project DEC-2012/05/N/ST8/03764.

P.S.A.4.

Evaluation of Inhibition Efficiency of Talloil Diethylenetriamine Imidazoline as Corrosion Inhibitor for Top of the Line Corrosion of Mild Steel in Multiphase Flow Environment

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A novel idea to mitigate top of the line corrosion (TLC) in wet gas pipelines is based on delivering the corrosion inhibitor to the top of the pipeline through a foam matrix. The inhibition effect of talloil diethylenetriamine imidazoline (TOFA/DETA imidazoline) on CO2 corrosion and validation of the novel TLC mitigation method were successfully conducted in a small scale laboratory setup using the potentiodynamic sweep (PDS), linear polarization measurements (LPR) and scanning electron microscopy (SEM). The TLC rate of mild steel, as measured in the flow loop by means of the electrical resistance (ER) probe, was reduced by successive injections of foam plugs containing 10000 ppmv of TOFA/DETA imidazoline with 90 % inhibition efficiency that lasted up to 50 h. The obtained results confirmed the applicability of novel TLC mitigation method in a large scale flow loop and applications in oil and gas field environments should be considered.

P.S.A.5.

Effect of Thermal Aging of Ethylene-Vinyl Acetate Copolymer (EVA) on Adhesive Properties for Optical Fibers Fixation

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The purpose of EVA on optical fibers is to hold the fibers in place on the bobbin, enable the unwinding under controlled conditions and won't damage the fibers during unwinding. Since the bobbins are often stored at elevated temperatures for extended periods of time, it is necessary to examine the effects of thermal aging EVA on optical fibers. EVA is a product of DuPont Company under the name Elvax. Elvax copolymers with different vinyl acetate (VA) content were tested. Accelerated aging was performed at 60 ºC for periods of 60 and 120 hours, and was compared with result of natural aging after 6 months. Analysis performed include: FTIR analysis, SEM and optical microscopy and tensile test. The typical results of an aging at an elevated temperature indicated networking of polymer in the first stage and acetic acid and water release afterwards. Diversity of behavior of Elvax copolymers, under accelerated ageing, was observed due to different VA content. The conclusions derived in this study are related to the type of EVA, which should be used as an adhesive for optical fibers and storage conditions of bobbins.

P.S.A.6.

Synthesis and Structure of Cobalt(III) Complex with Pyridoxylideneaminoguanidine

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In the reaction of water solutions of cobalt(II)-sulphate and the biologically relevant pyridoxylideneaminoguanidine (PLAG), in molar ratio 1:2, bis(ligand) complex of Co(III) was obtained. The complex was characterized by elemental analysis, IR spectra, conductometric measurements and X-ray crystallography. This is the first bis(ligand) complex with PLAG in which one molecule of the chelate ligand is in its neutral form and the other one is monoanion. In this complex, monoanion of the ligand is formed by the deprotonation of hydrazine nitrogen atom, instead of the usual nitrogen atom of pyridoxal moiety. Cobalt(III) is situated in octahedral surroundings of two meridional ligand molecules, coordinated in tridentate ONN manner, i.e. via oxygen atom of phenolic OH-group and two nitrogen atoms of azomethine and imino group of aminoguanidine fragment.

P.S.A.7.

The Kinetic Energy Dependence of Association Reactions for Alkali Metal Ions with Dimethoxyethane

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In this work we select most probable reactions of alkali metal ions (Li+, Na+, K+) with dimethoxyethane (DXE) molecule. Appropriate gas phase enthalpies of formation for the products were used to calculate scattering cross section as a function of kinetic energy with Denpoh-Nanbu theory. Calculated cross sections were compared with existing experimental results obtained by guided ion beam tandem mass spectrometry. Three body association reaction of ions with DXE for three different pressures is studied and compared to experimental results. Calculated cross sections can be used to obtain transport parameters for alkali metal ions in DXE gas.

P.S.A.8.

Electroless Deposition of Ni-P Coating on Wrought Mg-3Al-1Zn Magnesium Alloys

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Wrought magnesium alloys characteristic by low weight and high specific strength are perspective materials for automotive and aircraft industry. However their application is strongly limited by their low corrosion resistance. Application of corrosion protective coatings can significantly improve possibilities of magnesium alloys application.
The work deals with Ni-P based coating preparation on AZ31 wrought magnesium alloy. Electroless deposition was adopted for Ni-P coating preparation. Based on structural and chemical composition analysis results the parameters of bath for Ni-P coating preparation were optimized. Mechanical properties of prepared coatings were examined by microhardness, nanohardness and scratch tests. Corrosion resistance of Ni-P coated magnesium alloy was examined by immersion test.
Due to its good mechanical and corrosion properties, Ni-P coating seems to be suitable and effective corrosion protective coating for AZ31 magnesium alloy.
This work was supported by project Nr. LO1211, Materials Research Centre at FCH BUT-Sustainability and Development (National Programme for Sustainability I, Ministry of Education, Youth and Sports) and by project Nr. 7AMB14SK080 by the MSMT of the Czech Republic.

P.S.A.9.

Preparation of Cordierite Ceramic Materials Starting from Natural Raw Materials

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This study presents our investigations on the preparation of cordierite ceramic materials starting from Algerian raw materials; kaolin, and palygorskite clay. Precipitated magnesium hydroxide is added to assure the stoïchiometric formula of cordierite $Mg_2Al_4Si_5O_{18}$. Synthesis of the cordierite phase is investigated with the TG-DTA, and DRX.
Dense ceramic materials are elaborated from these mixtures which are pressed and sintered at 1350 °C. And for develop porous ceramics, a glucose is added to the starting mixture to create an interconnected porosity during sintering of pressed powder pellets.
The DTA analysis shows two exothermic peaks; the first at 968 °C which is attributed to the crystallization of m-cordierite, and the second peak at 1200 °C which is allotted to a-cordierite (indialite). A last endothermic peak occurs at 1400 °C indicates the fusion of cordierite. The XRD analysis of calcined mixture at 1300 °C shows that material is mainly composed by a-cordierite. The density of dense ceramic varies from 2.10 to 2.35, and the porosity of porous material varies from 30 % to 80 %. For high porosity material exhibits a cellular structure. The thermal coefficient of expansion (TEC) is $< 3.0 \times 10^{-6}$ °C.

P.S.A.10.

Complexes of Ru(II) with N-alkylphenothiazines – Biological Assay

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Metal complexes of ruthenium more than twenty years are focus of interest because of their catalytical properties as well as biological application. In this study we are investigated the effect of three different doses of dimethylsulphoxide-ruthenium(II) and p-cymene-ruthenium(II) complexes with trifluoperazine on acethylcholinesterase enzyme activity in rats blood under physiological conditions. This research clearly demonstrates positive influence of these complexes on enzyme activity in applied doses and confirms a great potential of ruthenium complexes with pharmacological drugs as potential biological compounds with promising applying.
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P.S.A.11.

Transport Parameters of Ne+ in CF_4 for Technological Applications

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Charge transfer reactions of ions with molecules are inavoidable elementary processes in modeling kinetics in terrestrial, industrial and astrophysical plasmas. In selected cases charge transfer reactions are known to represent the most significant part of a cross section set. Line spectra of excited atoms obtained in spectrometric measurements in CF_4 indicate that the charge transfer reaction is dominant process in collisions with inert gas ions. Thus, in this work we assessed cross section set for Ne+ in CF_4 by using existing experimental data for charge transfer collisions producing radical ions of CF_4.
Since no direct information is found in the literature how mobility of high recombination energy ions such as Ne+ ions behaves in CF_4 we also calculated transport parameters by using Monte Carlo simulation technique.

P.S.A.12.

Influence of Point Defects Concentration on Densification Process and Optical Properties of Sintered ZnO Ceramics

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Zinc oxide is one of the most studied materials due to its potential applications in electronics, optoelectronics and spintronics. In the forms of single crystal and thin-film ZnO could be used as UV and blue light emitter, while sintered ZnO-based ceramics are important as varistors, thermistors or wide-band gap semiconductors. Intrinsic defects, such as vacancies, interstitials and antisites, in the crystal structure of a ZnO strongly influenced its electrical and optical properties. Thus, understanding the behavior of intrinsic defects during densification of ZnO ceramics as well as correlation of the defects with band gap energy of final product is important to its application in opto-electronic devices.

In this study, the influence of point defects concentration on the densification process and optical properties of ZnO sintered ceramics was investigated. To obtain ZnO sintered ceramics with variety of point defects concentration we employed two starting powders with a different crystal structure ordering, as well different morphology and specific surface area. Sinterability of the powders was investigated by thermo mechanical analyzer; shrinkage data, collected in axial (h) direction during non-isothermal sintering with heating rates of 5, 10 and 20 °/min, were used to calculate activation energy of sintering process. Sintering of uniaxially pressed (P = 100 MPa) cylindrical compacts (ø 6 mm and h ≈ 3 mm) were done in air atmosphere by heating rate of 10 °/min up to 1100 and 1200 °C, and dwell time of 2 h. To study a crystal structure of the sintered samples XRD and Raman spectroscopy were used, for microstructural investigation field emission scanning electron micrographs were recorded while optical properties were determined by UV-Vis diffuse reflectance and photoluminescence spectroscopy. A detailed study shows that point defect strongly influenced densification process as well optical properties. Sintered ZnO ceramic with a high crystal defect concentration and nanosized grains shows band gap energy of about 2 eV while band gap energy increased with a decrease of defect concentration.

P.S.A.13.

Synthesis and Characterisation of Powder Metallurgy Bulk Magnesium

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Magnesium is lightweight metal suitable for various engineering and biomedical application due to its good strength-weight ratio and biocompatibility. Powder metallurgy (PM) of magnesium is a modern method of porous magnesium processing reaching specific mechanical properties influenced by high purity, material structure and controlled porosity. This study focuses on preparation and characterisation of porous magnesium prepared from magnesium powder with average powder size of 50 µm via sintering at hot pressing. Properties of porous magnesium prepared by PM are strongly dependent on individual processing parameters. Compaction pressure and temperature were altered to optimize preparation process. Mechanical properties of PM billets prepared using different processing parameters were examined with 3 point bending and fractographical analysis. Microstructure and porosity evaluation was performed to characterize the bulk magnesium prepared by PM. Obtained properties of PM porous magnesium were compared with conventional magnesium.

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P.S.A.14.

The gamma-irradiation effect on sintering and properties of zirconia ceramics

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Zirconia ceramics promising as the material used for the restoration of bone constructs exposed to significant physiological stress. The aim of this work is investigation of simultaneous the gamma-irradiation treatment and the synthesis conditions, the calcination temperature, stabilizing and melting additives influence in the sintering process of zirconia ceramics. The special technology of sintering was developed with the gamma-irradiation procedure introduction. The sintering was conducted in three steps:

1. preliminary heat treatment to initiate the sintering process at 850-1150 °C;
2. gamma-irradiation treatment with subsequent X-ray diffraction (XRD) to control the phase composition;
3. final heat treatment in a wide temperature range 1350-1550 °C.

As source of gamma-irradiation 60Co was used (dose rate 0.22 Gy/s according to ferrosulphate dosimeter). Irradiation treatment of samples was carried out from 0 to 21 days.

This work is supported by Russian Foundation for Basic Research, Grant No 14-03-31557.

P.S.A.15.

Modeling the Influence of Synthesis Parameters and Thermal Effects on Magnetic Properties of Pressed Powder System $Fe_xO_yBaTiO_3$

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A powder mixture of 30% Fe and 70% $BaTiO_3$ was activated in a planetary ball mill for a period of 60, 90, 120, 150, 180, 210, 240, 270, 300, and 360 minutes in an air atmosphere. During the activation, the iron powder goes into iron oxides. Depending on the time of activation, the percentage of iron oxides FeO, Fe_2O_3, and Fe_3O_4 is changed. At the same time, with the change of composition of the system, the corresponding magnetic properties are changed as well. The values of magnetization of pressed powder samples depending on the time of activation of the starting powder mixture were obtained by the thermomagnetic measurements based on Faraday's method. It is shown that the maximum magnetization prior to heating have the samples obtained by pressing of powder activated for 120 minutes and its value is M0 = 6.31 emu/g, with the strength of applied magnetic field of 20 kA/m.
With the non-isothermal heating and isothermal annealing of pressed powder for all the times of activation, the magnetization of refrigerated samples increases. It is shown that the maximum magnetization is occurred in all samples after annealing to 540° C for all the times of activation. The maximum magnetization after annealing to 540° C has a sample formed by pressing the powder activated for 120 minutes.
Based on the experimental results, with the modeling of time and temperature dependent processes, the mathematical relation of the magnetization dependence on the activation time and temperature is given.

P.S.A.16.

Analysis of Stress Distribution in the Case of Scarf Joint of Two Composite Materials

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The finite element method is used to analyze the stress distribution of scarf joint of two composite plates. Geometry of the joint, boundary condition and type as well as amount of loading can be varied as per the requirement. The mesh of the model is selected and shown in a graph. The normal stress in the three directions is calculated. (i. e. sx , sy and sz). The shear stress txy is also calculated.
The results are shown in colored graphs. The places where the maximum normal and shear stresses are accurse at the joint place.

P.S.A.17.

Application of New Composites for Fused Deposition Modeling (FDM) Technology in Wood Industry

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Additive manufacturing technologies enable rapid prototyping of different elements, based on 3D model realised with some selected 3D modeling software. This paper presents some aspects of Fused Deposition Modeling (FDM) technology and its application in wood industry. FDM technology uses 3D printing for fabrication of plastic parts, whereas ABS and PLA plastic materials are commonly applied. Possibilities for application of different composites for FDM in wood industry are discussed. Analysis of wood plastic composite is realised, since it is characterised by high durability, good mechanical strength, stiffness and low price compared to other materials. Application of other materials is also observed, as suitable for other industrial applications.

P.S.A.18.

Tuning Electronic Properties of Transition Metal Dichalcogenides by a Heterovalent Doping in Metal Sublattice

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The discovery of graphene and its unique properties caused a huge interest in the study of the other compounds with layered structures. Transition metal dichalcogenides MQ_2 (M= Nb, Ta, Mo, W, Re; Q= S, Se) are remarkable representatives of layered materials with various fundamental and useful properties. The chemical, electronic and mechanical properties of these dichalcogenides allow use some of them as photocatalysts, battery cathode materials including solar energy conversion units, optoelectronic sensors etc.
In many applications it is necessary to adjust the electronic properties of the used materials. In our work we propose an approach on tuning of properties of transition metal dichalcogenides by heterovalent substitution in the metal sublattice $M_{1-x}M'_xQ_2$ where M=Mo, W and M' =Nb, Re. We have studied synthesis, structural and electronic properties of molybdenum and tungsten dichalcogenides doped with electron-rich (Re) and electron-poor (Nb) atoms. The bulk compounds were exfoliated into few-layered structures by solution method. Properties of such few layered structures were compared with bulk materials.
The work was supported by the Russian Science Foundation (Grant № 14-13-00674).

P.S.B.1.

Valence State Ce(Yb), Electron Structure and Physical Properties of New Ternary Intermetallic Compounds

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High-energy spectroscopy (XES, XAS and XPS) has been used to study the electron structure of the investigated new ternary intermetallic compounds. In recent years there has been a continually increasing interest in investigation of ternary compounds with crystallize in the YNi_9Si_2, $CeGa_2Al_2$, $Yb_2Fe_4Si_9$, $ThMn_{12}$ and AlB_2, which have a large variety of ground state properties. LIII -absorption spectra Ce(Yb) in ternary compounds were obtained at 80K and 300K using a tube spectrometer. The mixed valence state of Ce(Yb) was obtained in the investigation compounds. The measurements were carried out both with classical methods as well with the Mossbauer effect in order to establish parameters of the hyperfine interactions (only for confirm Fe atoms compounds). The calculations of electron energy bands E(k) and partial DOS for compounds new $R.E.M_2X_2$ were performed by the semi relativistic linear muffin-tin orbital method without considerations of spin-orbit interactions A satisfactory agreement between theoretical and experimental data is achieved.

P.S.B.2.

Preparation of NdFeB Magnetic Nanoparticles by Surfactant-Assisted High Energy Ball Milling

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Improved permanent magnets are essential for emergent applications in electronic and electric devices. Different attempts have been made to produce nanoscale anisotropic rare-earth magnetic powder based on Nd-Fe-B material. Recently, high energy surfactant assisted ball milling has been proven to be an effective technique to produce anisotropic hard magnetic Nd-Fe-B nanoparticles. In this paper we are presenting our experimental results on high energy ball milling in planetary mill "Puverisette 7 premium line" from "Fritsch". Except milling material, there are several variables which influence the milling process for the selected mill type. They are: mechanical properties of the milling media material (bowls, balls, etc.), ball-to-powder ratio (BPR), extent of filling of the milling bowl, milling atmosphere, milling speed and duration, and type of solution and surfactant for wet milling. We are going to give influence of all these parameters on obtained NdFeB magnetic materials with nanosized dimensions starting from $Nd_2Fe_{14}B$ HDD (Hydrogenated Disproportionated Desorbed) material.
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P.S.B.3.

Thermodynamic Characteristics of Graphene

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The paper analyzes the monolayer graphene and dispersion laws for phonons and electrons, and on the basis of these dispersion laws temperature dependences of the internal energy and specific heat of graphene are calculated. In dispersion laws for phonons, all three branches of acoustic phonons are included (while much lower contribution of three optical phonon branches is neglected). In dispersion laws for electrons, the cases of pure graphene and graphene with impurities and defects are considered (with calculated screened Coulomb interaction between the charge carriers in the second case). The temperature dependences of thermodynamic properties are given in graphical form and compared with the available experimental data.

P.S.B.4.

Investigation of Optoelectronic and Heat Transport Properties of Graphene Modified with Boron Atoms

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We have investigated optoelectronic and heat transport properties of model graphene structures after modifications with boron atoms. The central rings of 3x3 armchair-armchair, zigzag-zigzag and armchair-zigzag models of graphene have been substituted with two boron atoms. In such manner we obtained 18 derivatives of graphene which have been subjected to investigation of optoelectronic and transport properties. The obtained results were compared with pristine structures of graphene. Related to optoelectronic properties the focus was on hole and electron reorganization energies and energy separation between the lowest excited singlet (S1) and triplet (T1) state, while electron heat transmission coefficients were calculated in order to investigate heat transport properties. Obtained initial results indicate that electron reorganization energies significantly lowered, thus improving the charge hopping properties between the investigated structures. Energy separation between the lowest excited singlet (S1) and triplet (T1) state decreased significantly upon modifications also, which indicates that investigated structures are potentially applicable in the field of thermally activated delayed fluorescence (TADF). Obtained results also indicate that investigated structures could also serve as the basis for organic light-emitting diode (OLED) devices as precious-metal-free organic molecules.

P.S.B.5.

Self-Healing Fiber-Reinforced Composite

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Thermosetting polymer composites with autonomic self-healing ability were prepared and investigated. Self-healing mechanism is based on catalyzed polymerization of healing agent. Epoxy based composites were reinforced with polymer fibers and microcapsules carrying active components for self-healing. Polymer fibers were prepared by electrospinning technique. Healing efficiency of the system was investigated using controlled energy impact tests; absorbed impact energies of virgin and healed samples were compared. For confirmation of healing monomer's polymerization, FTIR analysis was used. SEM analysis showed morphology of fibers and microcapsules.
Acknowledgement: This work was supported by the Ministry of Education, Science and Technology Development of the Republic of Serbia, Project Nos. TR 34011 and III 45019.

P.S.B.6.

Synthesis and consolidation of Ni_3B by Spark Plasma Sintering

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Ni–B alloys are promising materials for heating elements and wear-resistance coatings. Due to a large difference in the melting temperatures of nickel and boron, it is difficult to synthesize Ni-B alloys using melting-based techniques. This difficulty can be overcome if solid-state processing is used. Ni-B alloys can be prepared by mechanical alloying. For the synthesis and consolidation of metal borides, Spark Plasma Sintering (SPS) and hot pressing have been successfully applied. However, until now, no study has reported the synthesis and consolidation of nickel borides by SPS.
In this work, we propose, evaluate and compare two possible synthesis routes of bulk Ni_3B. The first route is based on the synthesis of the target phase by thermal explosion in the mechanically milled nickel and boron powder mixture followed by SPS of the reacted powders. The second route is the in situ synthesis of Ni_3B during SPS of the mechanically milled nickel and boron mixture. In this presentation, the characterization of synthesized products as well as hardness and electrical conductivity of the consolidated materials produced by two routes will be presented and compared. The influence of the purity of the boron powder on the phase composition of the synthesized boride products will be discussed.
This study is supported by the grant from the Mayor's Office of Novosibirsk, Russia, 2015.

P.S.B.7.

Magnetoimpedance Effect of Metastable $Fe_{72}Cu_1V_4Si_{15}B_8$ Alloy Ribbons

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One of the most interesting phenomena observed in soft magnetic amorphous ribbons (or wires or thin films) is magnetoimpedance (MI) effect. The influence of an external dc magnetic field (Hex) on a MI element is manifested by significant changes in the impedance Z(H). In classical skin-effect explanation, materials with high-magnetic permeability (μ) and low electrical resistivity (ρ), at relatively high frequencies (f) have penetration depth (δm) lower than the ribbon thickness (d): $\delta m = (\rho/ \pi\times \mu \times f)1/2 \leq d$ and therefore δm have influence on MI response.

The arc-melted ingots of master prealloys of nominal composition $Fe_{72}Cu_1V_4Si_{15}B_8$ were rapidly quenched using a single-roller technique. The thermal stability and crystallization behavior were examined by differential thermal analysis (DTA) and X-ray diffraction (XRD). Two crystallization processes were observed at 788 K and 904 K.

In this study the magnetoimpedance (MI) effect of $Fe_{72}Cu_1V_4Si_{15}B_8$ melt spun ribbon in its as-cast state is investigated. Frequency f in the range from 300 kHz to 6 GHz and external dc magnetic field Hex up to 25 kA/m were used for optimization of MI effect.

After sinusoidal signal optimization significant MI response of about $\Delta Z/Z \approx 170$ % as well as sensitivity of about 20 %/kA/m (for $H \approx 2–4$ kA/m), were recorded at driving frequencies of about 25-35 MHz.

P.S.B.8.

Voltammetric Determination of an Antipsyhotic Agent Trifluoperazine at Boron-Doped Diamond Electrode

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A simple and efficient procedure is described for electrochemical determination of trifluoperazine (TFP), a prominent compound in a large group of phenothiazine derivatives with potent physiological activity. This method is based on the electrochemical oxidation of TFP in Britton-Robinson buffer solution at pH 6 at a boron-doped diamond electrode. Cyclic voltammetry provided a four well defined oxidation peaks on +0.66, +0.80, +1.06 and +1.33 V (vs. Ag/AgCl/3 M KCl electrode). Differential pulse voltammetry was applied as a very sensitive analytical technique for the determination of micromolar amounts of TFP. Two oxidation peaks on higher potentials were chosen for a quantification of TFP. Under optimized conditions, the analytical curve obtained was linear in the TFP concentration range of 1.0 to 31.0 μmol L^{-1}, with a detection limit of 0.7 and 0.6 μmol L^{-1}, respectively. The effect of interfering agents (common urinary compounds) was appeared to be negligible confirming a favorable selectivity of method.
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P.S.B.9.

Mechanism of Increasing the Capacitance of Li-Ion Bettery with Nano-Coated Electrodes

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When the electrodes of Li-ion batteries overlay with nanoscopic (graphite, metal-oxide and/or similar) coatings, their electrical capacitance can be significantly increased. The mechanism of more efficient ionic transport in these batteries is not known. This paper presents the results of research of the role of phonon subsystem in ultrathin coatings of electrodes in Li-ion battery in increasing the efficiency of ion transport. By the Green's functions method and combined analytical and numerical analysis applications, it was demonstrated that the acoustic phonons of optical type were created in ultrathin films, i.e. in nano-coatings of electrodes. The amplitudes and energies of the mechanical oscillations of crystalline lattice on film surfaces were intensified occurring of standing waves. With its increased oscillating, phonons release the captured ions on and within electrodes, thus significantly increasing the ion mobility and the electric conductivity of these batteries.

P.S.B.10.

Modern Technologies to Be Applied into Ballistic Vests

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The presentation concerns new, innovative technologies used at the realisation of the project "Individualisation of the design of multifunctional concealable ballistic vests". The main objective of the project is to develop a procedure for individualised design of ballistic vest, based on the three-dimensional scanning technique.
3D scanning technique involves the use of innovative methods for contactless anthropometric measurements, carried out with the modern measuring apparatus - a scanner for registering the images of three-dimensional objects. The use of this method will allow for fast, professional determining the size and shape of ballistic concealable vests, taking into account the specificity of an individual wearer's body. The method proposed in the project, which makes use of the laser measurement of human silhouette and automatic matching of standard templates to an individual user profile will improve the process of developing a vest adjusted to the particular customer and significantly reduce the time of making-up such a vest. This method brings also a number of other benefits that will be presented in the course of the project. The success of the project relies on making the use of 3D scanning technology, the use of multimedia techniques - software programs dedicated for use in the business of special or protective clothing as well as on the use of advanced textile technologies, including phase-change materials (PCM).
The comparative research with the use of various types of the Outlast®-type materials have been carried out within the framework of the project. Based on results of the research, one of PCM materials was recommended for the products like ballistic vests, since it has been found the best from the point of view of the wearer's comfort.

P.S.B.11.

Protection of Personal and Biometric Data of Individuals from the Measurements with a 3D Scanner

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Within the project will be developed procedures for creating the manufacturing process using 3D technology, which provides a better fit (individualization) of ballistic vests made for the identified group of officers.
This process is achieved through the development of:
- The selection procedures vests functionality depending on the identified risks arising from the action,
- The procedures for ensuring the protection of personal data and the required ethical aspects,
- Procedures for the individualization of design vests based on 3D scanning technology,
- Validation procedures for laboratory, exploitation, fields trials programs ballistic vests.

P.S.B.12.

Optical and Mechanical Properties of PMMA Film Doped with QD

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Processing and characterization of PMMA-CdSe quantum dots (QD) nanocomposites is presented in this study. Nanocomposites were fabricated by solvent casting. Agglomeration is a significant problem in nanocomposite manufacturing, which include nanoparticles distributed within host matrix material. FTIR analysis performed to investigate bonding between QD and matrix. Thermal properties of films were analyzed by DSC. The optical properties of obtained nanocomposites were investigated by the time-resolved laser-induced fluorescence measurement. Nanoindentation was performed in order to determination of mechanical properties of nanocomposites. The adding of QD in PMMA improved optical, thermal and mechanical properties of PMMA film.
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P.S.B.13.

Investigation on Fracture Mechanics for Steel, Cast Iron and Bronze Materials

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The investigation conducted for the materials mentioned above is carried out to test the durability of these materials in compression and tension, as well as fatigue. Testing of these materials in these three methods of testing, is carried out to see how resistant these materials will be in different working conditions, in the railway industry, machinery manufacturing industry, the food industry etc. The study is based on a concrete work, the measurements and tests that have been made to the specimens in machinery testing, in different working conditions compression, withdrawal as well as fatigue. These measurements and tests are carried out at the University of Mittweida in Germany.
Based on scientific research, we have made appropriate recommendations, which may be available in the right direction in the investments required in various industries. Growing demand of private sector for functional machinery, in economic conditions of Albania, give us the opportunity to embody these data into real projects. Thanks to the data, and using computer applications in the design and simulation, we have achieved the construction of some mechanical equipment in the food industry (specific details).

P.S.B.14.

Low-Cycle Fatigue Behaviour of 6061 Aluminium Alloy Plated with Multi-Layered Coatings

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Coated aluminium alloys widely used in aero-space and transportation industries, mostly, because high toughness and strength-weight ratio. The low-cycle fatigue (LCF) of aluminum alloys has been extensively studied, mainly in a uniaxial push-pull loading mode, while in real applications the loading is much more complicated. The effect of one-, two- and three-layer coatings on the LCF behavior of 6061-T6 Al alloy coated with nickel, gold and silver was studied in a pure bending strain-controlled mode at strain ratio of 0.1 and maximum applied strain varied from 0.007 to 0.014. Test results are satisfactorily described by a well-known Coffin-Manson relation. The tensile and fatigue properties of the alloy coated with multi-layered deposits depend, first of all, on the thickness of the inner hard electroless nickel layer (EN) that drastically decreases the ductility of the system.
Deposition of 12-μm- and 26-μm-thick EN layers shortens the fatigue life of the system by 72% and 88%, respectively, at the maximum total strain of 0.007 (plastic strain 0.003). Incipient cracks were revealed, first of all, in the EN layer and in the substrate close to its surface. Electroplating by the second ductile Ni layer increases the lifetime of the alloy in comparison with that coated only by the EN layer, especially, at low and medium plastic strains. The deposition of the third silver or gold layers on the substrate worsens, as a rule, its fatigue properties.

P.S.B.15.

Spectroscopical Analyses of Laboratory Produced ODS Steels

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The laboratory produced ODS steels were received from laboratories involved in the IAEA Coordinated Research Project F11014 "Benchmarking of Structural Materials Pre-selected for Advanced Nuclear Reactors". Namely from India (IGCAR), Russia (Bochvar Institute), Korea (KAERI) and Japan (Kyoto University). The application of Mössbauer spectroscopy on these materials was aimed to reveal the complex information about studied materials via unique characteristics as micro-magnetic properties and homogeneity of admixtures distribution in steels. Furthermore the radiation resistance of these materials was studied via helium ions implantations. The comparison of defect accumulation in implanted ODS steels was based on Positron Annihilation Lifetime measurements.
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P.S.B.16.

The Pore Structure of Hydrated Portland Cement Paste

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In this study, the pore structure of Portland cement paste is experimentally characterized using a combination of three methods Mercury Intrusion Porosimetry (MIP), X-ray diffraction, and Environmental Scanning Electron Microscope (ESEM). The hardened cement paste with w/c = 0.4 and 0.5 at ages 1, 7 and 28 days are comprehensively investigated. Pore structure is a very important micro structural characteristic in a porous solid, because it influences the physical and mechanical properties, and controls the durability of the material. Using X-ray diffraction method, the diffraction spectra have identified the hydration products: portlandite, ettringite and tobermorite, as well as the mineralogical compounds. MIP was used as a generally accepted technique for deriving porosity and pore size distribution and results correlated to those received from ESEM image analysis.

P.S.B.17.

The Influence of Nano-Silica and Barite Aggregate on Properties of Ultra High Performance Concrete

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Development of building materials with improving characteristics and its application on increasing structure durability and sustainability is one of goals in civil engineering. The use of nano-silica in concrete is one of the possibilities to improve concrete properties. Concrete with nano-silica has denser and compact microstructure. Nano-silica has higher pozzolanic reactivity than silica fume and can reduce cement content in ultra high performance concrete (UHPC). Nano-silica in cementitious materials influences on cement hydration and modify pore structure. The main objective of this paper is to evaluate the influence of different content of nano-silica and barite aggregate on properties of UHPC. Barite aggregate is used to improve the properties of the concrete in the protection against ionizing radiation. By combining the properties of concrete with nano-silica and concrete with heavy-weight aggregate, ultra high performance concrete can be produced which have higher durability and better radiation shielding properties.

P.S.C.1.

Tailoring Surface Plasmon Resonance (SPR) of Bimetallic Ag/Au Nanoparticles through their Composition and Assembly

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The sensitivity of the localized surface plasmon resonance (LSPR) of the metallic nanostructures to the changes in the shape, size, composition and dielectric environment of the nanoparticles and plasmons electromagnetic field confinement leads to the application of the metallic nanostructures in fields of biomedicine, biosensing, energy and photonics.
Thin films of metallic nanoparticle arrays were formed by in situ nucleation and growth of bimetallic Ag/Au nanoparticles in polyion multilayer matrix. With the in-situ synthetic approach in polyion nanoreactor the size, volume fraction and concentration of the metallic nanoparticles which define the inter-particle distance in the matrix can be controlled by varying the number of ion binding/precipitation cycles. The tunability of the LSPR of the (Ag/Au) bimetallic arrays within the wavelength ranges for visible and near infrared light is achieved by varying the composition and size of the nanoparticles in bimetallic composite films. Among existing designs, crystalline metal nanostructures have been shown to exhibit greater sensitivity (LSPR spectral shift)($\Delta\lambda$) in response to the refractive index changes in compare to single nanoparticle sensors due to plasmonic coupling induced by nanoparticle pairs that are separated by less than 2.5 particle radii. The ability to measure the structural and plasmonic properties of individual bimetallic nanoparticles and their arrays in composite thin films is crucial to gain a deeper understanding of their LSPR characteristics. Using a monochromatic beam in STEM mode to perform EELS has been demonstrated as a successful technique to study localized plasmons of individual single metal nanoparticles and their dimers. In this study this technique will be performed on separated bimetallic Ag/Au nanoparticles and their arrays in polyion matrix in order to determine the influence of the size and composition of the individual nanoparticle over the effect of interparticle plasmonic coupling to the surface plasmon resonance properties of the nanoparticle assemblies.

P.S.C.2.

Alignment of MoS_2 Nanotubes in a Photopolymerizable Liquid–Crystalline Material

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We investigated the orientational distribution of MoS_2 nanotubes incorporated into a commercial photoreactive liquid–crystalline medium. Electron microscopy imaging and Raman spectroscopy measurements show that interaction with the liquid–crystalline host induces strong directional alignment of the nanotubes. The obtained alignment is "frozen" into the structure by subsequent photopolymerization reaction, which on one hand prevents agglomeration and on the other hand produces a solid composite film with controlled orientation of the nanotubes. Analysis of the mechanical properties shows that by addition of 0.1 wt % nanotubes the elastic modulus of the films is increased by 35%. Our results demonstrate that the nanotube alignment approach based on photopolymerizable liquid–crystalline media, which is relatively inefficient for carbon nanotubes, might be much more promising for inorganic nanotubes.

P.S.C.3.

Platinum Nanocatalysts at Titanium Oxide Based Supports for Low Temperature Fuel Cell Applications

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A comparative study on catalytic activity of platinum nanoparticles on different titanium oxide supports for proton exchange membrane fuel cells reactions was performed. Non stoichiometric titanium oxides – Ebonex, niobium doped titanium oxide and ruthenium doped titanium oxide were applied as the supporting materials.

Platinum nanocatalysts (20% Pt) on different support were synthesized by impregnation or borohydride reduction method. Synthesized supports and catalyst were characterized by BET (Brunauer, Emmett, Teller), X-ray diffraction (XRD) and high resolution transmission electron microscopy (HRTEM). Homogenous Pt nanoparticles distribution over the niobium and ruthenium doped TiO_2 support, without pronounced particle agglomeration was confirmed by HRTEM technique. The average Pt particle size was 3 nm and 5.4 nm for Pt at niobium doped TiO_2 and ruthenium doped TiO_2, respectively. However, it was not possible to determine accurately average Pt particle size at Ebonex support, due to the non-uniform distribution of the Pt nanoparticles. Electrochemically active Pt surface area of the catalysts was determined by integration of the cyclic voltammetry curve in the potential region of underpotential deposition of hydrogen, after double layer charge correction, taking into account the reference value of 210 μC cm^{-2} for full monolayer coverage.

Kinetics of the oxygen reduction reaction at Pt nanocatalysts on different titanium based supports was studied by cyclic voltammetry and linear sweep voltammetry at rotating gold disc electrode. Two different Tafel slopes at Pt catalysts on niobium and ruthenium doped supports were observed: one close to 60 mV dec^{-1} in low current density region, and other ~120 mV dec-1 in higher current densities region. Only at Ebonex based support one single Tafel slope (~ 106 mV dec^{-1}) was observed. The specific activities for oxygen reduction, expressed in terms of kinetic current densities per electrochemically Pt active surface area, as well as per mass of Pt loaded, at the constant potential of practical interest (0.85 V and 0.90 V vs RHE, where the mass transport contribution current can be neglected), were compared to carbon supported one, with the same Pt loading. Stability tests, by repetitive cycling from 0.03V to high anodic potentials (up to 1.4 V vs RHE) were performed. The advantages of carbon free supports application in terms of stability, durability and life time of the catalysts were discussed.

P.S.C.4.

Shape Evolution of Carbon Supported Pt Catalyst for PEMFC

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Platinum nanoparticles, used for the anodic proton exchange membrane fuel cell investigations, were prepared by water in oil microemulsion method. Different amounts of HCl were used to enhance cubic shape evolution of the synthesized particles. Cubic shape is sought-after, because such material combines favourable aspects of both nanoparticles and monocrystals. This way, it is possible to achieve a preferential plane orientation, and offer a more suitable catalyst surface for surface sensitive fuel cell reactions. Pt catalysts were characterised electrochemically, using cyclic voltammetry in 0.5 M H_2SO_4 as supporting electrolyte and by CO stripping method. Further catalyst characterisation included transmission electron microscopy (TEM) and X-ray diffraction (XRD) analysis. Both revealed the influence of HCl, in the microemulsion, on the shape evolution of Pt nanoparticles, as well as on the particle size, ranging from 4 to 8 nm.

P.S.C.5.

Photocatalytic Degradation of the Propranolol Hydrochloride in Natural Water Using Titania-Based Nanoparticles

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Propranolol hydrochloride ((RS)-1-(1-methylethylamino)-3-(1-naphthyloxy)propan-2-ol hydrochloride) is the first generation of nonselective β-blockers of adrenergic receptors in heart. Due to their frequent use, mentioned component has been detected in surface, sewage, and waste waters. The aim of this work was to investigate the kinetics of photocatalytic degradation of propranolol hydrochloride employing UVA/O_2 in the presence of pure TiO_2 nanoparticles, as well as TiO_2/polyaniline (TP) nano-composites, synthesized with different molar TiO_2:polyaniline ratios (TP-50, TP-100, and TP-150) in natural waters: rivers (Danube, Tisa, and Begej) and lakes (Sot and Moharač). Besides that, the efficiency of direct photolysis to the degradation of propranolol hydrochloride has been investigated and based on the obtained data it can be concluded that direct photolysis has insignificant influence to the overall photodegradation rate. Results have been compared with the results of degradation in double distilled water. Degradation was monitored by HPLC–PDA technique and mineralization was studied by TOC techniques. Acknowledgements: Authors acknowledge financial support of the Ministry of Education, Science and Technological Development of the Republic of Serbia (Project No. 172042) and of the Provincial Secretariat for Science and Technological Development of Vojvodina, Republic of Serbia (Project No. 114-451-1504/2014-03).

P.S.C.6.

Synthesis, Characterisation and Photocatalytic Properties of Two Novel Nanocomposites: TiO_2 Hombikat with Fullerene nC_{60} and with Fullerenol $C_{60}(OH)_{24}$ Nanoparticles

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Commercial TiO_2 Hombikat exhibits good photocatalytic properties as well as chemical and biological stability and insolubility in water within a wide pH range. It is known that fullerene nC_{60} nanoparticles and fullerenol $C_{60}(OH)_{24}$ nanoparticles (FNP) can demonstrate photocatalytic effects in the UV/visible spectral region. In order to obtain stable and potent photocatalytic system we synthesised, characterised and analysed two novel nanocomposites TiO_2 Hombikat with fullerene nC_{60} and with FNP. Size and zeta potential of obtained nanoparticles were measured by dynamic light scattering and the morphology was determined by scanning electron microscopy. Nanocomposites were negatively charged and formed stable agglomerates in water with size of about 100 nm. Besides, the activity of commercial photocatalyst and novel nanocomposites under simulated sunlight was compared. It is interesting to note that TiO_2 Hombikat with FNP showed better photocatalytic properties than TiO_2 Hombikat alone in the degradation of herbicide mesotrione from water.

P.S.C.7.

Synthesis of Sulphur Nanoparticles by Mechanochemical Route in the System $Na_2S_2O_3$−$H_2(C_4H_4O_4)$−Na_2SO_3

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Sulphur nanoparticles (nanosulphur) are used in a various fields of science, techniques and economics. A lot of methods have been proposed such as a gel techniques, in situ synthesis, microemulsion method and liquid crystalline phase reaction to prepare nanosulphur.
In this study, nanosulphur dispersed within a soluble matrix were synthesized by means of powders grinding in a planetary ball mill via “soft” dilution reaction $Na_2S_2O_3{\times}5H_2O$ + $C_4H_6O_4$ (Succinic Acid) + z Na_2SO_3 = (z+1) Na_2SO_3 +$H_2(C_4H_4O_4)$ +$5H_2O$ + S0n by sodium sulphite at z = 19.6. The mechanosynthesis of nanosulphur has been studied by thermal analysis and XRD (block sizes of coherent scattering for synthesized particle were found to be ~ 75 nm). The SEM, TEM and DLS (Dynamic Light Scattering) results showed the formation of nanosulphur with wide ranges of size distribution, commonly less than 300 nm.

P.S.C.8.

Hydrolytic Stability of Nanosilica-Based Urea-Formaldehyde Composite with Different Coumarine Derivates as Scavengers of the Formaldehyde

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Urea–formaldehyde (UF) resins, as the most popular type of the so-called amino plastic resins, are widely used in many manufacturing processes due to its useful properties. In spite of some advantages such as lower cost, fast curing, good performances in the panel, water solubility and colorless, UF resin adhesives also possess a critical disadvantage: formaldehyde emission from the panels.

The hydrolytic stability of three nano-SiO_2 based UF composites with coumarine derivates (names as K-1 and K-2) was investigated. Three types of nanosilica-based urea–formaldehyde (UF) composite materials with a formaldehyde-to-urea (F/U) ratio of 0.8 were synthesized (UF with SiO_2—Composite 1, UF + SiO_2 + K-1—Composite 2 and UF + SiO_2 + K-2—Composite 3). The hydrolytic stability of modified UF composite was determined by measuring the mass loss and liberated formaldehyde concentration of modified UF composite after acid hydrolysis. Obtained results showed that hydrolytic stability of modified resins with coumarine derivates was enhanced.

Acknowledgement: Financial support for this study was granted by the Ministry of Educations, Science and Technological Development of the Republic of Serbia (Projects Numbers 45022 and 45020).

P.S.D.1.

Investigation of Adsorption of Copper Ions by Poplar Wood Sawdust and Lignin

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The adsorption is carried out in several steps. The slowest step is usually adsorbate diffusion from the surrounding fluid to the active binding sites. In this paper is investigated the influence of diffusion on copper ions adsorption by poplar wood sawdust and Kraft lignin. The adsorption was done with different amount of adsorbents, from model water with 0.8 mmol/l of copper ions, on pH 4, in different times. For impact analysis of diffusion, the Weber-Morris intraparticle diffusion model was used. It was found that lignin saturation was achieved for a much longer time (1.5-2 hours) in comparison to the saturation of poplar wood sawdust (10-30 minutes). The smaller diameter of the pores, and the nature of lignin, leads to the fact that the pore diffusion is the limiting factor for adsorption on that adsorbent, while this is not the case for poplar wood sawdust.

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P.S.D.2.

Friction and Aerodynamic Offset of Cup Anemometer

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A millions of cup anemometers are rotating all over the word monitoring the climate, air pollution, weather changes, wind energy potential, wind electricity production efficiency and everyday life conditions. As a reference instrument in wind industry, the cup anemometer is used for continuous monitoring of wind energy conversion efficiency during a wind plant life of 20 to 25 years. The on-line detection of the cup anemometer degradation is of primary importance. Nearly 170 years after the invention of the cup anemometer, a model that describes the relative contribution of friction and aerodynamic effects to the anemometer calibration curve offset does not exists. In this paper a new model of cup anemometer, the Angular Speed Decrement model (ASD), which allows for monitoring the anemometer friction characteristics was presented. This model was applied for calculation of the relative contribution of friction and aerodynamic effects to the offset of two types of NRG anemometers: NRG #40 and NRG class 1. The shaft of NRG #40 anemometer is made of fully hardened beryllium copper and bearing of self-lubricating modified Teflon. Based on calibration curve measured in a wind tunnel, the offset of NRG #40 calibration curve due to friction was calculated as 0.1637m/s. In case of NRG class 1 anemometer, the ball bearing was used and the offset due to friction was calculated as 0.0756 m/s. The calibration curve offset due to aerodynamic effect was found to be the same for both types of anemometers and equal 0.1173 m/s. The friction offset of NRG #40 is higher than the aerodynamic offset, which is opposite in case of NRG class 1 anemometer. The ASD model of a cup anemometer allows for separate analysis of friction and aerodynamic effects during on-line monitoring and the corresponding changes in industrial standards for wind speed measurements are to be made.

P.S.D.3.

Newer Methods of Waste Disposal from Thermal Power Plants

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Thermal power plants in Serbia generate large amounts of waste in the form of ash, which requires a large area for storage and preservation. Thus disposed waste can get practical value in the asphalt mix as replacement for sand, because its morphological structure is similar to sand. Rheological properties of asphalt mixtures obtained in this way were examined Marshall method. On the basis of the results of testing, it's confirmed the possibility of using the waste ash in asphalt, including the achievement of multiple benefits. Asphalt mix with the waste ash showed greater resistance to mechanical deformation. The results showed that the sand can be replaced by waste ash in the range of 30 % to 70 %, depending on the required characteristics of asphalt mix.

P.S.E.1.

Bone Cements Based on Calcium Phosphate-Magnesium Phosphate System with (Ca+Mg)/P = 2

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The bone calcium phosphate cements (CPCs) are used in orthopedics and dentistry to fill cavities, implant fixation and connecting tissue fragments. Injection of the magnesium ions in CPCs increases strength and rate of biodegradation of the materials. Magnesium-containing CPCs powders with phase compositions close to hydroxyapatite, tricalcium phosphate and trimagnesium phosphate with the mass ratio (Ca+Mg)/P=1,5-1,7 are known. We proposed the development of the bone cements in the calcium phosphate – magnesium phosphate system by the formation of materials with a larger cation-anion ratio as (Ca+Mg)/P=2. Thus, a series of samples of the apatite cement (0, 10, 20 wt.% magnesium) occurred a slight increase of strength with magnesium content growth. The most high strength showed cements which were obtained from materials with substitution by magnesium as 40 wt.%, - up to 40 MPa.

P.S.E.2.

Synthesis, Characterization and Antimicrobial Activity of Ni(II) Complexes with Condensation Product of 2-(Diphenylphosphino)Benzaldehyde and Girard's T Reagent

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Square-planar chlorido ([NiLCl]BF_4) and isocyanato ([NiL(NCO)]BF_4) complexes of Ni(II) with tridentate PNO condensation product of 2-(diphenylphosphino)benzaldehyde and Girard's T reagent (HL) have been synthesized and their structures were determined by X-ray crystal analysis. Antimicrobial activity of the newly synthesized Ni(II) complexes ([NiLCl]BF_4 and [NiL(NCO)]BF_4) as well as three previously synthesized related complexes ([NiL(NCS)]BF_4, [NiL(NCS)]SCN and [NiHL$(NCS)_3$]) with condensation product of 2-(diphenylphosphino)benzaldehyde and Girard's T reagent and three different monodentates i.e. chloride, cyanate and thiocyanate has been investigated. The ligand (HL) and Ni(II) complexes were found to be active not only against laboratory control strains of bacteria and yeast, but also on clinical isolates of E. coli and P. aeruginosa strains resistant to most clinically used antibiotics.

P.S.E.3.

Crosslinked Electrospun Chitosan/PEO Nanofibers for Wound Healing Application

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Electrospun nanofibers of chitosan/PEO were produced in both, single nozzle and core-shell setup. Chitosan was dissolved in 10 % citric acid. Use of citric acid enabled crosslinking and produced prolonged stability of prepared mats. Crosslinking was performed by simple heating and temperature increase for crosslinking was observed. This kind of crosslinking enabled stability of scaffold, but significantly reduced antimicrobial properties of chitosan. Immersing nanofiber mats into antiseptic solution provided reestablishment of antimicrobial properties. Drug release of prepared chitosan/PEO blend and core-shell PEO-chitosan nanofibers was evaluated. This investigation promotes possibility of producing stable nanofiber scaffolds for wound healing by simple method without using any toxic crosslinking agents.

P.S.E.4.

Development of Multifunctional Oxaprozin/Poly(2-hydroxypropyl Acrylate/itaconic Acid) Delivery System

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Series of novel dual-sensitive poly(2-hydroxypropyl acrylate/itaconic acid) P(HPA/IA) hydrogels were designed as multifunctional drug delivery system which can provide several advantages including drug protection, self-regulated oscillatory release and targeted delivery to a single entity. The hydrogels were synthesized by the free-radical crosslinking copolymerization and evaluated as carriers for hydrophobic drug, Oxaprozin, with specific controlled release properties. Structural, morphological, surface charge, swelling and antimicrobial properties of the hydrogels were investigated for unloaded and Oxaprozin-loaded samples. Swelling studies demonstrated pH- and temperature-sensitivity of drug-free and drug-loaded P(HPA/IA) hydrogels. The results of swelling and oscillatory swelling, and swelling behavior of drug-free, and drug-loaded hydrogels in simulated gastrointestinal conditions, and in vitro Oxaprozin release studies confirmed these hydrogels as a highly effective colon-specific drug delivery system with excellent performance of long-term controlled release. These unique properties make the P(HPA/IA) hydrogels highly attractive materials for developing multifunctional drug delivery systems.

P.S.E.5.

The Influence of Gradient Copolymerisation Poly(oligo(propylene glycol) Methacrylate) Hydrogels with 2-hydroxyethyl Methacrylate on Thermoresponsive Properties

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Gamma radiation was used to prepare copolymer libraries based on oligo(propylene glycol) methacrylate (OPGMA) and 2-hydroxyethyl methacrylate (HEMA); a complete screening in composition of P(OPGMA/HEMA) copolymers was elaborated from 0 to 100% of OPGMA. Determination of gel fraction was performed as a first step after radiation induced synthesis. Tuning of the volume phase transition temperature (VPTT) of P(OPGMA/HEMA) copolymeric hydrogels was investigated by swelling study; the swelling properties were preliminary investigated over the wide pH (2.2-9.0) and temperature (4-80°C) ranges. It has been observed that P(OPGMA/HEMA) hydrogels followed a simple rule in their thermoresponsive behaviour showing a linear increase in VPTT with a decreasing wt% of OPGMA in the copolymer composition. Additional characterisation of the structure and properties was conducted by FTIR, DSC and UV-Vis spectroscopy. All results indicate that new P(OPGMA/HEMA) copolymeric hydrogels have wide diversity in thermoresponsive properties which strongly depend on their composition.

P.S.E.6.

Evaluation of Nano-Particulate Bioactive-Glass Reinforced Gellan-Gum Hydrogel Regarding the Formation of Hydroxyapatite under Shear Stress

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In this study we have investigated properties of gellan gum spongy-like scaffolds reinforced with nano-particulate bioactive-glass, with composition of 70 n/n % SiO_2 and 30 n/n % CaO; under biomimetic conditions in perfusion bioreactors, imitating physiological conditions in bone. The samples were 2 % w/w gellan gum discs (10 mm diameter, 5 mm thick) with 2 % w/w bioactive-glass while 2 % w/w gellan gum samples served as a control. Each sample was placed in a separate bioreactor cartridge and perfused with simulated body fluid (pH 7.4) at flow rate of 1.13 ml/min. Over 14 days of perfusion, degradation rates were monitored by measurements of sample weights, while hydroxyapatite formation was examined at the end of experiments by FEG-SEM, EDS and XRD analyses. In addition, flow patterns in the bioreactors were examined by tracer experiments and residence time distribution analysis. Based on the obtained results, an attempt was made to relate hydroxyapatite formation and distribution within gellan gum samples to the surrounding hydrodynamic conditions.

P.S.E.7.

Formation Mechanism of Biocompatible Fluoride Conversion Coating on AZ31 Magnesium Alloy

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Magnesium alloys are characterized by high strength to weight ratio and vibration absorbance, but the main disadvantage, llimiting their usage in engineering and medical fields, is magnesium high corrosion rate. Several methods were developed to improve corrosion resistivity of magnesium alloys. This study focuses on improving corrosion resistance of AZ31 magnesium alloy for biomedical applications by conversion coating.

Biocompatible fluoride conversion coating was prepared by immersion of AZ31 magnesium alloy in molten $Na[BF_4]$ salt kept at 693 K. Dependence of conversion coating growth on immersion time was evaluated, focusing on the coating thickness and compactness. Mechanism of fluoride conversion coating forming was studied in air-free atmosphere. The experiments were carried out to determine if the coating formation was controlled by diffusion or by chemical reaction of the magnesium alloy and the melt. Diffusion process seems to be controlling the coating formation. It was shown that oxidizing agent in this process is boron which is reduced from BIII to B0.

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P.S.E.8.

Squeeze Cast AZ31 Magnesium Alloy Long Term Degradation Analysis in Hanks' Solutions

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Magnesium alloys with a low specific weight, relatively high specific strength and damping capacity are considered as perspective biodegradable materials for implants. The rate of degradation significantly influences their using for various biomedical applications. In this work, the long term degradation behavior of AZ31 magnesium alloy prepared by squeeze casting method was investigated to determine its performance in a physiological environment which was simulated by two different Hanks' balanced salt solutions (HBSS) without and with Ca, Mg. The immersion test was used for study of degradation behavior of AZ31 magnesium alloy during exposition time in range of 0-1000 hours. The degradation rate after immersion in Hanks' solutions was calculated from the weight loss, and chemical compositions of degradation products were determined and examined via atomic spectroscopy; change of pH during degradation process was also determined in HBSS. The degradation of samples of AZ31 magnesium alloy was identified using SEM.

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P.S.E.9.

Influence of Coefficient of Friction and Contact Area on Prostheses-Implant Retention Force

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In dentistry, for purposes of attaching and stabilizing the total prostheses in patients with no teeth, implants of different dimensions are used. Long term performance of total prostheses is in terms of stability crucial for these patients. Retention (i.e. holding force) might decrease through intensive usage causing prostheses falling down and poor performance. Influence of coefficient of friction and contact area on retention force is investigated through combined optical and numerical methods with the analysis of the prostheses-implant contact. This investigation confirmed that coefficient of friction and contact area have significant influence on retention force as well as long term performance of total prostheses.

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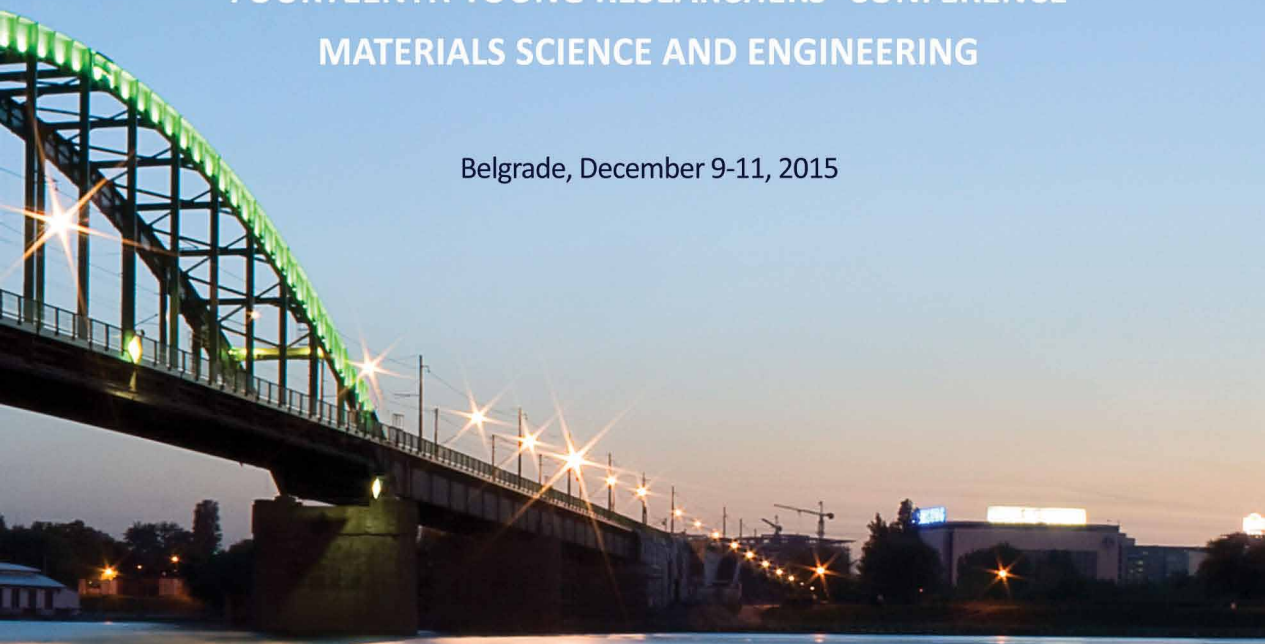

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