Sixteenth Annual Conference

YUCOMAT 2014

Hunguest Hotel Sun Resort Herceg Novi, Montenegro, September 1–5, 2014

PROGRAMME & THE BOOK OF ABSTRACTS

Organised by

MATERIALS RESEARCH SOCIETY OF SERBIA

endorsed by

FEDERATION OF EUROPEAN MATERIALS SOCIETIES (FEMS)

MATERIALS RESEARCH SOCIETY (MRS)

SIXTEENTH ANNUAL CONFERENCE

YUCOMAT 2014

Hunguest Hotel Sun Resort Herceg Novi, Montenegro,
September 1-5, 2014
http://www.mrs-serbia.org.rs

Programme
and
The Book of Abstracts

Organised by:
Materials Research Society of Serbia

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

Title: THE SIXTEENTH ANNUAL CONFERENCE
YUCOMAT 2014
Programme and The Book of Abstracts

Publisher: Materials Research Society of Serbia
Knez Mihailova 35/IV, 11000 Belgrade, Serbia
Phone: +381 11 2185-437; Fax: + 381 11 2185-263
http://www.mrs-serbia.org.rs

Editors: Prof. Dr. Dragan P. Uskoković and Prof. Dr. Velimir Radmilović

Technical editor: Aleksandra Stojičić

Cover page: Aleksandra Stojičić and Milica Ševkušić
Back cover photo: Author: Rudolf Getel
Source: Flickr (www.flickr.com/photos/rudolfgetel/4280176487)

Acknowledgments: This conference is held in honour of Prof. Dragan Uskoković's 70th birthday.

Printed in: Biro Konto
Sutorina bb, Igalo – Herceg Novi, Montenegro
Phones: +382-31-670123, 670025, E-mail: bkonto@t-com.me
Circulation: 220 copies. The end of printing: August 2014

TABLE OF CONTENTS

WELCOME SPEECH BY THE PRESIDENT OF MRS-SERBIA

My Esteemed Colleagues,

Welcome to the 16th YUCOMAT! Here we are, once again, in the beautiful coastal town of Herceg-Novi, to celebrate everything new that materials science has to offer. As I repeat year after year, a scenery as inspiring for the soul and rejuvenating for the body as this needs only a materials science conference to become officially a Paradise. Telling you about the fulfillment that lifetime in science brings to one would, of course, be preaching to the converted, but this is what the mission of YUCOMAT has been from the very first time it was held, in 1995, in a different venue in this same Montenegrin town and in very different conditions, with war raging on the other side of the mountains towering over this coast: to inspire the new generations to discover in materials science enjoyment that is larger than life, to humble their restless spirits and continue to walk in the footsteps of us, their academic forebears, who have gone through prosperous and harsh times alike in search of the way to do this science that is so dear to our hearts with excellence.

Please allow me to start off by mentioning a few dry numbers that illustrate the status of this year's conference. The number of participants is not significantly different from that in the previous years. Out of more than 210 submitted presentations, 69 will be made orally and the rest as posters. 27 oral presentations will be invited lectures given by the world-renowned experts in the field. The conference participants this year come from 35 different countries of the world. Works presented by scientists affiliated with Serbian scientific institutions logically comprise the majority of presentations: ~ 25 %. A great deal of presentations is given by our Russian colleagues: ~ 20 %. A plenty of guests are joining us from Slovakia, Slovenia, Poland, Austria, Czech Republic and other European Union countries, to the participants from which our doors are, of course, always open.

Securing sponsors and other support for YUCOMAT has turned into a strenuous effort as the result of the economic turmoil that hit the country hard in the previous years and various other factors. Science in Serbia has been pushed to the margins for a very long time now and the healing of this negative trend does not seem to be coming any time soon. The state funding has been flat for decades now at the level of 0.3 % of GDP (i.e., 15 – 20 euros per capita per annum), which is nowhere near 3 – 5 % of GDP that typifies the developed countries of the world. What is more, an average scientist working in a Serbian institution is also disconnected from various nongovernmental, private or charitable funding sources, let alone from crowdsourcing or other innovative ways of funding research that are available to his/her colleagues in the West. At the MRS Conference held this past spring in San Francisco, the central award, given incidentally to one of the participants of this year's YUCOMAT, bore the name of a late materials scientist who had established a philanthropic foundation in his mid-seventies and since then donated hundreds of millions of dollars for the advancement of science that benefits humanity. In spite of his personal welfare, a prominent businessman already in his eighties, he would be travelling exclusively in second-class train cars, believing that "contributing to advancing science is more important than making a marginal improvement in personal comfort" (*MRS Bulletin, Vol. 39, March 2014, pp. 285*). Although there are many prominent people in Serbia who have become exceptionally wealthy since the country transitioned to free market economy, nil incentives are found amongst them to share the way of thinking that typified this late philanthropist, let alone donate only a small portion of their fortune for the benefit of Serbian science.

In spite of the miserably low funding of science in Serbia, the recent statistical studies demonstrate that Serbia as a country ranks 44th in terms of the total number of publications from the field of nanoscience. The ability to arrive at valuable experimental or theoretical findings with little resources is the key to inventiveness and this trait can certainly be ascribed to a decent percentage of elite Serbian scientists. But a far bigger problem lurks here: namely, despite a decent number of publications on nanoscience, not a single patent or a marketable product in this field exist in Serbia, illustrating a catastrophic trend of complete disconnectedness of scientific productivity from the applicative domain. And this miniscule application potential of scientific findings on the current socioeconomic grounds does not only justify the wonky political argument in favor of the continued low funding of science, but it also distances the average citizen from the communal needs for science and, in turn, from the needs of the scientific community. It is clear now that the magic triangle, whose edges are represented by the numbers and the quality of publications, patents and products, respectively, has to be balanced lest a society experience a major dysfunction in its progress. When it comes to developing countries, creating this stable triad and maintaining it must be an imperative like no other.

Here, at YUCOMAT, we also continue to reflect the global expansion of the interest of the materials science community to contribute to the biomedical field. It has been a while since the human body has become the major target of investment and much is expected from materials scientists when it comes to improving the quality of healthcare. Many medical treatments have been in use, unchanged, for decades, yet the current research in the biomaterials field offers great prospect for improving or completely reinventing these traditional therapeutic methods. At the same time, however, we should not cease to keep in mind the risks born by every multidisciplinary research. The most critical one is, of course, the dilution of the quality of individual fields joined around it. Specifically, by necessitating the fluency in both materials science and life science, there is a risk that the materials science excellence might degrade over time. And remember, our role here, aside from having a good time, making friends and potential future collaborators is to strengthen each other’s science. Therefore, if time for questions after each talk is insufficient, do not hesitate to approach your fellow colleagues and ask them about a thing or two that you have found interesting or problematic during their talks. At the end of the day, there is no room for ego in the genuine way of doing science. Science, as a matter of fact, is an ideal route to liberation from it. Maintaining this pure and, I am free to say, romantic way of doing science is ever more a challenge in the modern academic world wherein egos are often inflated beyond proportion and wherein a sense of individual prestige and personal financial benefits increasingly play a central role in day-by-day decisions made by scientists, corrupting their dedication to the profession. Despite all of this, it has been the mission of us, the organizers of YUCOMAT, to maintain materials science in this pure state in which the benefits of the individual do never eclipse those of the community.

Finally, I am flattered by the decision of the Members of the Executive Board to dedicate this year’s conference to myself for the occasion of my 70th birthday. Although I have managed and overseen every single organizational aspect of this conference since its inception almost twenty years ago, an invaluable credit must go to other members of the materials science community of Serbia, particularly those who have been with us from the first YUCOMAT as well as to members of the International Advisory Committee, the Presidential Board and the Conference Organizing Committee. An immense credit goes to the members of my research team too, which have provided us with precious technical assistance throughout all these years. Last but not least, there is Ms. Aleksandra Stojičić, known to most of you as Sasha, who has been nothing short of impeccable in executing administrative tasks.

I would also like to use this opportunity to remind you that our next YUCOMAT will be the 20-year anniversary conference for which we expect a superb lineup of speakers and other participants. This is an advanced call to plan on joining us at this very same place in 2015.

Wishing you a pleasant stay in Herceg-Novi and many rewarding moments at this year’s YUCOMAT,

Cordially Yours,

Dragan Uskoković,

President of MRS-Serbia

MRS-Serbia

International Advisory Board

Chair: Robert Sinclair (USA)
Members: Fritz Aldinger (Germany), Rostislav A. Andrievski (Russia), Aline Auroux (France), Xavier Batlle (Spain), Serena Best (UK), Ivan Božović (USA), Philippe Colomban (France), Uli Dahmen (USA), Miha Drofenik (Slovenia), Mauro Ferrari (USA), László Forró (Switzerland), Yury Gogotsi (USA), Horst Hahn (Germany), Paul Harrison (UK), Felix T. Hong (USA), Robert Hull (USA), Wolfgang Jaeger (Germany), Josè M. Kenny (Italy), Alexander H. King (USA), Feng-Huei Lin (Taiwan), Toshiaki Makabe (Japan), Egon Matijević (USA), Amelia Montone (Italy), Eva Olsson (Sweden), Eiji Osawa (Japan), Davor Pavuna (Switzerland), Doug Perovic (Canada), Zoran S. Petrović (USA), Robert Ritchie (USA), Peter Franz Rogl (Austria), Frances Ross (USA), Richard W. Siegel (USA), Mamoru Senna (Japan), Valeriy V. Skorohod (Ukraine), Danilo Suvorov (Slovenia), Enrico Traversa (Italy), Vuk Uskoković (USA), Jose A. Varela (Brazil), Gordana Vunjak Novaković (USA), Jackie Ying (Singapore)

Conference Organising Committee

Chairperson: Mira Vukčević
Members: Nikola Cvjetićanin, Kemal Delijić, Dragana Jugović, Smilja Marković, Branko Matović, Jovan Mirković, Nebojša Mitrović, Željka Nikitović, Nebojša Romčević, Edin Suljovrujić, Ljiljana Živković
Conference Secretary: Aleksandra Stojičić

Conference Technical Committee

Milica Ševkušić, Zoran Stojanović, Miodrag Lukić, Ana Stanković, Maja Kuzmanović, Nenad Filipović, Miloš Milović, Ljiljana Veselinović

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 September 1-5, 2014, at the Hunguest Hotel Sun Resort, in Herceg Novi, Montenegro. Participants will also be accommodated there. The conference will begin on Monday, September 1st, at 09.00 and end on Friday, September 5th, 2014, 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 31, Monday, September 1, and Tuesday, September 2, 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 memo-stick, should be given at registration.

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 31, 2014

08^{00}-19^{00}	**Registration**

Monday, September 1, 2014

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

Tuesday, September 2, 2014

09^{00}-12^{00}	**Second Plenary Session**
15^{00}-18^{45}	**Symposium C, Conference Hall**
15^{00}-16^{45}	**Symposium E, Small Hall**
20^{00}-22^{00}	**Poster Session I** (Symposium A)

Wednesday, September 3, 2014

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

Thursday, September 4, 2014

09^{00}-12^{00}	**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 5, 2014

09^{00}-12^{00}	**Fifth Plenary Session**
12^{00}-12^{30}	**Awards and Closing of the Conference**

FIRST PLENARY SESSION

Monday, September 1, 2014

Session I: 09^{30}-13^{00}
Chairmen: Robert Sinclair and Velimir Radmilović

09^{30}-10^{00} **TISSUE REGENERATION BY HUMAN STEM CELLS ON BIOLOGICAL SCAFFOLDS**
Gordana Vunjak-Novakovic
Laboratory for Stem Cells and Tissue Engineering, Columbia University, New York, NY, USA

10^{00}-10^{30} **CHARACTERIZING NANOBIO CONJUGATES**
Richard W. Siegel
Rensselaer Nanotechnology Center and Materials Science and Engineering Department, Rensselaer Polytechnic Institute, Troy, New York, USA

10^{30}-11^{00} **AN UP-DATE ON NANOPARTICLE RESEARCH FOR POSSIBLE MEDICAL APPLICATIONS**
Robert Sinclair, Paul J. Kempen, Ai Leen Koh, Richard Chin, Steven J. Madsen
Department of Materials Science and Engineering, Stanford University, Stanford, California, USA

Break: 11^{00}-11^{30}
Chairpersons: Gordana Vunjak-Novakovic and Richard W. Siegel

11^{30}-12^{00} **GROWTH AND PHYSICAL PROPERTIES OF $CH_3NH_3PbI_3$ PEROVSKITE**
László Forró
Laboratory of Physics of Complex Matter, Ecole Polytechnique Fédérale de Lausanne, Switzerland

12^{00}-12^{30} **THE ROLE OF GRAIN BOUNDARIES IN ENHANCING OXYGEN EXCHANGE**
Fritz B. Prinz
Department of Mechanical Engineering, Stanford University, Stanford, CA, USA; Department of Materials Science and Engineering, Stanford University, Stanford, CA, USA

12^{30}-13^{00} **FORMATION OF MONODISPERSE NANOPARTICLES IN SOLIDS**
C. Ophus[1], D.H. Moreno[2], A. Gautam[1], W. Bras[2], U. Dahmen[1], Velimir R. Radmilović[3]
[1]National Center for Electron Microscopy, Lawrence Berkeley National Lab, University of California, Berkeley, CA, USA, [2]Netherlands Organization for Scientific Research (NWO), DUBBLE@ESRF, BP220, Grenoble Cedex, France, [3]University of Belgrade, Faculty of Technology and Metallurgy, Nanotechnology and Functional Materials Lab, Belgrade, Serbia

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

SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

Conference Hall

Session I: 15^{00}-18^{30}
Chairmen: Slobodan Milonjić and Vuk Uskoković

15^{00}-15^{15} **SYNTHESIS AND PROPERTIES OF BULK TRANSPARENT COMPOSITE OF BARIUM HEXAFERRITE PLATELETS DISPERSED IN A PMMA MATRIX**
Miha Drofenik[1,2], Gregor Ferk[1], Peter Krajnc[1], Anton Hamler[3], Darja Lisjak[2]
[1]Faculty of Chemistry and Chemical Engineering, University of Maribor, Slovenia, [2]Department for Materials Synthesis, Jožef Stefan Institute, Ljubljana, Slovenia, [3]Faculty of Electrical Engineering and Computer Science, University of Maribor, Slovenia

15^{15}-15^{30} **ON THE APPLICABILITY OF MAXWELL RELATIONS IN SURFACE THERMODYNAMICS AND ELECTROCHEMISTRY**
Emmanuel M. Gutman
Ben-Gurion University of the Negev, Beer-Sheba, Israel

15^{30}-15^{45} **Li_2FeSiO_4 CATHODE MATERIAL: THE STRUCTURE AND ELECTROCHEMICAL PERFORMANCES**
Dragana Jugović[1], M. Milović[1], M. Mitrić[2], V. N. Ivanovski[2], M. Avdeev[3], B. Jokić[4], R. Dominko[5], D. Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia, [3]Bragg Institute, Australian Nuclear Science and Technology Organisation, Locked Bag 2001, Kirrawee DC, NSW, Australia, [4]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [5]Laboratory for Materials Electrochemistry, National Institute of Chemistry, Ljubljana, Slovenia

15^{45}-16^{00} **RHEED STUDY OF THE EARLY STAGES OF OXIDE FILM FORMATION AND QUANTIFICATION OF THE GROWTH KINETICS**
Anatole N. Khodan[1], M.V. Sorokin[1], D.-G. Crete[2]
[1]National Research Center "Kurchatov Institute", Moscow, Russian Federation, [2]Unite Mixte de Physique C.N.R.S./THALES, Palaiseau, France

16^{00}-16^{15} **EFFICIENT SOLUTION COMBUSTION SYNTHESIS OF CERIA-BASED CATALYSTS FOR HYDROGEN PRODUCTION**
Georgeta Postole, Thanh-Son Nguyen, Patrick Gélin, Laurent Piccolo
Institut de Recherches sur la Catalyse et l'Environnement de Lyon (IRCELYON), CNRS & Université Lyon 1, Villeurbanne Cedex 9, France

16^{15}-16^{30} **AN ALCOHOL INFLUENCE ON MORPHOLOGY OF ZnO STRUCTURES PRECIPITATED FROM AQUEOUS-ALCOHOLIC SOLUTIONS**
Nataliya S. Nikolaeva, I.A. Blokhina
Siberian Federal University, Krasnoyarsk, Russia

16^{30}-16^{45} **KINETIC ANALYSIS OF THE TiB_2 CARBOTHERMAL SYNTHESIS**
Irina A. Blokhina, V.V. Ivanov, N.N. Nikolaeva
Siberian Federal University, Krasnoyarsk, Russia

16^{45}-17^{00} **NUMERICAL ANALYSIS OF RAPID SOLIDIFICATION PROCESS OF NiTi BINARY ALLOY**
Primoz Ternik[1], Matej Zadravec[2], Rebeka Rudolf[2], Milan Svetec[3]
[1]Ternik Primož-Private Researcher, Bresternica, Slovenia, [2]Faculty of Mechanical Engineering, Maribor, Slovenia, [3]Pomurska akademsko znanstvena unija, Murska Sobota, Slovenia

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

17^{30}-17^{45} **Al_2O_3/TiO_2 AND $Al_2O_3/TiO_2/WO_3$ MIXED OXIDE COATINGS: OPTIMIZATION OF PROCESSING PARAMETERS REGARDING PHOTOCATALYTICAL PROPERTIES**
N. Tadić[1], N. Radić[2], B. Grbić[2], Rastko Vasilić[1], S. Stojadinović[1]
[1]University of Belgrade, Faculty of Physics, Belgrade, Serbia, [2]University of Belgrade, Institute of Chemistry, Technology, and Metallurgy, Department of Catalysis and Chemical Engineering, Belgrade, Serbia

17^{45}-18^{00} **APPLYING RADIATION PROCESSING FOR OBTAINING HIGH-RESISTIVITY SILICON WITH IMPROVED CHARACTERISTICS**
Svetlana P. Kobeleva[1], I.M. Anfimov[1], N.A. Sobolev[2]
[1]National Technological University "MISiS", Moscow, Russia, [2]Universidade de Aveiro, Portugal

18⁰⁰-18¹⁵ **CAST NANO-STRUCTURED POLYMETALLIC HIGH ENTROPY ALLOYS AND COATINGS OF THEM BY CENTRIFUGAL SHS CASTING**
Vladimir Sanin, Denis Ikornikov, Dmitry Andreev, Vladimir Yukhvid
Institute of Structural Macrokinetics and Materials Science RAS, Chernogolovka, Moscow Region, Russia

18¹⁵-18³⁰ **INFLUENCE OF ALKALI ION ON THE PROPERTIES OF ALKALI ACTVATED SLAG**
Irena Nikolić[1], I. Janković-Častvan[2], V.V. Radmilović[2], Lj. Karanović[3], S. Mentus[4], V.R. Radmilović[2]
[1]University of Montenegro, Faculty of Metallurgy and Technology, Podgorica, Montenegro, [2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia, [3]University of Belgrade, Faculty of Mining and Geology, Laboratory of Crystallography, Belgrade, Serbia, [4]University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia

SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

Small Hall

Session I: 15⁰⁰-18¹⁵
Chairpersons: Milena Špírková and Bostjan Jančar

15⁰⁰-15¹⁵ **INTEGROWN THERMOELECTRIC LAYERED COBALTATES**
Bostjan Jančar[1], Damjan Vengust[1], Goran Dražić[1,2] Andreja Sestan[1], Danilo Suvorov[1]
[1]Jozef Stefan Institute, Ljubljana, Slovenia, [2]National Institute of Chemistry, Ljubljana, Slovenia

15^{15}-15^{30} **NOVEL THERMOELECTRIC SKUTTERUDITES IN THE SYSTEM Ni-Sn-Sb**

Werner Paschinger[1], G. Rogl[2], A. Grytsiv[2,3], P.F. Rogl[1,2] , E. Bauer[2,3], H. Michor[3], Ch. Eisenmenger-Sitter[3], E. Royanian[3], P.R. Heinrich[3], M. Zehetbauer[4], J. Horky[4], S. Puchegger[5], M. Reinecker[6], G. Giester[7], P. Broz[8], A. Bismarck[1,2]

[1]Institute of Physical Chemistry, University of Vienna, Vienna, Austria, [2]Christian Doppler Laboratory for Thermoelectricity, TU-Wien, Vienna, Austria, [3]Institute for Solid State Physics, TU-Wien, Vienna, Austria, [4]Research Group Physics of Nanostructured Materials, University of Vienna, Vienna, Austria, [5]Faculty Center for Nanostructure Research, University of Vienna, Vienna, Austria, [6]Research Group Physics of Nanostructured Materials, University of Vienna, Vienna, Austria, [7]Institute of Mineralogy and Crystallography, University of Vienna, Vienna, Austria, [8]Faculty of Science, Deparment of Chemistry, Masaryk University, Brno, Czech Republic

15^{30}-15^{45} **Yb-Pt-B AND RELATED SYSTEMS WITH Sc AND Y: PHASE EQUILIBRIA AND CRYSTAL STRUCTURE OF COMPOUNDS. A CONTRIBUTION TO THE STRUCTURAL CHEMISTRY OF THE BINARY PLATINUM BORIDES**

Oksana Sologub[1,2], P. Rogl[2], E. Bauer[1], L. Salamakha[1], B. Stöger[3], G. Giester[4], L. Bogun[5]

[1]Institute of Solid State Physics, Vienna University of Technology, Wien, Austria, [2]Institute of Physical Chemistry, University of Vienna, Wien, Austria, [3]Institute of Chemical Technologies and Analytics, Vienna University of Technology, Wien, Austria, [4]Institute of Mineralogy and Crystallography, University of Vienna, Wien, Austria, [5]Lviv Polytechnic National University, Lviv, Ukraine

15^{45}-16^{00} **ALL ALIPHATIC POLYCARBONATE-BASED POLYURETHANE ELASTOMERS CONTAINING DEGRADABLE UNITS**

Milena Špírková, Luďka Machová and Rafał Poręba

Institute of Macromolecular Chemistry AS CR, v.v.i., Prague, Czech Republic

16^{00}-16^{15} **SUPERPARAMAGNETIC γ-Fe_2O_3 NANOPARTICLES OBTAINED BY ONE-STAGE HYDROTHERMAL SYNTHESIS**

Mikhail G. Osmolowsky, O.M. Osmolowskaya, M.A. Kozlova, A.D. Furasova, I.V. Murin

Saint- Petersburg State University, Chemistry Department, St. Petersburg, Russia

16^{15}-16^{30} **SYNTHESIS AND CHARACTERISATION OF $La_{2-x}Sr_xCoO_4$ WITH PEROVSKITE-LIKE STRUCTURE**

Natalia P. Bobrysheva[1], A.A. Selutin[1], N.V. Dalakova[2]

[1]Saint-Petersburg State University Chemistry Department, St. Petersburg, Russia, [2]Verkin Institute for Low Temperature Physics and Engineering of National Academy of Sciences of Ukraine, Kharkov, Ukraine

16^{30}-16^{45} **A SEMI EMPIRICAL ANALYSIS OF MICROCRACKING IN AN AMORPHOUS POLYMER**
Mohamed Chabaat
Built & Environmental Research Lab., Civil Engineering Faculty, University of Sciences and Technology Houari Boumediene, B.P. 32 El-Alia, Bab-Ezzouar Algiers, Algeria

16^{45}-17^{00} **SOLIDIFICATION OF MELT SPUN HEUSLER ALLOYS**
Pavel Diko[1], V. Kavečanský[1], S. Piovarči[1], T. Ryba[2], R. Varga[2]
[1]Institute of Experimental Physics, Slovak Academy of Sciences, Košice, [2]Institute of Physics, UPJS Kosice, Košice, Slovak Republic

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

17^{30}-17^{45} **THE SYSTEM Ce-Zn-Si at <33.3 at.% Ce: PHASE EQUILIBRIA, CRYSTAL STRUCTURES, AND PHYSICAL PROPERTIES**
Fainan Failamani[1], A. Grytsiv[1], Z. Malik[1], P. Broz[2], G. Giester[3], P. Rogl[1], E. Bauer[4], W. Kautek[1]
[1]Institute of Physical Chemistry, University of Vienna, Vienna, Austria, [2]Masaryk University, Faculty of Science, Department of Chemistry, Brno, Czech Republic, [3]Institute of Mineralogy and Crystallography, University of Vienna, Vienna, Austria, [4]Institute of Solid State Physics, Vienna University of Technology, Vienna, Austria

17^{45}-18^{00} **REVERSIBLE RANDOM SEQUENTIAL ADSORPTION OF POLYDISPERSE MIXTURES ON A TRIANGULAR LATTICE**
Dijana Dujak[1], I. Lončarević[2], Lj. Budinski-Petković[2], A. Karač[3], S. B. Vrhovac[4]
[1]Faculty of Metallurgy and Materials, Zenica, Bosnia and Herzegovina, [2]Faculty of Technical Sciences, Novi Sad, Serbia, [3]Faculty of Mechanical Engineering, Zenica, Bosnia and Herzegovina, [4]Institute of Physics Belgrade, Zemun, Serbia

18^{00}-18^{15} **EXPERIENCE PRODUCTION OF MICROSPHERES FROM COAL SLAG AND THEIR APPLICATION FOR SORPTION OF URANIUM**
Tlek Ketegenov[1], A. Kononow[2], T. Oserov[1], O. Tyumenceva[1]
[1]National Engineering Academy of Republic Kazakhstan, [2]Institute of High Technology by the National Atomic Company “Kazatomprom”, Kazakhstan

SECOND PLENARY SESSION

Tuesday, September 2, 2014

Session II: 09^{00}-12^{30}
Chairmen: Robert Hull and Wolfgang Jäger

09^{00}-09^{30} **WATER AT INTERFACES: WETTING, STRUCTURE AND REACTIONS**
Miquel Salmeron
Lawrence Berkeley National Laboratory, University of California Berkeley, USA

09^{30}-10^{00} **TOWARDS THREE-DIMENSIONAL ELECTROSTATIC POTENTIAL AND MAGNETIC FIELD CHARACTERIZATION USING ELECTRON HOLOGRAPHY**
Rafal E. Dunin-Borkowski[1], Vadim Migunov[1], Jan Caron[1], András Kovács[1] and Giulio Pozzi[2]
[1]Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons and Peter Grünberg Institute, Forschungszentrum Jülich, Jülich, Germany, [2]Department of Physics and Astronomy, University of Bologna, Bologna, Italy

10^{00}-10^{30} **ELECTRON ENERGY LOSS SPECTRUM-IMAGING OF LOCALISED SURFACE PLASMON RESONANCES OF METAL NANOPARTICLES IN TWO AND THREE DIMENSIONS**
Paul A. Midgley, O. Nicoletti, S.M. Collins, F. de la Pena, T. Ostasevicius, D. Rossouw, E. Ringe, R.K. Leary, D. Holland, C. Ducati
Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, United Kingdom

Break: 10^{30}-11^{00}
Chairmen: Paul A. Midgley and Rafal E. Dunin-Borkowski

11^{00}-11^{30} **INVERSE SIMULATION OF DISLOCATION NETWORK GENERATION IN EPITAXIAL FILMS**
Robert Hull, Dustin Andersen and Hamed Parvaneh
Department of Materials Science and Engineering, Rensselaer Polytechnic Institute, Troy, NY, USA

11^{30}-12^{00} **ELECTRON VORTEX BEAMS – A NOVEL PROBE FOR NANOANALYTICS**
Peter Schattschneider
Institute of Solid State Physics and Service Centre for Electron Microscopy, Vienna University of Technology, Vienna, Austria

12^{00}-12^{30} **INTERFACE AND DEFECT PHENOMENA IN HIGH-EFFICIENCY SOLAR CELLS**
Wolfgang Jäger
Institute for Materials Science, Christian-Albrechts-University of Kiel, Kiel, Germany

Break: 12^{30}-15^{00}

SYMPOSIUM C: NANOSTRUCTURED MATERIALS

Conference Hall

Session I: 15^{00}-18^{45}
Chairpersons: Natalia V. Kamanina and Satoshi Ohara

15^{00}-15^{15} **NANO- AND BIOSTRUCTURIZATION PROCESS TO OPTIMIZE THE OPTICAL MATERIALS FEATURES**
Natalia V. Kamanina[1,2]
[1]Lab for Photophysics of Media with Nanoobjects, Vavilov State Optical Institute, St.- Petersburg, 199053, Russia, [2]Saint-Petersburg Electrotechical University (“LETI”), St. Petersburg

15^{15}-15^{30} **MECHANOCHEMICAL SYNTHESIS OF NANOCARBON AND METAL OXIDE NANOPARTICLES USING SUPER-HIGH-ENERGY BALL MILLING**
Satoshi Ohara, Zhenquan Tan, Kazuhiro Yamamoto, Nan Qiu, Takeshi Hashishin
Joining and Welding Research Institute, Osaka University, Ibaraki, Osaka, Japan

15^{30}-15^{45} **STRUCTURE AND PROPERTIES OF COPPER MATRIX COMPOSITES WITH GRAPHENE ADDITIONS**
Jan Dutkiewicz[1], Bogusz Kania[1], Piotr Dłużewski[2], Wojciech Maziarz[1]
[1]Institute of Metallurgy and Materials Science of the Polish Academy of Sciences Kraków, Poland, [2]Institute of Physics of the Polish Academy of Sciences, Warsaw, Poland

15^{45}-16^{00} **MYSTERIOUS STRUCTURES IN SDS-CONTAINING DISPERSIONS OF HEMATITE**
Edward Mączka, Marek Kosmulski
Lublin University of Technology, Lublin, Poland

16^{00}-16^{15} **TEMPLATE SYNTHESIS OF Mo_2C NANOWIRES AND SINGLE-PHASE δ_3 - MoN SUPERCONDUCTING NANOWIRES**
Aleš Mrzel, A. Kovič, Z. Jagličič, A. Jesih, J. Buh, D. Mihailović
Jožef Stefan Institute, Ljubljana, Slovenia

16^{15}-16^{30} **NOVEL MIXED PHASE SnO_2 NANORODS FOR ENHANCING GAS-SENSING PERFORMANCE TOWARDS ISOPROPANOL GAS**
Igor Djerdj, Marko Nuskol, Jasminka Popović
Division of Materials Physics, Ruđer Bošković Institute, Zagreb, Croatia

16^{30}-16^{45} **PHOTOCATALYTIC ACTIVITY OF ZnO-PEO COMPOSITES**
Smilja Marković, V. Rajić, A. Stanković, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

16^{45}-17^{00} **SYNTHESIS AND PROPERTIES OF MULTIFUNCTIONAL POLYMER COMPOSITES AND ORDERED ARRAYS OF NANOSTRUCTURES WITH PHOTOCHROMIC 3D METAL COMPLEXES**
Nataliya A. Sanina
Institute of Problems of Chemical Physics RAS, Chernogolovka, Russian Federation

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

17^{30}-17^{45} **SYNTHESIS AND APPLICATIONS OF CARBON NANOWALL FILMS**
Victor A. Krivchenko, K.V. Mironovich, P.V. Voronin, S.A. Evlashin
D.V. Skobeltsyn Institute of Nuclear Physics of M.V. Lomonosov Moscow State University, Moscow, Russia

17^{45}-18^{00} **ORDERED ARRAYS OF SINGLE PHOTON EMITTERS BASED ON GaN NANOWIRES HOSTING InGaN NANO-DISKS**
E. Chernysheva[1], Snežana Lazić[1], Ž. Gačević[2], S. Albert[2], A. Bengochea-Encabo[2], M. Müller[3], F. Bertram[3], J. Christen[3], H. van der Meulen[1], J. M. Calleja[1], E. Calleja[2]
[1]Departamento de Física de Materiales, Universidad Autónoma de Madrid, Madrid, Spain, [2]ISOM and Departamento de Ingeniería Electrónica, ETSI Telecomunicación, Universidad Politécnica de Madrid, Madrid, Spain, [3]Institute of Experimental Physics, Otto-von-Guericke-University Magdeburg, Magdeburg, Germany

18^{00}-18^{15} **OLEIC-ACID-COATED COBALT FERRITE NANOPARTICLES**
Sonja Jovanović[1], M. Spreitzer[1], M. Tramšek[2], Z. Trontelj[3], D. Suvorov[1]
[1]Advanced Materials Department, Jožef Stefan Institute, Ljubljana, Slovenia, [2]Department of Inorganic Chemistry and Technology, Jožef Stefan Institute, Ljubljana, Slovenia, [3]Institute of Mathematics, Physics and Mechanics, Ljubljana, Slovenia

18^{15}-18^{30} **THE EFFECT OF ULTRAFINE PARTICLES FORMED DURING AGING AND ULTRAFINE GRAIN STRUCTURE AFTER HIGH PRESSURE TORSION IN THE HARDENING OF THE Mg-Y-Gd-Zr ALLOY**
Elena A. Lukyanova[1,2], L.L. Rokhlin[1], S.V. Dobatkin[1,2], T.V. Dobatkina[1]
[1]A.A.Baikov Institute of Metallurgy and Materials Science, Russian Academy of Sciences, Moscow, Russia, [2]National Science and Technology University "MISIS", Laboratory of Hybrid Nanostructured Materials, Moscow, Russia

18^{30}-18^{45} **ENHANCEMENT OF COERCIVITY FOR Nd-Fe-B SINTERED MAGNETS**
Young Do Kim
Department of Materials Science and Engineering, Hanyang University, Seoul, Korea

SYMPOSIUM E: BIOMATERIALS

Small Hall

Session I: 15^{00}-16^{30}
Chairmen: Dejan Raković and Nenad Ignjatović

15^{00}-15^{15} **POLY (DL-LACTIDE-CO-GLYCOLIDE) NANOSPHERES WITH ENCAPSULATED SELENIUM NANOPARTICLES AS A SYSTEM WITH THERAPEUTIC FUNCTIONALITY**
Magdalena Stevanović[1], Jana Nunić[2], Jonghoon Choi[3], Miloš Filipović[4], Dragan Uskoković[1], Theodore Tsotakos[5], Eirini Fragogeorgi[5], Dimitris Psimadas[5], Lazaros Palamaris[5], George Loudos[5]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Department of Genetic Toxicology and Cancer Biology, National Institute of Biology, Ljubljana, Slovenia, [3]Center for Biomaterials, Biomedical Research Institute, Korea Institute of Science and Technology, Seoul, Republic of Korea, [4]Department of Chemistry and Pharmacy, University of Erlangen-Nuremberg, Erlangen, Germany, [5]Department of Biomedical Technology Engineering, Technological Educational Institute of Athens, Greece

15^{15}-15^{30} **EGGSHELL MEMBRANE BIOMATERIAL AS A PLATFORM FOR SYNTHESIS OF SEMICONDUCTOR NANOCRYSTALS**
Matej Baláž, Peter Baláž
Institute of Geotechnics, Slovak Academy of Sciences, Košice, Slovakia

15^{30}-15^{45} **THE SUCCESS RATE OF HYDROXYAPATITE NANOPARTICLES COATED WITH BIORESORBABLE POLYMERS IN A BIOLOGICAL ENVIRONMENT**

Nenad Ignjatović[1], Zorica Ajduković[2], Sanja Vranješ-Djurić[3], Dragan Uskoković[1]

[1]Centre for Fine Particles Processing and Nanotechnologies, Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Clinic of Stomatology, Department of Prosthodontics, Faculty of Medicine, University of Niš, Niš, Serbia, [3]Laboratory for radioisotopes, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

15^{45}-16^{00} **EVALUATION OF Ag/ALGINATE COLLOID SOLUTIONS REGARDING CYTOTOXICITY: *IN VITRO* AND *IN VIVO* STYDIES**

Jovana Zvicer[1], Lenart Girandon[2], Urška Potočar[2], Mirjam Fröhlich[2,5], Ivan Jančić[3], Biljana Bufan[3], Marina Milenković[3], Jasmina Stojkovska[4], Vesna Mišković-Stanković[1], Bojana Obradović[1]

[1]Faculty of Technology and Metallurgy, University of Belgrade, Serbia, [2]Educell LLC, Ljubljana, Slovenia, [3]Department of Microbiology and Immunology, Faculty of Pharmacy, University of Belgrade, Serbia, [4]KreativTeh LLC, Belgrade, Serbia, [5]Department of Biochemistry, Molecular and Structural Biology, Jožef Stefan Institute, Ljubljana, Slovenia

16^{00}-16^{15} **THE ROLE OF THE MORPHOLOGY AND STRUCTURAL CHARACTERISTICS ON THE SOLUBILITY OF VANADIUM PENTOXIDE- PLGA COMPOSITES**

Nemanja Aničić, Marija Vukomanović, Danilo Suvorov

Insitute Jožef Štefan, Ljubljana, Slovenia

16^{15}-16^{30} **PEGYLATED MAGNETIC NANOPARTICLES FOR BIOMEDICAL APPLICATIONS**

Romulus Tetean[1], Cristian Iacovita[2], Rares Stiufiuc[2], Sever Mican[1], Constantin Mihai Lucaciu[2]

[1]Babes-Bolyai University, Faculty of Physics, Cluj-Napoca, Romania,
[2]Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

16^{30}-16^{45} **ULTIMATE SOLUTIONS DEVELOPMENT IN ABERRATION CORRECTED ELECTRON MICROSCOPY APPLIED TO THE FIELD OF ADVANCED MATERIALS SCIENCE**

Dominique Delille

FEI Company, France

THIRD PLENARY SESSION

Wednesday, September 3, 2014

Session III: 09^{00}-12^{00}
Chairmen: László Forró and Werner Mader

09^{00}-09^{30} **THE SURFACE OF STRONTIUM TITANATE**
Laurence D. Marks
Department of Materials Science and Engineering, Northwestern University, Evanston, IL, USA

09^{30}-10^{00} **UNDERSTANDING THE ATOMIC STRUCTURE OF Li-ION SPINEL BATTERY CATHODES WITH ABERRATION-CORRECTED HAADF STEM**
C. Amos, J. Song, J. Goodenough, Paulo J. Ferreira
Materials Science and Engineering Program, The University of Texas at Austin, Austin, TX, USA

10^{00}-10^{30} **LAYERED OXIDE STRUCTURES AS TRANSPARENT ELECTRONICS**
Werner Mader, Simon Eichhorn
Institute for Inorganic Chemistry, University of Bonn, Bonn, Germany

Break: 10^{30}-11^{00}
Chairmen: Laurence D. Marks and Paulo J. Ferreira

11^{00}-11^{30} **MULTI-SCALE STUDY OF INTERCONNECT STRUCTURES FOR ADVANCED PACKAGING OF INTEGRATED CIRCUITS - CHALLENGES TO MICROSCOPY AND SAMPLE PREPARATION**
Ehrenfried Zschech[1,2], Sven Niese[1,3], Markus Löffler[2], Martin Gall[1], Reiner Dietsch[3]
[1]Fraunhofer Institute for Ceramic Technologies and Systems, Dresden, Germany, [2]Technical University Dresden, Dresden Center for Nanoanalysis, Dresden, Germany, [3]AXO GmbH, Dresden, Germany

11^{30}-12^{00} **THERMO-SENSITIVE HYDROGEL AS CELL CARRIER FOR NUCLEUS PULPOSUS REGENERATION**
Feng-Huei Lin
Institute of Biomedical Engineering, National Taiwan University, Taipei, Taiwan

FOURTH PLENARY SESSION

Thursday, September 4, 2014

Session IV: 09^{00}-12^{00}
Chairmen: Max Avdeev and Andrei Kanaev

09^{00}-09^{30} **HARMONIZATION OF MECHANICAL AND THERMAL PROCESSES FOR FUNCTIONAL OXIDE NANOPARTICLES VIA A SOLID STATE ROUTE**
Mamoru Senna
Faculty of Science and Technology, Keio University, Yokohama, Japan

09^{30}-10^{00} **RECENT ADVANCES IN PROCESSING OF MATERIALS BY ELECTRIC ASSISTED MECHANICAL MILLING: THE METHOD, DEVICE DESCRIPTION AND APPLICATIONS**
Andržej Čalka
University of Wollongong, Faculty of Engineering and Information Sciences, Wollongong, NSW, Australia

10^{00}-10^{30} **STABILITY OF NANOMATERIALS AT HIGH MECHANICAL ACTIONS**
Rostislav A. Andrievski
Institute of Problems of Chemical Physics, Russian Academy of Sciences, Chernogolovka, Moscow Region, Russia

Break: 10^{30}-11^{00}
Chairmen: Mamoru Senna and Rostislav A. Andrievski

11^{00}-11^{30} **CRYSTAL STRUCTURAL DATA MINING FOR NEW INSERTION HOSTS AND SOLID ELECTROLYTES**
Max Avdeev, Matthew Sale
Bragg Institute, Australian Nuclear Science and Technology Organisation, Lucas Heights, Australia

11^{30}-12^{00} **NANOPARTICULATE SOL-GEL BASED MATERIALS FOR PHOTOCATALYSIS AND PHOTONICS**
M. Amamra[1], M. Ben Amar[1], M. Traore[1], K. Chhor[1], L. Museur[2], Andrei Kanaev[1]
[1]Laboratoire des Sciences des Procédés et des Matériaux, CNRS, Université Paris 13, Sorbonne Paris Cité, Villetaneuse, France, [2]Laboratoire de Physique des Lasers CNRS, Université Paris 13, Sorbonne Paris Cité, Villetaneuse, France

FIFTH PLENARY SESSION

Friday, September 5, 2014

Session V: 09^{00}-12^{00}
Chairmen: Tom Diekwisch and Vuk Uskoković

09^{00}-09^{30} **SOFT MICROSCOPY FOR CHARACTERIZATION OF THE FUNCTIONAL MICROSTRUCTURE OF ADVANCED SOFT MATERIALS AND MATERIALS REQUIRING SOFT MICROSCOPY**
Eva Olsson
Department of Applied Physics, Chalmers University of Technology, Gothenburg, Sweden

09^{30}-10^{00} **PROCESSING AND APPLICATIONS OF MULTIFUNCTIONAL NANOSTRUCTURED POLYMERIC BIOMATERIALS**
José M. Kenny
Instituto de Ciencia y Tecnología de Polímeros, ICTP-CSIC, Juan de la Cierva, Madrid, Spain; Materials Engineering Center, UdR INSTM, University of Perugia, Terni, Italy

10^{00}-10^{30} **APPLICATIONS OF ENVIRONMENTAL (SCANNING) TRANSMISSION ELECTRON MICROSCOPY TO STUDY OXIDATION AND HYDROGENATION PHENOMENA IN NANOMATERIALS**
Ai Leen Koh
Stanford Nanocharacterization Laboratory, Stanford University, Stanford, California, USA

Break: 10^{30}-11^{00}
Chairpersons: Ai Leen Koh and José M. Kenny

11^{00}-11^{30} **MATERIALS DESIGN FOR PERIODONTAL REGENERATION**
Tom Diekwisch
UIC Department of Oral Biology, Chicago, USA

11^{30}-12^{00} ***SIMILIA SIMILIBUS CURANTUR*: BONE-MIMICKING COMPOSITES AS THE NEW GENERATION OF BONE REPLACEMENT MATERIALS**
Vuk Uskoković
Advanced Materials and Nanobiotechnology Laboratory, Department of Bioengineering, University of Illinois, Chicago, IL, USA

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

POSTER SESSION I

Tuesday, September 2, 2014, 20^{00}-22^{00}

SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

P.S.A.1. **THE INFLUENCE OF STRAIN RATE BETWEEN 10^{-3} - 10^{3} S^{-1} OF AUTOMOTIVE STEELS SHEETS**
Maria Mihaliková, M. Német
Department of Materials Science, Faculty of Metallurgy, Technical University of Košice, Slovak Republic

P.S.A.2. **THE FORMATION OF REFRACTORY CARBIDES IN THE TERNARY HETEROGENEOUS Me-C-F SYSTEMS**
Victor V. Lozanov[1], S.V. Sysoev[2], N.I. Baklanova[1]
[1]Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia [2]Nikolaev Institute of Inorganic Chemistry SB RAS, Novosibirsk, Russia

P.S.A.3. **STRUCTURE AND THERMAL PROPERTIES OF PYRIDOXAL THIOSEMICARBAZONE AND PYRIDOXAL ISOTHIOSEMICARBAZONE BASED COPPER(II) COMPLEXES**
Marko V. Rodić[1], Berta Barta Holló[1], Ljiljana S. Vojinović-Ješić[1], Sonja A. Ivković[2], Vukadin M. Leovac[1], Katalin Mészáros Szécsényi[1]
[1]Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia, [2]Faculty of Environmental Protection, University EDUCONS, Sremska Kamenica, Serbia

P.S.A.4. **SYNTHESIS AND STRUCTURE OF THE FIRST ZINC(II) COMPOUND CONTAINING PYRIDOXALAMINOGUANIDINE**
Mirjana M. Radanović, Ljiljana S. Vojinović-Ješić, Vukadin M. Leovac
Faculty of Sciences, Novi Sad, Serbia

P.S.A.5. **LANTHANIDE (III) POLYOXOMETALATES: SYNTHESIS, STRUCTURE AND PROPERTIES**
Doina Humelnicu[1], Mihail Liviu Craus[2], Nicoleta Cornei[1], Ionel Humelnicu[1]
[1]Faculty of Chemistry, "Al. I. Cuza" University, Iasi, Romania, [2]Frank Laboratory for Neutron Physics (FLNP), Dubna, Rusia

P.S.A.6. **BARIUM CERATE PREPARED BY OXALATE COPRECIPITATION**
Renata Verbová, V. Kavečanský, S. Piovarči, V. Antal, P. Diko
Institute of Experimental Physics, Slovak Academy of Sciences, Kosice, Slovak Republic

P.S.A.7. **INFLUENCE OF DIFERENT POISSON'S COEFFICIENTS OF ADHERENTS ON STRESS DISTRIBUTION IN THE CASE OF STEP COMPOSITE JOINT**
Abdurrahman O. Houssein
Al jabel Algharbi university, Dean of Faculty of engineering - Jadoo, Libya

P.S.A.8. **SYNTHESIS OF $LiFePO_4$ BY MECHANICAL STRESSING AND THERMAL ANNEALING**
Miloš Milović[1], D. Jugović[1], M. Mitrić[2], N. Cvjetićanin[3], A. Mraković[2], M. Senna[4], D. 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]Faculty of Science and Technology, Keio University, Kohoku-ku, Yokohama, Japan

P.S.A.9. **TALLOIL DIETHYLENETRIAMINE IMIDAZOLINE AS A CORROSION INHIBITOR FOR MILD STEEL IN CHLORIDE SOLUTION SATURATED WITH CARBON DIOXIDE**
Ivana Jevremović[1], Marc Singer[2], Srđan 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.10. **THE HYDROTHERMAL SYNTHESIS OF 1D BIOMEDICAL HYDROXYAPATITE NANOSTRUCTURES**
Zoran Stojanović[1], Ljiljana Veselinović[1], Nenad Ignjatović[1], Miroslav Miljković[2], Dragan Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Laboratory for Electronic Microscopy, Faculty of Medicine, University of Nis, Niš, Serbia

P.S.A.11. **MECHANOCHEMICAL SYNTHESIS OF $ZnO:SnO_2$ MATERIAL AS A POTENTIAL PHOTOCATALYSTS**
Ana Stanković, S. Marković, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

P.S.A.12. **GEL COMBUSTION SYNTHESIS OF $NaTi_2(PO_4)_3/C$ COMPOSITE, SUITABLE TO BE ANODE OF AQUEOUS SODIUM-ION BATTERY**
Milica Vujković[1], M. Mitrić[2], S. Mentus[1,3]
[1]University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia, [2]The Vinča Institute for Nuclear Sciences, Laboratory for Theoretical and Condensed Matter Physics, Vinča, Belgrade, Serbia, [3]Serbian Academy of Science and Arts, Belgrade, Serbia

P.S.A.13. **HYDROXYAPATITE SINTERING IN THE PRESENCE OF $LiFePO_4$**
Miodrag J. Lukić, M. Kuzmanović, Lj. Veselinović, S. Marković, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

P.S.A.14. **SYNTHESIS OF $LiFePO_4$/C COMPOSITES FROM CELLULOSE GEL**
Maja Kuzmanović[1], D. Jugović[1], M. Mitrić[2], B. Jokić[3], N. Cvjetićanin[4], D. Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]The Vinča Institute of Nuclear Science, University of Belgrade, Belgrade, Serbia, [3]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [4]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia

P.S.A.15. **STRUCTURAL INVESTIGATION OF $CaCu_3B_4O_{12}$ (B = Ti, Ru)**
Ljiljana Veselinović[1], S. Marković[1], M. Lukić[1], L. Mančić[1], S.D. Škapin[2], M. Mitrić[3], D. Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Jožef Stefan Institute, Ljubljana, Slovenia, [3]Institute of Nuclear Sciences Vinča, University of Belgrade, Belgrade, Serbia

P.S.A.16. **PLATINUM NANOPARTICLES PREPARED BY WATER IN OIL MICROEMULSION METHOD**
Mila N. Krstajić[1], Sanja I. Stevanović[1], Dušan V. Tripković[1], Jelena R. Rogan[2], Nedeljko V. Krstajić[2], Snežana Lj. Gojković[2], Vladislava M. Jovanović[1]
[1]Department of Electrochemistry, ICTM, University of Belgrade, Serbia
[2]Faculty of Technology and Metallurgy, University of Belgrade, Serbia

P.S.A.17. **SINTERING OF CORDIERITE IN THE PRESENCE OF MoO_3 AND CRYSTALLIZATION ANALYSIS**
N. Djordjević[1], N. Obradović[2], Darko Kosanović[2], M. Mitrić[3], V. Pavlović[2]
[1]Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Institute of Nuclear Sciences Vinča, University of Belgrade, Belgrade, Serbia

P.S.A.18. **DETECTION OF CUP ANEMOMETER FRICTION TORQUE CHANGE IN CASE OF SELF LUBRICATED SLEEVE BEARING AND BALL BEARING**
Miodrag Zlatanović, Ivan Popović
School of Electrical Engineering, University of Belgrade, Serbia

P.S.A.19. **MAGNETIC PROPERTIES OF MnZn FERRITE FOR MICROELECTRONIC APPLICATION**
Nebojša Mitrović[1], Slobodan Djukić[1], Aleksandra Kalezić -Glišović[1], Sanja Aleksić[2], Maja Kićanović[1], Obrad Aleksić[3]
[1]Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia, [2]Faculty of Electronic Engineering, University of Niš, Serbia, [3]Institute for Multidisciplinary Research, University of Belgrade, Serbia

P.S.A.20. **FACILE CHEMICAL SYNTHESIS AND CHARACTERIZATION OF POLYESTER/MAGNESIUM OXIDE NANOPARTICLES FOR BIOMEDICAL APLICATION**
Nenad Filipović[1], Magdalena Stevanović[1], Jelena Djurdjević[1], Jadranka Milikić[2], Ljiljana Veselinović[1], Vladimir Pavlović[1,3], Dragan Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, [3]Faculty of Agriculture, University of Belgrade, Belgrade, Serbia

P.S.A.21. **RADIATION-INDUCED SYNTHESIS AND PROPERTIES OF POLY(OLIGO(PROPYLENE GLYCOL) METHACRYLATE) HYDROGELS**
Edin Suljovrujić, D. Miličević, M. Mićić
Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

P.S.A.22. **THE BREATH ANALYSIS AS A NON-INVASIVE DIAGNOSTICAL METHOD FOR DIABETES TYPE 2**
Mirjana Perišić[1], Marija Todorović[1], Željka Nikitović[1], Aleksandra Jotić[2], Sandra Aleksić[3]
[1]Institute of Physics, University of Belgrade, Belgrade, Serbia, [2]Institute of Endocrinology, Faculty of Medicine, Univesity of Belgrade, Belgrade, Serbia, 3Rutgers University New Jersey Medical School, USA

P.S.A.23. **NANOMECHANICAL AND STRUCTURAL CHARACTERIZATION OF POLY (ETHYLENE OXIDE)/KERATIN BLEND FILMS REINFORCED WITH FUNCTIONALIZED GRAPHENE**
Mirjana Grković[1], D. Stojanović[2], A. Kojović[2], I. Balać[3], T. Kreže[4], S. Strnad[4], R. Aleksić[2], P.S. Uskoković[2]
[1]Innovation centre, Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [3]The Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia, [4]Faculty of Mechanical Engineering, University of Maribor, Slovenia

P.S.A.24. **SYNTHESIS OF $ZrGeO_4$ AND $HfGeO_4$ BY DIFFERENT ROUTES**
Aleksei Utkin, V. Prokip, N. Baklanova
Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia

P.S.A.25. **PREPARATION AND CHARACTERIZATION OF THE NANOSTRUCTURED LAYERED TRANSITION METAL CHALCOGENIDES THROUGH THEIR COLLOIDAL DISPERSIONS**
Vladimir E. Fedorov, Sofya B. Artemkina, Mariia N. Kozlova, Yu.V. Mironov
Nikolaev Institute of Inorganic Chemistry, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russian Federation

P.S.A.26. **THE INFLUENCE OF SILICA NANOPARTICLES MODIFICATION ON THE PROPERTIES OF COMPOSITES FOR ENVIRONMENTALLY-FRIENDLY TIRES**

Nada Lazić[1], Tamara Erceg[1], Milenko Plavšić[2], Jelena Pavličević[1], Jaroslava Budinski-Simendić[1], Nevena Vukić[1], Radmila Radičević[1], Borislav Simendić[3]
[1]University of Novi Sad, Faculty of Technology, Novi Sad, Serbia, [2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia, [3]Higher Education Technical School of Professional Studies, Novi Sad, Serbia

P.S.A.27. **DEPOSITION OF ZINC OXIDE NANORODS ON CONDUCTIVE CARBON FIBERS**

Olga Rac, Helena Teterycz
Wrocław University of Technology, Faculty of Microsystem Electronics and Photonics, Wrocław, Poland

P.S.A.28. **IMPROVEMENT OF H_2S SENSING PROPERTIES OF ZNO-THICK FILM GAS SENSORS DOPED WITH GOLD NANOPARTICLES**

Patrycja Suchorska-Woźniak, Helena Teterycz
Wroclaw University of Technology, Faculty of Microsystem Electronics and Photonics, Wroclaw, Poland

P.S.A.29. **INFLUENCE OF RE SUBSTITUTIONS ON MICROSTRUCTURE AND SUPERCONDUCTING PROPERTIES OF YBCO BULK SUPERCONDUCTORS**

Daniela Volochova[1], S. Piovarci[1], V. Antal[1], K. Jurek[2], J. Kovac[1], P. Diko[1]
[1]Institute of Experimental Physics SAS, Kosice, Slovak Republic, [2]Institute of Physics ASCR, Praha, Czech Republic

P.S.A.30. **ANOMALOUS COMPRESSIBILITY OF CERIUM AND DOCOSANE UNDER SHOCK-WAVE ACTION**

Vasily A. Sosikov, A.N. Zubareva, A. V. Utkin
Institute of Problems of Chemical Physics RAS, Chernogolovka, Russia

POSTER SESSION II

Wednesday, September 3, 2014, 20^{00}-22^{00}

SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

P.S.B.1. **GAS CHROMATOGRAPHY-MASS SPECTROMETRY FOR IDENTIFICATION OF THE PYROLYSIS PRODUCTS OF CELLULOSE-BASED POLYMERS**
Branimir Jovančićević[1], Vesna Antić[2], Mališa Antić[2], Nadia Al Sandouk-Lincke[3], Jan Schwarzbauer[3]
[1]Faculty of Chemistry, Belgrade, Serbia; [2]Faculty of Agriculture, Zemun, Serbia; [3]Institute of Geology and Geochemistry of Petroleum and Coal, RWTH Aachen University, Aachen, Germany

P.S.B.2. **YBCO BULK SINGLE GRAIN SUPERCONDUCTORS PREPARED BY INFILTRATION GROWTH METHOD**
Liudmila Vojtkova, Daniela Volochová, Viktor Kavečanský, Vitaliy Antal, Samuel Piovarči, Pavel Diko
Institute of Experimental Physics Slovak Academy of Sciences in Kosice, Slovak Republic

P.S.B.3. **EVALUATION OF SURFACE ROUGHNESS OF SLIP CAST COMPOSITE Al_2O_3-ZrO_2 CERAMICS IN SOLID PARTICLE EROSION**
Krešimir Grilec, Marijana Majić Renjo, Lidija Ćurković, Matija Sakoman, Gorana Baršić
University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia

P.S.B.4. **INFLUENCE OF HIGH PRESSURE OXYGENATION ON THE STRUCTURE AND MAGNETIC PROPERTIES OF LA-CA-SR-MN-O PEROVSKITE CERAMIC MATERIALS**
Katarina Zmorayova[1], V. Antal[1], S. Piovarci[1], V. Kavecansky[1], J. Kovac[1], M. Kanuchova[2], P. Diko[1]
[1]Institute of Experimental Physics SAS, Kosice, Slovakia
[2]The Technical University of Kosice, Kosice, Slovakia

P.S.B.5. **NON-ISOTHERMAL CRYSTALLIZATION KINETICS OF PARTIALLY CRYSTALLINE Fe(38)Ni(36)B(18)Si(8) METALLIC GLASS**

Suada Sulejmanović[1], Matej Lozančić[1], Amra Salčinović Fetić[1], Bega Karadža[1], Ljerka Slokar[2], Suada Bikić[3]

[1]Faculty of Science, University of Sarajevo, Bosnia and Herzegovina, [2]Faculty of Metallurgy, University of Zagreb, Croatia, [3]Faculty of Metallurgy and Materials, University of Zenica, Bosnia and Herzegovina

P.S.B.6. **HIGH-TEMPERATURE PHASE TRANSFORMATIONS OF Nb-18.7Si IN-SITU COMPOSITES ALLOYED WITH YTTRIUM AND SCANDIUM**

Liudmila Udoeva, R. Gulyaeva, V.Chumarev

Institute of Metallurgy, Ural Branch of Russian Academy of Sciences, Yekaterinburg, Russia

P.S.B.7. **VEGARD`S LAW AND PROPERTIES OF AMORPHOUS COPPER**

Ramir Ristić[1], K. Zadro[2], D. Pajić[2], J.R. Cooper[3], J. Ivkov[4], E. Babić[2]

[1]Department of Physics, Osijek, Croatia, [2]Department of Physics, Faculty of Science, Zagreb, Croatia, [3]Dept. of Physics, Cavendish Laboratory, Cambridge, UK, [4]Institute of Physics, Zagreb, Croatia

P.S.B.8. **PHASE STATE OF ELEMENTS IN MULTICOMPONENT COMPOSITE BASED ON THE Nb-Si ALLOY**

Vladimir Chumarev, N.Selmenskih, L.Udoeva, L. Leont’ev

Institute of Metallurgy, Ural Branch of Russian Academy of Sciences, Yekaterinburg, Russia

P.S.B.9. **SYNTHESIS, STRUCTURAL ANALYSIS, MAGNETIC AND ELECTRIC PROPERTIES OF $La_{0.9}Sr_{0.1}Cr_{1-X}Co_{X}O_3$ PEROVSKITES**

C. Mita[1], M.-L. Craus[2,3], N. Cornei[2], Doina Humelnicu[1], G. Nemtoi[1] and V. Dobrea[2]

[1]”Al.I.Cuza” University, Faculty of Chemistry, Iasi, Romania , [2]National Institute of Research and Development for Technical Physics, Iasi, Romania, [3]Joint Institute of Nuclear Research, Dubna, Russia

P.S.B.10. **QUANTUM OPTICAL LITHOGRAPHY FROM 1 nm WRITING RESOLUTION**

Sorin Ion Jinga[1], E. Pavel[2]

[1]Faculty of Applied Chemistry and Materials Science,“Politehnica”University of Bucharest, Bucharest, Romania; [2]Storex Technologies, Bucharest, Romania

P.S.B.11. **RELATION BETWEEN MICROSTUCTURE AND IMPACT STRENGTH OF MODERN FINE-GRAINED AND QT STEELS USED IN DESIGN OF NEW INDUSTRIAL TRAILERS**

František Nový[1,2], Libor Trško[2], Robert Ulewicz[3], Pawel Szataniak[4]
[1]Research Centre of the University of Žilina, Žilina, Slovak Republic, [2]University of Žilina, Faculty of Mechanical Engineering, Department of Materials Engineering, Žilina, Slovak Republic, [3]Czestochowa University of Technology, Faculty of Management, Institute of Engineering Production, Czestochowa, Poland, [4]WIELTON S.A., Wielun, Poland

P.S.B.12. **THE AUTOWAVE CRITERIA OF PLASTICITY AND FRACTURE BY CREEP**

Dina V. Orlova[1,2], V.I. Danilov[1], L.B. Zuev[1]
Institute of Strength Physics and Materials Science, SB RAS, Tomsk, Russia
National Research Tomsk Polytechnic University, Tomsk, Russia

P.S.B.13. **PROPERTIES OF HIGH PRESSURE OXYGENATED YBCO BULK SUPERCONDUCTORS**

Samuel Piovarči, Vitaliy Antal, Daniela Volochova, Pavel Diko
Institute of Experimental Physics SAS, Košice, Slovak Republic

P.S.B.14. **EXAMINATION AND COMPARISION OF PHYSICO-CHEMICAL CHARACTERISTICS OF POLYMERIC AND GYPSUM FLUIDS DESIGNED FOR RINSING OF OIL WELLS**

Matilda M. Lazić[1], Dragan Vrebalov[2]
[1]Technical College of Applied Sciences in Zrenjanin, Zrenjanin, Serbia, [2]NIS Gazpromnjeft, Novi Sad, Serbia

P.S.B.15. **OPTICAL PROPERTIES OF PERTURBED MOLECULAR NANOFILMS**

Ana J. Šetrajčić-Tomić[1], Dragana Rodić[2], Svetlana S. Pelemiš[3], Igor J. Šetrajčić[2], Siniša M. Vučenović[4], Jovan P. Šetrajčić[2]
[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Novi Sad, Vojvodina – Serbia, [2]University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina – Serbia, [3]University of East Sarajevo, Faculty of Technology in Zvornik, Zvornik, Republic of Srpska – B&H, [4]University of Banja Luka, Faculty of Sciences, Department of Physics, Banja Luka, Republic of Srpska – B&H

P.S.B.16. **CHARACTERIZATION OF DEGRADABLE POLYCARBONATE-BASED POLYURETHANE ELASTOMERS**

Rafał Poręba, Libor Kobera, Jiří Hodan, Jana Kredatusová and Milena Špírková
Institute of Macromolecular Chemistry AS CR, v.v.i., Prague, Czech Republic

P.S.B.17. **ON THE PHYSICAL PROPERTIES OF R_2AgGe_6 (R=La,Ce,Pr,Nd,Sm,Gd)**
Leonid Salamakha[1], E. Bauer[1], H. Michor[1], O. Sologub[1,2]
[1]Institute of Solid State Physics, Vienna University of Technology, Vienna, Austria,
[2]Institute of Physical Chemistry, University of Vienna, Vienna, Austria

P.S.B.18. **CRYSTAL STRUCTURE AND PHYSICAL PROPERTIES OF $YbPt_5B_2$**
Leonid Salamakha[1], E. Bauer[1], H. Michor[1], P. Heinrich[1], O. Sologub[1,2], P. Rogl[2]
[1]Institute of Solid State Physics, Vienna University of Technology, Vienna, Austria,
[2]Institute of Physical Chemistry, University of Vienna, Vienna, Austria

P.S.B.19. **OXYGEN PERMEATION STUDY OF THE NEW CERAMIC MEMBRANE MATERIAL BASED ON BSCF**
Mikhail Popov, I. Starkov, S. Bychkov, A. Nemudry
Institute of Solid State Chemistry and Mechanochemistry, SB RAS, Novosibirsk, Russia

P.S.B.20. **ELECTROCHEMICAL OXYGEN REDUCTION AT PLATINUM CATALYST ON TIN OXIDE BASED SUPPORT IN ALKALINE SOLUTION**
Ljiljana M. Gajić-Krstajić[1], N.R. Elezović[2], B.M. Babić[3], J. Kovač[4], V.R. Radmilović[5], N.V. Krstajić[5]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Institute for Multidisciplinary Research, University of Belgrade, Belgrade, Serbia, [3]Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia, [4]Jozef Stefan Institute, Ljubljana, Slovenia, [5]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.B.21. **TEMPERATURE DEPENDENCE OF GRAPHENE TRANSPORT PROPERTIES**
S. Jaćimovski[1], Dejan Raković[2], V. Sajfert[3]
[1]Academy of Criminalistic and Police Studies, Belgrade, Serbia, [2]University of Belgrade, Faculty of Electrical Engineering, Serbia, [3]University of Novi Sad, Technical Faculty „Mihajlo Pupin“ Zrenjanin, Serbia

P.S.B.22. **RELAXATION PHENOMENA IN SSG Fe_3O_4 NANOPARTICLE SYSTEM**
Violeta Nikolić, V. Spasojević, V. Kusigerski, M. Perović, A. Mraković, M. Bošković, J. Blanuša
The Vinča Institute, Condensed Matter Physics Laboratory, University of Belgrade, Belgrade, Serbia

P.S.B.23. **RAMAN SPECTROSCOPY AND ELECTRON MICROSCOPY OF POLYMER BASED NANOCOMPOSITES WITH CARBON NANOTUBES AND GRAPHENE**

Vuk V. Radmilović[1], Carlo Carraro[2], Petar Uskoković[3], Radoslav Aleksić[3], Velimir R. Radmilović[3]

[1]Innovation center, Faculty of Technology and Metallurgy, University of Belgrade,, Belgrade, Serbia, [2]Department of Chemical and Biomolecular Engineering, University of California at Berkeley, Berkeley, CA, USA, [3]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.B.24. **PROPERTIES AND STRUCTURAL CHANGES OF THERMALLY AND MECHANICALLY ACTIVATED KAOLIN CLAY**

Aleksandra Mitrović[1], Miodrag Zdujić[2], Ljiljana Miličić[1], Dragica Jevtić[3]

[1]Institute for Testing of Materials, Belgrade, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Faculty of Civil Engineering, University of Belgrade, Belgrade, Serbia

P.S.B.25. **X-RAY EMISSION AND MOSSBAUER SPECTRA AND ELECTRONIC STRUCTURE OF $ScFe_2Si_2$ AND $HfFe_2S_2$ COMPOUNDS**

Ivan Shcherba[1,3], D. Uskokovich[2] M. Sacharevych[3], B.M. Jatcyk[4]

[1]Institute of Technology, the Pedagogical University of Cracow, Cracow, Poland, [2]Institute of Technical sciences of SASA, Belgrade, Serbia, [3]Ivan Franko National University of Lviv, Ukraine, [4]University of Forestry and Wood Technology, Lviv, Ukraine

P.S.B.26. **THERMOSETTING POLYMER COMPOSITE WITH SELF-HEALING ABILITY**

Ivana Radović, Omar Yerro, 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.27. **SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF POLY(GMA-*co*-EGDMA) POLYMER DECORATED WITH SILVER NANOPARTICLES**

Ivana D. Vukoje[1], Enis S. Džunuzović[2], Vesna V. Vodnik[1], Suzana Dimitrijević[2], S. Phillip Ahrenkiel[3], Jovan M. Nedeljković[1]

[1]Institute of Nuclear Sciences Vinča, University of Belgrade, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [3]South Dakota School of Mines and Technology, Rapid City, SD, USA

P.S.B.28. **INVESTIGATION OF PHYSICAL AND MECHANICAL PROPERTIES OF EPOXY RESIN FILLED WITH NANOSIZED POWDER**
Tatyana Brusentseva, Artem Philippov
Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia

P.S.B.29. **ANALYSIS AND CHARACTERIZATION OF COAL MINE CONVEYOR IDLERS CONTAMINATION PARTICLES**
Radivoje Mitrović[1], Žarko Mišković[1], Vesna Maksimović[2], Dragan Jovanović[3], Gradimir Ivanović[1], Zoran Stamenić[1], Milan Tasić[4]
[1]*University of Belgrade – Faculty of Mechanical Engineering, Belgrade, Serbia;* [2]*Vinča Institute of Nuclear Sciences, Belgrade, Serbia;* [3]*Termoelektrane i Kopovi Kostolac d.o.o. Company, Kostolac, Serbia;* [4]*Tehnikum Taurunum College of Applied Science, Belgrade, Serbia*

P.S.B.30. **LOCAL ATOMIC STRUCTURE OF DOPED ZINC-FERRITE NANOPOWDERS PREPARED BY CO-PRECIPITATION**
Marija Milanović, Ivan Stijepović, Ljubica M. Nikolić, Vladimir V. Srdić
University of Novi Sad, Faculty of Technology, Department of Materials Engineering, Novi Sad, Serbia

P.S.B.31. **FREE-VOLUME STRUCTURAL EVOLUTION IN CRYSTALLIZED Ge-Ga-Se GLASSES**
Halyna Klym[1], A. Ingram[2], O. Shpotyuk[3]
[1]*Lviv Polytechnic National University, Lviv, Ukraine,* [2]*Opole University of Technology, Opole, Poland,* [3]*Scientific Research Company “Carat”, Lviv, Ukraine*

P.S.B.32. **NOVEL HYDROGEL PORE-FILLED COMPOSITE MEMBRANES FOR HEAVY METAL ADSORPTION**
Aleksandar Stajčić[1], J. Stajić-Trošić[1], S. Putić[2], P.S. Uskoković[2], F. Radovanović[1], R. Aleksić[2]
[1]*University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Belgrade, Serbia,* [2]*University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*

POSTER SESSION III

Thursday, September 4, 2014, 20^{00}-22^{00}

SYMPOSIUM C: NANOSTRUCTURED MATERIALS

P.S.C.1. **EROSION RESISTANCE OF SOL-GEL TiO_2-ZrO_2 FILM ON STAINLESS STEEL**
Krešimir Grilec, Lidija Ćurković, Marijana Majić Renjo, Suzana Jakovljević, Vera Rede
University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia

P.S.C.2. **CRYSTALLIZATION OF CERIUM PHOSPHATE GELS UNDER HYDROTHERMAL AND THERMAL TREATMENT**
Taisya O. Shekunova[1], A.E. Baranchikov[2], V.K. Ivanov[2]
[1]Moscow State University, Faculty of Materials Science, Moscow, Russia
[2]Kurnakov Institute of General and Inorganic Chemistry, Moscow, Russia

P.S.C.3. **CELL PERFORMANCES OF LENGTH-TUNABLE SILICON NANOWIRE/POLYMER HYBRID SOLAR CELLS**
Keisuke Sato[1,2], Mrinal Dutta[2], Naoki Fukata[2]
[1]Department of Electrical and Electronic Engineering, Tokyo Denki University, Adachi-ku, Tokyo, Japan, [2]World Premier International Research Center for Materials Nanoarchitectonics, National Institute for Materials Science, Tsukuba, Ibaraki, Japan

P.S.C.4. **DEGRADATION OF THIN 4,4′-bis(2,2′DIPHENYL VINYL)-1,1′-BIPHENYL FILMS BY UV LIGHT**
Aleksandar Ž. Tomović[1], V.P. Jovanović[1], I. Djurišić[1], V.Z. Cerovski[1], B. Nastasijević[2], S. Veličković[2], K. Radulović[3], R. Žikić[1], V.I. Srdanov[4]
[1]Institute of Physics, University of Belgrade, Belgrade, Serbia, [2]Vinča Institute of Nuclear Sciencies, University of Belgrade, Belgrade, Serbia, [3]Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [4]V&G Research, Santa Barbara, CA, USA

P.S.C.5. **VARIATION OF ENERGY DENSITY STATES IN QUANTUM DOTS ARRAYS DUE TO INTERPARTICLE ELECTRONIC COUPLING**
Manca Logar[1], Shicheng Xu[1], Shinjita Acharya[1], Fritz B. Prinz[1,2]
[1]Department of Mechanical Engineering, Stanford University, CA, USA,
[2]Department of Material Science and Engineering, Stanford University, CA, USA

P.S.C.6. **ULTRASONIC DEAGGLOMERATION OF TUNGSTEN DISULFIDE NANOPARTICLES (WS_2) IN DIFFERENT SOLVENTS FOR ENHANCING NANOMECHANICAL PROPERTIES IN POLY (VINYL BUTYRAL) (PVB) NANOCOMPOSITES**

Danica Simić[1], Dušica B. Stojanović[2], Aleksandar Kojović[2], Ljubica Totovski[1], Zijah Burzić[1], Petar S. Uskoković[2], Radoslav Aleksić[2]
[1]Military-Technical Institute, Belgrade, Serbia, [2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.C.7. **IMPACT TESTING OF HYBRID THERMOPLASTIC ARAMID FABRICS WITH DIFFERENT KINDS OF REINFORCEMENT**

Vera Obradović, D. Stojanović, M. Petrović, I. Živković, V. Radojević, P. Uskoković, R. Aleksić
University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.C.8. **STIMULI RESPONSIVE HYBRID NANOMATERIALS WITH A COMBINED MAGNETO-PHOTOTHERMAL EFFECT FOR NANOMEDICAL APPLICATIONS**

Sašo Šturm, Nina Kostevšek, Kristina Žužek Rožman, Spomenka Kobe
Department for Nanostructured Materials, Jožef Stefan Institute, Ljubljana, Slovenia

P.S.C.9. **KINETICS OF HYDROCHLOROTHIAZIDE PHOTOCATALYTIC DEGRADATION**

Sanja Armaković, Biljana Abramović
University of Novi Sad, Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, Novi Sad, Serbia

P.S.C.10. **PROPERTIES OF SUMANENE UNDER INFLUENCE OF ELECTRIC FIELD**

Stevan Armaković[1], Sanja J. Armaković[2], Ana J. Šetrajčić-Tomić[3], Jovan P. Šetrajčić[1]
[1]Department of Physics, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia, [2]Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia, [3]Institute of Pharmacology, Toxicology and Clinic Pharmacology, Medical Faculty, University of Novi Sad, Novi Sad, Serbia

P.S.C.11. **IN-SITU SURFACE FUNCTIONALIZATION OF SILICA NANOPARTICLES FOR DENTAL APPLICATIONS**

Ivan Stijepović[1], Daniel Čeh[1], Marija Milanović[1], Tijana Lainović[2], Larisa Blažić[2], Vladimir V. Srdić[1]
[1]University of Novi Sad, Faculty of Technology, Department of Materials Engineering, Novi Sad, Serbia, [2]University of Novi Sad, Faculty of Medicine, Department of Dentistry, Novi Sad, Serbia

P.S.C.12. **EFFECT OF PORES GEOMETRY OF ALUMINA CERAMICS MECHANICAL BEHAVIOR SUBJECTED TO THERMAL SHOCK**

Nataša Z. Tomić, Marija Dimitrijević, Bojan Međo, Radmila Jančić – Heinemann, Marko Rakin, Radoslav Aleksić
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.C.13. **CdS QUANTUM DOTS SENSITIZATION OF TiO_2 NANOTUBES USING MERCAPTO SILANE AS A BINDING REAGENT**

Andjelika Bjelajac[1], Veljko Djokić[2], Rada Petrović[2], Jelena Radević[2], Jovana Ćirković[3], Jovan M. Nedeljković[4], Djordje Janaćković[2]
[1]Innovation Center of Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [3]Institute for Multidisciplinary Research, University of Belgrade, Belgrade, Serbia, [4]Vinca Institute of Nuclear Sciences, Belgrade, Serbia

SYMPOSIUM D: ECO-MATERIALS AND ECO-TECHNOLOGIES

P.S.D.1. **INVESTIGATION OF COAGULATION ACTIVITY OF FAVA BEAN EXTRACTS**
Dragana Kukić, Marina Šćiban, Jelena Prodanović
University of Novi Sad, Faculty of Technology, Novi Sad, Serbia

P.S.D.2. **CONDITIONS OF ADSORPTION OF HEAVY METAL IONS FROM WATER BY SUGAR BEET SHREDS**
Marina Šćiban, Dragana Kukić, Jelena Prodanović, Mirjana Antov, Darjana Ivetić
Faculty of Technology, Novi Sad, Serbia

P.S.D.3. **COAGULATION EFFICIENCY OF NATURAL COAGULANTS OBTAINED FROM COMMON BEAN UNDER DIFFERENT CONDITIONS**
Jelena M. Prodanović, Marina B. Šćiban, Mirjana G. Antov, Dragana V. Kukić, Vesna M. Vasić
Faculty of Technology, University of Novi Sad, Novi Sad, Republic of Serbia

P.S.D.4. **TENSILE AND IMPACT PROPERTIES OF HYBRID WOOD COMPOSITES**
Srdjan Perišić, V. Radojević, M. Petrović, M. Zrilić, D. Trifunović, D. Stojanović, R. Aleksić
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

SYMPOSIUM E: BIOMATERIALS

P.S.E.1. **EVALUATION OF CALCIUM PHOSPHATE COATING ELECTRODEPOSITED ON AZ31 ALLOY SURFACE BY LARGE AMPLITUDE SINUSOIDAL VOLTAMMETRY (LASV)**

Filip Pastorek[1], Miroslav Omasta[2], Stanislava Fintová[3], Branislav Hadzima[1]

[1]Research Centre of the University of Žilina, Žilina, Slovak Republic, [2]University of Žilina, Faculty of Mechanical Engineering, Department of Materials Engineering, Žilina, Slovak Republic, [3]Institute of Physics of Materials of the AVČR, v. v. i., Brno, Czech Republic

P.S.E.2. **CERAMICS IN THE MAGNESIUM PHOSPHATE – CALCIUM PHOSPHATE SYSTEM**

Margarita A. Goldberg, V.V. Smirnov, M.R. Kasimova, O.S. Antonova, L.I. Shvorneva, S.V. Kutsev, S.M. Barinov

A.A. Baikov Institute of Metallurgy and Material Science RAS, Moscow, Russia

P.S.E.3. **PLLA-STARCH COMPOSITES WITH CALCIUM PHOSPHATES FOR MEDICINE**

Alexander S. Fomin[1], I.V. Fadeeva[1], E.V.Trofimchuk[2], E.V. Polupudnova[1], N.I. Nikonorova[2], M.A. Goldberg[1], S.M. Barinov[1]

[1]Institution of Russian Academy of Sciences A.A. Baikov Institute of Metallurgy and Material Science RAS, Moscow, Russia, [2]M.V. Lomonosov Moscow State University, Chemistry Facility, Moscow, Russia

P.S.E.4. **THE PHASE CHANGE UNDER THE GAMMA-IRRADIATION IN ZIRCONIA CERAMICS**

Olga S. Antonova[1], V.V. Smirnov[1], G.P. Kochanov[1], A.A. Zanin[2], L.I. Shvorneva[1], S.M. Barinov[1]

[1]Baikov' Institute of Metallurgy and Materials Science RAS, Moscow, Russia, [2]D. Mendeleev University of Chemical Technology of Russia, Moscow, Russia

P.S.E.5. **EXPERIMENTAL ANALYSIS OF PMMA BLOCK SURFACE DURING AXIAL LOADING ON INSERTED STRAIGHT AND ANGLED DENTAL IMPLANTS USING DIGITAL IMAGE CORRELATION METHOD**

D. Šarac[1], N. Mitrović[2], I. Tanasić[3], M. Milošević[1], Lj. Tihaček-Šojić[3], Žarko Mišković[2], P. Popović[4]

[1]University of Belgrade, Innovation Center of Faculty of Mechanical Engineering, Serbia, [2]University of Belgrade, Faculty of Mechanical Engineering, Serbia, [3]University of Belgrade, School of Dental Medicine, Serbia, [4]University of Belgrade, Vinča Institute of Nuclear Sciences, Serbia

P.S.E.6. **SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF Co(III) AND Pd(II) COMPLEXES WITH 2-(DIPHENYLPHOSPHINO)BENZALDEHYDE GIRARD T HYDRAZONE CHLORIDE**

Milica R. Milenković[1], B.R. Čobeljić[1], K. Adaila[1], M.T. Milenković[2], K.K. Andjelković[1]
[1]Faculty of Chemistry, University of Belgrade, Belgrade, Serbia, [2]Department of Microbiology and Immunology, Faculty of Pharmacy, University of Belgrade, Serbia

P.S.E.7 **CORROSION RESISTANCE OF AZ31 MAGNESIUM ALLOY COATED BY BIOCOMPATIBLE CALCIUM PHOSPHATE**

Branislav Hadzima[1], Filip Pastorek[1], Miroslav Omasta[2]
[1]Research Centre of the University of Žilina, Žilina, Slovak Republic, [2]University of Žilina, Faculty of Mechanical Engineering, Department of Materials Engineering, Žilina, Slovak Republic

P.S.E.8. **SURFACE PROPERTIES IMPROVEMENT OF AZ31 MAGNESIUM ALLOY BY SHOT PEENING AND DCPD COATING**

Filip Pastorek, Branislav Hadzima
Research Centre of the University of Žilina, Žilina, Slovak Republic

P.S.E.9. **FATIGUE CRACK INITIATION MECHANISMS OF AZ91 MAGNESIUM CAST ALLOY DURING FATIGUE TESTING**

Libor Trško[1], Stanislava Fintová[2], František Nový[1,3]
[1]Research Centre of the University of Žilina, Žilina, Slovak Republic, [2]Institute of Physics of Materials Academy of Sciences of the Czech Republic, v. v. i., Brno, Czech Republic, [3]University of Žilina, Faculty of Mechanical Engineering, Department of Materials Engineering, Žilina, Slovak Republic

P.S.E.10. **INTERACTION OF NANOPARTICLES AND BIOLOGICAL FLUIDS**

Zorica Ajduković[1], Nenad Ignjatović[2], Nenad Petrović[1], Jelena Rajković[3], Dragana Kenić Marinković[1], Stevo Najman[4], Dragan Mihailović[5], Dragan Uskoković[2]
[1]Faculty of Medicine, Clinic of Stomatology, Department of Prosthodontics, University of Niš, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Department of Biology and Ecology Faculty of Science and Mathematics, University of Niš, Serbia, [4]Faculty of Medicine, Institute of Biomedical Research, University of Niš, Serbia, [5]Faculty of Medicine, Institute of pathology, University of Niš, Serbia

P.S.E.11. SIMULTANEOUS INFLUENCE OF DOPED Sr^{2+} IONS AND GRAIN SIZE DECREASING ON THE MECHANICAL PROPERTIES, IN VITRO DIFFERENTIATION OF MESENCHYMAL STEM CELLS AND IN VIVO BEHAVIOR OF HAP BASED BIOCERAMICS

Djordje Veljović[1], D. Marković[2], M. Kovačević-Filipović[2], D. Djurdjević[3], V. Danilović[4], Dj. Janaćković[1]
[1]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Faculty of Veterinary Medicine, University of Belgrade, Belgrade, Serbia, [3]Institute for Medical Research, Military Medical Academy, Belgrade, Serbia, [4]School of Dental Medicine, University of Belgrade, Belgrade, Serbia

Abstracts

Oral Presentation

PL.S.I.1

TISSUE REGENERATION BY HUMAN STEM CELLS ON BIOLOGICAL SCAFFOLDS

Gordana Vunjak-Novakovic
Columbia University, Department of Biomedical Engineering, New York, NY, USA

Tissue engineering aims to restore the native structure and function lost to injury or disease. Engineered tissues can also provide high fidelity models for biological and medical research. The utility of engineered tissues ultimately depends on our ability to direct the cells to express the right phenotype in the right place and at the right time.

Our laboratory is approaching tissue engineering by an integrated use of stem cells (the actual "tissue engineers"), biomaterial scaffolds (cell-instructive templates) and bioreactors (biomimetic culture environments). This talk will focus on biological scaffolds for regeneration of highly complex human tissues. Two distinctly different systems: bone reconstruction by anatomically shaped living grafts and regeneration of human lung will be discussed to derive some common principles for the use of biological scaffolds in regenerative medicine.

PL.S.I.2

CHARACTERIZING NANOBIO CONJUGATES

Richard W. Siegel
Rensselaer Nanotechnology Center and Materials Science and Engineering Department,
Rensselaer Polytechnic Institute, Troy, New York, USA

Developments over the past few decades worldwide have greatly increased our ability to synthesize and utilize nanoscale building blocks to create advanced materials and devices with novel properties and a wide range of functionalities. Among their novel properties, nanostructures have been shown to elicit more favorable and selective bio-molecular and cellular responses than surfaces at coarser length scales, owing to nanoscale-specific, biomolecule-nanostructure interactions. Using and understanding these interactions is enabling nanobiomaterials to create a platform for a new healthcare field, nanomedicine. Fundamental to developing a clear understanding of these interactions, and their eventual control, however, is the comprehensive characterization of nanobio-conjugates. In order to characterize these conjugates at a variety of biomolecule loadings, and for precisely controlled nanostructures with both positive and negative surface curvatures, several model experiments have now been carried out. The results of these studies will be presented and discussed in the broader contexts of not only enabling new materials and developing nanomedicine for improved healthcare, but also what would be valuable in terms of the characterization capabilities needed to move this field forward.

PL.S.I.3

AN UP-DATE ON NANOPARTICLE RESEARCH FOR POSSIBLE MEDICAL APPLICATIONS

Robert Sinclair, Paul J. Kempen, Ai Leen Koh, Richard Chin, Steven J. Madsen
Department of Materials Science and Engineering, Stanford University,
Stanford, California, USA

There are many avenues for the application of nanotechnology in medical research. However, because of their small dimensions, advanced characterization techniques are required to determine the location and size of nanoparticles. Our approach has been to utilize advanced electron microscopy techniques, including aberration corrected, transmission electron microscopy, monochromated electron energy loss spectroscopy and high resolution scanning electron microscopy. Some recent case studies will be described, including the location of gold-silica nanoparticles used for surface enhanced Raman spectroscopy (SERS). We have also explored the utility of electron beam lithography to fabricate nanoparticles of specific shapes and sizes in order to develop systems with more enhanced SERS capability which would allow detection of tumors at earlier stages in their development.

PL.S.I.4

GROWTH AND PHYSICAL PROPERTIES OF $CH_3NH_3PbI_3$ PEROVSKITE

László Forró
Laboratory of Physics of Complex Matter,
Ecole Polytechnique Fédérale de Lausanne, Switzerland

The lead-halide octahedra in organic-inorganic hybrid compounds can form 0, 2 and 3D structures. Recently, a 3D member of this family, the methylammonium lead iodide ($CH_3NH_3PbI_3$) perovskite turned out to be extremely efficient material in photovoltaic cells, with a light conversion efficiency up to 15% (M.M. Lee et al., Science 338, 644 (2012). The investigation of the basic physical properties of this material is primordial for improving its performance in solar cells. We have grown large single crystals which allow detailed investigations. In this presentation the optical and transport properties will be reported.

Acknowledgment: This work is performed in collaboration with E. Horváth, M. Spina, A. Pisoni, B. Nafradi, P. Szirmai, A. Akrap, J. Jacimovic, E. Tutis, O. Barisic.

PL.S.I.5

THE ROLE OF GRAIN BOUNDARIES IN ENHANCING OXYGEN EXCHANGE

Fritz B. Prinz
Department of Mechanical Engineering, Stanford University, Stanford, CA, USA;
Department of Materials Science and Engineering, Stanford University, Stanford, CA, USA

This talk will report on the role of grain boundaries in enhancing oxygen incorporation in oxide ion conductors. Oxygen isotope exchange measurements were carried out using high spatial resolution secondary ion mass spectrometry (nano-SIMS) and scanning transmission electron microscopy combined with electron energy loss spectroscopy (STEM-EELS). Surface mapping of the O18 distribution by SIMS shows high activity at surface grain boundaries, suggesting that these boundary regions provide preferential pathways for oxide ion incorporation into YSZ. The results are supported by a.c. impedance spectroscopy measurements conducted on polycrystalline YSZ membranes with surface grains engineered for different sizes. These results open up the possibility of engineering nanostructured YSZ surfaces containing a high density of grain boundaries to achieve enhanced performance of electrochemical devices, particularly for solid oxide fuel cells operating at low temperatures. Atomic scale resolution TEM and STEM-EELS observations together with molecular dynamics simulations provide a self-consistent picture with the above nano-SIMS measurements.

PL.S.I.6

FORMATION OF MONODISPERSE NANOPARTICLES IN SOLIDS

C. Ophus[1], D.H. Moreno[2], A. Gautam[1], W. Bras[2], U. Dahmen[1], Velimir R. Radmilović[3]
[1]National Center for Electron Microscopy, Lawrence Berkeley National Lab, University of California, One Cyclotron Rd., Berkeley, CA, USA, [2]Netherlands Organization for Scientific Research (NWO), DUBBLE@ESRF, BP220, Grenoble Cedex, France, [3]University of Belgrade, Faculty of Technology and Metallurgy, Nanotechnology and Functional Materials Lab, Belgrade, Serbia

This presentation will illustrate the importance of understanding the fundamental features that underlie the behavior of complex core/shell nanoscale phases embedded in a solid matrix, shell formation kinetics, and their role in the evolution of microstructure. Due to the scale and nature of such nanostructures, aberration corrected scanning transmission electron microscopy (STEM) and small angle X-ray scattering (SAXS), in tandem with modeling and computation are essential tools in their characterization. The fundamental principles established using model alloy systems are employed in the design and testing of new materials such as Al-based alloys of interest for energy-related technologies. For the ternary AlLiSc alloy we show a way of producing a uniform distribution of monodisperse $Al_3(LiSc)$ core/shell nanostructures embedded in an Al matrix. In a preliminary in-situ SAXS study, we have examined the nucleation and growth stages of the precipitate shells at different temperatures over long times. We directly compare the fitted size distributions to high-resolution STEM micrographs to verify our modeling efforts. We examine the question of whether shell growth in the size-focusing regime can be directly measured from SAXS data. The outcome of this research is that using differential diffusivities and solubilities of alloying elements in metallic matrices it is possible to control precipitate morphology and distribution in solid state.

This work was financially supported by Ministry of Education, Science and Technological Development, Republic of Serbia, under contract No. 172054. Electron microscopy characterization was performed at the National Center for Electron Microscopy, Lawrence Berkeley National Laboratory, which is supported by the Office of Science, Office of Basic Energy Sciences, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231. VRR acknowledges support from the Serbian Academy of Sciences and Arts and Nanotechnology and Functional Materials Lab.

O.S.A.1

SYNTHESIS AND PROPERTIES OF BULK TRANSPARENT COMPOSITE OF BARIUM HEXAFERRITE PLATELETS DISPERSED IN A PMMA MATRIX

Miha Drofenik[1,2], Gregor Ferk[1], Peter Krajnc[1], Anton Hamler[3], Darja Lisjak[2]
[1]*Faculty of Chemistry and Chemical Engineering, University of Maribor, Slovenia*
[2]*Department for Materials Synthesis, Jožef Stefan Institute, Ljubljana, Slovenia*
[3]*Faculty of Electrical Engineering and Computer Science, University of Maribor, Slovenia*

Transparent nanocomposite comprising of monodomain barium hexaferrite doped with scandium; BaM) nanoparticles inserted in poly(methyl methacrylate) (PMMA) matrix was prepared with good prospective for magneto-optic applications. We report the first incorporation of monodomainBaM nanoparticles in a transparent PMMA matrix. At this time the PMMA was doped with varying amounts of BaM with diameters in the range 20 to 130 nm and thickness around 3 nm in size. BaM nanoparticles were synthesized hydrothermally and stabilized in 1-butanol forming highly stabile ferrofluid (FF) with a long-term stability. Transparent nanocomposite was prepared with admixing ferrofluid of the BaM nanoparticles to the liquid monomer and subjected to polymerization. Static magnetic properties such as M–H loops were measured and the ferromagnetic response was consistent with the varying volume concentration of the nanoparticles, where the polymer itself contributes a diamagnetic response. Outstanding dispersion coupled with reasonable control over magnetic properties achieved in our investigation is encouraging for magneto-optic applications of these materials.

O.S.A.2

ON THE APPLICABILITY OF MAXWELL RELATIONS IN SURFACE THERMODYNAMICS AND ELECTROCHEMISTRY

Emmanuel M. Gutman
Ben-Gurion University of the Negev, Beer-Sheba, Israel

We have shown that two known conditions of the applicability of Maxwell's relations (mutual independence of the chosen pair of variables and conformity of the fundamental thermodynamic equation to the requirements for the thermodynamic potential to be a 'characteristic function') make these relations inapplicable for the description of capillary and electrocapillary phenomena, as they lead, if used correctly, to trivial results. Attempts to use Maxwell's relations for the case of solid electrodes available in the literature are based on mathematical defects and, consequently, yield erroneous results. Attempts to use the fundamental equation transformed to the *per-unit-area basis* (in densities) have been erroneous because a correct transformation excludes the surface area from the set of independent variables. We have shown that a correct intensive version of the fundamental equation obtained by classical method applied to the electrical double layer is actually reduced to one "electrical" term.

O.S.A.3

Li_2FeSiO_4 CATHODE MATERIAL: THE STRUCTURE AND ELECTROCHEMICAL PERFORMANCES

Dragana Jugović[1], M. Milović[1], M. Mitrić[2], V.N. Ivanovski[2],
M. Avdeev[3], B. Jokić[4], R. Dominko[5], D. Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia, [3]Bragg Institute, Australian Nuclear Science and Technology Organisation, Locked Bag 2001, Kirrawee DC, NSW, Australia, [4]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [5]Laboratory for Materials Electrochemistry, National Institute of Chemistry, Ljubljana, Slovenia

Monoclinic Li_2FeSiO_4 that crystallizes in $P2_1/n$ space group was investigated as a potential cathode material for lithium-ion batteries. A combined X-ray diffraction and Mössbauer spectroscopy study was used for the structural investigation. It was found that the crystal structure is prone to an “antisite” defect, the one in which the Fe ion and the Li ion exchange places. This finding was also confirmed by the Mössbauer spectroscopy. In order to obtain composites of Li_2FeSiO_4 and carbon, several synthesis techniques that use different carbon sources were involved. Electrochemical performances were investigated through galvanostatic charge/discharge tests. Discharge curve profile did not reflect a two-phase intercalation reaction (no obvious voltage plateau) due to the low conductivity at room temperature.

O.S.A.4

RHEED STUDY OF THE EARLY STAGES OF OXIDE FILM FORMATION AND QUANTIFICATION OF THE GROWTH KINETICS

Anatole N. Khodan[1], M.V. Sorokin[1], D.-G. Crete[2]
[1]National Research Center "Kurchatov Institute", Moscow, Russian Federation,
[2]Unite Mixte de Physique C.N.R.S./THALES, Palaiseau, France

RHEED was applied for in situ study of homoepitaxial SrTiO3 (STO) film growth with the aim to find accordance between estimations following from theoretical growth models and real film parameters measured by AFM, XRD and RHEED. Pulsed Laser Deposition (PLD) with constant pulse rate up to 5 Hz was used and relaxation kinetics of the deposited particles was estimated from RHEED intensity changes caused by the surface layer ordering. The proposed data treatment allowed us to estimate the relaxation rate in the deposited surface layer and the overall relaxation of the structure of homoepitaxial thin film. It has been shown that growth at temperatures above 650 °C is characterized by presence of surface phase. It mean, that experimental estimations of a kinetic processes at the surface are attributing first of all to the surface phase properties, whereas a growing film structure is formed deeper, under film-surface layer interface and determined by the conditions of phase stability. This structural transition occurs at depth, which exceeds the number of not completely filled monolayers. In this connection, the evolution of the theory of Smooth Multilayer Growth (SML) seems promising enough.

O.S.A.5

EFFICIENT SOLUTION COMBUSTION SYNTHESIS OF CERIA-BASED CATALYSTS FOR HYDROGEN PRODUCTION

Georgeta Postole, Thanh-Son Nguyen, Patrick Gélin, Laurent Piccolo
Institut de Recherches sur la Catalyse et l'Environnement de Lyon (IRCELYON), CNRS & Université Lyon 1, Villeurbanne Cedex 9, France

This work deals with the development of effective ceria-based materials for the catalytic production of hydrogen from CH_4/H_2O mixture. For this, pure ceria and ceria doped with noble metals (Ir, Rh) were prepared by a non-conventional one-pot method, namely solution combustion syntheses (SCS). The studied powders were physically characterized and tested in steam reforming of methane (SRM) at 750°C, under highly water-deficient conditions (CH_4/H_2O molar ratio of 10) with/without H_2S. The as-prepared catalysts appear highly active in SRM and resistant to poisoning by carbon and sulfur. The performances could be further improved by a mild thermo-chemical treatment, which was optimized and correlated with the structure of the active surface sites and their reactivity toward CH_4. The investigation of the catalytic properties confirms that, with the SCS method, catalysts with stable and reproducible performances can be prepared in a simple manner.

O.S.A.6

AN ALCOHOL INFLUENCE ON MORPHOLOGY OF ZnO STRUCTURES PRECIPITATED FROM AQUEOUS-ALCOHOLIC SOLUTIONS

Nataliya S. Nikolaeva, I.A. Blokhina
Siberian Federal University, Krasnoyarsk, Russia

A chemical route of structured ZnO synthesis provides ones flexible morphology control. In the present work, the ZnO structures were obtained on the glass substrates by a chemical precipitation from the aqueous-alcoholic solutions containing urea and zinc salt. The morphology and microstructure of the synthesized ZnO products were analyzed using a scanning electron microscopy (JEOL JSM-7001F). A X-ray diffraction data were obtained using a X'Pert-Pro (Cu Kα, λ=0,15406 Å). It was found that the different types of the alcoholic (methanol, ethanol, 2-propanol, 1-butanol) and its concentration significantly affected the formation of the ZnO morphology. The final ZnO microstructures are of flowers-, stars-, spheres-like forms. The hypothetical reaction mechanism was proposed.

O.S.A.7

KINETIC ANALYSIS OF THE TiB_2 CARBOTHERMAL SYNTHESIS

Irina A. Blokhina, V.V. Ivanov, N.N. Nikolaeva
Siberian Federal University, Krasnoyarsk, Russia

TiB_2 is a solid high-temperature compound, applied as a material of wettable cathodes engineering in the aluminum electrolysis. The most spread method of TiB_2 production is a carbothermal synthesis (CTS). This method gives the possibility influence the size and morphology under the temperatures lower than 1570K. The mechanism of the CTS is very complicated and its investigation by different methods is of the current importance. This work presents the results of the CTS process kinetic analysis carried out by Ozawa-Flynn-Wall and Coats-Redfern methods based on differential thermal analysis data. The kinetics significantly depends on the thermal parameters. In general, the CTS mechanism is a sequence of the single-stage reactions. The overall reaction is of the first order and characterized with the calculated activation energy value of $\approx$ 400 kJ/mol.

O.S.A.8

NUMERICAL ANALYSIS OF RAPID SOLIDIFICATION PROCESS OF NiTi BINARY ALLOY

Primoz Ternik[1], Matej Zadravec[2], Rebeka Rudolf[2], Milan Svetec[3]
[1]Ternik Primož-Private Researcher, Bresternica, Slovenia,[2]Faculty of Mechanical Engineering, Maribor, Slovenia, [3]Pomurska akademsko znanstvena unija, Murska Sobota, Slovenia

The objective of the present work is to analyze the solidification process of NiTi binary alloy. Physical medium is taken as an incompressible fluid where the heat is transferred by conduction and convection, including the thermal phase change phenomenon. The last one is modelled by the improvement procedure, called enthalpy-porosity formulation, where the liquid-solid mushy zone is treated as a porous zone with porosity equal to the liquid fraction. The numerical model is based on the finite volume method in body fitted coordinates with a SIMPLER scheme to couple pressure and velocity fields. The results are compared with the available experimental results, and good agreement was found.

Key words: Solidification, Finite volume method, Phase change.

O.S.A.9

Al_2O_3/TiO_2 AND $Al_2O_3/TiO_2/WO_3$ MIXED OXIDE COATINGS: OPTIMIZATION OF PROCESSING PARAMETERS REGARDING PHOTOCATALYTICAL PROPERTIES

N. Tadić[1], N. Radić[2], B. Grbić[2], Rastko Vasilić[1], S. Stojadinović[1]
[1]University of Belgrade, Faculty of Physics, Belgrade, Serbia, [2]University of Belgrade, Institute of Chemistry, Technology, and Metallurgy, Department of Catalysis and Chemical Engineering, Belgrade, Serbia

Influence of processing parameters on photocatalytic properties of mixed oxide Al_2O_3/TiO_2 and $Al_2O_3/TiO_2/WO_3$ coatings are investigated. Mixed oxide semiconductors are prepared using plasma electrolytic oxidation of aluminum in water solution of sodium silicate, with varying concentrations of Degussa P25 and sodium tungstate. Obtained oxide coatings are characterized using SEM-EDS and XRD analyses, while their photocatalytic activity is determined by degrading methyl-orange at room temperature. Optimization of processing parameters identified concentration of 2 g/L TiO_2 combined with low tungsten concentrations as most favorable for producing mixed oxide coatings with high photocatalytic activity.

O.S.A.10

APPLYING RADIATION PROCESSING FOR OBTAINING HIGH-RESISTIVITY SILICON WITH IMPROVED CHARACTERISTICS

S.P. Kobeleva[1], I.M. Anfimov[1], N.A. Sobolev[2]
[1]National Technological University “MISiS”, Moscow, Russia
[2]Universidade de Aveiro, Portugal

Radiation processes allow using relatively low temperatures to change parameters of semiconductor materials and devices. It is very important for different types of radiation detectors to use high resistivity materials with the largest recombination lifetime. The paper presents results of a study of the thermoacceptor effect in the FZ single crystal n-type Si irradiated by 6 MeV electrons. It was shown that when using silicon with initial resistivity of 1-2 KOhm•cm we may obtain high resistivity (up to 100 kOhm/cm) both n-and p-type silicon characterised by a large value of the recombination life time. The reason for these changes is the formation of thermoacceptors during annealing. It was found that a two-step annealing is necessary to form the thermoacceptors. We suggested that deep acceptor-like recombination centers play an important role in the formation of thermoacceptors.

The authors gratefully acknowledge the financial support of the Ministry of Education and Science of the Russian Federation in the framework of Increase Competitiveness Program of NUST «MISiS» (№ K3-2014-046).

O.S.A.11

CAST NANO-STRUCTURED POLYMETALLIC HIGH ENTROPY ALLOYS AND COATINGS OF THEM BY CENTRIFUGAL SHS CASTING

Vladimir Sanin, Denis Ikornikov, Dmitry Andreev, Vladimir Yukhvid
Institute of Structural Macrokinetics and Materials Science RAS,
Chernogolovka, Moscow Region, Russia

For many centuries, the conventional strategy for development of practical alloy systems has been based mainly on one principal element. With the fast development of the new technologies and theories for developing advanced materials, the number of constituent principal elements for metallic alloys is increased from one to three or more. In 2004, Jien-Wei Yeh et al. reasoned that the high configurational entropy of alloys containing multiple elements would be sufficient to thermodynamically stabilize a single-phase solid solution via a reduction of the Gibbs free energy. This led them to propose a new class of materials with potentially beneficial properties, the so-called high-entropy alloys (HEAs). HEAs contain five or more principal elements in equal or near-equal atomic ratios, in which all the atomic concentrations are between 5% and 35%, and none of them should be over 50%. HEAs can possess many interesting mechanical and physical properties, and particularly they have great potentials to be used as high temperature materials, or coating materials requiring high hardness and high wear resistance. Up till now, more than 300 HEAs have been developed, forming a new frontier of metallic materials. Most studies on HEAs are focused on the relationships between phase, microstructure, and mechanical properties. Less attention was paid to study processing route and developing new methods of HEA's preparation. Although a formation of the homogenous metallic multi-component alloys is complicated science and application task. In this work, we for the first time attempted to fabricate cast HEAs containing NiCrCoFeAl, NiCrCoFeAlCu, $NiCrCoFeMnAl_x$ by means of SHS-metallurgy. On the second stage we carried out a search for the systems and process parameters that would be favorable for deposition of protective coatings of the HEAs in-situ SHS (SHS surfacing). As follows from SEM analysis the cast HEAs exhibit a clearly pronounced nanostructure. Increasing of Al content into HEA was found to markedly change the microstructure and phase composition of HEAs. The Vickers hardness of synthesized HEAs was found to vary between 400 and 800 *Hv*.

The work was supported by the RFBR (project no. 14-08-00694).

O.S.A.12

INFLUENCE OF ALKALI ION ON THE PROPERTIES OF ALKALI ACTVATED SLAG

Irena Nikolić[1], I. Janković-Častvan[2], V.V. Radmilović[2],
Lj. Karanović[3], S. Mentus[4], V.R. Radmilović[2]
[1]University of Montenegro, Faculty of Metallurgy and Technology, Podgorica, Montenegro,
[2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia,
[3]University of Belgrade, Faculty of Mining and Geology, Laboratory of Crystallography, Belgrade, Serbia, *[4]University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia*

In recent decades great attention has been paid to the use of alkali-activate slag (AAS) as a possible replacement for cement binder due to their enhanced durability properties compared to the cement binder.

The aim of this research is to investigate the influence of alkali ions (Na^+ and K^+) on the properties of AAS at both ambient and elevated temperatures. Electric arc furnace slag was used as source materials for alkali activation. The results have shown that the compressive strength of AAS before and after thermal treatment is strongly influenced by the nature of alkali cation. Generally, the samples of AAS displayed increase in strength after temperature exposure. The decrease of porosity and development of new crystalline phase appeared to be the most critical parameters with regards to general strength and thermal resistance of the AAS sample.

This research was supported by a Ministry of Science of Montenegro under the contract No 01-460.

O.S.B.1

INTEGROWN THERMOELECTRIC LAYERED COBALTATES

Bostjan Jančar[1], Damjan Vengust[1], Goran Dražić[1,2] Andreja Sestan[1], Danilo Suvorov[1]
[1]*Jožef Stefan Institute, Ljubljana, Slovenia*
[2]*National Institute of Chemistry, Ljubljana, Slovenia*

Materials based on layered cobaltates $Na_xCoO_{2+\delta}$ and $Ca_3Co_4O_{9+\delta}$ have been identified as potential candidates for p-type legs in high-temperature thermoelectric modules. These materials exhibit a combination of high Seebeck coefficient, high electrical conductivity and low thermal conductivity, which are believed to stem from a combination of electronic correlations, spin-state degeneracy and layered crystal structure. In terms of coordination polyhedra the $Na_xCoO_{2+\delta}$ crystal structure consists of sheets of edge-sharing CoO_6 octahedra with sodium in two different prismatic sites between the layers. For $x<1$ the prismatic layers are partially filled which results in ordering of sodium ions and vacancies leading to a variety of incommensurately modulated structures. In $Ca_3Co_4O_{9+\delta}$ the edge-sharing CoO_6 layers are separated by a triple rock-salt-type structure consisting of a CoO and two CaO layers or alternatively the crystal structure of $Ca_3Co_4O_{9+\delta}$ can be interpreted as a misfit compound of rock salt Ca_2CoO_3 and CdI_2-type CoO_2 systems. Electrical conductivity in layered cobaltates takes place in the plane of CoO_2 layers, which as a consequence of charge transfer between the layers contain a high concentration of electron holes.[1] In the case of ceramics a high degree of texturing is thus required in order to achieve high conductivity in the direction parallel to CoO_2 layers. The relatively high Seebeck coefficient is interpreted as a consequence of high spin entropy arising from crystal-field splitting of energy levels in CoO_2 layers. It has recently been shown, utilizing EELS, that stacking faults in the $Ca_3Co_4O_{9+\delta}$ structure result in local increase of spin states of cobalt ions within the CoO_2 layers which in combination with low spin states within the CoO layers results in an increased Seebeck coefficient.[2] In terms of thermoelectric figure of merit zT the materials based on $Na_xCoO_{2+\delta}$ with $0.66<x<0.75$ are superior to materials based on $Ca_3Co_4O_{9+\delta}$, however, high mobility of interlayer sodium ions renders $Na_xCoO_{2+\delta}$ prone to reaction with atmospheric water and carbon dioxide.[3] We have found that intergrowth (Fig. 1) of both structural types leads to atmosphere-resistant materials with high degree of spontaneous texturing, exhibiting moderate electrical conductivity and enhanced Seebeck coefficient.

O.S.B.2

NOVEL THERMOELECTRIC SKUTTERUDITES IN THE SYSTEM Ni-Sn-Sb

Werner Paschinger[1], G. Rogl[2], A. Grytsiv[2,3], P.F. Rogl[1,2] , E. Bauer[2,3], H. Michor[3],
Ch. Eisenmenger-Sitter[3], E. Royanian[3], P.R. Heinrich[3], M. Zehetbauer[4], J. Horky[4],
S. Puchegger[5], M. Reinecker[6], G. Giester[7], P. Broz[8], A. Bismarck[1,2]

[1]Institute of Physical Chemistry, University of Vienna, Vienna, Austria, [2]Christian Doppler Laboratory for Thermoelectricity, TU-Wien, Vienna, Austria, [3]Institute for Solid State Physics, TU-Wien, Vienna, Austria, [4]Research Group Physics of Nanostructured Materials, University of Vienna, Vienna, Austria, [5]Faculty Center for Nanostructure Research, University of Vienna, Vienna, Austria, [6]Research Group Physics of Nanostructured Materials, University of Vienna, Vienna, Austria, [7]Institute of Mineralogy and Crystallography, University of Vienna, Vienna, Austria, [8]Faculty of Science, Deparment of Chemistry, Masaryk University, Brno, Czech Republic

Physical and mechanical properties have been investigated for novel filled and unfilled Ni-Sn-Sb based skutterudites of general formula $Ep_yNi_4Sb_{12-x}Sn_x$ (Ep = Ba and La), which have been prepared by arc melting followed by annealing at 250°C, 350°C and 450°C up to 30 days in sealed quartz vials. The maximal achievable filling level for the Ba and La filled skutterudite was $y = 0.93$ and $y = 0.65$, respectively. Extension of the homogeneity region, solidus temperatures and crystal structures were determined for the skutterudite phase in the ternary Ni-Sn-Sb and in the quaternary Ba-Ni-Sb-Sn system. Phase equilibria in the Ni-Sn-Sb system at 450°C were established by means of Electron Probe Microanalyses (EPMA) and X-ray Powder Diffraction (XPD). Physical properties i.e. temperature dependent electrical resistivity, Seebeck coefficient and thermal conductivity have been established for single-phase samples with the composition $Ni_4Sb_{8.2}Sn_{3.8}$, $Ba_{0.42}Ni_4Sb_{8.2}Sn_{3.8}$ and $Ba_{0.92}Ni_4Sb_{6.7}Sn_{5.3}$. Resistivity data showed a crossover from metallic to semiconducting behaviour, which is discussed in terms of a temperature-dependent carrier concentration employing a simple model for a rectangular density of states with the Fermi energy slightly above a narrow band gap. The corresponding gap width was extracted from maxima in the Seebeck coefficient data as a function of temperature. Temperature dependent single crystal X-ray structure analyses (at 100 K, 200 K and 300 K) revealed the thermal expansion coefficients, Einstein and Debye temperatures for two selected samples $Ba_{0.73}Ni_4Sb_{8.1}Sn_{3.9}$ and $Ba_{0.95}Ni_4Sb_{6.1}Sn_{5.9}$. These data compare well with Debye temperatures from measurements of specific heat ($4.4\text{ K} < T < 200\text{ K}$). Several mechanical properties were measured and evaluated. Elastic moduli, collected from Resonant Ultrasonic Spectroscopy (RUS), range from 100 GPa for $Ni_4Sb_{8.2}Sn_{3.8}$ to 116 GPa for $Ba_{0.92}Ni_4Sb_{6.7}Sn_{5.3}$. Thermal expansion coefficients (capacitance dilatometry and DMA) are 11.8×10^{-6} K^{-1} for $Ni_4Sb_{8.2}Sn_{3.8}$ to 13.8×10^{-6} K^{-1} for $Ba_{0.92}Ni_4Sb_{6.7}Sn_{5.3}$. Room temperature Vicker’s hardness values (up to a load of 24.5 mN) vary from 2.6 GPa to 4.7 GPa. Severe plastic deformation (SPD) via high-pressure torsion (HPT) was used to introduce nanostructuring. Physical properties before and after HPT were compared to define the effect on the material’s thermoelectric behaviour.

O.S.B.3

Yb-Pt-B AND RELATED SYSTEMS WITH Sc AND Y: PHASE EQUILIBRIA AND CRYSTAL STRUCTURE OF COMPOUNDS. A CONTRIBUTION TO THE STRUCTURAL CHEMISTRY OF THE BINARY PLATINUM BORIDES

Oksana Sologub[1,2], P. Rogl[2], E. Bauer[1], L. Salamakha[1], B. Stöger[3], G. Giester[4], L. Bogun[5]
[1]Institute of Solid State Physics, Vienna University of Technology, Wien, Austria, [2]Institute of Physical Chemistry, University of Vienna, Wien, Austria, [3]Institute of Chemical Technologies and Analytics, Vienna University of Technology, Wien, Austria, [4]Institute of Mineralogy and Crystallography, University of Vienna, Wien, Austria, [5]Lviv Polytechnic National University, Lviv, Ukraine

Phase relations within the ternary system Yb-Pt-B and binary boundary system Pt-B were studied, employing optical and electron microscopy, X-ray powder and single crystal diffraction, electron probe microanalysis and DTA. Phase equilibria were determined within the isothermal sections at 750 °C for the B-poor part (≤40 at.% B) and at 900 °C for the B-rich part (≥40 at.% B) of the system. The crystal structures of compounds have been studied by X-ray powder and single crystal diffraction: $YbPt_5B_2$, a unique structure type, space group C2/m, a=1.54982 nm, b=0.55288 nm, c=0.55600 nm, β=105.367°; $YbPt_9B_2$, a unique structure type, space group P-1, a=0.54650 nm, b=0.55403 nm, c=1.22596 nm, α=96.417°, β=96.981°, γ=90.173°; $YbPt_2B$, $CePt_2B$-type structure, space group $P6_222$, a=0.52498 nm, c=0.78672 nm; $YbPt_3B_x$, $CaTiO_3$-type structure, space group Pm-3m, a=0.40405 nm–0.41177 nm; ~$Yb_{2-x}Pt_{1-y}B_{42}$, a=1.03022 nm, b=1.75880 nm, c=0.82292 nm. Crystal structures of $Pt_{\sim 2}B$ and $Pt_{\sim 3}B$ have been re-investigated; both compounds form new structure types. Whereas the Pt-rich ternary structures are related to the $CeCo_3B_2$-type exhibiting boron atoms in trigonal-prismatic metal atom coordination as a typical feature of structure types at low boron contents, the ~$Yb_{2-x}Pt_{1-y}B_{42}$ crystal structure shows a framework of [B12] icosahedra with metal atoms occupying the empty sites in the icosahedral boron framework. Ternary systems Sc-Pt-B and Y-Pt-B have been studied with respect to the formation of isotypic compounds with Yb-Pt-B system. Phase relations and structural chemistry of compounds in all three systems will be discussed.

Acknowledgement: Research supported by Austrian FWF project V279-N19.

O.S.B.4

ALL ALIPHATIC POLYCARBONATE-BASED POLYURETHANE ELASTOMERS CONTAINING DEGRADABLE UNITS

Milena Špírková, Luďka Machová and Rafał Poręba
Institute of Macromolecular Chemistry AS CR, v.v.i., Prague, Czech Republic

Oligomeric D,L-lactide-based diol (DLL) formed by ring-opening polymerization was prepared and characterized by GPC, NMR spectroscopy and end-group titration analysis. The series of polyurethane elastomers (PUE) was prepared from polycarbonate diol (PCD), DLL, butane-1,4-diol (BD) and 1,6-diisocyanatohexane (HDI) changing the ratio of individual OH groups of diols, but keeping the ratio $[NCO]_{HDI}/[OH]_{total}$ equal 1.05; $[OH]_{total} = [OH]_{PCD} + [OH]_{DLL} + [OH]_{BD}$). One-step procedure preparation was used in all cases. All PUEs are distinguished by segmental character: while PCD and DLL contribute to the soft segments, HDI and BD form hard-segment domains. The degree of soft/hard segment mixing depends significantly on PUE composition. PUE containing equimolar ratio of all hydroxyl groups in the polyurethane backbone is the candidate for potential practical use, e.g., as mechanically strong and degradable PU film.

Acknowledgement: The authors wish to thank the Czech Science Foundation, GAČR (project No. 13-06700S) for financial support.

O.S.B.5

SUPERPARAMAGNETIC γ-Fe_2O_3 NANOPARTICLES OBTAINED BY ONE-STAGE HYDROTHERMAL SYNTHESIS

Mikhail G. Osmolowsky, O.M. Osmolowskaya, M.A. Kozlova, A.D. Furasova, I.V. Murin
Saint-Petersburg State University, Chemistry Department, St. Petersburg, Russia

γ-Fe_2O_3 is well known as a ferromagnetic material with a wide range of applications in medicine. It can usually be obtained in the result of thermal treatment of iron oxides and oxyhydroxides, including magnetite. As a consequence particles of various size and shape are formed. However, their disadvantage is the presence of pores and agglomerates. We have investigated the nanoparticles of maghemite obtained in the process of hydrothermal transformation of $Fe(OH)_3$ with the involvement of modifying agents that regulate the growth of the crystals. The maghemite particles are about 6 nm in diameter, have size narrow distribution and demonstrate all typical superparamagnetic characteristics e.g. their blocked temperature is 77 K approximately.

The reported study was supported by RFBR, research project No. 13-03-00943-a.

O.S.B.6

SYNTHESIS AND CHARACTERISATION OF $La_{2-x}Sr_xCoO_4$ WITH PEROVSKITE-LIKE STRUCTURE

Natalia P. Bobrysheva[1], A.A. Selutin[1], N.V. Dalakova[2]
[1]Saint-Petersburg State University Chemistry Department, St. Petersburg, Russia, [2]Verkin Institute for Low Temperature Physics and Engineering of National Academy of Sciences of Ukraine, Kharkov, Ukraine

Sr-doped cobaltates have attracted considerable attention due to unordinary magnetic and electrical properties. We present the results of synthesis of $La_{2-x}Sr_xCoO_4$ ($0.005 \leq x \leq 1$) and their characterization by XRD, SEM, magnetic susceptibility and resistivity methods. Phase transition antiferromagnetic (AF) – ferromagnetic (FM) is found as temperature grows from 80 to 400 K and the fraction of FM component depends on a Sr-doping level. Temperature dependence of conductivity corresponded to non-activated electron tunneling between adjacent grains of ceramics. All features observed can be explained by the process of microstructural domain formation with various Sr content and the state of interdomain boundaries. Correlations between conditions of synthesis, composition and behavior of cobaltates will be discussed using the model of spin and charge ordering in such ceramics.

O.S.B.7

A SEMI EMPIRICAL ANALYSIS OF MICROCRACKING IN AN AMORPHOUS POLYMER

Mohamed Chabaat
Built & Environmental Research Lab., Civil Engineering Faculty, University of Sciences and Technology Houari Boumediene, B.P. 32 El-Alia, Bab-Ezzouar Algiers, Algeria

This paper presents results of an analysis which considers the interaction between a main crack and a surrounding layer of crazing patterns. Analysis of the stress field distribution as well as the energy release rates induced during these interactions is based on the resolution of some differential equations along with appropriate boundary conditions. Besides, 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. On the other hand, Green’s functions presented herein; can be employed in semi empirical analyses. 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 crazing patterns (or microdefects) on the crack tip shielding or amplification. To quantify the effects of this damage on the main crack, it is shown that the Energy Release Rates (ERR) which arise from the interaction between a finite length crack and surrounding crazes, are defined as being a superposition of the energy released due to the linear propagation of the main crack as well as the one due to the translational change in the growth of the damage. It is also proven that crazes closer to the main crack dominate the resulting interaction effect and reflect an anti-shielding of the damage while a reduction constitutes a material toughness.

Keywords: Displacement, major and minor principal stress, stress intensity factor, energy release rate, crack, crazing patterns, Tresca’s function.

O.S.B.8

SOLIDIFICATION OF MELT SPUN HEUSLER ALLOYS

Pavel Diko[1], V. Kavečanský[1], S. Piovarči[1], T. Ryba[2], R. Varga[2]
[1]Institute of Experimental Physics, Slovak Academy of Sciences, Košice, [2]Institute of Physics, UPJS Kosice, Košice, Slovak Republic

Rapid quenching of Heusler alloys by melt spinning giving very fast cooling rates 10^5-10^6 K/s. It may offer two desirable advantages: avoidance of thermal annealing to reach a homogeneous single-phase alloy and production of highly textured polycrystalline ribbons with improved properties along a specific direction. Heusler alloys prepared by melt spinning were studied by optical and electron microscopy, electron back scattered diffraction and X-ray diffraction. It is shown that faster cooling prevents evolution of phases corresponding to the equilibrium state at higher temperatures and the single phase Heusler alloy can be obtained. Detailed structural analyses had shown that the mechanism of solidification is dominant in microstructure formation. Changes of microstructure at annealing are discussed.

Acknowledgement: This work was realized within the framework of the projects: New Materials and Technologies for Energetics (ITMS 2 6220220061), Infrastructure Improving of Centre of Excellence of Advanced Materials with Nano- and Submicron - Structure (ITMS 26220120 035), which are supported by the Operational Programme ‘Research and Development’ financed through the European Regional Development Fund, VEGA No. 2/0090/13, APVV 0330-12 and SAS Centre of Excellence: CFNT MVEP.

O.S.B.9

THE SYSTEM Ce-Zn-Si AT <33.3 at.% Ce: PHASE EQUILIBRIA, CRYSTAL STRUCTURES, AND PHYSICAL PROPERTIES

Fainan Failamani[1], A. Grytsiv[1], Z. Malik[1], P. Broz[2], G. Giester[3], P. Rogl[1], E. Bauer[4], W. Kautek[1]
[1]Institute of Physical Chemistry, University of Vienna, Vienna, Austria, [2]Masaryk University, Faculty of Science, Department of Chemistry, Brno, Czech Republic, [3]Institute of Mineralogy and Crystallography, University of Vienna, Vienna, Austria, [4]Institute of Solid State Physics, Vienna University of Technology, Vienna, Austria

Phase equilibria in the temperature range from 500°C to 800°C have been determined in the system Ce-Zn-Si revealing five compounds at 600°C: τ_1-$Ce_7Zn_{21}(Zn_{1-x}Si_x)_2$ (unique type; $0.45 \leq x \leq 0.99$), τ_2-$Ce(Si_{1-x}Zn_x)_2$ (AlB_2-type; $0.36 \leq x \leq 0.73$), τ_5-$CeZn(Zn_{1-x}Si_x)_2$ ($CeNiSi_2$-type; $0.68 \leq x \leq 0.76$), τ_6-$CeZn_2(Si_{1-x}Zn_x)_2$ ($ThCr_2Si_2$-type; $0.25 \leq x \leq 0.30$) and τ_7-$Ce_{37}Zn_{48}Si_{15}$ (structure unknown). However only τ_1 and τ_2 are stable also at 800°C. τ_5 and τ_6 form in peritectic reactions at 795±5°C and 695±5°C, respectively. A partial Schultz-Scheil diagram was constructed from DTA performed in closed silica tubes. Crystal structures of τ_1, τ_2, τ_5, τ_6, have all been elucidated from X-ray single crystals refinements. The surface of primary crystallization for binary $CeSi_2$ (α-$ThSi_2$-type) extends far into the Zn-rich corner (>95 at % Zn). Physical properties of the ternary compounds will be discussed.

O.S.B.10

REVERSIBLE RANDOM SEQUENTIAL ADSORPTION OF POLYDISPERSE MIXTURES ON A TRIANGULAR LATTICE

Dijana Dujak[1], I. Lončarević[2], Lj. Budinski-Petković[2], A. Karač[3] and S. B. Vrhovac[4]
[1]Faculty of Metallurgy and Materials, Zenica, Bosnia and Herzegovina, [2]Faculty of Technical Sciences, Novi Sad, Serbia, [3]Faculty of Mechanical Engineering, Zenica, Bosnia and Herzegovina, [4]Institute of Physics Belgrade, Zemun, Serbia

We study adsorption-desorption processes of polydisperse mixtures of extended objects on a triangular lattice. Adsorption-desorption processes can be used as a model of compaction of granular materials, which are often polydisperse. The depositing objects are formed by self-avoiding lattice steps. Numerical simulations were performed to determine the influence of the number of mixtures components and length of the shapes making the mixture on the kinetics of the deposition process. For the mixtures of equal sized objects, we propose a simple formula for predicting the value of steady-state coverage fraction of mixture from the values of the staedy-state coverage fractions of pure component shapes.

O.S.B.11

EXPERIENCE PRODUCTION OF MICROSPHERES FROM COAL SLAG AND THEIR APPLICATION FOR SORPTION OF URANIUM

Tlek Ketegenov[1], A. Kononow[2], T. Oserov[1], O.Tyumenceva[1]
[1]National Engineering Academy of Republic Kazakhstan, [2]Institute of High Technology by the National Atomic Company "Kazatomprom", Kazakhstan

Sustainable development of the fuel and energy complex is impossible without solving the problem of waste disposing generated in significant quantities by coal burning. Currently scientists from different countries are rather intensively developing areas connected with waste processing of large energy companies, containing in its composition from one to three percent of microsphere components. Characteristics of the chemical and mineralogical composition of the microspheres (cenospheres) combined with their low density and high mechanical strength can predict further expansion of their application.

One of these lines is associated with immobilization of radioactive waste. Before, in the works of Russian scientists they have shown the possibility of using microspheres as components of ceramic matrices for binding solid radioactive waste. Meanwhile, hence the chemical composition and the structure of the microspheres we can assume the possibility of their use as synthetic sorbents.

Therefore, the aim of this study was the use of microspheres for the extraction from solutions of heavy and radioactive metals, which is of some practical interest in creating geotechnical barriers.

Conducted in the present work experiments of developing modes of flotation separation of microspheres from wet zolounos slags have allowed to identify the main technological characteristics of the process. In the testing process of wet zolounos slags they proposed the original method of express determination of microsphere intension in the slags. Carried works on the flotation separation of microspheres have enabled to determine the technological characteristics and the flotation regime that has been tested in pilot industrial conditions on a large batch of slag.

Further studies were aimed at obtaining block structures from the isolated microspheres. To obtain block structures of required quality there has been a series of experiments on the selection of various components affecting their properties. There has been considered options of microsphere sintering using mechanical activation and self-propagating high-temperature synthesis. It has been shown that during the combustion process of aluminothermic aluminum - silicon alloys may be successfully replaced by pure aluminum. The received block structure further was tested to explore the possibility of their use for the extraction from solutions of uranium and rhenium. Quite satisfactory results were obtained on the sorption and desorption of uranium and rhenium. In the course of experiments there was established full dynamic exchange capacity of uranium and rhenium structures.

The obtained results on the sorption and desorption of uranium and rhenium by block structures have showed that the products have sorption properties relatively close to the source of cenospheres, but they may be demanded more in the technological aspect of the problem .

PL.S.II.1

WATER AT INTERFACES: WETTING, STRUCTURE AND REACTIONS

Miquel Salmeron
Lawrence Berkeley National Laboratory, University of California Berkeley, USA

We study the structure, growth and wetting properties of water on metals, with emphasis on the molecular scale level. On clean metal surfaces water adsorbs molecularly at low temperature forming unique hexagonal structures resembling basal planes of ice, however the hydrogen bonding rules impose restrictions on the crystal arrangements and growth kinetics. On some metals such as ruthenium and copper, water dissociates into H and OH at temperatures above 140Km forming ordered structures. Using Scanning Tunneling Microscopy we follow the diffusion and aggregation of the water molecules. We also use the STM tip as a manipulator tool, to move, excite and dissociate individual molecules. Finally, for studies under relevant atmospheric conditions we use x-ray photoelectron spectroscopies that operate under environmental ambient conditions. With them we learn about the structure of liquid water surfaces, its melting and its composition in solutions that contain ions.

PL.S.II.2

TOWARDS THREE-DIMENSIONAL ELECTROSTATIC POTENTIAL AND MAGNETIC FIELD CHARACTERIZATION USING ELECTRON HOLOGRAPHY

Rafal E. Dunin-Borkowski[1], Vadim Migunov[1], Jan Caron[1], András Kovács[1]
and Giulio Pozzi[2]
[1]*Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons and*
Peter Grünberg Institute, Forschungszentrum Jülich, Jülich, Germany,
[2]*Department of Physics and Astronomy, University of Bologna, Bologna, Italy*

Off-axis electron holography is a powerful technique for recording the phase shift of the 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, the application of electron holographic tomography to record three-dimensional potentials with nm spatial resolution and the use of ultra-stable transmission electron microscopes to achieve sub-2π/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 typically 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 based on two lines of opposite charge density 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 often 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 inside a specimen from a series of phase images recorded using electron holography. In order to develop the technique, we are generating simulated magnetic induction maps by projecting three-dimensional magnetization distributions onto two-dimensional Cartesian grids. We use known analytical solutions for the phase shifts of simple geometrical objects to pre-compute contributions to the phase from individual parts of the grids, in order to simulate phase images of arbitrary three-dimensional objects from any projection direction, with numerical discretization performed in real space in order to avoid artifacts generated by discretization in Fourier space without a significant increase in computating time. This forward simulation approach is 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 phase images. The use of such a model-based approach avoids many of the artifacts that result from using classical tomographic techniques based on backprojection, as well as allowing additional physical constraints to be incorporated.

PL.S.II.3

ELECTRON ENERGY LOSS SPECTRUM-IMAGING OF LOCALISED SURFACE PLASMON RESONANCES OF METAL NANOPARTICLES IN TWO AND THREE DIMENSIONS

Paul A. Midgley, O. Nicoletti, S.M. Collins, F. de la Pena, T. Ostasevicius,
D. Rossouw, E. Ringe, R.K. Leary, D. Holland, C. Ducati
Department of Materials Science and Metallurgy, University of Cambridge,
Cambridge, United Kingdom

Monochromated scanning transmission electron microscopes offer remarkably high spatial and energy resolution that enable detailed investigations of the surface plasmons (SPs) of metal nanoparticles using electron energy loss spectrum-imaging (EELSI). Here we report results for silver and gold nanoparticles supported on silicon nitride substrates in which individual SP modes are mapped using EELSI and non-negative matrix factorization (NMF) spectral processing. Further, we have focussed on understanding the 3D plasmonic response of silver nanocubes and, by acquiring maps at different orientations, have been able to image directly substrate-induced hybridization of dipolar and quadrupolar modes. By using a series of approximations, a tilt series of EELS maps can be combined in a tomographic fashion to provide a 3D visualization of the LSPRs.

PL.S.II.4

INVERSE SIMULATION OF DISLOCATION NETWORK GENERATION IN EPITAXIAL FILMS

Robert Hull, Dustin Andersen and Hamed Parvaneh
Department of Materials Science and Engineering
Rensselaer Polytechnic Institute, Troy, NY, USA

The kinetics of plastic deformation by dislocations is generally defined by a complex balance of dislocation nucleation, propagation and interaction mechanisms. Misfit dislocation networks in strained epitaxial films represent a model system for illuminating and deconvolving these mechanisms through control of key experimental parameters: through control of several key parameters: (i) The resolved shear stress can be quantitatively controlled through the film thickness, lattice mismatch and substrate orientation; (ii) The dislocation Burgers vector can be controlled through the orientation of the interface and the sign of the mismatch stress; (iii) The geometry of the interfacial dislocation array can be controlled through the interface orientation; and (iv) The length of the propagating dislocation segments can be controlled through the film thickness. We have experimentally studied and quantified dislocation nucleation, propagation and interaction mechanisms in strained GeSi/Si(100) films, and have developed a predictive simulator for development of misfit dislocation arrays. However, while we have relatively robust universal descriptions for dislocation propagation and interaction in this system, the dislocation nucleation rate is particularly complex to quantify because different mechanisms (homogeneous, heterogeneous or multiplication) dominate or compete in different film strain-thickness regimes. Thus no single equation can accurately describe this full set of nucleation mechanisms. By comparing extensive sets of experimental data and simulation predictions of the development of the dislocation array within different film strain-thickness regimes, we can refine the quantitative description of the dislocation nucleation mechanism by optimizing the relevant parameters (e.g. nucleation activation energy, stress dependence, attempt frequency) to minimize the difference between experimental and simulated data sets. This inverse simulation approach is proving to be particularly efficient as the simulator structure is transitioned between different systems. For example, translation of the simulator between the GeSi/Si(100) system (where most of original data for development of the simulator was developed) to the GeSi/Si(110) system improved the predictive accuracy of the simulator by an order of magnitude for the new system when this refinement was performed over about twenty data points spread over five different structures. Ultimately, our goal is to be able to extend these methodologies as efficiently as possible to new systems, describing both structural and electronic properties of dislocation arrays, by defining the minimum data sets necessary to build predictive capability through these refinement methods. Work is in process to extend these methods to III-nitride epitaxial structures.

Previous experimental work in collaboration with J. Bean, J. Floro (U. Virginia); F. Ross (IBM); E. Stach (BNL); and C.C. Wu (ARL). Work now supported by NSF-DMR-1309535.

PL.S.II.5

ELECTRON VORTEX BEAMS – A NOVEL PROBE FOR NANOANALYTICS

Peter Schattschneider
Institute of Solid State Physics and Service Centre for Electron Microscopy,
Vienna University of Technology, Vienna, Austria

Shortly after the discovery of vortex electrons in 2010, free electrons with quantized angular momentum could be routinely created in the electron microscope. Such vortices are characterized by a spiraling wavefront and a phase singularity at the center. Owing to their short wavelength, these matter waves can be focused to atomic size. Another novel aspect is their magnetic moment $\mu_{\mathbf{B}}\, m$ quantized in multiples of the Bohr magneton, independent of the electron spin. These features make electron vortices extremely attractive as a nanoscale probe in solid state physics. Nanocluster rotation and detection of spin polarisation of single atomic columns has been demonstrated, and we are still exploring novel applications. Vortices could serve as electron tweezers to move or rotate single atoms or molecules, to improve spatial resolution in the electron microscope, or to detect sub-meV energy differences.

Acknowedgements: The financial support of the Austrian Science Fund (I543-N20) is gratefully acknowledged.

PL.S.II.6

INTERFACE AND DEFECT PHENOMENA IN HIGH-EFFICIENCY SOLAR CELLS

Wolfgang Jäger
Institute for Materials Science, Christian-Albrechts-University of Kiel, Kiel, Germany

Multi-junction solar cells are of interest for power generation in space applications and in terrestrial concentration photovoltaics (CPV). They consist of several cells of different III-V compound semiconductor materials. Each cell absorbs a different wavelength range of the solar spectrum and converts it into electric power. Efficiencies for the conversion of sunlight into electricity well above 40% have been obtained for concentrator solar cells grown by metal-organic vapor deposition on Ge substrates, with a record efficiency of 44.7 % measured for a new solar cell structure [*]. We applied high-resolution imaging and spectroscopic techniques of transmission electron microscopy to support the development of novel multi-junction solar cell concepts through comprehensive analyses of microstructure and layer interfaces. These investigations contributed to controlling defects and layer strains in lattice-mismatched epitaxial layer growth on Ge [1,2] and on Si [3], and to monitoring quantitatively and with high precision the structure and elemental distribution near interfaces after semiconductor wafer bonding for solar cells on Si substrates [3-5]. Methods of aberration-corrected transmission electron microscopy extend the analytical capabilities of interface analyses by far [4]. In situ TEM annealing experiments allow monitoring the influence of elevated temperatures (≤ 400C°) on the interface structure in wafer-bonded solar cells. Optimized solar cell concepts result in active cell regions with significantly reduced defect densities. Such concept developments led to a GaInP/GaAs/Ge cell [**] with a record efficiency of 41.1 % [**] and a GaInP/GaAs/Si solar cell [5] with an efficiency of 26.1 %.

It is a pleasure to acknowledge the contributions of my former colleagues Jan Schöne, Erdmann Spiecker, Mert Kurttepeli and Dietrich Häussler from the Microanalysis of Materials Group, CAU Kiel, Germany, of Frank Dimroth and colleagues Karen Derendorf, Stephanie Essig, Vera Klinger, Tobias Roesener and Andreas W. Bett from the Fraunhofer Institute for Solar Energy Systems, Freiburg, Germany, and of Lothar Houben and Rafal Dunin-Borkowski from the Ernst-Ruska Center, Jülich, Germany.

References

(1) J. Schöne, E. Spiecker et al.: *Defect Formation and Strain Relaxation in graded GaPAs/GaAs, GaNAs/GaAs and GaInNAs/Ge Buffer Systems for high-efficiency Solar Cells*. Journal of Physics: Conference Series 471, 012008 (2013). (2) J. Schöne, E. Spiecker et al.: *Misfit dislocation blocking by dilute nitride intermediate layers.* Appl. Phys. Lett. 92, 081905 (2008). (3) K. Derendorf, S. Essig et al.: *Fabrication of GaInP/GaAs//Si Solar Cells by Surface Activated Direct Wafer Bonding*. IEEE Journal of Photovoltaics Vol 3, Issue 4 (2013) p.1423-1428. (4) D. Häussler, L. Houben et al.: *Aberration-corrected transmission electron microscopy analyses of GaAs/Si interfaces in wafer-bonded multi-junction solar cells.* Ultramicroscopy 134**,** 55–61 (2013). (5) F. Dimroth, T. Roesener et al.: *Comparison of Direct Growth and Wafer Bonding for the Fabrication of GaInP/GaAs Dual-Junction Solar Cells on Silicon.* IEEE Journal of Photovoltaics, accepted for publication (2014). (*) Fraunhofer Institute for Solar Energy Systems, Freiburg: www.ise.fraunhofer.de/en/press-and-media/press-releases/presseinformationen-2013/world-record-solar-cell-with-44.7-efficiency (**) Fraunhofer Institute for Solar Energy Systems, Freiburg: press release No. 01/09 (Jan14, 2009), www.ise.fraunhofer.de

O.S.C.1

NANO- AND BIOSTRUCTURIZATION PROCESS TO OPTIMIZE THE OPTICAL MATERIALS FEATURES

Natalia V. Kamanina[1,2]
[1]Lab for Photophysics of Media with Nanoobjects, Vavilov State Optical Institute, St.- Petersburg,
[2]Saint-Petersburg Electrotechical University ("LETI"), St. Petersburg, Russia

In the present paper some accent are given to show the advantage of the nano- and bio-structurization process to modify the refractive features of the organic optical materials treated by holographic laser technique. Laser-induced change of the refractive index is observed in the organics with fullerenes, quantum dots, DNA, etc. Moreover, some evidences to decrease the resistivity of the conducting inorganic structures and wetting angle of some different inorganic materials are discussed.

The presented results are correlated with the work partially supported by Russian Foundation for Basic Research, grants No.13-03-00044 (2013-2015) as well as by FP7 Marie Curie International researchers exchange proposal "BIOMOLEC" (2011-2015).

O.S.C.2

MECHANOCHEMICAL SYNTHESIS OF NANOCARBON AND METAL OXIDE NANOPARTICLES USING SUPER-HIGH-ENERGY BALL MILLING

Satoshi Ohara, Zhenquan Tan, Kazuhiro Yamamoto, Nan Qiu, Takeshi Hashishin
Joining and Welding Research Institute, Osaka University, Ibaraki, Osaka, Japan

Herein a unique mechanochemical approach to produce sophisticated nanocarbons is reported. It is demonstrated that unique carbon nanostructures, including carbon nanotubes, carbon onions, and new carbon nanorings are synthesized by super-high-energy ball milling of steel balls [1,2]. It is considered that the gas-phase reaction takes place around the surface of steel balls under local high temperatures induced by the collision energy in super-high-energy ball milling, which results in phase separated unique nanocarbons. This paper also shows the mechanochemical synthesis of metal oxide nanoparticles such as ilmenite with a high-temperature and high-pressure phase by the super-high-energy ball milling [3,4].

[1] S. Ohara, Z. Tan, J. Noma, T. Hanaichi, K. Sato, and H. Abe, "Collision Synthesis of Unique Carbon Nanomaterials Inspired by the Allende Meteorite", Solid State Comm., 150, p.198-200, (2010).
[2] Z. Tan, H. Chihara, C. Koike, H. Abe, K. Kaneko, K. Sato, and S. Ohara, "Interstellar Analogues from Defective Carbon Nanostructures Account for Interstellar Extinction", Astronomical Journal, 140, p.1456-1461, (2010).
[3] S. Ohara, K. Sato, Z. Tan, H. Shimoda, M. Ueda, and T. Fukui, "Novel Mechanochemical Synthesis of Fine $FeTiO_3$ Nanoparticles by a High-Speed Ball-Milling Process", J. Alloys and Compounds, 504, p.L17-L19, (2010).
[4] T. Hashishin, Z. Tan, K. Yamamoto, Q. Nan, J. Kim, C. Numako, T. Naka, J.-C. Valmalette, and S. Ohara, "Quenching Ilmenite with a High-Temperature and High-Pressure Phase using Super-High-Energy Ball Milling", Scientific Reports, 4, 4700; DOI: 10.1038/srep04700, (2014).

O.S.C.3

STRUCTURE AND PROPERTIES OF COPPER MATRIX COMPOSITES WITH GRAPHENE ADDITIONS

Jan Dutkiewicz[1], Bogusz Kania[1], Piotr Dłużewski[2], Wojciech Maziarz[1]
[1]Institute of Metallurgy and Materials Science of the Polish Academy of Sciences Kraków, Poland, [2]Institute of Physics of the Polish Academy of Sciences, Warsaw, Poland

Copper matrix composites with 1-2 wt. % of graphene were prepared in order to combine excellent mechanical and electrical conductivity properties of grapheme and copper. They were consolidated from powders using hot pressing in vacuum. The powders were ball milled in a high energy mill to mix powders and to refine graphene by milling, since it was reported in literature that ball milling allows to refine multilayer graphene particles. Two types of commercial graphene were used. The first one from ~10-20 nm in thickness N-006 from Angstrom Materials and the second one FL-RGO reduced graphene oxide from Nanomaterials company in Warsaw. The latter one is much finer and contain less than 10 atomic layers. The TEM high resolution studies confirmed these specifications and the N006 graphene was identified as nano-graphite flakes, as confirmed by X-ray diffraction of thickness 8-16 nm, while that from nanomaterials shows diffused reflections which were identified as graphene oxide and grapheme. TEM studies performed using microtome cut samples from epoxy inclined grapheme, confirmed only a few atomic layer structure of the grapheme flakes. The composites were prepared starting from ball milling, followed by hot pressing in vacuum at temperature of 525^{o}C at uniaxial pressure of 600 MPa, what allowed to obtain composites of porosity below 1%. The measured microhardness of composited was 72-77 HV and Young's modulus 74 GPa, indicating significant strengthening as compared to pure Cu. SEM studies shown rather nonhomogeneous distribution of graphene arranged in bands reach in graphene, separated by addition free bands, in spite of 5 hours milling. TEM studies confirmed SEM observation and in addition allowed to show diffused reflections from places rich in graphene corresponding to d = 0.335 nm from nano-graphite flakes being often visible in the form of layers between copper fine grains. Atomic resolution micrographs allowed to distinguish nano-graphite layers of thickness 4 – 10 nm, from copper due to different contrast and lattice distance and highly defected character of nano-graphite lattice planes.

O.S.C.4

MYSTERIOUS STRUCTURES IN SDS-CONTAINING DISPERSIONS OF HEMATITE

Edward Mączka, Marek Kosmulski
Lublin University of Technology, Lublin, Poland

Hematite dispersions in SDS-containing solutions (1 or 10 mM) have been studied. Surprisingly the apparent particle size in the presence of SDS was substantially higher than in hematite dispersions far from isoelectric point, in absence of SDS. This observation can be interpreted as formation of aggregates composed of several primary hematite particles, in which SDS acts as a bridge between those particles. Aggregation is SDS-containing is rather unexpected because of high absolute value of ζ potential. The effect of inorganic anions on the aggregation behavior of hematite in the presence of SDS was also studied.

Reference:

E.Mączka, M.Kosmulski, Colloid and Interface Science Communications 1 (2014).

O.S.C.5

TEMPLATE SYNTHESIS OF Mo_2C NANOWIRES AND SINGLE-PHASE δ_3 -MoN SUPERCONDUCTING NANOWIRES

Aleš Mrzel, A. Kovič, Z. Jagličič, A. Jesih, J. Buh, D. Mihailović
Jožef Stefan Institute, Ljubljana, Slovenia

We have demonstrated a new facile method for the controllable synthesis of Mo_2C nanowires and superconducting high quality single-phase MoN nanowires with T_c 13 K from MoSI nanowires templates. By controlling the reaction conditions during the transformation, the carbon nanofibres have been densely grown on Mo_2C nanowires resulting a novel hybdide nanomaterial. The MoN nanowire diameters were controlled exclusively by the MoSI nanowires template diameters, which were in the range between 30 and 500 nm in this study. Furthermore, we have demonstrated that Ohmic contacts can be prepared on $\boldsymbol{\delta_3}$–MoN with ion beam induced platinum deposition using an FIB, allowing detailed and comprehensive characterization of the superconducting and transport properties of $\boldsymbol{\delta_3}$–MoN nanowires. The demonstration of the template synthesis facilitates the controlled manufacture of both single nanowires and nanowire circuits, whose topology is determined only by the MoSI starting material. X-ray diffraction, scanning electron microscopy with wave dispersive analysis, transmission electron microscopy, four probe electrical transport measurements and SQUID were used to characterize the starting nanowires and the final products.

O.S.C.6

NOVEL MIXED PHASE SnO_2 NANORODS FOR ENHANCING GAS-SENSING PERFORMANCE TOWARDS ISOPROPANOL GAS

Igor Djerdj, Marko Nuskol, Jasminka Popović
Division of Materials Physics, Ruđer Bošković Institute, Zagreb, Croatia

The synthesis and the gas sensing properties of a novel mixed phase (i.e., tetragonal and orthorhombic phase) coexistence SnO_2 nanorods is presented. The mixed phases SnO_2 nanorods were obtained by calcinations of SnC_2O_4 synthesised with a chemical precipitation method using $SnCl_2{\cdot}2H_2O$ and PEG 400 as precursors. The resulting nanorods appear as polycrystalline composed of spherical mixed phases SnO_2 nanocrystals and have a high surface area. It was observed that the calcination temperature was the key parameter determining the content of the orthorhombic phase. The as-synthesized compounds were used as sensing materials of the sensors of indirect heating structure and tested for their ability to detect volatile organic compounds (VOCs), such as isopropanol, acetone, alchohol, and formaldehyde. Gas sensing tests showed that these mixed phases SnO_2 nanorods are highly promising for gas sensor applications, as the gas response for isopropanol was significantly enhanced by the presence of orthorhombic phase (S=61.5 to 1000 ppm isopropanol and response time and recovery time of 4 and 10 s). The as-prepared two phases SnO_2 nanorods with the highest content of the orthorhombic phase exhibit excellent gas response, selectivity, and stability toward isopropanol gas at the optimized operating temperature of 255 °C. The enhancement in sensitivity is attributed to the presence of small orthorhombic SnO_2 crystals with average radius shorther than the Debye screening length of 7 nm for SnO_2.

We acknowledge the Unity through Knowledge Fund (www.ukf.hr) of the Croatian Ministry of Science, Education and Sports (grant no. 7/13).

O.S.C.7

PHOTOCATALYTIC ACTIVITY OF ZnO-PEO COMPOSITES

Smilja Marković, V. Rajić, A. Stanković, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

The removal of organic pollutants from wastewater is very important for environmental protection. During the years different methods have been developed and applied on wastewater treatment. Between those methods a heterogeneous photocatalysis has received extensive attention since it allows a complete mineralization of pollutants. ZnO-based materials has established role in heterogeneous photocatalysis. However, major drawback of ZnO is a band energy gap of 3.37 eV (368 nm) which restricts the material to absorb only UV light. Since sunlight is a source of clean and cheap energy, where UV light makes no more than 3–5% while visible light is about 45% of the total sunlight, it is highly desirable to synthesize ZnO-based materials capable for visible light photocatalysis. To modify the optical absorption properties and improving the visible light photocatalytic activity of ZnO materials several approaches have been applied: (1) metal ion doping, (2) nonmetal doping, (3) defect induced doping, (4) surface sensitization of ZnO particles to extend the spectral response into the visible region, (5) band gap modification by creation of oxygen vacancies and oxygen sub-stoichiometry, etc.

In this study, ZnO powder with nanospherical morphology was synthesized by microwave processing. In the continuation, the synthesized powder was used for preparation of composites with polyethylene oxide (PEO). PEO powders with three different molecular mass (200.000, 600.000 and 900.000) were used for composites preparation. The phase purity and crystal structure of the composites were investigated by X-ray diffraction and Raman spectroscopy. The particles morphology and size distributions were studied by FE–SEM and laser diffraction particle size analyzer, respectively. The optical properties were studied using UV–Vis diffuse reflectance and photoluminescence spectroscopy. The photocatalytic activity of ZnO-PEO composites was examined *via* decomposition of methylene blue (MB) under direct sunlight irradiation. A large efficiency of MB degradation was found after 6 h of irradiation. An enhanced optical and photocatalytical properties of ZnO-PEO composites were attributed to: (1) lattice defects introduced in crystal structure of ZnO by fast microwave processing, and (2) surface sensitization by polyethylene oxide (PEO).

O.S.C.8

SYNTHESIS AND PROPERTIES OF MULTIFUNCTIONAL POLYMER COMPOSITES AND ORDERED ARRAYS OF NANOSTRUCTURES WITH PHOTOCHROMIC 3D METAL COMPLEXES

Nataliya A. Sanina
Institute of Problems of Chemical Physics RAS, Chernogolovka, Russian Federation

One of the key directions in nanotechnology is the organization of nano-objects in the system of interacting elements that are managed by external influences and is compatible with existing element base of electronic-optical devices. Design of the powder nanostructures widespread and brings the certain results, showing that the physical properties of organic and metal-organic materials essentially change as a result of nanostructuring. However actual application of nano-objects of the polyfunctional compounds is possible in case of their organization in ordered structures. Complexes of 3d metals with photochromic organic cations have a number of advantages in comparison with known compounds displaying photocontrol magnetism: i) the possibility of a light reversible change magnetic moment at room temperature; ii) the change of the magnetic moment under the action of light by a large amount (50-100%); iii) to be convenient objects for nanostructuring and to create nanofilms. The latter can be considered as a technological project of nanochip creation with fotocontrol magnetic elements.

In present work homogeneous composites of polyvinylpyrrolidone and polystyrene with photochromic magnetic complexes of the 3d metal (tris)oxalates with photochromic indoline spiropyrans were obtained for the first time. Their photochemical characteristics and magnetic properties were studied. Changes in the spectra of electron paramagnetic resonance under the action of UV irradiation in polymer films polystyrene containing photochromic paramagnetics were detected.

Ordered arrays of nanowires of the photochromic antiferromagnets based on 3d metals (tris)oxalates and indoline spiropyranes incorporated into the pores anodised aluminium oxide (AAO) diameter of 20 nm were synthesized too. The change of the magnetic properties of the materials obtained as a result of their nanostructuring was detected. It was shown that the nanostructuring leads to the suppression noncollinear ordering spins, turning spin-the canted antiferromagnetic in uniaxial antiferromagnets.

The work has been supported by the Program of the Presidium of RAS ”Fundamental studies of nanotechnologies and nanomaterials”.

O.S.C.9

SYNTHESIS AND APPLICATIONS OF CARBON NANOWALL FILMS

Victor A. Krivchenko, K.V. Mironovich, P.V. Voronin, S.A. Evlashin
D.V. Skobeltsyn Institute of Nuclear Physics of
M.V. Lomonosov Moscow State University, Moscow, Russia

The carbon nanowall (CNW) film is a material composed of a dense array of micron-size flakes with layered graphite-like structure and dominating vertical orientation and chaotic lateral displacement with hundreds of nm mean spacing. Thickness of each flake may vary from several graphene layers to tens of nanometers which is the reason for term nanowall. The most widely used method for the CNW film fabrication is plasma enhanced chemical vapour deposition with different ways of plasma activation. The present work is aimed at an overview of general aspects of catalyst-free nucleation and growth of CNWs on silicon substrates in the plasma of dc glow discharge. Also different applications of the CNW films are considered. The work may be divided of the following sections. Thus evolution of the CNW structure during its growth is considered in the first section. Second section is devoted to both results of plasma calculation and phenomenological model of the CNW nucleation and growth. Application of the CNW films as electron field emitter, catalyst support, light absorber, an electrode material in supercapacitors and Li-ion batteries is considered in the third section.

This work was financially supported by grant MK-2773.2014.2.

O.S.C.10

ORDERED ARRAYS OF SINGLE PHOTON EMITTERS BASED ON GaN NANOWIRES HOSTING InGaN NANO-DISKS

E. Chernysheva[1], Snežana Lazić[1], Ž. Gačević[2], S. Albert[2], A. Bengochea-Encabo[2], M. Müller[3], F. Bertram[3], J. Christen[3], H. van der Meulen[1], J. M. Calleja[1] and E. Calleja[2]
[1]Departamento de Física de Materiales, Universidad Autónoma de Madrid, Madrid, Spain, [2]ISOM and Departamento de Ingeniería Electrónica, ETSI Telecomunicación, Universidad Politécnica de Madrid, Madrid, Spain, [3]Institute of Experimental Physics, Otto-von-Guericke-University Magdeburg, Magdeburg, Germany

We demonstrate here highly efficient single-photon emission from (In,Ga)N nano-disks embedded into two-dimensional ordered arrays of GaN nanowires (NWs). The structures were fabricated by molecular beam epitaxy on (0001) GaN-on-sapphire templates using nanohole masks prepared by colloidal lithography. Intense and narrow excitonic transitions originating from the apices of the (In,Ga)N sections are observed in the green spectral region. They show a high degree of linear polarization and pronounced photon antibunching with a $g^{(2)}(0)$ values below 0.5. The antibunching rate increases linearly with the optical excitation power, extrapolating to the exciton decay rate of ~1 ns^{-1} at vanishing pump power. Comparison of the emission spectra of the NW arrays and of individual NWs dispersed on a Si substrate indicates a marked increase in the emission efficiency along the NW direction. Efficient, fast generation and strong linear polarization of antibunched photons as well as the possibility to control the spatial location of quantum emitters, render this system promising for the realization of arrays of site-controlled single-photon sources for on-chip quantum information management.

O.S.C.11

OLEIC-ACID-COATED COBALT FERRITE NANOPARTICLES

Sonja Jovanović[1], M. Spreitzer[1], M. Tramšek[2], Z. Trontelj[3], D. Suvorov[1]
[1]Advanced Materials Department, Jožef Stefan Institute, Ljubljana, Slovenia, [2]Department of Inorganic Chemistry and Technology, Jožef Stefan Institute, Ljubljana, Slovenia, [3]Institute of Mathematics, Physics and Mechanics, Ljubljana, Slovenia

In recent years, cobalt ferrite (CFO) has been investigated because of its properties such as a large magnetic anisotropy, high coercivity, moderate saturation magnetization, significant chemical stability and mechanical hardness. Consequently, CFO can be used in various applications, such as recording media, magnetic refrigeration, ferrofluids, and for drug delivery, etc.

In this work, an effort was made to examine the influence of the oleic acid concentration on the physicochemical properties of solvothermally derived CFO nanoparticles (NPs). X-ray diffraction (XRD) and transmission electron microscopy (TEM) showed that samples prepared with an oleic acid concentration between 0 and 0.15 M consist of agglomerated nanoplatelets and nanoparticles with a crystallite size between 11 and 19 nm, while the samples prepared with an oleic acid concentration above 0.20 M consists of well-dispersed sphere-like NPs with a size of ~6 nm. Thermo-gravimetric (TG) analysis revealed that the samples prepared with an oleic acid concentration above 0.25 M have a relatively constant surface coverage of the oleic acid ligand, while Fourier transform infrared spectroscopy (FT-IR) showed that particle-size control was achieved by bridging bidentate interactions between the oleic acid molecules and the metal atoms on the surface of the NPs. According to the Raman spectra, the interactions between oleic acid ligands and metal atoms on the NP surfaces affected the strain of the NPs, but kept the initial cation redistribution. The room-temperature measurements performed on a vibrating-sample magnetometer (VSM) showed that the magnetic behavior of the CFO NPs, which changes from ferrimagnetic to superparamagnetic, can be controlled by the oleic acid concentration. Low-temperature magnetic measurements performed on a superconducting quantum interference device (SQUID) revealed a decrease of the surface anisotropy for the samples prepared with an oleic acid concentration above the critical value.

O.S.C.12

THE EFFECT OF ULTRAFINE PARTICLES FORMED DURING AGING AND ULTRAFINE GRAIN STRUCTURE AFTER HIGH PRESSURE TORSION IN THE HARDENING OF THE Mg-Y-Gd-Zr ALLOY

Elena A. Lukyanova[1,2], L.L. Rokhlin[1], S.V. Dobatkin[1,2], T.V. Dobatkina[1]
[1]A.A.Baikov Institute of Metallurgy and Materials Science, Russian Academy of Sciences, Moscow, Russia, [2]National Science and Technology University "MISIS", Laboratory of Hybrid Nanostructured Materials, Moscow, Russia

In recent years many scientific investigations were carried out in order to develop high strength magnesium alloys with rare earth elements for the widespread application. Among the most promising magnesium alloys are alloys of Mg-Y-Gd-Zr system. The hardening effects of one of the wrought alloys of this system, IMV7-1 (Mg-4.7%Y-4.6%Gd-0.3%Zr) by the structure transformations during decomposition of the Mg-base supersaturated solid solution and severe plastic deformation (SPD) were studied. IMV7-1 alloy demonstrates UTS = 435 MPa at EL = 4.9% in aged after hot extrusion condition. It was established that the maximum strengthening effect is achieved in it during aging at 200°C as a result of the precipitation of the ultradisperse particles (~ 20-30 nm) of the metastable β’ phase with orthorhombic crystal lattice. In accordance with transmission electron microscopy (TEM) analysis, the β’ phase and the early formed β” phase with DO_{19} lattice co-existed in the peak-aged condition. Both of them were coherent with magnesium matrix. The higher aging temperature 250ºC resulted in formation of the equilibrium precipitates corresponding to the $Mg_{24}(Y,Gd)_5$ formula. They are formed as plates along dislocations. Precipitates are located on the prism planes of magnesium matrix and perpendicular to the basal plane slip. Thus this provides the strengthening effect of IMV7-1 alloy. To achieve higher mechanical properties IMV7-1 alloy was subjected to SPD by high pressure torsion (HPT). HPT was carried out at temperatures of 20, 200 and 300ºC under pressure of 6 GPa with 10 turns on the samples with dia. of 20 mm. The initial annealed (510°C, 4 h) IMV7-1 alloy has a strength of UTS = 280 MPa at EL = 18% and HV = 1000 MPa. SPD by HPT leads to essential hardening. With increasing deformation temperature, the microhardness decreases from 1400 down to 1340 and 1210 MPa at 20, 200 and 300ºC respectively. Microhardness maximum is achieved after HPT at room temperature, but all samples were broken brittle in the elastic region during tensile tests. TEM analysis of IMV7-1 alloy after HPT at room temperature showed the formation of nonuniform structure with shear bands and regions of nano-level grains with average size of ~30 nm. Aging behavior of IMV7-1 alloy after HTP showed that it could be additionally toughened due to aging treatment. The aging possibility of IMV7-1 alloy after HPT in the temperature interval 175-200°C is presented by results of measurements of electrical resistivity and microhardness. The maximum strengthening is achieved after aging at 200°C for 16 hours. In this case IMV7-1 alloy had homogenous structure with average grain size of 50-60 nm. HPT at temperature of 200°C allowed to obtain the highest strength of UTS=475 MPa at EL = 2.5%.

O.S.C.13

ENHANCEMENT OF COERCIVITY FOR Nd-Fe-B SINTERED MAGNETS

Young Do Kim
Department of Materials Science and Engineering, Hanyang University, Seoul, Korea,

Nd-Fe-B sintered magnets are core materials of variable advanced industries from electronic vehicles to medical devices because of their outstanding magnetic properties. However, typical sintered Nd-Fe-B magnet is limited in application by its thermal degradation of coercivity due to low Curie temperature. Thermal degradation can be overcome by obtaining higher coercivity for the utilization of sintered Nd-Fe-B magnets at temperatures close to Curie temperature.

In this study, we demonstrate grain refinement and interfacial control via modified sintering process to achieve higher coercivity. The increase in coercivity of the Nd-Fe-B sintered magnet is discussed from a microstructural point of view.

O.S.E.1

POLY (DL-LACTIDE-CO-GLYCOLIDE) NANOSPHERES WITH ENCAPSULATED SELENIUM NANOPARTICLES AS A SYSTEM WITH THERAPEUTIC FUNCTIONALITY

Magdalena Stevanović[1], Jana Nunić[2], Jonghoon Choi[3], Miloš Filipović[4],
Dragan Uskoković[1], Theodore Tsotakos[5], Eirini Fragogeorgi[5], Dimitris Psimadas[5],
Lazaros Palamaris[5], George Loudos[5]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Department of Genetic Toxicology and Cancer Biology, National Institute of Biology, Ljubljana, Slovenia, [3]Center for Biomaterials, Biomedical Research Institute, Korea Institute of Science and Technology, Seoul, Republic of Korea, [4] Department of Chemistry and Pharmacy, University of Erlangen-Nuremberg, Erlangen, Germany, [5] Department of Biomedical Technology Engineering, Technological Educational Institute of Athens, Greece

Selenium (Se) is an essential trace element with important physiological functions and extensive pharmacological actions. The role of selenium as a chemopreventive and chemotherapeutic agent has been supported by a large number of epidemiological, preclinical, and clinical trials. Uniform, stable, amorphous selenium nanoparticles (SeNps) have been synthesized and additionally encapsulated within spherical PLGA particles (PLGA/SeNps). The morphology (size and shape) of the particles plays key role in their adhesion and interaction with the cell. Synthesized particles were characterized by FTIR spectroscopy, FESEM, TEM, HRTEM, and Zeta potential measurements. The influence of PLGA/SeNps on cell viability, ROS generation in HepG2 cells, as well as anticancer activity against epithelial tumor cells was investigated. As a part of this study, we have also performed *in vivo* dynamic imaging studies in normal mice, using SPECT imaging and a high resolution gamma camera. The PLGA/SeNps nanoparticles have been radiolabelled with Tc-99m, by applying the direct labeling method. Ex vivo biodistribution measurements, as well as in vivo dynamic studies up to 1h p.i. and at 24h were performed, showing increased concentration in liver and spleen.

O.S.E.2

EGGSHELL MEMBRANE BIOMATERIAL AS A PLATFORM FOR SYNTHESIS OF SEMICONDUCTOR NANOCRYSTALS

Matej Baláž, Peter Baláž
Institute of Geotechnics, Slovak Academy of Sciences, Košice, Slovakia

Eggshell membrane (ES) is a unique biomaterial, which is generally considered as waste. However, it has extraordinary properties which can be utilized in various fields and its potential applications are therefore now being widely studied [1]. In this study, ESM and lead acetate $(CH_3COO)_2Pb.3H_2O$ were successfully used as sulfur and lead precursors for the mechanochemical synthesis of PbS nanocrystals [2]. This synthetic approach can be considered environmentally friendly, because a solvent-free mechanochemical procedure was performed under ambient temperature and atmospheric pressure. The resulting nanocrystals are ~8 nm in size. Characterization by XRD, EDS, FE-SEM, TEM (HRTEM) and specific surface area measurement methods showed that the particles are single, defect-free crystals with high crystallinity.

[1] Baláž M.: Eggshell membrane biomaterial as a platform for applications in materials science, Acta Biomater., in press (2014), doi 10.1016/j.actbio.2014.03.020.

[2] Baláž M., Baláž P., Sayagués M. J., Zorkovská A.: Bio-inspired mechanochemical synthesis of semiconductor nanomaterial using eggshell membrane, Mater Sci. Semiconductor Process. 6 (2013) 1899-1903.

O.S.E.3

THE SUCCESS RATE OF HYDROXYAPATITE NANOPARTICLES COATED WITH BIORESORBABLE POLYMERS IN A BIOLOGICAL ENVIRONMENT

Nenad Ignjatović[1], Zorica Ajduković[2], Sanja Vranješ-Djurić[3], Dragan Uskoković[1]
[1]Centre for Fine Particles Processing and Nanotechnologies, Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Clinic of Stomatology, Department of Prosthodontics, Faculty of Medicine, University of Niš, Niš, Serbia, [3]Laboratory for radioisotopes, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

Hydroxyapatite (HAp) nanoparticles coated with bioresorbable polymers have been successfully used as filler, carriers of antibiotics, vitamins and stem cells in bone tissue engineering. Interactions in the microenvironment of nanoparticulate hydroxyapatites and tissues are of a particular interest and present a challenge in regenerative medicine. The phenomena that influence the success of targeting and controlled operation or therapeutic nanosystems are numerous and complex: size, shape, surface charge, functional groups of nanoparticles, electrical double-layer formation, zeta potential, partial molar free energy, sorption molar free energy, isoelectric point of solid–liquid interface; receptor–ligand binding interactions of nano-bio interface etc.

In our studies we present the synthesis, characterization, *in vitro* and *in vivo* research of nanoparticulate form of HAp-coated polymers systems. Synthesized nanoparticulate HAp coated with different types of bioresorbable polymers: poly(D,L-lactide-co-glycolide), chitozan and other similar by the solvent/non-solvent method. The physical and chemical analyses have confirmed that HAp particles are coated with bioresorbable polymers. Results of spectroscopic analysis suggests formation of hydrogen bonds between the surface groups of HAp and =O and –H groups in the polymer chain from bioresorbable polymers. By adding nanoparticulate HAp in the polymer matrix was achieved the changes in the partial molar free energy and sorption molar free energy of the system. *In vitro* results showed satisfactory biocompatibility of nanoparticulate HAp-coated polymers systems. The use of these systems in the form of filler was achieved a high quality osteogenesis in reconstruction of bone tissue, *in vivo*.The biodistribution of ^{125}I-labeled HAp particles after intravenous injection in rats showed the potential use of these materials as a organ-targeting system: uncoated-HAp mostly targeted the liver, coated-HAp spleen and lungs.

O.S.E.4

EVALUATION OF Ag/ALGINATE COLLOID SOLUTIONS REGARDING CYTOTOXICITY: *IN VITRO* AND *IN VIVO* STYDIES

Jovana Zvicer[1], Lenart Girandon[2], Urška Potočar[2], Mirjam Fröhlich[2,5],
Ivan Jančić[3], Biljana Bufan[3], Marina Milenković[3], Jasmina Stojkovska[4],
Vesna Mišković-Stanković[1], Bojana Obradović[1]
[1]Faculty of Technology and Metallurgy, University of Belgrade, Serbia, [2]Educell LLC, Ljubljana, Slovenia, [3]Department of Microbiology and Immunology, Faculty of Pharmacy, University of Belgrade, Serbia, [4]KreativTeh LLC, Belgrade, Serbia, [5]Department of Biochemistry, Molecular and Structural Biology, Jožef Stefan Institute, Ljubljana, Slovenia

In this study, we have investigated cytotoxicity of 1 mM Ag/alginate colloid solution in two *in vitro* systems: cell monolayer cultures (on cell line L929, human Adipose-derived Stem Cells (hASCs) and bovine calf chondrocytes) and bovine calf articular cartilage tissue culture in a biomimetic bioreactor imitating physiological loadings. The colloid solution was also evaluated *in vivo* in wound treatment in a rat burn model. At high solution loadings, strong cytotoxicicity was observed in monolayers, while only slight superficial effects in bioreactor cultured cartilage explants. *In vivo* studies have indicated enhanced wound healing and no toxicity of the colloid solution as compared to non-treated controls, thus demonstrating potentials for the biomedical use. Also, higher sensitivity of cells in monolayers was observed as compared to *in vivo* or *in vivo*-like conditions in bioreactors.

O.S.E.5

THE ROLE OF THE MORPHOLOGY AND STRUCTURAL CHARACTERISTICS ON THE SOLUBILITY OF VANADIUM PENTOXIDE- PLGA COMPOSITES

Nemanja Aničić, Marija Vukomanović, Danilo Suvorov
Insitute Jožef Štefan, Ljubljana, Slovenia

The role of the morphology and structural characteristics of vanadium pentoxide-related compounds on the solubility of poly(lactic-*co*-glycolic acid) (PLGA)-based composite materials is investigated. Vanadium pentoxide and related compounds have layered structure, which can explain versatile applications. They are used in fields like chemical sensing, actuators, high-energy lithium batteries and as catalysts for various chemical reactions. However, their use in aqueous media is limited due to the reasonably high water solubility (e.g. use in biomedicine is impossible because even ppm concentrations of dissolved vanadium ions can induce cytotoxicity). Our goal was to resolve this problem by formation of the vanadium oxide-based structures with slower and controlled solubility. For that purpose, we have assumed that it would be possible to lower the solubility of V_2O_5 by incorporating it into the PLGA matrix to form composite. 1D nanostructures of V_2O_5, $K_{0.33}V_2O_5$ and $V_2O_5{\cdot}xH_2O$ were synthesized hydrothermally. Composites were prepared using PLGA dissolved in chloroform. Two commercially available vanadium pentoxide powders, with different crystal size, were used as references. The solubility of the composites was investigated in PBS medium, at temperature of 37 ^{0}C and shaking rate of 60 rpm. It has been shown that composite formation can be useful to reduce the solubility of vanadium pentoxide. It can be related to the prevention of the diffusion of the particles to the solution probably caused by physical capture of particles by polymer. Furthermore, the morphology of the vanadium pentoxide-related compounds plays major role in the solubility control. 1D nanostructures are most convenient for solubility control since they formed composites with the strongest physical capture of inorganic part within polymeric matrix. In the contribution, the relation of morphological and structural peculiarities of V_2O_5, $K_{0.33}V_2O_5$ and $V_2O_5{\cdot}xH_2O$ to the solubility of the PLGA based composites will be discussed.

O.S.E.6

PEGYLATED MAGNETIC NANOPARTICLES FOR BIOMEDICAL APPLICATIONS

Romulus Tetean[1], Cristian Iacovita[2], Rares Stiufiuc[2], Sever Mican[1], Constantin Mihai Lucaciu[2]
[1]*Babes-Bolyai University, Faculty of Physics, Cluj-Napoca, Romania*
[2]*Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania*

A simple, green and cost effective synthesis method for preparing stable biocompatible and hydrophilic magnetic nanoparticles by a solvothermal reduction method was used. In this method the reduction of $FeCl_3$ to Fe_3O_4 is mediated by the polyethylene glycol of different molecular weights being assisted by the sodium acetate. The mixture heated at 240°C for 6 h gives rise to magnetic nanoparticles having a cubic shape. The mean diameter of the magnetic nanoparticles is about 100 nm. MFe_2O_4 (M=Fe, Co, Zn) nanoparticles were prepared with the same method. The XRD characterization confirms the crystalline structure of MFe_2O_4.The magnetic properties of the ferrite nanocubes were investigated with a vibrating sample magnetometer and they exhibit a superparamagetic behavior at room temperature, a very important characteristics for hyperthermia applications.

PL.S.III.1

THE SURFACE OF STRONTIUM TITANATE

Laurence D. Marks
Department of Materials Science and Engineering, Northwestern University, Evanston, IL, USA

For the last decade there has been substantial interest in the use of strontium titanate in applications ranging from use as a heterogeneous catalysis support to thin film growth of various oxides including being an active element in electronic oxides. A critical issue is understanding the surface structure, as changes in both the structure and composition can completely change second phases at the surface, for instance the epitaxy of catalytic Pt nanoparticles or the existence of a 2D electron gas. This talk will focus upon results we have obtained jointly with a number of collaborators on the (001), (110) and (111) surfaces by combining transmission electron microscopy, scanning tunneling microscopy as well as modelling using high-level density functional theory methods such as metaGGAs. I will also talk about a new technique, atomic-resolution secondary electron microscopy.

PL.S.III.2

UNDERSTANDING THE ATOMIC STRUCTURE OF Li-ION SPINEL BATTERY CATHODES WITH ABERRATION-CORRECTED HAADF STEM

C. Amos, J. Song, J. Goodenough, Paulo J. Ferreira
Materials Science and Engineering Program, The University of Texas at Austin, Austin, TX, USA

In order for Li-ion batteries to mature to a level useful for integration into the current or future energy infrastructure, basic problems such as cyclability, cost and rate capability must be overcome. The series $LiNi_xMn_{2-x}O_4$ (LNM) ($0<x\leq½$), a spinel cathode material, has the advantage of being both cost-effective and a high-rate capable material, but it is plagued with cyclability problems. In the LNM system the main contributor to cycling degradation is the high operating voltage which leads to solid-electrolyte interphase (SEI) formation. We find that excess-Mn doping of this material ($LiNi_{0.5-X}Mn_{1.5+X}O_4$ where x=0.05) leads to increased cyclability through natural passivation . To understand the exact role that excess Mn plays in the passivation of this cathode material, it is crucial to determine the surface's atomic structure. This is because the surface structure determines how reactive the cathode will be with the electrolyte during oxidation and reduction cycles.

In order to understand how excess-Mn LNM reacts with the electrolyte, it is critical to understand the different phases that form in this system. In this regard, aberration-corrected HAADF STEM was used to identify the surface and bulk structures in the excess-LNM system. HAADF STEM confirms the spinel structure and shows good agreement with STEM simulations in the bulk. Near the surface however, other phases are observed. These include a rock-salt structure which is expected from x-ray diffraction (XRD) results and a new phase, defined here as "ring-type structure", because of the characteristic rings that are formed within the first few atomic surface layers. All three phases are observed near the surface, however only the spinel is found within the bulk of the particles. HAADF STEM enables a detailed characterization of these phases and has led to an important understanding of the cycling degradation mechanisms in the excess-Mn LNM system. In turn, this work enables us to develop a well-suited cathode material for future energy storage that will potentially spur the evolution of the future sustainable energy landscape.

PL.S.III.3

LAYERED OXIDE STRUCTURES AS TRANSPARENT ELECTRONICS

Werner Mader, Simon Eichhorn
Institute for Inorganic Chemistry, University of Bonn, Bonn, Germany

Transparent and conducting materials are today one of the most advanced topics for a wide range of device applications, not only as passive components in flat and touch panel displays or solar cell contacts but also as active elements such as thin film transistors (TFTs). While in the 1960ies, the first TFTs were based on SnO_2 and ZnO, and research was being devoted to these binary oxides, to In_2O_3 and to indium tin oxide (ITO), in 2003 Nomura et al. [1] realized the oxide $InGaO_3(ZnO)_5$ to have impressive effective mobility of 80 $cm^2V^{-1}s^{-1}$, turn-on voltage of -0.5 V, and on/off ratio of 10^6. This compound is a member of the homologous series $InGaO_3(ZnO)_m$ with layered structure of general type $ABO_3(ZnO)_m$ in which octahedral AO_2^- layers (large A^{3+} ion) and wurtzite type $BO(ZnO)_m^+$ sheets (small B^{3+} ion) are alternating stacked along the *c* axis. In the meantime, $InGaZnO_4$ (m=1) transistors with extremely low leakage current and on/off ratio of > 10^9 have been built in commercial smartphone displays [2]. In this contribution, we focus on the structural details of the layered oxides $InGaO_3(ZnO)_m$ with varying composition *m* and the relation to electronic transport properties. Powders and single crystals were used for structural characterization and electronic properties were measured on films prepared by chemical routes. Since In and Ga are critical elements, substitution of these elements is of some importance. We show that In can be substituted by main group elements of the same period, and that 3d transition metals are suited to substitute the small Ga ion. The amount of substitution can be shown to depend on the member of the homologous series, i.e. on the composition *m*. With this variability of site occupation we are offered a modular system to construct compounds with variable and defined composition and eventually to design the materials properties.

[1] K. Nomura, et al., Science 300 (2003) 1269.
[2] K. Kato, et al., Jap. J. Appl. Phys. 51 (2012) 021201.

PL.S.III.4

MULTI-SCALE STUDY OF INTERCONNECT STRUCTURES FOR ADVANCED PACKAGING OF INTEGRATED CIRCUITS – CHALLENGES TO MICROSCOPY AND SAMPLE PREPARATION

Ehrenfried Zschech[1,2], Sven Niese[1,3], Markus Löffler[2], Martin Gall[1], Reiner Dietsch[3]
[1]*Fraunhofer Institute for Ceramic Technologies and Systems, Dresden, Germany*
[2]*Technical University Dresden, Dresden Center for Nanoanalysis, Dresden, Germany*
[3]*AXO GmbH, Dresden, Germany*

Three-dimensional (3D) IC integration is a novel technology that creates highly integrated systems by vertical stacking and by connecting various processes, materials and functional components. The potential benefits of 3D IC integration will vary depending on the chosen approach and the application. They include increased performance, reduced power and small form factor as well as multifunctionality and flexible heterogeneous integration. Therefore, 3D IC integration is recognized as an enabling technology for future microelectronic products and for low-cost heterogeneous systems. The development and introduction of new analytical techniques and concepts for process control and failure analysis are key task to ensure high performance and high reliability of products manufactured in advanced nodes of CMOS-based semiconductor technology.

The combination of nondestructive X-ray imaging and X-ray computed tomography (XCT) with destructive cross-sectioning using Focused Ion Beam (FIB) and subsequent inspection with Scanning Electron Microscopy (SEM) provide a high potential for process control and failure analysis in microelectronic industry. However, there occur great challenges: New concepts have to be developed and introduced that include a reliable solution for sample navigation and transfer, as well as the identification, target cross-sectioning and the study of identified structures with X-ray and electron imaging techniques within a large range of spatial resolution.

This paper demonstrates the capabilities of micro-XCT (resolution in the sub-micron range), nano-XCT (resolution in the sub-100nm range) and SEM for multi-scale studies of failures in 3D Through-Silicon-Via (TSV) and microbump structures, including the navigation / sample transfer and preparation approach applying FIB - important for advanced packaging technologies to stack of ICs vertically.

New concepts are in evaluation to extend X-ray microscopy to higher resolution and to higher photon energies using novel types of diffractive X-ray lenses and different condenser optics [1,2].

[1] Niese, P. Krueger, A. Kubec, S. Braun, J. Patommel, C. Schroer, A. Leson, E. Zschech, “Full-field X-ray Microscopy with Crossed Partial Multilayer Laue Lenses”, Optics Express, accepted (2014)

[2] S. Niese, B. Lechowski , D. Rogler , R. Dietsch , S. Braun , M. Gall , E. Zschech, „Condenser for lab-based full-field X-ray microscopy with multilayer Laue lenses”, 2nd Dresden Nanoanalysis Symposium, Dresden, Germany (2014)

PL.S.III.5

THERMO-SENSITIVE HYDROGEL AS CELL CARRIER FOR NUCLEUS PULPOSUS REGENERATION

Feng-Huei Lin
Institute of Biomedical Engineering, National Taiwan University, Taipei, Taiwan

Intervertebral disc degeneration usually starts at the nucleus pulposus. In the past decades, several techniques and prosthetics (artificial disc) have been developed to regenerate or replace the nucleus pulposus. However, these kind of pre-formed devices have to remove the nucleus pulposus and then replace an artificial one to relief the symptom of intervertebral disc degeneration. Recently, cell-based tissue engineering provides a rational approach to regenerate active nucleus pulposus cells (NP cells) to restore intervertebral disc architecture and function. However, the source of autologous nucleus pulposus cells are limited and their functional state does not favor regeneration. Besides, nucleus pulposus cells grown in monolayer may result in fibroblast-like transformation. Thus, the 3D hydrogel co-culture system maybe an alternative method to provide an adequate environment for nucleus pulposus cells proliferation, extracellular matrix production, cytokines secretion. In this study, we demonstrated that cell proliferation, total DNA and sulfated glycosaminoglycans synthesis of nucleus pulposus cells were significantly increased in the 3D hydrogel co-culture system. Furthermore, the extracellular matrix related gene expression and anabolism-related gene expression in 3D hydrogel co-culture system were significantly higher than other culture condition (such as monolayer culture or cultured in 3-D hydrogel without mesenchymal stem cells regulation).The gene expression of TIMP-1 and MMP-3 decreased in 3D hydrogel with mesenchymal stem cells co-culture system. This study suggests that the thermo-sensitive hyrogel could be an adequate material for nucleus pulposus cells proliferation and extracellular matrix production. Moreover, mesenchymal stem cells could regulate the isolated nucleus pulposus cells back to normal state through paracrine communications in the developed 3-D co-culture system.

PL.S.IV.1

HARMONIZATION OF MECHANICAL AND THERMAL PROCESSES FOR FUNCTIONAL OXIDE NANOPARTICLES VIA A SOLID STATE ROUTE

Mamoru Senna
Faculty of Science and Technology, Keio University, Yokohama, Japan

Novel and rational solid state syntheses of functional oxides based on the author’s ongoing research works are presented. Target materials include $K_{0.5}Na_{0.5}NbO_3$ (KNN), $Li_4Ti_5O_{12}$ (LTO), $Li_7La_3Zr_2O_{12}$ (LLZO) and SiO, with and without anionic dopants or additives. Efforts are focused to obtain them in a well-defined state with small grain size and high crystallinity. For this purpose, maximizing the reactivity of the starting materials turned out to be a key issue. In view of affordable and scalable processes, syntheses were started from core oxide nanoparticles, around which other ingredients are enveloping. Hints were acquired from other routes, e.g. sol-gel, hydrothermal or chemical deposition. Importance of evaluating the reactanting mixtures to harmonize the mechanical and thermal treatments and hence rationalization of the production processes was emphasized.

PL.S.IV.2

RECENT ADVANCES IN PROCESSING OF MATERIALS BY ELECTRIC ASSISTED MECHANICAL MILLING: THE METHOD, DEVICE DESCRIPTION AND APPLICATIONS

Anržej Čalka
University of Wollongong, Faculty of Engineering and Information Sciences,
Wollongong, NSW, Australia

Advanced materials manufacturing methods require clean non-polution process, high speed and precise process, mechano-chemically integrated process, and highly reliable final products. Many functional materials are traditionally synthesized by slow reaction processes that are energy and time consuming. In the present world there is strong demand on development of modern materials and materials processing methods that could offer rapid reaction rates, energy efficiency and be environmentally safe.

Electric discharge assisted mechanical milling (EDAMM) [1] is a new and exciting materials processing technique which combines the attributes of conventional mechanical milling with all effects generated by electric discharges. It is demonstrated that EDAMM can be used to synthesize a range of functional materials in a matter of minutes, rather than days.

This presentation provides an overview of recent development of EDAMM method and its application in rapid materials processing and synthesis of functional materials and their applications

This presentation provides an overview of recent development of Electric Discharge Assisted Mechanical Milling and its application in rapid materials processing and synthesis of functional materials and their applications.

In particular:

i) detailed analysis of the method will be presented
ii) the effect of AC and DC discharges on phase transformations in solid will be discussed
iii) characteristic of power supplies and construction of reaction chambers will be presented
iv) example applications of this method for rapid synthesis of range of functional materials will be shown: rapid synthesis of complex oxides, ultrahard materials, hydrogen storage materials and others.

[1] A.Calka and D.Wexler, Nature, 419,(2002)147-151

PL.S.IV.3

STABILITY OF NANOMATERIALS AT HIGH MECHANICAL ACTIONS

Rostislav A. Andrievski
*Institute of Problems of Chemical Physics, Russian Academy of Sciences,
Chernogolovka, Moscow Region, Russia*

This report is devoted to the possibility analyses to use the consolidated nanoma-terials at high mechanical actions such as fatigue and high static/dynamic pressures. The nanostructure effect on the fatigue of materials-based cupper, titanium and stainless steel are generalized and discussed in detail. Cu/Nb nanocomposites processed by severe plastic deformation have very high mechanical properties including high electrical conductivity and resistance to irradiation and high-pulsed-magnetic field. The effect of high static/dynamic pressures on the phase stability of different nanomaterials is also considered and discussed. The special attention is taken to the role of size effects and non-monotone changes. Little-studied and non-resolved questions are pointed out.

PL.S.IV.4

CRYSTAL STRUCTURAL DATA MINING FOR NEW INSERTION HOSTS AND SOLID ELECTROLYTES

Max Avdeev, Matthew Sale
*Bragg Institute, Australian Nuclear Science and Technology Organisation,
Lucas Heights, Australia*

It is well understood that energy density of conventional rechargeable Li-ion batteries is at the moment limited by capacity of available cathodes, typically some derivatives of $LiCoO_2$, $LiMn_2O_4$, or $LiFePO_4$. In attempt to improve the situation researchers staying in the domain of insertion cathodes actively explore new materials. Polyanion materials, in particular, recently received considerable attention in attempts of either harnessing two-electron reactions (e.g. orthosilicates Li_2MSiO_4, M=Mn,Fe,Co) or improving performance by tuning the redox potential of Fe^{3+}/Fe^{2+} reaction (phosphates, sulfates, borates). However, the activities are typically focused on finding or designing an optimal chemical composition and crystal structure of the material is accepted as a given. As the result, newly reported materials often display low charge/discharge rates due to their low ionic conductivity. Reduction of particle size down to nanoscale in some cases alleviates the problem but also reduces volumetric energy density.

We adopted an alternative approach focusing on the search for robust frameworks capable of high ionic conductivity. Depending on the chemical composition, such materials may be either insertion hosts or solid electrolytes. Exhaustive screening of materials accumulated in the Inorganic Crystal Structure Database was carried out using the bond-valence method [1]. The method has several advantages over much more accurate but several orders of magnitude more computationally expensive DFT calculations. Not only can bond-valence calculations be done in a completely automatic mode but they can also easily handle non-stoichiometric materials, in contrast to DFT calculations. I will present results of the latest calculations which identified new Li^+, Na^+, and Mg^{+2} materials with promising crystal structures.

[1] Solid State Ionics, 225, 43-46

PL.S.IV.5

NANOPARTICULATE SOL-GEL BASED MATERIALS FOR PHOTOCATALYSIS AND PHOTONICS

M. Amamra[1], M. Ben Amar[1], M. Traore[1], K. Chhor[1], L. Museur[2], Andrei Kanaev[1]
[1]Laboratoire des Sciences des Procédés et des Matériaux, CNRS, Université Paris 13, Sorbonne Paris Cité, Villetaneuse, France, [2]Laboratoire de Physique des Lasers CNRS, Université Paris 13, Sorbonne Paris Cité, Villetaneuse, France

The fabrication of non-agglomerated nanoparticulate solids with an open structure is a chalenging task in the field of nanotechnology and nanomaterials. Such solids permit specific size-selected physical and chemical properties and highest specific area of the active phase, by avoiding severe health problems related to undesirably nanoparticles inhalation.

We report on the process of preparation of pure, doped and composite size-selected oxide nanoparticles and, on their base, coatings, ultra-porous monoliths and organic-inorganic hybrids with highly reproducible nanoscale morphology for applications in environmental catalysis and photonics. The method is based on a controlled nucleation-growth of metal-oxo-alkoxy nanoparticles (NP) in sol-gel reactor with rapid (turbulent) micromixing, followed by their chemical deposition onto the supporting materials. We describe novel nanoparticulate organic-inorganic hybrids (TiO_2-HEMA, TiO_2-MAPTMS) and inorganic composites (TiO_2/ZrO_2-Al_2O_3, Ag/Au-TiO_2). These materials offer suppressed NP aggregation and permit fine optimisation of the electronic response. In particularly, the bnanoparticulate composites present a novel solution for catalytic media with nanoscale morphology control of the active phase.

References:

1. R. Azouani, A. Soloviev, M. Benmami, K. Chhor, J.-F. Bocquet, A. Kanaev, J. Phys. Chem. C 111 (2007) 16243.
2. P. Gorbovyi, A. Uklein, S. Tieng, M. Traore, K. Chhor, L. Museur, A. Kanaev, Nanoscale 3 (2011) 1807.
3. M. Bouslama, M. C. Amamra, Z. Jia, M. Ben Amar, O. Brinza, K. Chhor, M. Abderrabba, J.-L. Vignes, A. Kanaev, ASC Catal. 2 (2012) 1884.
4. X. Jia, M. Ben Amar, A. Astafiev, V. Nadtochenko, A. B. Evlyukhin, B. N. Chichkov, X. Duten, A. Kanaev, J. Phys. Chem. C 116 (2012) 17239.
5. X. Jia, A. Vega-Gonzalez, M. Ben Amar, K. Hassouni, S. Tieng, S. Touchard, A. Kanaev, X. Duten, Catalysis Today 208 (2013) 82.

PL.S.V.1

SOFT MICROSCOPY FOR CHARACTERIZATION OF THE FUNCTIONAL MICROSTRUCTURE OF ADVANCED SOFT MATERIALS AND MATERIALS REQUIRING SOFT MICROSCOPY

Eva Olsson
Department of Applied Physics, Chalmers University of Technology
Gothenburg, Sweden

The potential and interest in advanced soft matter and hybrid materials with interfaces between hard and soft materials is steadily growing. The properties of the different material systems depend on the microstructure of the materials. It is therefore crucial to determine the correlation between structure, properties and fabrication parameters. The need for high spatial resolution imaging and spectroscopy can in many cases for these structures only be met by electron microscopy or a combination of electron microscopy and other techniques. The characterisation of these materials and in particular the hard-soft interfaces is hampered by the differences in interaction between the electrons and the specimens giving rise to differences in scattering and contrast mechanisms for the many imaging and spectroscopy modes available in state-of-the-art microscopes. Electron microscopy and spectroscopy for studies of the functional microstructure of these materials, where the details of the structure of the materials are correlated to the properties and performance for tailoring new materials and devices, also show that the electron beam damage during the experiments can be severe. Each system is unique where optimum conditions for imaging, diffraction, spectroscopy and in-situ experiments need to be tailored individually. Soft microscopy expands the experimental parameter space for the studies especially by including microscopy at lower acceleration voltages and at lower temperatures. The microscopy enables ground-breaking findings in the fields of controlled drug delivery, wound care, hygiene products, renewable packaging materials, pulp and paper, functional food, biomaterials, medical diagnostics and drug discovery, medical like implants including the interface between implant/bone/tissue and polymer based solar cell systems. From recent studies it is also clear that other materials such as graphene and noble particle catalyst on oxide support systems also require soft microscopy. Examples of functional nanostructures of different material systems, 3-dimensional reconstruction and in situ microscopy will be presented.

PL.S.V.2

PROCESSING AND APPLICATIONS OF MULTIFUNCTIONAL NANOSTRUCTURED POLYMERIC BIOMATERIALS

José M. Kenny
Instituto de Ciencia y Tecnología de Polímeros, ICTP-CSIC, Juan de la Cierva, Madrid, Spain,
Materials Engineering Center, UdR INSTM, University of Perugia, Terni, Italy

This research is focused on the promising perspectives of nanostructured biomaterials based on biodegradable polymers and their relevance in biomaterials applications with particular focus on tissue engineering. The effects of polymeric nanoparticles, nanocomposites and nanotopography development are here extensively investigated and reported in terms of polymer properties and cell response. A number of recent advances developed in our laboratories, concerning the synthesis of polymeric nanoparticles and nanoshells, the processing of polymeric multifunctional nanocomposites and surface modification techniques will be highlighted.

Polymeric nanoparticles with well defined size and morphology were produced by double emulsion and this method was used for protein encapsulation, offering interesting possibilities for revolutionary improvements in tissue engineering, diagnosis and targeted drug delivery systems.

Nanocomposite scaffolds were produced by casting and electrospinning combining the biodegradable polymer with functional nanostructures, while surface properties were modulated by radiofrequency plasma treatments. The physical properties as well as the chemical properties of materials, including size, shape, mechanical properties, surface texture, etc. can regulate biological responses and provide mechanical stimuli to stem cells. Traction forces generated by cells may markedly influence many biological processes such as self-renewal and differentiation. The possibility to control specific cell functions by modulating the polymer scaffold properties, represents a key point of material science in tissue engineering applications.

Finally, the development of biodegradable polymer blends, copolymers and their nanocomposites with shape memory behavior will be discussed.

Nanostructured biodegradable materials are ready for take-off and certainly promise an exciting future at the interface of chemistry, biology and material science.

PL.S.V.3

APPLICATIONS OF ENVIRONMENTAL (SCANNING) TRANSMISSION ELECTRON MICROSCOPY TO STUDY OXIDATION AND HYDROGENATION PHENOMENA IN NANOMATERIALS

Ai Leen Koh
Stanford Nanocharacterization Laboratory, Stanford University, Stanford, California, USA

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 ultrahigh-vacuum system with base pressure of ~ 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 also 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].

We have also utilized electron energy-loss (EEL) spectroscopy in the E(S)TEM to probe hydrogen absorption in individual Pd nanocrystals, by measuring the shift in their bulk plasmon resonance modes, as Pd transforms into PdH_x during hydrogen absorption. Using this approach, we constructed pressure – energy-loss isotherms of individual Pd nanocrystals and obtained insights into the hydrogen intercalation in nanostructured metals [7]. 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.

References:

[1] S Iijima, Nature **354** (1991), pp. 56-58.
[2] G. Cao et al., Med. Phys. **37** (2010), pp. 5306–5312.
[3] X. Qian et al., Med. Phys. **39** (2012), pp. 2090–2099.
[4] K. A. Dean and B. R. Chalamala, Appl. Phys. Lett. **75** (1999), pp. 3017–3019.
[5] J.-M. Bonard, et al., Ultramicroscopy **73** (1998), pp. 7–15.
[6] A.L. Koh, et al., ACS Nano 7, 2013, 2566-2572.
[7] A. Baldi et al., *under review* (2014).

PL.S.V.4

MATERIALS DESIGN FOR PERIODONTAL REGENERATION

Tom Diekwisch
UIC Department of Oral Biology, Chicago, USA

The mammalian periodontium is a complex tissue characterized by a central soft tissue ligament and two flanking mineralized tissues, alveolar bone and root cementum. This composite structure with alternating soft and hard tissues and ligament/mineral interfaces subjected to extreme mechanical loads poses unique challenges for tissue engineering and materials design. Here we report the results of three very different materials-driven approaches that have shown promise in our quest for optimum procedures to aid periodontal regeneration. First, we have examined the use of nanohydroxyapatites of various consistencies for their abilities to predetermine tissue fate in periodontal regeneration. Second, we have added the matricellular protein periostin as a novel component to freeze-casted collagen scaffolds and determined the effect of such scaffolds on periodontal regeneration. Finally, we have determined the effect of platelet-rich fibrin (PRF), a blood plasma component, as a means to regenerate both hard and soft tissues of the periodontal apparatus. In summary, all three materials hold promise for the regeneration of different components of the periodontal complex, and all three might be useful in future periodontal regenerative therapy.

PL.S.V.5

SIMILIA SIMILIBUS CURANTUR: BONE-MIMICKING COMPOSITES AS THE NEW GENERATION OF BONE REPLACEMENT MATERIALS

Vuk Uskoković
Advanced Materials and Nanobiotechnology Laboratory, Department of Bioengineering, University of Illinois, Chicago, IL, USA

The demand for a new generation of bone replacement materials has never been higher, given more than 2 million bone graft operations performed annually worldwide and the constant increase in this number owing to the aging population of the Earth. Despite an intense research in the field, no bone replacement material for load-bearing applications has been developed yet. The age-old principle *similia similibus curantur*, dictating the substitution of like with like, is expected to apply in every aspect of tissue engineering, including its bone province. Correspondingly, calcium phosphate and polymers of adequate microstructure, porosity and mechanical properties are considered as ideal candidates for achieving the functional synergy such as that occurring between nanoscopic crystals of hydroxyapatite and collagen in bone. Presented will be results on studies utilizing calcium phosphate and calcium-phosphate/polymer composites as prospective materials for bone regeneration. Examples will include the effects of morphology, topography and phase composition on an array of physicochemical and biological properties relevant for the given application. A particular emphasis will be placed on composite materials for advancing bone infection therapies. In conclusion, we will reiterate the idea that multicomponent, synergetic and multifunctional nanostructures are the most prospective types of materials for tissue engineering in general. However, in spite of the strivings towards complexity in the design of advanced materials for substitution of bone tissues, the potential of their elemental mineral component, calcium phosphate, remains largely untapped and the chemistry of this simple, yet elusive compound can be said to still conceal great treasures within.

Poster Presentation

P.S.A.1

THE INFLUENCE OF STRAIN RATE BETWEEN 10^{-3} - 10^{3} S^{-1} OF AUTOMOTIVE STEELS SHEETS

Maria Mihaliková[1], M. Német [1]
[1] *Department of Materials Science, Faculty of Metallurgy,*
Technical University of Košice, Slovak Republic

The automotive industry is currently focusing on detailed information about various types of materials and their behavior during dynamic loading. Dynamic tensile testing of sheet steels is becoming more important. Experimental dynamic tensile technique is depending on the strain rate. Each serves for a specific range of strain rates and provides specific type of information. This work deals with the influence of the strain rate on the mechanical properties of automotive steel sheets. For comparison of static and dynamic properties three different types of steel IF – steel, DP – steel, a micro-alloyed steel S 460 were used. We conclude that with increasing strain rate in all three steels, there is an increase in strength properties and change plastic properties.

Acknowledgments: This study was supported by the Grand Agency of Slovak Republic project VEGA 1/0549/14.

P.S.A.2

THE FORMATION OF REFRACTORY CARBIDES IN THE TERNARY HETEROGENEOUS Me-C-F SYSTEMS

Victor V. Lozanov[1], S.V. Sysoev[2], N.I. Baklanova[1]
[1]*Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia* [2]*Nikolaev Institute of Inorganic Chemistry SB RAS, Novosibirsk, Russia*

Refractory carbides are of great interest for high-temperature applications. There are several approaches to form refractory carbides and coating from them including CVD, carbothermal reduction of oxides, molten salt synthesis, polymeric precursors, and liquid metal transfer agent. The listed processes are multistage and long duration ones, which are no cost-effective. In the present work the formation of refractory carbides in the ternary heterogeneous Me – C – F (where Me = Ta or Hf, C – carbon, F - fluorine) system was studied. Thermodynamic equilibria in the Ta – C – F and Hf – C – F systems were calculated in the wide temperature and pressure intervals. The experimental study of the ternary heterogeneous Ta – C - F and Hf – C - F systems confirmed that refractory carbides can form on carbon substrates under isothermal conditions at rather low temperatures.

P.S.A.3

STRUCTURE AND THERMAL PROPERTIES OF PYRIDOXAL THIOSEMICARBAZONE AND PYRIDOXAL ISOTHIOSEMICARBAZONE BASED COPPER(II) COMPLEXES

Marko V. Rodić[1], Berta Barta Holló[1], Ljiljana S. Vojinović-Ješić[1], Sonja A. Ivković[2], Vukadin M. Leovac[1], Katalin Mészáros Szécsényi[1]
[1]Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia, [2]Faculty of Environmental Protection, University EDUCONS, Sremska Kamenica, Serbia

Schiff-base type pyridoxal derivatives are potentially biologically active compounds. The coordination to transition metals can improve their activity. As copper is an important trace element for numerous organisms, in this publication the syntheses and the structures of a series of new copper(II) complexes with pyridoxal thiosemicarbazone (PLTSC) and a pyridoxal isothiosemicarbazone (PLITSC) are reported. PLTSC coordinates in a tridentate fashion through ONS donor set. Depending on the experimental conditions the following complexes were obtained: $[Cu(PLTSC\text{-}H)]_2SO_4\cdot 2H_2O$, $[Cu(PLTSC)(H_2O)]_2(SO_4)_2\cdot 6H_2O$, $[Cu(PLTSC)(H_2O)]_2(SO_4)_2\cdot 2H_2O$, $[Cu(PLTSC)(H_2O)_2]SO_4\cdot H_2O$ and $Cu(PLTSC)(H_2O)_2SO_4\cdot H_2O$. The tridentate coordination of PLITSC is established through its ONN atoms and the monomeric $[Cu(PLITSC)]SO_4\cdot H_2O$ complex is formed. The thermal stability and the decomposition of the compounds were determined in a flowing nitrogen atmosphere. The decomposition pattern of the compounds is related to their structure.

P.S.A.4

SYNTHESIS AND STRUCTURE OF THE FIRST ZINC(II) COMPOUND CONTAINING PYRIDOXALAMINOGUANIDINE

Mirjana M. Radanović, Ljiljana S. Vojinović-Ješić, Vukadin M. Leovac
Faculty of Sciences, Novi Sad, Serbia

The first compound of zinc(II) containing pyridoxalaminoguanidine (PLAG), has been synthesized and characterized by elemental analysis, IR spectra, conductometric measurements and X-ray crystallography. Single crystals of the compound were obtained in the reaction of methanolic solution of zinc(II) chloride and pyridoxalaminoguanidine hydrochloride monohydrate. In this compound the coordination of the potential tridentate ligand is absent and tetrachlorido complex of zinc(II) with pyridoxalaminuguanidinium cation as contraion is obtained. The zinc(II) is situated in a slightly distorted tetrahedral geometry. Due to the absence of coordination and the presence of the extended system of conjugated double bonds both pyridoxalaminuguanidinium ions are planar.

P.S.A.5

LANTHANIDE (III) POLYOXOMETALATES: SYNTHESIS, STRUCTURE AND PROPERTIES

Doina Humelnicu[1], Mihail Liviu Craus[2], Nicoleta Cornei[1], Ionel Humelnicu[1]
[1]Faculty of Chemistry, "Al. I. Cuza" University, Iasi, Romania
[2]Frank Laboratory for Neutron Physics (FLNP), Dubna, Rusia

Polyoxometalates of lanthanides (III) ions are currently under extensive investigations for both theoretical and practical points of view. The synthesis and characterization of such compounds is a topic discussed more frequently due to the interesting properties of these. The synthesis of POMs containing lanthanides is an issue of increasing importance because of the chemical and physical properties. The characterization of the systems Ln^{3+} -POM was carried out by means of FT-IR and UV-Vis spectroscopy, thermal analysis and structure was confirmed by XRD results.

P.S.A.6

BARIUM CERATE PREPARED BY OXALATE COPRECIPITATION

Renata Verbová, V. Kavečanský, S. Piovarči, V. Antal, P. Diko
Institute of Experimental Physics, Slovak Academy of Sciences, Kosice, Slovak Republic

It is well known that critical current density of $YBa_2Cu_3O_{7-\delta}$ (YBCO, Y123) bulk superconductors is indirectly proportional to the size of Y_2BaCuO_5 (Y211) particles. As a result different additives, such as Pt or Ce are used to inhibit coarsening of Y211 particles during melt processing. It has already been shown that addition of very fine $BaCeO_3$ powder to the nominal composition leads to smaller Y211 particles. We report on chemical preparation of $BaCeO_3$ powder. This powder was prepared by the oxalate coprecipitation method from the nitrates of Ba and Ce, which results to very fine powder of nano dimensions. The prepared powders were studied by X-ray Powder Diffraction (XRD) and by scanning electron microscope (SEM) equipped with Energy Dispersive Spectrometer (EDS).Thermal decomposition of oxalates was studied by Thermal Analysis.

Acknowledgment: This work was realized within the Framework of the projects: ITMS 26220120019, ITMS 26220120035, ITMS 26220220061, ITMS 26220220041, which are supported by the Operational Programme "Research and Development" financed through the European Regional Development Fund, ITMS 26110230061, ITMS 26110230097, VEGA No. 2/0090/13, APVV 0330-12 and SAS Centre of Excellence: CFNT MVEP.

P.S.A.7

INFLUENCE OF DIFERENT POISSON’S COEFFICIENTS OF ADHERENTS ON STRESS DISTRIBUTION IN THE CASE OF STEP COMPOSITE JOINT

Abdurrahman O. Houssein
Al jabel Algharbi university, Dean of Faculty of engineering - Jadoo, Libya

The influences of Poisson's coefficients the case of step joint of two composite plates are analyzed using the finite element method. Geometry of the joint, boundary condition and type as well as amount of loading can be varied as per the requirement. Method also allows varying the properties of adherents and adhesives that include modulus of elasticity, Poisson's ratio as well as allowable stress values. Mesh size is

The results show the places where the maximum normal and shear stresses accurse. It is interesting to note that the variations of stress values in the x direction is small when compared with x and y directions.

Key words: composite plates, finite element analysis, step joint.

P.S.A.8

SYNTHESIS OF LiFePO$_4$ BY MECHANICAL STRESSING AND THERMAL ANNEALING

Miloš Milović[1], D. Jugović[1], M. Mitrić[2], N. Cvjetićanin[3],
A. Mraković[2], M. Senna[4], D. 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]Faculty of Science and Technology, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, Japan

Mechanical activation can be regarded as a multi-step process with changes in the energetic parameters and the amount of accumulated energy of solids in each step. Here we report the influence of mechanochemical processing on the synthesis of LiFePO$_4$ powders. The different precursor powders were milled in a planetary mill by using WC vials and 5 mm balls made of the same material. A slightly reductive atmosphere (Ar + 5%H$_2$) was used in both mechanical stressing and thermal annealing so as to prevent the oxidation of iron. All synthesis steps were followed by an X-ray diffractometry and FT-IR spectroscopy. The results were compared with previous findings of precipitated and annealed powder, without mechanochemical treatment.

P.S.A.9

TALLOIL DIETHYLENETRIAMINE IMIDAZOLINE AS A CORROSION INHIBITOR FOR MILD STEEL IN CHLORIDE SOLUTION SATURATED WITH CARBON DIOXIDE

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*

The effect of talloil diethylenetriamine imidazoline (TOFA/DETA imidazoline) on corrosion of mild steel in 3 wt. % NaCl solution saturated with CO_2 was investigated by weight loss measurements (WL) and atomic force microscopy (AFM). Adsorption mechanism was studied using the quartz crystal microbalance measurements (QCM). WL measurements shown that the addition of TOFA/DETA imidazoline inhibitor to 3 wt. % NaCl solution significantly reduced the corrosion rate, while the inhibition efficiency was calculated to be around 95 %. AFM results demonstrated that TOFA/DETA imidazoline decreases the steel surface roughness and effectively protects mild steel from corrosion due to the formation of the inhibitor film. QCM measurements confirmed that TOFA/DETA imidazoline forms self-assembled monolayers on gold coated quartz crystals. The obtained values of standard Gibbs free energy of adsorption, ΔG_{ads}^0 at different temperatures indicate that adsorption of TOFA/DETA imidazoline on the gold surface is spontaneous and favorable.

P.S.A.10

THE HYDROTHERMAL SYNTHESIS OF 1D BIOMEDICAL HYDROXYAPATITE NANOSTRUCTURES

Zoran Stojanović[1], Ljiljana Veselinović[1], Nenad Ignjatović[1],
Miroslav Miljković[2], Dragan Uskoković[1]
[1]*Institute of Technical Sciences of SASA, Belgrade, Serbia,* [2]*Laboratory for Electronic Microscopy, Faculty of Medicine, University of Nis, Niš, Serbia*

1D hydroxyapatite nanostructures such as nanotubes, ultra long nanowires and other morphological varieties have been promising material for bone reconstruction and therapy. Advantages like high specific surface, packing properties and mechanical properties make those nanostructures excellent candidates for scaffolds. This work is focused on soft hydrothermal routes for preparing different 1D nanostructures. Using hydroxyapatite formation mechanisms in hydrothermal and solvothermal systems, various chemical parameters, i.e. precursor chemical composition, are investigated for obtaining these 1D materials on gram scale. The synthesized materials are characterized by X – ray diffraction, scanning electron microscopy and laser diffraction methods.

P.S.A.11

MECHANOCHEMICAL SYNTHESIS OF ZnO:SnO_2 MATERIAL AS A POTENTIAL PHOTOCATALYSTS

Ana Stanković, S. Marković, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

Zinc oxide (ZnO) is a semiconductor material with direct band-gap energy of approximately 3.2 eV. Irradiation of ZnO with ultraviolet (UV) light results in the promotion of electrons from the conduction band followed with formation of holes in the valence band. These photo-generated charge carriers can consequently transfer to the surface of the ZnO and initiate redox reactions with adsorbed molecules in a chemical process known as heterogeneous photocatalysis. The phenomenon of heterogeneous photocatalysis has attracted extensive attention as a practicable method for the decomposition of chemical waste.

ZnO:SnO_2 nanocrystalline powders with a different molar ratio of ZnO and SnO_2 phase (0.9:0.1 and 0.1:0.9) were examined as a potential photocatalysts under direct sunlight irradiation. It was found that high-energy ball milling of anhydrous $ZnCl_2$ and SnO_2 in an inert NaCl matrix results in the formation of a composite powder consisting of oxide grains embedded within a matrix. To remove the NaCl matrix, milled powders were washed with deionized water and centrifuged several times; finally, they were dried at 80 °C for 24 h. The dried powders mixtures were pressed into pellets by uniaxial pressing and calcined at 700 °C for 1 h to get crystalline ZnO:SnO_2 powders. The effect of ZnO:SnO_2 molar ratios on the phase composition, crystal structure, optical and photocatalytic properties was investigated. The phase composition and crystal structure of the prepared ZnO:SnO_2 powders were characterized by XRD and Raman spectroscopy. The particles size and morphology were determined using laser diffraction particle size analyzer and FE–SEM, respectively. The optical properties were studied by UV–Vis diffuse reflectance and photoluminescence spectroscopy. The photocatalytic activity of ZnO:SnO_2 powders was examined through decomposition of methylene blue (MB) solution under direct sunlight irradiation. A large efficiency of MB degradation was found after 6 h of irradiation. ZnO:SnO_2 powders calcined at 700 °C shows better photocatalytic activity than single-phased ZnO powder.

P.S.A.12

GEL COMBUSTION SYNTHESIS OF $NaTi_2(PO_4)_3/C$ COMPOSITE, SUITABLE TO BE ANODE OF AQUEOUS SODIUM-ION BATTERY

Milica Vujković[1], M. Mitrić[2], S. Mentus[1,3]
[1]University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia, [2]The Vinča Institute for Nuclear Sciences, Laboratory for Theoretical and Condensed Matter Physics, Vinča, Belgrade, Serbia, [3]Serbian Academy of Science and Arts, Belgrade, Serbia

The Nasicon-type $NaTi_2(PO_4)_3$ nanoparticles covered by carbon layer was successfully synthesized by the combustion of a combustible gelled precursor, and subsequent isothermal heat treatment of the combustion product in an inert atmosphere. Upon isothermal treatments at various temperatures, both XRD and TGA/DTA measurements revealed that combustion product should be heated at least at 700 ^oC, in order to obtain crystalline phase. The electrochemical behavior of obtained composites was tested by cyclic voltammetry in aqueous $NaNO_3$ and $LiNO_3$ solution. The sodium intercalation/deintercalation kinetic of $NaTi_2(PO_4)_3/C$ from aqueous electrolyte was evidenced to be faster than the lithium one, which was explained by differences in occupancy of crystallographic sites by intercalated ions. The desodiation capacity of nasicon obtained at 700 ^oC in saturated aqueous $NaNO_3$ solution amounted to ~52 $mAhg^{-1}$ and ~40 $mAhg^{-1}$ at very high scan rates of 10 mVs^{-1} and 50 mVs^{-1}, respectively.

P.S.A.13

HYDROXYAPATITE SINTERING IN THE PRESENCE OF $LiFePO_4$

Miodrag J. Lukić, M. Kuzmanović, Lj. Veselinović, S. Marković, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

Sintering of hydroxyapatite attracts attention for decades with the final aim to obtain reliable materials for bio-applications. Various kind of sintering techniques as well as sintering additives were investigated to obtain desired functional properties. Previously, sintering was performed in the presence of lithium phosphate, with certain improvements.

This paper describes sintering behavior of hydroxyapatite in the presence of $LiFePO_4$. The added material melts around 960 °C, what is usually the temperature of hydroxyapatite intermediate sintering stage. The formed liquid phase could improve atomic motion between hydroxyapatite particles, with possibility of intergranular reinforcing phase formation. Potential interfacial reactions and its influence on microstructural properties of sintered material will be studied.

P.S.A.14

SYNTHESIS OF $LiFePO_4$/C COMPOSITES FROM CELLULOSE GEL

Maja Kuzmanović[1], D. Jugović[1], M. Mitrić[2], B. Jokić[3], N. Cvjetićanin[4], D. Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]The Vinča Institute of Nuclear Science, University of Belgrade, Belgrade, Serbia, [3]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [4]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia

Among other cathode materials $LiFePO_4$ stands out as a structure stable material with high theoretical capacity, acceptable operating voltage, long cycle life, low cost, superior safety and environmental friendliness. The problem of low rate capability, caused by low electronic conductivity, can be solved to some extent by surface carbon coating. In this work we used methyl cellulose as a carbon source. Different amounts of methyl cellulose were added to the precursor water solutions. After removing the majority of water by evaporation, the gelled precursor was rapidly heated at 700 ^{o}C for 10 minutes, and then quenched to room temperature. The structural and morphological properties of $LiFePO_4$/C were characterized by X-ray diffraction, scanning electron microscopy and particle size analyzer. Amount of carbon in the composite was determined by TGA measurements. $LiFePO_4$/C cathode performances were examined by constant current charge-discharge cycling.

P.S.A.15

STRUCTURAL INVESTIGATION OF $CaCu_3B_4O_{12}$ (B = Ti, Ru)

Ljiljana Veselinović[1], S. Marković[1], M. Lukić[1], L. Mančić[1],
S.D. Škapin[2], M. Mitrić[3], D. Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Jožef Stefan Institute, Ljubljana, Slovenia, [3]Institute of Nuclear Sciences Vinča, University of Belgrade, Belgrade, Serbia

Perovskite-related materials with the general formula $AC_3B_4O_{12}$ have great technological significance due to their specific physical properties. The crystal structure of $AC_3B_4O_{12}$ compounds is cubic with $Im\bar{3}$ symmetry. Different cations can occupy *A* and *B* sites, while the *C* site is commonly occupied by Cu^{2+} or Mn^{3+} ions. It has been found that the nature of *B* cation changes the physical properties of the material. In our previous studies we dealt with $CaCu_3Ti_4O_{12}$ (CCTO) and $CaCu_3Ru_4O_{12}$ (CCRO) compounds. CCTO has the gigantic permittivity of ~10^4–10^5 in the kilohertz region and good stability over the temperature range from -170 to 330 °C. While Ti-compound is semiconductor, the Ru one is conductive oxide and could be used as interfaces between CCTO and metallic electrodes. Thus, CCTO and CCRO have potential application for preparation of layer capacitors with CCRO as the electrode and CCTO as the dielectric material. Since the oxygen vacancies and/or intrinsic defects in perovskites have a crucial role in the physical properties it is important to determine crystal structure of ceramic materials.

In this work, a detailed structural investigation of CCTO and CCRO perovskites was performed. The powders were prepared by precipitation and successive calcination at 1100 °C with 3 h dwell time to obtained single phased materials. The phase composition and crystal structure of synthesized powders were studied by X-ray powder diffraction (XRD), transmission electron microscopy (TEM), high-resolution TEM (HRTEM), selected-area electron diffraction (SAED) and Raman spectroscopy analyses. Rietveld refinement of XRD data was used to calculate the powders stoichiometry. Furthermore, since the XRD method is not adequate for determination of oxygen atoms due to their small scattering factors, to confirm the (oxygen-) stoichiometry of the ceramic powders, thermogravimetric (TG) measurements were employed. Two sets of experiments were performed; powders were heated in a flowing: (1) air atmosphere, and (2) reducing atmosphere (mixture of 5% H_2 with Ar; 20 ml/min), to 1100 °C with a heating rate 10 °C/min with 3 h dwell time. TG measurements were performed on system coupled to a quadrupole mass spectrometer used for determination of volatile compounds. The weight losses measured by TG, in two different atmospheres, were compared; minor deviations in stoichiometries of $CaCu_3B_4O_{12}$ compounds determined by Rietveld refinement were corrected.

P.S.A.16

PLATINUM NANOPARTICLES PREPARED BY WATER IN OIL MICROEMULSION METHOD

Mila N. Krstajić[1], Sanja I. Stevanović[1], Dušan V. Tripković[1], Jelena R. Rogan[2],
Nedeljko V. Krstajić[2], Snežana Lj. Gojković[2], Vladislava M. Jovanović[1]
[1]Department of Electrochemistry, ICTM, University of Belgrade, Serbia
[2]Faculty of Technology and Metallurgy, University of Belgrade, Serbia

Recent advances in design and preparation of Pt-based nanocatalysts include control of shape, composition and nanoscale structure of platinum. In the present study Pt nanoparticles were prepared by w/o microemulsion method, using Polyethileneglycol-dodecylether (BRIJ®30) as a surfactant, and the same method was used with addition of HCl in the water phase. Addition of HCl influenced the structure and electrocatalytic properties of nanoparticles. Both catalysts were supported on Vulcan XC-72R carbon. Supported and unsuppored catalysts were characterized electrochemically using cyclic voltammetry, and by CO oxidation. Supported catalysts were analysed by TGA method, and surface morfology of nanoparticles was investigated using microscopy techniques. Furthermore, their electrocatalytic activity for oxidation of small organic molecules was examined.

P.S.A.17

SINTERING OF CORDIERITE IN THE PRESENCE OF MoO_3 AND CRYSTALLIZATION ANALYSIS

N. Djordjević[1], N. Obradović[2], Darko Kosanović[2], M. Mitrić[3], V. Pavlović[2]
[1]Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia,
[2]Institute of Technical Sciences of SASA, Belgrade, Serbia,
[3]Institute of Nuclear Sciences Vinča, University of Belgrade, Belgrade, Serbia

Cordierite (MAS) is difficult to sinter because of the very narrow sintering temperature range (1300-1400ºC). Because a low temperature process is desirable, it is necessary to find functional ads which can allow easier sintering process at lower temperature. The influence of MoO_3 on the preparation process of cordierite ceramics was investigated. $2MgO-2Al_2O_3-5SiO_2$ was researched by sintering followed binary systems: MgO/MoO_3, Al_2O_3/MoO_3 and SiO_2/MoO_3 (all sintered at 850ºC and 1100ºC, sintering time 2h). Composition of these systems was 80% of oxide and 20% MoO_3. The effects of sintering, the composition and morphology were followed by X-ray diffraction, SEM microscopy and EDS analysis. It has been found that MoO_3, beside liquid phase, forms intermediary unstable compounds with MgO and Al_2O_3, which is the significance information for further research. MAS ceramics were sintered with 20% MoO_3 at 1100ºC, 1200ºC and 1300ºC, during 2h.

P.S.A.18

DETECTION OF CUP ANEMOMETER FRICTION TORQUE CHANGE IN CASE OF SELF LUBRICATED SLEEVE BEARING AND BALL BEARING

Miodrag Zlatanović, Ivan Popović
School of Electrical Engineering, University of Belgrade, Serbia

Some cup anemometers with the shaft made of fully hardened beryllium copper and self-lubricating modified Teflon bearings have shown significant degradation of performance after 2 to 26 weeks of operation, which was attributed to dry friction dip effect. In our open field experiments the degradation of NRG #40 cup anemometer performance was detected after three years of continuous operation and recalibration was carried out in an aerodynamic tunnel. A new model of sensor operation was developed in order to investigate the fiction torque characteristics, which we assumed to be valid for considered type of anemometer only. Our initial comparison of sensor calibration curve residuals shows that model of NRG #40 cup anemometer my also be applied to some anemometers with ball bearing and a method to recognize the friction torque change during sensor field operation was suggested.

P.S.A.19

MAGNETIC PROPERTIES OF MnZn FERRITE FOR MICROELECTRONIC APPLICATION

Nebojša Mitrović[1], Slobodan Djukić[1], Aleksandra Kalezić -Glišović[1],
Sanja Aleksić[2], Maja Kićanović[1], Obrad Aleksić[3]
[1]Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems,
Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia,
[2]Faculty of Electronic Engineering, University of Niš, Serbia
[3]Institute for Multidisciplinary Research, University of Belgrade, Serbia

Wide range of relative magnetic permeability values (from 10^3 to 10^4 and therefore low magnetic losses) enable MnZn ferrites application in microelectronics as a material for microwave components. MnZn ferrites attracted attention also due to high thermal stability (high saturation magnetic flux density at high temperatures (B_s > 0.4 T at 100 ^{O}C) and a relatively high Curie temperature of about 230 ^{O}C).

Recently, a variety of technologies have been examined for MnZn ferrite production: powder injection moulding, chemical co-precipitation method, mechanochemical processing, sol-gel or microemulsion.

In this study a toroidal samples of MnZn ferrites with dimensions appropriate for applications in microelectronics (inner diameter 7 mm, outer diameter 3.5 mm, height 3 mm) were investigated. Magnetic properties were measured by hysteresis graph (B-H curve at different excitation magnetic fields and at different frequencies up to 10 kHz).

Magnetic power (active) losses as well as relative magnetic permeability were analysed as frequency and temperature dependent. As the hysteresis losses are proportionally to the frequency (~ f) and eddy-current losses are proportionally to the square of frequency (~ f^2) it was performed separation between these two components from total magnetic power (active) losses. The results obtained were compared with the data for other technologies of preparing MnZn ferrite components for applications in microelectronics.

P.S.A.20

FACILE CHEMICAL SYNTHESIS AND CHARACTERIZATION OF POLYESTER/MAGNESIUM OXIDE NANOPARTICLES FOR BIOMEDICAL APLICATION

Nenad Filipović[1], Magdalena Stevanović[1], Jelena Djurdjević[1], Jadranka Milikić[2], Ljiljana Veselinović[1], Vladimir Pavlović[1,3], Dragan Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, [3]Faculty of Agriculture, University of Belgrade, Belgrade, Serbia

Magnesium, a naturally occurring mineral, is very important for the normal functioning of the body. However, certain situations such as poor diet, alcoholism, poorly controlled diabetes, etc., cause body to lose magnesium faster than it can be replace it from diet. Magnesium also plays a role in body's detoxification processes and therefore is important for preventing damage from environmental chemicals, heavy metals and other toxins. Polyesters like polylactide (PLA), polyglycolide (PGA) or poly(lactide-co-glycolide) (PLGA) are used for the controlled delivery of several classes of medicaments like anticancer agents, immunomodulatory drugs, hormones, vitamins, antibodies, etc. Magnesium oxide nanoparticles (MgO) have been synthesized by chemical reduction method and additionally encapsulated within spherical polyester poly(lactide-co-glycolide) (PLGA) particles (PLGA/MgO). Synthesized particles were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS) and transmission electron microscopy (TEM).

P.S.A.21

RADIATION-INDUCED SYNTHESIS AND PROPERTIES OF POLY(OLIGO(PROPYLENE GLYCOL) METHACRYLATE) HYDROGELS

Edin Suljovrujić, D. Miličević, M. Mićić
Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

The synthesis of poly(oligo(propylene glycol) methacrylate) (POPGMA) from functionalised oligo(propylene glycol) methacrylate (OPGMA) monomers by gamma radiation-induced radical polymerisation is reported for the first time; POPGMA homopolymeric hydrogel with OPGMA pendant chains, as a non-linear PPGMA-analogue, was synthesised from an oligomer-solvent ($OPGMA_{375}$-wather/ethanol) mixture at different irradiation doses (5, 10, 25, and 40 kGy). Determination of the gel fraction was conducted after synthesis. The swelling properties of the POPGMA hydrogel were preliminarily investigated over wide pH (2.2-9.0) and temperature (4-70 °C) ranges. Additional characterisation of structure and properties was conducted by UV-Vis and Fourier transform infrared (FTIR) spectroscopy as well as by differential scanning calorimetry (DSC). In order to evaluate the potential for biomedical applications, biocompatibility (cytocompatibility and haemolytic activity) studies were performed as well. Sol-gel conversion was relatively high for all irradiation doses, indicating radiation-induced synthesis as a good method for fabricating this hydrogel. Thermoresponsiveness and variations in swelling capacity as a result of thermosensitive OPGMA pendant chains with a lower critical solution temperature (LCST) were mainly observed below room temperature; thus, the volume phase transition temperature (VPTT) of POPGMA homopolymeric hydrogel is about 15 °C. Furthermore, POPGMA has satisfactory biocompatibility. All these results indicate that the new POPGMA hydrogel, as a smart and biocompatible polymer, has great potential in different applications. To attain even greater potential for different biomedical applications it is necessary to tune the thermo-sensitivity to higher (e.g. body) temperatures; a possible design methodology is also proposed.

Keywords: Radiation synthesis, Poly(propylene glycol) methacrylate**,** Thermoresponsive hydrogel, LCST.

P.S.A.22

THE BREATH ANALYSIS AS A NON-INVASIVE DIAGNOSTICAL METHOD FOR DIABETES TYPE 2

Mirjana Perišić[1], Marija Todorović[1], Željka Nikitović[1], Aleksandra Jotić[2], Sandra Aleksić[3]
[1]*Institute of Physics, University of Belgrade, Belgrade, Serbia,*
[2]*Institute of Endocrinology, Faculty of Medicine, University of Belgrade, Belgrade, Serbia,*
[3]*Rutgers University New Jersey Medical School, USA*

Analysis of volatile organic compounds (VOCs) in human breath is an additional non-invasive diagnostic tool for certain diseases and progress monitoring during therapy. Of the many potential modalities of diagnosis of diabetes type 2, a method based on the analysis of breath has many advantages. In collaboration with Institute of Endocrinology, Diabetes and Metabolic Diseases in Belgrade, the measurements and analysis of VOCs, potential biomarkers in the patients breath were performed. Proton Transfer Reaction Mass Spectrometer (PTR -MS) measurement technique characterized by high sensitivity and real-time response was used to assess concentration levels of VOCs. Relation between the VOCs concentrations in the breath of patients and specific parameters of standard medical blood tests were determined using the appropriate mathematical models.

P.S.A.23

NANOMECHANICAL AND STRUCTURAL CHARACTERIZATION OF POLY (ETHYLENE OXIDE)/KERATIN BLEND FILMS REINFORCED WITH FUNCTIONALIZED GRAPHENE

Mirjana Grković[1], D. Stojanović[2], A. Kojović[2], I. Balać[3], T. Kreže[4],
S. Strnad[4], R. Aleksić[2], P.S. Uskoković[2]
[1]*Innovation centre, Faculty of technology and metallurgy, University of Belgrade, Belgrade, Serbia,* [2]*Faculty of technology and metallurgy, University of Belgrade, Belgrade, Serbia,* [3]*The Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia,* [4]*Faculty of Mechanical Engineering, University of Maribor, Slovenia*

Polymer blends of poly (ethylene-oxide) and keratin were prepared in different contents with the aim to obtain bio-compatible materials suitable for film production. The morphological and spectroscopic investigation of blend films showed influence of keratin on PEO crystallization process, due to decrease of PEO spherulites with increase of keratin amount. Nanoidentation investigation was performed and the blend film with highest values of hardness and reduced elastic modulus was reinforced with functionalized graphene. Functionalized graphene was obtained with ultrasonic irradiation with poly (ethylene-oxide) radicals. This functionalization enriches the graphene inert surface with hydrogen bonds that allows good exfoliation and interference with both polymers in blends. This investigation confirmed effective method for functionalization of graphene and preparing composite blend films with outstanding mechanical properties and green processing routes.

P.S.A.24

SYNTHESIS OF $ZrGeO_4$ AND $HfGeO_4$ BY DIFFERENT ROUTES

Aleksei Utkin, V. Prokip, N. Baklanova
Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia

Germanates of IVB group metals are promising materials for different applications spreading from UV-emitting X-ray scintillators to high-temperature materials. The aim of this work was (i) to synthesize $MGeO_4$ (M = Zr, Hf) by three different chemical routes; (ii) to characterize and compare zirconium and hafnium germanates in terms of the phase composition, stoichiometry, and microstructure. It was stated that there is the strong dependence of the phase composition and morphology of products on the preparation route. The ceramic route requires a high-temperature multi-stage treatment to obtain germanates of 94% purity or more, but this technique can be improved by preliminary mechanochemical activation. Precipitation route leads to the formation of nanocrystalline single phase germanates of stoichiometric composition at a relatively low temperatures.

P.S.A.25

PREPARATION AND CHARACTERIZATION OF THE NANOSTRUCTURED LAYERED TRANSITION METAL CHALCOGENIDES THROUGH THEIR COLLOIDAL DISPERSIONS

Vladimir E. Fedorov, Sofya B. Artemkina, Mariia N. Kozlova, Yu.V. Mironov
Nikolaev Institute of Inorganic Chemistry, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russian Federation

Layered transition metal chalcogenides attract a great attention due to their some remarkable useful properties: they can use in microelectronics, optoelectronics, as solar cell elements, electrodes for lithium batteries, effective catalysts, and in other fields. Layered structure of such type compounds allows exfoliating bulk materials and preparing nanoparticles with different thickness down to single layers. In this work we have exfoliated molybdenum, tungsten and niobium di- and trichalcogenides MQ_2 and MQ_3 in different organic solvents – CH_3CN, dmf, ^iPrOH, EtOH, $EtOH/H_2O$, *n*-BuOH by ultrasonic treatment. Prepared colloidal dispersions were used for preparation of nanostructured thin films and composites with metal nanoparticles (Ag, Au, Pt, Pd). Colloidal dispersions and solid materials are characterized by a set of modern high informative methods.

P.S.A.26

THE INFLUENCE OF SILICA NANOPARTICLES MODIFICATION ON THE PROPERTIES OF COMPOSITES FOR ENVIRONMENTALLY-FRIENDLY TIRES

Nada Lazić[1], Tamara Erceg[1], Milenko Plavšić[2], Jelena Pavličević[1],
Jaroslava Budinski-Simendić[1], Nevena Vukić[1], Radmila Radičević[1],
Borislav Simendić[3]
[1]University of Novi Sad, Faculty of Technology, Novi Sad, Serbia, [2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia, [3]Higher Education Technical School of Professional Studies, Novi Sad, Serbia

Activities to reduce landfill and pollutants from discarded elastomeric products have motivated the industry to produce more environmentally-friendly tires and to improve the longevity and wear performance. Precipitated silica is an excellent reinforcing filler and provides improved resistance to hot air ageing and abrasion of final products and exhibits improved bonding of rubber to steal or to cord fabric. The use of silica nanoparticles for elastomeric material preparation reduces the tread rolling resistance (fuel saving) and improves dry/wet grip properties. The goal of this work was to study the influence of thermally and hydrothermally treated silica particles on the properties of hybrid materials based on styrene-butadiene rubber (SBR) as network precursor. Unfilled and filled samples were prepared by mixing silica with SBR in laboratory mixer and sulphur curing in the next stage. Modified fillers were prepared by thermal treatment of precipitated silica with BET surface area in the range from 160 to 200 m^2/g and average size of primary particles 22 nm (Vulkasil S, Bayer Germany) in an oven (at 170°C, 240°C, 400°C, 520°C and 660°C) during 16 hours and hydrothermal treatment in an autoclay (at 120°C, 150°C, 180°C, 200°C and 220°C). Glass transition temperatures of obtained materials were assessed using modulated differential scanning calorimetry (MDSC). Dynamic mechanical behavior was determined by Dynamic Mechanical Analyzer with dual cantilever mode in the temperature range from -100 to 100°C at the six frequencies.

P.S.A.27

DEPOSITION OF ZINC OXIDE NANORODS ON CONDUCTIVE CARBON FIBERS

Olga Rac, Helena Teterycz
Wrocław University of Technology, Faculty of Microsystem Electronics and Photonics, Wrocław, Poland

Recently zinc oxide is a very common used material due to the fact of interesting properties such as optical, antibacterial and piezoelectric. For this reason, deposition of textile materials it may result in generation of advanced functional materials eg. which could generate current (piezoelectric nanogenerators). For this purpose it is necessary to deposited on an electrically conductive substrate. The authors presented a method of growing the ZnO hexagonal rods on a conductive filament substrates. The substrate is made of carbon fibers. The fibres with a desired electrical conductivity are obtained in the process of carbonization of polyacrylonitrile (PAN) fibers. They will also be presented preliminary results of electrical measurements of the fibers.

Scientific work financed from fund for science in the years 2013-2017 as a research project within the program under the name “Diamond Grant”.

P.S.A.28

IMPROVEMENT OF H_2S SENSING PROPERTIES OF ZNO-THICK FILM GAS SENSORS DOPED WITH GOLD NANOPARTICLES

Patrycja Suchorska-Woźniak, Helena Teterycz
Wroclaw University of Technology, Faculty of Microsystem Electronics and Photonics, Wroclaw, Poland

The conductivity of resistive gas sensors is changing as the result of the chemical reactions that occur on the sensitive layer after the exposition to gases. To get higher selectivity the sensor layer can be modified by e.g. implementation of additives into the sensitive layer. The main purpose of this work is to present the results of chemical synthesis of gold nanoparticles which were used as a dopants of ZnO gas sensitive layer in order to improve the sensor sensitivity to low concentration of hydrogen sulphide. In comparison with the sensors described in literature, where the issue of sulphur poisoning was common, in this case, sensors were fully reversible and the addition of nanogold caused a large increase of sensor sensitivity to H_2S.

The project was funded by the National Science Centre based on decision number DEC-2012/07/N/ST7/02304.

P.S.A.29

INFLUENCE OF RE SUBSTITUTIONS ON MICROSTRUCTURE AND SUPERCONDUCTING PROPERTIES OF YBCO BULK SUPERCONDUCTORS

Daniela Volochova[1], S. Piovarci[1], V. Antal[1], K. Jurek[2], J. Kovac[1], P. Diko[1]
[1]Institute of Experimental Physics SAS, Kosice, Slovak Republic
[2]Institute of Physics ASCR, Praha, Czech Republic

The influence of RE (RE = Gd, Sm or Yb) substitutions on microstructure and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ (YBCO, Y123) bulk superconductors have been studied for different RE concentrations. YBCO bulk superconductors with REO_2 addition were prepared by the optimized Top Seeded Melt Growth (TSMG) process in the form of single-crystals. Microstructure and structure of prepared samples were studied by polarized light microscope, scanning electron microscope (SEM) equipped with Energy Dispersive Spectrometer (EDS) and Wavelength Dispersive Spectrometer (WDS) as well as by X-ray Powder Diffraction (XRD). The effect of RE substitutions on critical temperature, T_c, critical current density, J_c and trapped magnetic field, B_{max} is reported.

Acknowledgment: This work was realized within the Framework of the projects: ITMS 26220120019, ITMS 26220120035, ITMS 26220220061, ITMS 26220220041, which are supported by the Operational Programme “Research and Development” financed through the European Regional Development Fund, ITMS 26110230061, ITMS 26110230097, VEGA No. 2/0090/13, APVV 0330-12 and SAS Centre of Excellence: CFNT MVEP.

P.S.A.30

ANOMALOUS COMPRESSIBILITY OF CERIUM AND DOCOSANE UNDER SHOCK-WAVE ACTION

Vasily A. Sosikov, A.N. Zubareva, A. V. Utkin
Institute of Problems of Chemical Physics RAS, Chernogolovka, Russia

In this work we determine the shear stress and evolution of compression wave in the area of cerium anomalous compressibility. The value of longitudinal stress at which the γ-α phase transition occurs is also determined. It is shown that the phase transition pressure, under dynamic and static compression coincide and is equal to 0.8 GPa. The dependence of spall strength of cerium on the strain rate is investigated. At its increase from $1.5 \cdot 10^4$ to $8.5 \cdot 10^5$ s^{-1} the spall strength rises from 0.3 to 0.8 GPa. Similar experiments with docosane in solid and liquid state have been conducted. It was shown that the solid docosane demonstrate an elastic-plastic properties and has abnormal compressibility at pressures below 100 MPa. It was found that the strength of docosane remains practically constant and equals to about 24 MPa when passing through the melting point.

P.S.B.1

GAS CHROMATOGRAPHY-MASS SPECTROMETRY FOR IDENTIFICATION OF THE PYROLYSIS PRODUCTS OF CELLULOSE-BASED POLYMERS

Branimir Jovančićević[1], Vesna Antić[2], Mališa Antić[2],
Nadia Al Sandouk-Lincke[3], Jan Schwarzbauer[3]
[1]Faculty of Chemistry, Belgrade, Serbia; *[2]Faculty of Agriculture, Zemun, Serbia*; *[3]Institute of Geology and Geochemistry of Petroleum and Coal, RWTH Aachen University, Aachen, Germany*

Development of pyrolysis based analytical methods for polymer identification and quantification at trace levels opens the possibility to detect polymers in the environment, which has not been done so far. The analytical restrictions in the past hindered the environmental characterization of polymer emissions and, consequently, their environmental assessment. Chemically modified celluloses - carboxymethyl cellulose, CMC, and hydroxyethyl cellulose, HEC, are used in drilling fluids for on-shore and off-shore drilling. Since the usage of drilling fluids is not a strictly closed system application, continuous emission of drilling fluids towards ecosystems is evident. Leakages, accidents and careless handling of drilling waste might also lead to drilling fluid emissions. In this study off-line pyrolysis-GC/MS analysis of cellulose-based polymers was performed in order to identify specific degradation products. Pyrolysis of the commercial pure cellulose, CMC and HEC, was performed in order to cause rapid polymer fragmentation into volatile products – compounds capable of being analyzed using GC/MS. The aim was to establish the specific degradation products, which can clearly be linked to the structure of the polymer, and to identify specific molecular indicators that can be applied as potential marker substances for drilling activities. The structures detected after pyrolysis of pure cellulose, CMC and HEC are compared with the pyrolysis results of drilling fluid samples. It was possible to identify two to three specific molecular indicator substances for CMC and HEC. All structures determined as potential marker substances for modified celluloses were negative-proofs with the pyrolysis results of pure cellulose.

P.S.B.2

YBCO BULK SINGLE GRAIN SUPERCONDUCTORS PREPARED BY INFILTRATION GROWTH METHOD

Liudmila Vojtkova, Daniela Volochová, Viktor Kavečanský,
Vitaliy Antal, Samuel Piovarči, Pavel Diko
Institute of Experimental Physics Slovak Academy of Sciences in Kosice, Slovak Republic

YBCO is a perspective superconducting material for using at liquid nitrogen temperature. Top seeded liquid infiltration growth (TSLIG) method is an effective way for preparation of bulk YBCO single grain superconductors. In comparison with top seeded melt growth (TSMG) method, TSLIG method suppresses generation of pores, which are formed due to the evolution of oxygen at melting process of Y123 matrix, and also Y211 particles are smaller and more homogeneously distributed in Y123 matrix. In this study, samples of YBCO bulk superconductors were prepared by TSLIG method at various conditions. The structure of the sample was studied by SEM and X-ray diffraction and trapped field measurements were performed. The influence of parameters of starting powders and the form of Ce additions on the final properties of YBCO superconductor were evaluated.

Acknowledgment: This work was realized within the Framework of the projects: ITMS 26220120019, ITMS 26220120035, ITMS 26220220061, ITMS 26220220041, which are supported by the Operational Programme “Research and Development” financed through the European Regional Development Fund, ITMS 26110230061, ITMS 26110230097, VEGA No. 2/0090/13, APVV 0330-12 and SAS Centre of Excellence: CFNT MVEP.

P.S.B.3

EVALUATION OF SURFACE ROUGHNESS OF SLIP CAST COMPOSITE Al_2O_3-ZrO_2 CERAMICS IN SOLID PARTICLE EROSION

Krešimir Grilec, Marijana Majić Renjo, Lidija Ćurković, Matija Sakoman, Gorana Baršić
University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture,
Zagreb, Croatia

In this paper, surface roughness parameters (R_a, R_{max}, R_z) of monolithic and composite ceramics produced by slip casting were monitored before and after solid particle erosion. Prepared samples were monolithic Al_2O_3 and composite Al_2O_3–t-ZrO_2 ceramics (composition: 95 wt. % Al_2O_3 – 5 wt. % t-ZrO_2 and 90 wt. % Al_2O_3 – 10 wt. % t-ZrO_2). The erosive wear behaviour was studied at the impact angle of 90°, using dry silica sand (SiO_2) as an erodent. Obtained results indicated that values of roughness parameters increased after erosion, and the largest increase was observed for monolithic Al_2O_3 ceramics. Surface roughness parameter values decrease with the increase of ZrO_2 content. Obtained results showed that tribological properties of monolithic Al_2O_3 can be improved with the addition of t-ZrO_2.

P.S.B.4

INFLUENCE OF HIGH PRESSURE OXYGENATION ON THE STRUCTURE AND MAGNETIC PROPERTIES OF LA-CA-SR-MN-O PEROVSKITE CERAMIC MATERIALS

Katarina Zmorayova[1], V. Antal[1], S. Piovarci[1], V. Kavecansky[1], J. Kovac[1],
M. Kanuchova[2], P. Diko[1]
[1]*Institute of Experimental Physics SAS, Kosice, Slovakia*
[2]*The Technical University of Kosice, Kosice, Slovakia*

In this contribution, the influence of high pressure oxygenation on the structure and magnetisation behaviour of $La_{0.67}Ca_{0.33-x}Sr_xMnO_3$ (x = 0.33; 0.03; 0) (LCSM) perovskite ceramics were investigated. The LCSM perovskite ceramics were prepared by solid state synthesis in air and sintering at 1520°C. The samples were subsequently treated by high pressure oxygenation with different conditions. The purity of calcined powders and sintered samples was checked by X-ray diffraction. The formation of the LCSM perovskite ceramics and changes in the oxidation states of elements were studied by X-ray photoelectron spectroscopy. For determination of the Curie temperature the small sample pieces were measured by a vibrating-sample magnetometer.

Acknowledgment: This work was realized within the Framework of the projects: ITMS 26220120019, ITMS 26220120035, ITMS 26220220061, ITMS 26220220041, which are supported by the Operational Programme “Research and Development” financed through the European Regional Development Fund, ITMS 26110230061, ITMS 26110230097, VEGA No. 2/0090/13, APVV 0330-12 and SAS Centre of Excellence: CFNT MVEP.

P.S.B.5

NON-ISOTHERMAL CRYSTALLIZATION KINETICS OF PARTIALLY CRYSTALLINE Fe(38)Ni(36)B(18)Si(8) METALLIC GLASS

Suada Sulejmanović[1], Matej Lozančić[1], Amra Salčinović Fetić[1],
Bega Karadža[1], Ljerka Slokar[2], Suada Bikić[3]
[1]*Faculty of Science, University of Sarajevo, Bosnia and Herzegovina*
[2]*Faculty of Metallurgy, University of Zagreb, Croatia*
[3]*Faculty of Metallurgy and Materials, University of Zenica, Bosnia and Herzegovina*

Partially crystalline metallic glass in ribbon form was obtained by melt spinning. Master alloy was prepared using an argon arc furnace. Scanning electron microscopy and energy-dispersive X-ray spectroscopy were performed to examine the homogeneity and chemical composition of the material. The diffractogram showed a set of well-defined crystalline peaks superimposed on an amorphous matrix. As the metallic glass with the specified composition is ferromagnetic at room temperature, investigation of its thermal behaviour is of great interest. Differential scanning calorimetry showed a complex crystallization process. Overall activation energies of the crystallization were calculated using different models for non-isothermal process.

P.S.B.6

HIGH-TEMPERATURE PHASE TRANSFORMATIONS OF Nb-18.7Si IN-SITU COMPOSITES ALLOYED WITH YTTRIUM AND SCANDIUM

Liudmila Udoeva, R. Gulyaeva, V. Chumarev
Institute of Metallurgy, Ural Branch of Russian Academy of Sciences, Yekaterinburg, Russia

The structural-phase state of high-temperature Nb-18.7Si *in situ* composites alloyed with yttrium (0.9-6.0 at. %) and scandium (0.9-2.6 at. %) has been considered. The results of X-ray diffraction and electron probe microanalysis showed that an addition of Sc or Y leads to the formation of disperse microstructure based on the solid solution α-Nbss and metastable silicide Nb_3Si. Alloying elements are in the α-Nbss as metal and in silicide phase as Y_5Si_3 and $Nb_{4.6}Sc_{0.4}Si_3$. During the differential-thermal analysis in the “heating-cooling” cycle (1000-1980°C) the alloyed samples give a double endothermic effect associated with the melting of the eutectic and the composite completely. Crystallization temperature of alloys with yttrium and scandium exceeds the liquidus temperature in consequence of the formation of $\beta\text{-}Nb_5Si_3$ and peritectic transformation $Nb_3Si+\beta\text{-}Nb_5Si_3 \leftrightarrow \alpha\text{-}Nb_5Si_3$ at 1940 °C.

This work was supported by the Russian Foundation for Basic Research (project OFI_m №13-03-12160) and Ural Branch of RAS (project OFI №13-3-014-VNIIAM).

P.S.B.7

VEGARD`S LAW AND PROPERTIES OF AMORPHOUS COPPER

Ramir Ristić[1], K. Zadro[2], D. Pajić[2], J.R. Cooper[3], J. Ivkov[4], E. Babić[2]
[1]Department of Physics, Osijek, Croatia, [2]Department of Physics, Faculty of Science, Zagreb, Croatia, [3]Dept. of Physics, Cavendish Laboratory, Cambridge, UK, [4]Institute of Physics, Zagreb, Croatia

Properties of nonmagnetic amorphous TE-TL alloys (TE=Ti,Zr,Hf;TL=Ni,Cu) have been studied over a broad concentration range in order to estimate the parameters associated with the electronic and atomic structure in pure amorphous Ti,Zr and Hf [1]. We achieved this by extrapolating approximately linear variation of the data for alloys to zero TL content. Here we show that the same data can also be used to obtain the properties of pure amorphous cooper. This is correlated with the validity of the Vegard´s law for atomic volumes in amorphous Ti-Cu and Zr-Cu alloys [2] which extends also to Hf-Cu alloys. The reliability of results is supported by the fact that irrespective of TE, the variations of all studied properties of amorphous TE-Cu alloys extrapolate to the same value for amorphous Cu. Depending on a particular property, their values are either close/somewhat below those for crystalline copper, or are close to those of liquid copper. As already noted, the electronic transport properties extrapolate to those of liquid Cu, whereas the electronic density of states, the Debye temperature and the Young´s modulus are close or little lower than those of crystalline Cu. As expected, the microhardness, Hv, of amorphous Cu is much larger than that of crystalline copper due to absence of extended defects. The results are discussed in some detail and their impact on present understanding of amorphous TE-TL alloys (which is crucial for understanding of formation of bulk metallic glasses) emphasized.

References:

[1] R. Ristić, E. Babić, D. Pajić, K. Zadro, A. Kuršumović, I.A. Figueroa, H.A. Davies, I. Todd, L.K. Varga, I. Bakonyi, J. Alloys Compd., 504S (2010) S194-S197.
[2] I. Bakonyi, Acta Materialia, 53 (2005) 2509-2520.

P.S.B.8

PHASE STATE OF ELEMENTS IN MULTICOMPONENT COMPOSITE BASED ON THE Nb-Si ALLOY

Vladimir Chumarev, N. Selmenskih, L. Udoeva, L. Leont'ev
Institute of Metallurgy, Ural Branch of Russian Academy of Sciences, Yekaterinburg, Russia

The eutectic Nb-Si in-situ alloys doped with one element (yttrium or boron) and multicomponents (Nb-Si)-based samples obtained by vacuum-arc melting and directional solidification have been investigated with the help of optical microscopy and electron microprobe analysis. The phase composition and microstructure of the high-temperature Nb-Si composites containing Ti, Cr, Hf, Zr, Mo, Y, Al and B have been considered. Dispersity of structure, forms of the presence of alloying elements and their distribution on the phase components were determined from the results of these studies. The effect of B and Y on the phase formation and microhardness of niobium silicide phase of Nb-18.7Si composite was revealed. To determine temperatures of the phase transformations at high temperature a thermal analysis of the samples has been conducted up to 2000°C.

This work was supported by the Russian Foundation for Basic Research (project OFI_m №13-03-12160) and Ural Branch of RAS (project OFI №13-3-014-VNIIAM).

P.S.B.9

SYNTHESIS, STRUCTURAL ANALYSIS, MAGNETIC AND ELECTRIC PROPERTIES OF $La_{0.9}Sr_{0.1}Cr_{1-X}Co_XO_3$ PEROVSKITES

C. Mita[1], M.-L. Craus[2,3], N. Cornei[2], Doina Humelnicu[1], G. Nemtoi[1] and V. Dobrea[2]
[1]"Al.I.Cuza" University, Faculty of Chemistry, Iasi, Romania, [2]National Institute of Research and Development for Technical Physics, Iasi, Romania, [3]Joint Institute of Nuclear Research, Dubna, Russia

The cobalt-based materials display high ionic and electronic conductivities among the perovskites. $La_{0.9}Sr_{0.1}Cr_{1-x}Co_x$ ($0\leq x\leq 0.5$) perovskites were synthesized using the sol-gel technique. Pyrolysis of dry gels occur under 350 ^{0}C. XRD analysis and IR spectra indicated the formation of only one perovskite phase. The samples contain only a rhombohedral phase, identified as R-3c. Magnetic properties and transport characteristics were investigated between 77 and 400 K. Curie temperature (T_C) increases slightly with Cr substitution. The negative magnetoresistance effect is observed as well. The influence of structure and Cr/Co concentration on electrochemical response was studied by cyclic voltametry. The anodic and cathodic current signals increases and cathodic peak shifted to high potential with x.

P.S.B.10

QUANTUM OPTICAL LITHOGRAPHY FROM 1 nm WRITING RESOLUTION

Sorin Ion Jinga[1], E. Pavel[2]
[1]Faculty of Applied Chemistry and Materials Science,"Politehnica"University of Bucharest, Bucharest, Romania; [2]Storex Technologies, Bucharest, Romania

We report and demonstrate a lithography method, quantum optical lithography, able to attain 1nm resolution by optical means using new materials (fluorescent photosensitive glass–ceramics and QMC-5 resist). The performance is several times better than that described for any optical or electron beam lithography (EBL) methods. The written patterns on resist were transferred to Si wafer. SEM and TEM measurements show 5 nm line widths.The performance is severaltimes better than that described for any optical or EBL methods.Writing at 1 nm resolutionin fluorescent photosensitive glass-ceramics and resist involve only few (5–8) individual chemical bonds (C-C: 0.120-0.154 nm; Si–O: 0.154–0.171 nm). The experiments demonstrated that quantum optical lithography is a suitable lithography technique for sub-5 nm regime. In our opinion quantum optical lithography involves a cooperative interaction of many photons. A three-photon process is observed in absorption phase and a 540 photons process is suggested by quantum lithography theory for the writing phase.

P.S.B.11

RELATION BETWEEN MICROSTUCTURE AND IMPACT STRENGTH OF MODERN FINE-GRAINED AND QT STEELS USED IN DESIGN OF NEW INDUSTRIAL TRAILERS

František Nový[1,2], Libor Trško[2], Robert Ulewicz[3], Pawel Szataniak[4]
[1]Research Centre of the University of Žilina, Žilina, Slovak Republic, [2]University of Žilina, Faculty of Mechanical Engineering, Department of Materials Engineering, Žilina, Slovak Republic, [3]Czestochowa University of Technology, Faculty of Management, Institute of Engineering Production, Czestochowa, Poland, [4]WIELTON S.A., Wielun, Poland

Industrial trailer consists of many different components produced from different materials. The main aim of design of every new prototype is the mass reduction of the trailer and increase of the pay load. The main rule of the new design is that new trailer must have almost the same or better mechanical behavior than the original. Impact strength together with tensile strength, fatigue and wear resistance are the critical mechanical properties in design of the trailer's main components. The aim of this work is to study relation between the microstructure and impact strength of modern steels used in new concepts of the trailers with lower mass. Impact tests, metalography and fractography were performed and obtained results were compared with standard structural steel used in old trailer design. Significant differences were recorded mainly in the low temperature range.

Acknowledgment: The research is supported by the project "Research centre of the University of Žilina", ITMS 26220220183.

P.S.B.12

THE AUTOWAVE CRITERIA OF PLASTICITY AND FRACTURE BY CREEP

Dina V. Orlova[1,2], V.I. Danilov[1], L.B. Zuev[1]
Institute of Strength Physics and Materials Science, SB RAS, Tomsk, Russia
National Research Tomsk Polytechnic University, Tomsk, Russia

The process of plastic deformation macro-localization was investigated for polycrystalline aluminum by low-temperature creep. It has been found that at the stages of steady-state and enhanced-rate creep the process behavior has an autowave nature.

At the stage of steady-state creep, a phase autowave of localized plastic deformation would form. The wave propagation rate is found to be proportional to the rate of total deformation growth. The unit processes involved in the deformation by creep and in the propagation of localized plasticity autowaves have similar activation volumes corresponding to the thermally activated motion of dislocations overcoming local barriers.

The macro-localization nuclei emergent at the stage of enhanced-rate creep would move in a concerted manner towards a stationary high-amplitude strain localization zone. A similar scenario is observed at the pre-fracture stage in the sample tested by active loading.

The time-space coordinates have been calculated and kinetic equations have been derived for the localization nuclei observed for the pre-fracture stage in the sample tested by active loading. On the base of these data, the location and time of fracture was determined for the sample by creep. Good agreement is observed between the calculated and real coordinates of the location and time of sample fracture by creep.

Thus, the emergence of mobile localized plasticity nuclei at the prefracture stage by active loading or at the stage of enhanced-rate creep is considered to be a forerunner of viscous fracture in the deforming sample.

P.S.B.13

PROPERTIES OF HIGH PRESSURE OXYGENATED YBCO BULK SUPERCONDUCTORS

Samuel Piovarci, Vitaliy Antal, Daniela Volochova, Pavel Diko
Institute of Experimental Physics SAS, Kosice, Slovak Republic

High pressure oxygenation of YBCO superconductors is interesting in terms of elimination of oxygenation cracks leading to improve magnetic properties. As it is described in others works, higher temperature allows a higher diffusion rate and thus the more uniform distribution of the oxygen in the material during oxygenation process. This leads to less tensions in the material and eliminates cracks. In this work we present several tests of a high pressure oxygenation that was done on YBCO superconductors in our new high pressure chamber furnace. Samples of YBCO Bulk superconductor (18mm diameter and 10mm height) was oxygenated in pure oxygen at pressure of 96bar at 700 and 800°C during 1 and 5 hours. After oxygenation a trapped magnetic field was measured at temperature of liquid nitrogen. Profile of the trapped magnetic field showed different behavior of the oxygen diffusion during high pressure oxygenation when compared to standard oxygenation (400°C at 1bar pure oxygen). The microstructure of the oxygenated samples was observed by polarized light microscope and by scanning electron microscope.

Acknowledgment: This work was realized within the Framework of the projects: ITMS 26220120019, ITMS 26220120035, ITMS 26220220061, ITMS 26220220041, which are supported by the Operational Programme “Research and Development” financed through the European Regional Development Fund, ITMS 26110230061, ITMS 26110230097, VEGA No. 2/0090/13, APVV 0330-12 and SAS Centre of Excellence: CFNT MVEP.

P.S.B.14

EXAMINATION AND COMPARISION OF PHYSICO-CHEMICAL CHARACTERISTICS OF POLYMERIC AND GYPSUM FLUIDS DESIGNED FOR RINSING OF OIL WELLS

Matilda M. Lazić[1], Dragan Vrebalov[2]
[1]*Technical College of Applied Sciences in Zrenjanin, Zrenjanin, Serbia,*
[2]*NIS Gazpromnjeft, Novi Sad, Serbia*

Investigated and compared the physico-chemical characteristics of “KCL” polymer and commercial formulations of gypsum fluids designed for flushing of oil wells in order to assess the benefits of using a polymeric fluid during the drilling of oil wells. Investigation of the following characteristics of both fluids was performed in field laboratories in the two wells of the same type on the project and with the same oilfield in Turija according to ISO 10414-1:2008. Samples of both fluids intended to flush during drilling of oil in the operating conditions are examined once a day for seven days. On the basis of the compared characteristics of the preparation, processing and used in the drilling process in direct operating conditions, determined the lead examined recipes “KCL” polymer compared to the tested recipe gypsum fluid achieving quality drilling process and prices.

Key words: fluids to flush of oil wells, KCL polymer, gypsum, drilling process.

P.S.B.15

OPTICAL PROPERTIES OF PERTURBED MOLECULAR NANOFILMS

Ana J. Šetrajčić-Tomić[1], Dragana Rodić[2], Svetlana S. Pelemiš[3],
Igor J. Šetrajčić[2], Siniša M. Vučenović[4], Jovan P. Šetrajčić[2]
[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Novi Sad, Vojvodina – Serbia, [2]University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina – Serbia, [3]University of East Sarajevo, Faculty of Technology in Zvornik, Zvornik, Republic of Srpska – B&H, [4]University of Banja Luka, Faculty of Sciences, Department of Physics, Banja Luka, Republic of Srpska – B&H

We have supplemented and reformulated microscopic theory of optical properties of crystalline molecular film defined by layers in particular [1,2], to the theory of optical properties of the whole ultra-thin film. Using the well-known method of two-time, retarded, temperature dependent Green's functions [2,3] and the model of ultrathin perturbed molecular films [1–4], by the defined of exciton dispersion law, probability and space distribution of their possible states, were calculated and analyzed the dielectric and optical properties of these crystalline nano-structures. Research result shows that the two effects appearing in the system: quantum size and conformation effects. Consequently, the permittivity strongly narrow and discrete, which is a consequence of resonance effects and depends on the film thickness as well as on boundary parameters. These influences on optical characteristics (through analyses of dynamical absorption, reflection, refraction and transparent indices) of observed nanostructures were especially explored in details through to layers [3,4] and to whole film separately. The result is particularly interesting when we get only one absorption peak as well as the phenomenon of selective transparency of individual frequency lines appearance.

Key words: Nano-film, permittivity, absorption, reflection, refraction, transparency.

[1] A.J.Šetrajčić-Tomić, D.Rodić, I.J.Šetrajčić, S.S.Pelemiš, J.P.Šetrajčić: Optical Particularities of Whole Extra-Thin Molecular Films, 16th Yucomat, Herceg Novi 2013.

[2] J.P.Šetrajčić: Exact Microtheoretical Approach To Calculation Of Optical Properties Of Ultralow Dimensional Crystals, *Arxiv*, Eprint Arxiv:1004.2387 (04/2010).

[3] B.Škipina, D.Lj.Mirjanić, S.M.Vučenović, J.P.Šetrajčić, I.J.Šetrajčić, A.J.Šetrajčić-Tomić, S.S.Pelemiš, B.Markoski: Selective IR Absorption in Molecular Nanofilms, *Optical Materials* 33, 1578-1584 (2011).

[4] J.P.Šetrajčić, B.Markoski, D.Rodić, S.S.Pelemiš, S.M. Vučenović, B.Škipina and D.Lj.Mirjanić: Absorption Features of Symmetric Molecular Nanofilms, *Nanoscience and Nanotechnology Letters* **5**, 1–5 (2013).

P.S.B.16

CHARACTERIZATION OF DEGRADABLE POLYCARBONATE-BASED POLYURETHANE ELASTOMERS

Rafał Poręba, Libor Kobera, Jiří Hodan, Jana Kredatusová and Milena Špírková
Institute of Macromolecular Chemistry AS CR, v.v.i., Prague, Czech Republic

The series of thermoplastic polyurethane elastomers (PUE) made from polycarbonate diol (PCD), oligomeric D,L-lactide-based diol (DLL), butane-1,4-diol (BD) and 1,6-diisocyanatohexane (HDI) was prepared by one-step procedure. The complex characterization of all-aliphatic PUE films (comprised of solid-state NMR spectroscopy, thermal, mechanical and surface analysis) will be presented. It was found that the flexibility/rigidity differences detectable on the segmental level (together with the character and the extent of hydrogen bonding and other dipol-dipol interactions) are very probably responsible for strong differences in mechanical (especially tensile) properties. Other methods of analysis revealed property differences in some degree, however they are not so dramatic.

Acknowledgement: The authors wish to thank the Czech Science Foundation, GAČR (project No. 13-06700S) for financial support.

P.S.B.17

ON THE PHYSICAL PROPERTIES OF R_2AgGe_6 (R=La,Ce,Pr,Nd,Sm,Gd)

Leonid Salamakha[1], E. Bauer[1], H. Michor[1], O. Sologub[1,2]
[1]Institute of Solid State Physics, Vienna University of Technology, Vienna, Austria, [2]Institute of Physical Chemistry, University of Vienna, Vienna, Austria

The interest in ternary rare earth - transition metal *p*-element - rich systems is related with a search of new thermoelectric materials. Binary compounds such as unfilled skutterudite TX_3 (T=transition metal, X=P,Sb,As) exhibit voids in which the rare earth element can be inserted. This increases phonon scattering and decreases lattice thermal conductivity without increasing electrical resistivity leading to enhanced value of figure of merit of thermoelectric materials. From the other hand, germanium rich ternary rare earth transition metal compounds attract attention due to the interesting electron properties, interplay of superconductivity and magnetic order [1]. In our study we have turned attention the series of ternary rare earth silver germanides for which we have studied the electric resistivity, magnetic suceptebility and specific heat in a temperature region from 273 K to 0.3 K. The crystal structures of Pr and Sm compounds have been studied by single crystal X-ray diffraction and exhibited the new structural arrangements. Ce-, Pr-, Sm-, Gd-compounds were found to order magnetically at 11.4, 13.3, 8.5 and 16.3 K respectively. Out of the line, Nd- compound shows no magnetic ordering al the temperature range studied.

[1] M. Falmbigl, F. Kneidinger, M. Chen, A. Grytsiv, H. Michor, E. Royanian, E. Bauer, H. Effenberger, R. Podloucky, P. Rogl, Cage-Forming Compounds in the Ba-Rh-Ge System: From Thermoelectrics to Superconductivity, Inorganic Chemistry, 52 (2013), S. 931 - 943.

P.S.B.18

CRYSTAL STRUCTURE AND PHYSICAL PROPERTIES OF $\mathbf{YbPt_5B_2}$

Leonid Salamakha[1], E. Bauer[1], H. Michor[1], P. Heinrich[1], O. Sologub[1,2], P. Rogl[2]
[1]*Institute of Solid State Physics, Vienna University of Technology, Vienna, Austria,*
[2]*Institute of Physical Chemistry, University of Vienna, Vienna, Austria*

Specific heat, magnetic susceptibility, electric transport properties and thermal expansion have been measured for a new ytterbium platinum boride $YbPt_5B_2$ (space group *C*2/*m*, a=1.54982(6) nm, b=0.55288(3) nm, c=0.55600(3) nm, β=105.367(3)°); isotypic compound $LuPt_5B_2$ was used as non-magnetic analogue for physical properties evaluations. $YbPt_5B_2$ forms a new type of structure. The unit cell is composed of two structural fragments alternating along a axis: slabs of face-fused boron filled and empty triangular prisms built of Pt atoms are formally separated by puckered sheets of edge-linked boron filled distorted trigonal prisms constructed of five platinum and one ytterbium atom. $YbPt_5B_2$ was found to demonstrate two sequential antiferomagnetic phase transitions at 4.6 and 7.8 K from all the physical properties studied. While the later transition was found to be of the second order, the former one is of the first order and is associated with spin reorientation magnetic transition along one of the crystalline axis. Moreover, in the temperature region below 1K an onset of another transition is noticeable proofing the magnetic structure of the compound to be extensively complex.

P.S.B.19

OXYGEN PERMEATION STUDY OF THE NEW CERAMIC MEMBRANE MATERIAL BASED ON BSCF

Mikhail Popov, I. Starkov, S. Bychkov, A. Nemudry
Institute of Solid State Chemistry and Mechanochemistry, SB RAS, Novosibirsk, Russia

Ceramic materials exhibiting mixed oxygen and electronic conductivity (MIECM) provide a new way for oxygen production. For instance, ceramic oxygen membrane reactors can combine the separation of oxygen from air and the conversion of natural gas into syngas (POM) in one stage, thereby eliminating a costly oxygen separation plant that is needed in the POM units. In this study, we present the results of the functional properties study of the new promising membrane material based on $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF). It is shown that the isomorphic substitution of 2% of cobalt on tungsten leads to stabilization of the cubic phase and not only suppresses the «cubic – hexagonal» phase transition in BSCF but increases the oxygen permeability and long-term stability of the materials in CO_2 atmosphere.

P.S.B.20

ELECTROCHEMICAL OXYGEN REDUCTION AT PLATINUM CATALYST ON TIN OXIDE BASED SUPPORT IN ALKALINE SOLUTION

Ljiljana M. Gajić-Krstajić[1], N.R. Elezović[2], B.M. Babić[3],
J. Kovač[4], V.R. Radmilović[5], N.V. Krstajić[5]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Institute for Multidisciplinary Research, University of Belgrade, Belgrade, Serbia, [3]Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia, [4]Jozef Stefan Institute, Ljubljana, Slovenia, [5]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

Platinum on Sb doped tin oxide support (Sb/SnO_2) was synthesized and characterized as the catalyst for oxygen reduction reaction in 0.1 mol dm^{-3} NaOH solution, at 25^oC. Sb (5%) doped tin oxide support was synthesized by sol-gel procedure.

Platinum nanocatalyst (20% Pt) on Sb-SnO_2 support was synthesized by borohydride reduction method. Synthesized support and catalyst were characterized by BET (Brunauer, Emmett, Teller), X-ray diffraction (XRD), high resolution transmission electron microscopy (HRTEM) and X-ray photoelectron spectroscopy (XPS). XRD diffraction spectra of the support contained only SnO_2 belonging peaks. X-ray photoelectron spectroscopy was applied to characterize chemical status of elements before and after Pt-treatment. XPS spectra Sn 3d, Pt 4f, Sb 3d and O 1s revealed that the Pt-deposition on Sb+SnO_2 support induced reduction of Sn(4+) oxidation state to Sn(2+) and Sn(0) states, while Pt remained in metallic state and Sb was in (3+) oxidation state. Homogenous Pt nanoparticles distribution over the support, without pronounced particle agglomeration was confirmed by HRTEM technique. The average Pt particle size was 2.9 nm. Electrochemically active Pt surface area of the catalyst 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 $\mu C\ cm^{-2}$ for full monolayer coverage. This calculation gave the value of 51 $m^2\ g^{-1}$.

Kinetics of the oxygen reduction reaction at Pt/Sb-SnO_2 catalyst was studied by cyclic voltammetry and linear sweep voltammetry at rotating gold disc electrode. Two different Tafel slope 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, as it was already referred in literature for oxygen reduction reaction at polycrystalline Pt, as well as at different Pt based nanocatalysts. 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), were compared to carbon supported (Vulcan XC-72) catalyst. Pt/Sb-SnO_2 catalyst exhibited similar catalytic activity for oxygen reduction reaction like carbon supported one. The advantages of carbon free support application in terms of durability and stability of the catalysts were discussed.

P.S.B.21

TEMPERATURE DEPENDENCE OF GRAPHENE TRANSPORT PROPERTIES

S. Jaćimovski[1], Dejan Raković[2], V. Sajfert[3]
[1]*Academy of Criminalistic and Police Studies, Belgrade, Serbia*
[2]*University of Belgrade, Faculty of Electrical Engineering, Serbia*
[3]*University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Serbia*

The exceptional transport properties of graphene, coupled with its high thermal, mechanical and chemical stabilities, provide wide opportunities for practical application. Temperature dependencies of graphene electrical and thermal characteristics will be hereby analyzed in the wide range of 50–400 K, by solving semiclassical Boltzmann equations in the approximations of relaxation time. Basic relaxation mechanisms in graphene monolayer will be accounted, with corresponding relaxation times introduced phenomenologically. For calculation of graphene electrical conductivity, different mechanisms of scattering of charge carriers and their partial and overall contributions will be accounted. In the case of graphene thermal conductivity, the exact contribution of all phonon branches will be accounted. The theoretical results will be compared with the experimentally observed.

P.S.B.22

RELAXATION PHENOMENA IN SSG Fe_3O_4 NANOPARTICLE SYSTEM

Violeta Nikolić, V. Spasojević, V. Kusigerski, M. Perović,
A. Mraković, M. Bošković, J. Blanuša
The Vinča Institute, Condensed Matter Physics Laboratory,
University of Belgrade, Belgrade, Serbia

Fe_3O_4 nanoparticles were synthesized by thermal decomposition of organic precursor (acac complex) and the structural characterization was done by TEM measurements. In order to understand magnetic behavior of the examined Fe_3O_4 system magnetic characterization was done by SQIUD measurements in AC and DC regime. Sample exerts memory effects and aging phenomena, all pointing to the existence of super spin glass state at low temperatures. Appropriate interpretation of the measured effects can be provided within the framework of droplet and hierarchical models. Investigation of relaxation phenomena comprised measurements of zero field cooled and thermoremanent magnetization time decay. Time dependence of the related relaxation rates showed unusual trend of slowing down with increasing temperature. The origin of observed behavior still remains an open question.

P.S.B.23

RAMAN SPECTROSCOPY AND ELECTRON MICROSCOPY OF POLYMER BASED NANOCOMPOSITES WITH CARBON NANOTUBES AND GRAPHENE

Vuk V. Radmilović[1], Carlo Carraro[2], Petar Uskoković[3],
Radoslav Aleksić[3], Velimir R. Radmilović[3]
[1]Innovation center, Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Department of Chemical and Biomolecular Engineering, University of California at Berkeley, Berkeley, CA, [3]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

Raman spectroscopy is an essential nondestructive method for tracking changes in purity and structural morphology such as disorder, thickness, doping, edge and grain boundaries, etc. for crystalline and amorphous carbonous materials. The aim of this research was to characterize Polyvinyl butyral (PVB) based nanocomposites with three different types of nanofillers: multiwalled carbon nanotubes (MWCNT), singlewalled carbon nanotubes (SWCNT) and graphene (G) by means of Raman spectroscopy, scanning electron microscopy (SEM) and aberration corrected transmission electron microscopy (TEM). Raman spectroscopy was performed using blue laser source of 473 nm wavelength and red laser source of 633 nm wavelength. Significant differences between Raman spectra with blue and red lasers were observed not only for pure carbonous nanofillers but also for all three PVB based nanocomposites. This work demonstrates that from the different shapes and positions of the Raman peaks (G, D, and 2D), the presence of carbonous nanofillers in PVB matrix can be confirmed. Raman signal from carbonous nanofillers was detected not only from the area where their agglomerates are present in PVB matrix, but also in between the agglomerates, indicating the presence of networks of nanofillers. The presence of these networks, with needed partial or complete percolation, appears to be responsible for the achieved improved properties of the nanocomposites.

P.S.B.24

PROPERTIES AND STRUCTURAL CHANGES OF THERMALLY AND MECHANICALLY ACTIVATED KAOLIN CLAY

Aleksandra Mitrović[1], Miodrag Zdujić[2], Ljiljana Miličić[1], Dragica Jevtić[3]
[1]Institute for Testing of Materials, Belgrade, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Faculty of Civil Engineering, University of Belgrade, Belgrade, Serbia

The paper presents properties of thermally and mechanically activated kaolin clay, with respect to its application as a pozzolanic additive in cement-based systems. Starting kaolin clay is mainly composed of minerals kaolinite and quarz. Properties of thermally activated clay in the laboratory furnace at temperature 650°C for 120 min (optimal conditions) are: pozzolanic activity of 0.45g $Ca(OH)_2$/g Pozz, mean particle size of 10.2 µm and loss on ignition (LOI) of 0.88. Mechanical activation for 120 min in a planetary ball mill significantly affects the properties, activity is 0.74g $Ca(OH)_2$/g Pozz, mean particle size 4.5 µm and LOI of 6.82. Structural changes were monitored using XRD and TG/DTA analysis. The advantage of mechanical activation is not only in the high activity and small mean particle diameter, but also in simplicity of the process and its environmental benefits.

P.S.B.25

X-RAY EMISSION AND MOSSBAUER SPECTRA AND ELECTRONIC STRUCTURE OF $ScFe_2Si_2$ AND $HfFe_2S_2$ COMPOUNDS

Ivan Shcherba[1,3], D. Uskoković[2] M. Sacharevych[3], B.M. Jatcyk[4]
[1]Institute of Technology, the Pedagogical University of Cracow, Cracow, Poland, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Ivan Franko National University of Lviv, Ukraine, [4]University of Forestry and Wood Technology, Lviv, Ukraine

The valence band electronic structure of compounds with the $HfFe_2S_2$ crystal lattice type has been established for the first time based on X-ray emission spectroscopy measurements. Band structure and theoretical spectra of X-ray emission bands of atoms located in non-equivalent crystallographic positions are calculated by means of the LMTO method. A satisfactory agreement between theoretical and experimental data is achieved. As it can be seen from the performed calculations and experimental data, the *s*-states of Si hybridize with the *p*-states Sc (Hf) and Fe and are located at the bottom of valence band. Contribution of the *s*-symmetry electrons to the chemical bond is substantially different for Si atoms located in non-equivalent crystallographic positions. ^{57}Fe Mossbauer absorption measurements confirm iron atoms occupying non-equivalent positions in the crystal lattice.

P.S.B.26

THERMOSETTING POLYMER COMPOSITE WITH SELF-HEALING ABILITY

Ivana Radović, Omar Yerro, Vesna Radojević, Petar S. Uskoković,
Dušica B. Stojanović, Miloš Petrović and Radoslav Aleksić
University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

Thermosetting polymer composites with autonomic self-healing ability were prepared and investigated. Epoxy matrix based on diglycidyl ether of bisphenol A (DEGBA) was reinforced with hollow glass tubes filled with active components for self-healing. One set of tubes was filled with solution of Grubbs' 1st generation catalyst, while the other contained solution of healing agent, dicyclopentadiene (DCPD). Controlled energy impact tests were performed for determination of healing efficiency of the system, where absorbed impact energies of virgin and healed samples were compared. For confirmation of DCPD polymerization and influence of solvent on Grubbs' catalytic activity, FTIR analysis was used.

P.S.B.27

SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF POLY(GMA-*co*-EGDMA) POLYMER DECORATED WITH SILVER NANOPARTICLES

Ivana D. Vukoje[1], Enis S. Džunuzović[2], Vesna V. Vodnik[1],
Suzana Dimitrijević[2], S. Phillip Ahrenkiel[3], Jovan M. Nedeljković[1]
[1]Institute of Nuclear Sciences Vinča, University of Belgrade, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [3]South Dakota School of Mines and Technology, Rapid City, SD, USA

Composite consisting of silver nanoparticles coordinated to poly(GMA-*co*-EGDMA) macroporous copolymer was prepared by attachment of amino group to the poly(GMA-*co*-EGDMA) in the reaction with ethylene diamine, and consequent reduction of silver ions with amino groups at elevated temperature. The infrared measurements indicated that surface of silver nanoparticles is passivated through the coordination of the lone pare on the N atom of the imine present in the sceleton of the poly(GMA-*co*-EGDMA) copolymer. The inductively coupled plasma atomic emission, UV-Vis reflection spectroscopy, X-ray diffraction and transmission electron microscopy measurements revealed the high content (52 wt.-%) of well separated silver nanoparticles in the size range of 5 to 10 nm onto composite. Antimicrobial efficiency of composite was tested against Gram-negative bacteria *E. coli*, Gram-positive bacteria *S. aureus*, and fungus *C. albicans* in wide concentration range of composite. The composite ensured almost maximum reduction of both bacteria, while the fungi reduction reached 96.5 %.

P.S.B.28

INVESTIGATION OF PHYSICAL AND MECHANICAL PROPERTIES OF EPOXY RESIN FILLED WITH NANOSIZED POWDER

Tatyana Brusentseva, Artem Philippov
Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia

Polymer materials often do not possess sufficient rigidity and strength to satisfy the requirements to various structures made of these materials. Inclusion of various reinforcing fillers is a conventional method of improving these properties so that filled polymers could be used as structural materials. The development of polymer technologies leads to the permanent extension of the class of polymers filled with particles, which, in it's turn, raises the necessity of predicting the mechanical properties of such materials. Epoxy resins, widely used as the basis of modern composite insulation materials, have great potential for targeted modification of properties. The strength properties of articles made of polymer composite materials (PCMs) are determined by various factors: mechanical properties of the phases, character of phase interaction, filler geometry, degree of filling, fabrication technology, etc. The PCM strength properties are not constant because of instability of parameters of technological processes of fabrication of PCM articles. The paper is devoted to the development of formulations and modes of catalytic curing of compositions based on epoxy resin DER330. As fillers there have been selected 5 types of nanopowders SiO2, Al2O3, AlN, the nature, size and shape vary. Dependence of the mechanical properties in a mode of three-point bending composite on the concentration and nature of the filler has been experimentally studied. Mass fraction of nanoparticles in the material varied from 0% to 4%. A technological process was developed, which allows one to reach the maximum effect of modification of the epoxy matrix by nanoparticles by means of intensification of dispersion of agglomerates by means of ultrasonic dispersion. It was found that the most beneficial way is to insert nanoparticles into the least viscous medium (hardener) because such a medium ensures the minimum obstacles to dispersion of agglomerates and uniform distribution of particles. The morphology of the fracture surface of the composite was examined by scanning electron microscope. It has been ascertained that the inclusion of particles of SiO2 and Al2O3 in the amount of 0.2 % to 1.2 % of the binder weight favorably affects the Young's modulus and flexural fracture strain . The greatest effect on the fracture stress is increase in 30% compared to the base composition, which is caused by additives nanosilica A-380. Aluminum nitride nanoparticles have maximum effect on the modulus of elasticity - 12 % increase, without compromising the fracture stress .

P.S.B.29

ANALYSIS AND CHARACTERIZATION OF COAL MINE CONVEYOR IDLERS CONTAMINATION PARTICLES

Radivoje Mitrović[1], Žarko Mišković[1], Vesna Maksimović[2], Dragan Jovanović[3],
Gradimir Ivanović[1], Zoran Stamenić[1], Milan Tasić[4]
[1]*University of Belgrade – Faculty of Mechanical Engineering, Belgrade, Serbia;*
[2]*Vinča Institute of Nuclear Sciences, Belgrade, Serbia;*
[3]*Termoelektrane i Kopovi Kostolac d.o.o. Company, Kostolac, Serbia;*
[4]*Tehnikum Taurunum College of Applied Science, Belgrade, Serbia;*

According to the relevant literature, one of the most common causes of coal mine conveyor idlers failure is contamination. That's why the main research goal of this paper (realised within the MPNTR TR35029 Project) was to determine origin, type and size of environmental particles usually causing coal mine idlers failure. It was concluded that there are usually three types of particles present on the open pit coal mine: surface dust, excavation dirt and coal dust. Samples from all three types of particles were taken and analysed regarding to their size distribution and chemical composition. After that, fifteen used conveyor idlers were disassembled and contamination particles from their bearings were extracted, analysed and compared with the previous results, pointing out that the typical cause of conveyor idlers failure was the excavation dirt (not the surface dust, as expected), mostly consisted of different kinds of quartz.

P.S.B.30

LOCAL ATOMIC STRUCTURE OF DOPED ZINC-FERRITE NANOPOWDERS PREPARED BY CO-PRECIPITATION

Marija Milanović, Ivan Stijepović, Ljubica M. Nikolić, Vladimir V. Srdić
University of Novi Sad, Faculty of Technology, Department of Materials Engineering, Novi Sad, Serbia

In this work, solid solutions of yttrium and indium doped $ZnFe_2O_4$ nanopowders were synthesized by co-precipitation method and their structure was probed by XRD and EXAFS methods. No secondary phase was detected in the as-synthesized powders and all samples had cubic spinel structure. EXAFS analysis confirmed that the inversion parameter of the spinel ferrite depends on added cations. Type and amount of the dopant cation had significant influence on the local atomic structure and cation coordination number.

P.S.B.31

FREE-VOLUME STRUCTURAL EVOLUTION IN CRYSTALLIZED Ge-Ga-Se GLASSES

Halyna Klym[1], A. Ingram[2], O. Shpotyuk[3]
[1]Lviv Polytechnic National University, Lviv, Ukraine, [2]Opole University of Technology, Opole, Poland, [3]Scientific Research Company “Carat”, Lviv, Ukraine

$GeSe_2$–Ga_2Se_3 chalcogenide glasses (ChG) have shown many advantages for potential applications of optical modulator or frequency converter, efficient laser host materials, and fiber-optical amplifier in the IR spectral region. One of the best techniques capable to probe such fine free volumes is the positron annihilation lifetime (PAL) spectroscopy. In the present paper, we imply the PAL method to study of crystallization processes in $80GeSe_2$-$20Ga_2Se_3$ ChG.

The crystallization of the $80GeSe_2$-$20Ga_2Se_3$ was performed with a single step of heat treatment at T_g+10 ^oC. Thus, glass samples were placed in a ventilated furnace where the accuracy of temperature is ± 2 ^oC for various time varying from 10 to 80 hours. The PAL spectra were recorded with ORTEC system. The measured PAL spectra of ChG were processed with standard LT 9.0 computer program. The positron trapping modes in the studied ChG, e.g. average positron lifetimes τ_{av}, positron lifetime in defect-free bulk τ_b, positron trapping rate in defects κ_d and fraction of trapped positrons η were calculated.

Assuming two-state positron trapping model like as for typical ChG systems, two components in the fit of experimental PAL spectra can be provided with reduced bulk positron lifetime τ_1 which itself has no physical meaning, positron lifetime in free-volume entities (positron traps) τ_2 and corresponding intensities I_1 and I_2. With increase of annealing duration from $80GeSe_2$-$20Ga_2Se_3$ glass to samples annealed for 10 h, the lifetimes τ_2 increases and I_2 intensities decreases to 0.29 because of void expansion. This trend correspondingly reduces the positron trapping rate in defect κ_d without significant changes in $\tau_{av.}$ and τ_b lifetimes. With further annealing duration proceeding to 25 and 50 and 80 h, the I_2 intensity ceases to increase, while lifetime τ_2 appreciably decreases. These changes result in increase of positron trapping rate in defect κ_d.

During crystallization, the glass structure relaxes towards more thermodynamically favourable state (crystallization shrinkage or densification), eliminating the excess of free volume of neighbouring voids. It means that existing free volume voids either disappear or convert into a greater number of smaller ones. We can argue that crystallization in $80GeSe_2$-$20Ga_2Se_3$ glass induced by long-term annealing (25-80 h) is accompanied by void growth because their expansion and appearance of new tiny voids due to mismatch between glassy and crystalline regions. The described crystallization precedes opposite changes caused by nucleation in $80GeSe_2$-$20Ga_2Se_3$ glasses at lower annealing times (10 h).

Thus, crystallization behavior of $80GeSe_2$-$20Ga_2Se_3$ glasses during annealing at 380°C for 10, 25, 50 and 50 h indicates on the possibility of formation of $GeGa_4Se_8$ and Ga_2Se_3 crystals.

P.S.B.32

NOVEL HYDROGEL PORE-FILLED COMPOSITE MEMBRANES FOR HEAVY METAL ADSORPTION

Aleksandar Stajčić[1], J. Stajić-Trošić[1], S. Putić[2], P.S. Usković[2], F. Radovanović[1], R. Aleksić[2]
[1]*University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Belgrade, Serbia,*
[2]*University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*

Hydrogels containing strong acid groups have been used in the past for the removal of heavy metals. In this work we prepared asymmetric membranes incorporating cross-linked 2-acrylamido-2-methyl-1-propane sulfonic acid (AMPS) hydrogel by combining photopolymerization and liquid phase inversion. An experimental design measuring water content and ion-exchange capacity of these membranes was used to select the optimal membrane composition for the removal of Pb^{2+}, Ni^{2+}, and Cd^{2+} ions from aqueous solutions. SEM images revealed an ultrafine hybrid structure with an interconnected network of submicron particles embedded within the microporous polymer support. The results demonstrated fast sorption kinetics and high capacity for the investigated metals. This work is supported by Ministry of Education and Science: TR 34011 and III 45019.

P.S.C.1

EROSION RESISTANCE OF SOL-GEL TiO_2-ZrO_2 FILM ON STAINLESS STEEL

Krešimir Grilec, Lidija Ćurković, Marijana Majić Renjo, Suzana Jakovljević, Vera Rede
University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture,
Zagreb, Croatia

Wear resistance of metallic materials can be improved by modifying their surface with different coating deposition techniques, one of which is a sol-gel technology. In this paper, the erosive wear resistance of a ceramic nanostructured sol-gel TiO_2-ZrO_2 film deposited on the stainless steel substrate (X5CrNi18-10) by the dip coating technique has been described. Dry silica sand was used as erodent, with impact angle of 30° and 90°. The coating thickness, as well as chemical composition after erosion, was analyzed by the Glow Discharge Optical Emission Spectrometer (GD-OES). Wear scars were analyzed by the scanning electron microscope (SEM). Obtained results showed that erosive wear resistance of the sol-gel TiO_2-ZrO_2 film significantly depends on the erodent impact angle, while the erosive wear resistance decreases with the impact angle increase.

P.S.C.2

CRYSTALLIZATION OF CERIUM PHOSPHATE GELS UNDER HYDROTHERMAL AND THERMAL TREATMENT

Taisya O. Shekunova[1], A.E. Baranchikov[2], V.K. Ivanov[2]
[1]*Moscow State University, Faculty of Materials Science, Moscow, Russia*
[2]*Kurnakov Institute of General and Inorganic Chemistry, Moscow, Russia*

This study is aimed at investigation of cerium phosphate gels crystallization under hydrothermal conditions and during thermal treatment. We have shown that hydrothermal microwave treatment (HTMW) at 155–220°C during 10–120 min of the gels in aqueous solutions of phosphoric acid resulted in formation of $Ce^{IV}(PO_4)(HPO_4)_{0.5}(H_2O)_{0.5}$ (**I**) phase. On the contrary, HTMW treatment of the gels in neutral aqueous media resulted in formation of $Ce^{III}PO_4\cdot xH_2O$ (rhabdophane). Thus the acidity of hydrothermal media probably governs the valence state of cerium in resultant materials. According to impedance spectroscopy measurements (**I**) possesses relatively high electron conductivity at ~200°C. Thermal decomposition of (**I**) at low temperatures results in stepwise water elimination. At temperatures higher than 700°C successive formation of $Ce^{IV}P_2O_7$, $Ce^{III}P_3O_9$, and $Ce^{III}PO_4$ (monazite) was detected.

P.S.C.3

CELL PERFORMANCES OF LENGTH-TUNABLE SILICON NANOWIRE/POLYMER HYBRID SOLAR CELLS

Keisuke Sato[1,2], Mrinal Dutta[2], Naoki Fukata[2]
[1]Department of Electrical and Electronic Engineering, Tokyo Denki University, 5 Senju-Asahi-cho, Adachi-ku, Tokyo, Japan, [2]World Premier International Research Center for Materials Nanoarchitectonics, National Institute for Materials Science, 1-1 Namiki, Tsukuba, Ibaraki, Japan

Hybrid solar cells that combine inorganic nanostructured materials with organic materials have gained much attention, because they enable not only enhancement of power conversion efficiency (PCE) but also reduction in material cost. We fabricated the hybrid solar cells consisting of length-tunable and vertically-aligned n-type silicon nanowires (SiNWs) and organic poly(3,4-ethylene- dioxythiophene):poly (styrene-sulfonate) (PEDOT:PSS). We report herein on the effects of nanowire length and annealing temperature on the cell performances of SiNW/PEDOT:PSS hybrid solar cells. The obtained hybrid solar cells achieved the best cell performance with the PCE of 9.3% by optimizing the nanowire length and annealing temperature. Our approach is a significant contribution to design for higher-performance and lower-cost inorganic/organic hybrid solar cells.

P.S.C.4

DEGRADATION OF THIN 4,4′-BIS(2,2′DIPHENYL VINYL)-1,1′-BIPHENYL FILMS BY UV LIGHT

Aleksandar Ž. Tomović[1], V.P. Jovanović[1], I. Djurišić[1], V.Z. Cerovski[1], B. Nastasijević[2], S. Veličković[2], K. Radulović[3], R. Žikić[1], V.I. Srdanov[4]
[1]Institute of Physics, University of Belgrade, Belgrade, Serbia, [2]Vinča Institute of Nuclear Sciencies, University of Belgrade, Belgrade, Serbia, [3]Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [4]V&G Research, Santa Barbara, CA, USA

We studied degradation of 4,4′-bis(2,2′diphenyl vinyl)-1,1′-biphenyl (DPVBi), well know OLED material. Thermally evaporated thin films of DPVBi were irradiated with UV light in ambient, vacuum and under different oxygen pressures. The cause of degradation is reaction between UV excited DPVBi molecules and oxygen, via formation of singlet oxygen or electron transfer from excited DPVBi to molecular oxygen. Reaction rates depend on oxygen concentration and UV light intensity. These reactions lead to formation of oxidized species as evidenced by ASAP and MALDI-TOF mass spectroscopy. Photoluminescence quenching has two parts. One part is reversible and may imply formation of charge transfer complexes and the other is irreversible, caused by formation of oxidized species. IR and absorption spectra are studied by Density Functional Theory and results compared with the experiment.

P.S.C.5

VARIATION OF ENERGY DENSITY STATES IN QUANTUM DOTS ARRAYS DUE TO INTERPARTICLE ELECTRONIC COUPLING

Manca Logar[1], Shicheng Xu[1], Shinjita Acharya[1], Fritz B. Prinz[1,2]
[1]*Department of Mechanical Engineering, Stanford University, CA, USA*
[2]*Department of Material Science and Engineering, Stanford University, CA, USA*

Ordered arrays of colloidal quantum dots exhibiting collective optical and electrical phenomenon has gained interests recently due to their promising applications in photovoltaics, optoelectronics, information technologies and catalysis. Mediated by capping ligands, the quantum dots as artificial atoms, can be assembled into higher order nanostructures with programmable physical and chemical properties. Interparticle distances in self-assembled lead sulfide colloidal quantum dot superlattices were varied by changing lengths of the capping ligands. By measuring joint local density of states using electron energy-loss spectroscopy in a (scanning) transmission electron microscope, we found larger amount of energy density of states between quantum dots as well as smaller value of lowest available transition energy in superlattices with shorter interparticle distances, which are direct experimental evidence of interparticle electronic coupling from electron/hole wavefunction overlapping.

P.S.C.6

ULTRASONIC DEAGGLOMERATION OF TUNGSTEN DISULFIDE NANOPARTICLES (WS_2) IN DIFFERENT SOLVENTS FOR ENHANCING NANOMECHANICAL PROPERTIES IN POLY (VINYL BUTYRAL) (PVB) NANOCOMPOSITES

Danica Simić[1], Dušica B. Stojanović[2], Aleksandar Kojović[2], Ljubica Totovski[1],
Zijah Burzić[1], Petar S. Uskoković[2], Radoslav Aleksić[2]
[1]*Military-Technical Institute, Belgrade, Serbia,* [2]*University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*

This work reports an investigation of promising new generation nanocomposites made of poly (vinyl butyral) and nanoparticles of tungsten disulfide. To prepare test samples by the solvent-casting technique, PVB was dissolved in ethanol, 2-propanol, ethyl-acetate and n-butanol; then WS_2 was added in contents of 0 wt.%, 1 wt.% and 2 wt.%. Homogenization and particle deagglomeration was achieved by stirring (magnetic stirrer) and different modes of ultrasonication. The composites were dried in oven and thin-films were obtained. The quality of WS_2 dispersion and deagglomeration in PVB matrix was analyzed by scanning electron microscope (SEM). The reinforcing effect of WS_2 has been examined determining hardness and reduced modulus of elasticity, by nanoindentation (Hysitron TI 950 Triboindenter), in terms of the different solvents applied in preparation of samples, mode of stirring and different contents of WS_2.

P.S.C.7

IMPACT TESTING OF HYBRID THERMOPLASTIC ARAMID FABRICS WITH DIFFERENT KINDS OF REINFORCEMENT

Vera Obradović, D. Stojanović, M. Petrović, I. Živković,
V. Radojević, P. Uskoković, R. Aleksić
University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

The physical and mechanical properties of the seven samples of polyurethane/*p*-aramid multiaxial fabric forms (Colon fabrics) were analysed by high speed impact tester. Except for the two of them, the samples were mainly impregnated with 10 wt.% poly (vinyl butyral) (PVB)/ethanol solution and modified with γ-aminopropyltriethoxysilane (AMEO silane)/ethanol solution. Pristine silica (SiO_2) nanoparticles, tungsten disulfide (WS_2) nanoparticles and multiwalled carbon nanotubes (MWCNT) were used as reinforcement for different samples. All composite samples consisted of four pieces of the impregnated fabrics. The SiO_2/PVB content was 10 wt.%, while the WS_2/PVB and MWCNT/PVB contents were the same - 1 wt.%. The results revealed that Colon/AMEO/PVB/1 wt.% sample produced 112% of improvement in the maximum impact force compared to the neat Colon fabric sample. The above mentioned three kinds of reinforcement were added in order to enhance the mechanical properties of the materials for the ballistic protection.

P.S.C.8

STIMULI RESPONSIVE HYBRID NANOMATERIALS WITH A COMBINED MAGNETO-PHOTOTHERMAL EFFECT FOR NANOMEDICAL APPLICATIONS

Sašo Šturm, Nina Kostevšek, Kristina Žužek Rožman, Spomenka Kobe
Department for Nanostructured Materials, Jožef Stefan Institute, Ljubljana, Slovenia

As the EU are increasingly prioritising cancer research, targeted drug delivery has been recognized as one of the most promising approaches to treatment, as therapy localization minimises many of the unwanted side effects that patients suffer due to nonspecific delivery of cancer terminating drugs and therapies. In this study we present a novel approach to create hybrid multifunctional nanostructures that enable treatment, retention, and manipulation in a controlled manner by combining the magnetic and optically active components in a single nanoparticle (NP). The stimuli-responsive targeted therapy is based on hybrid optically and magnetically active NP, where the magnetic properties of hybrid NPs will permit their extraction from the tumour site, while their strong wavelength-specific optical absorption and exerted heat (41–47°C) will trigger photothermal tumour cell death.

P.S.C.9

KINETICS OF HYDROCHLOROTHIAZIDE PHOTOCATALYTIC DEGRADATION

Sanja Armaković, Biljana Abramović
University of Novi Sad, Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, Novi Sad, Serbia

Hydrochlorothiazide (6-chloro-1,1-dioxo-3,4-dihydro-2*H*-1,2,4-benzothiadiazine-7-sulfonamide, ($C_7H_8ClN_3O_4S_2$) is a diuretic drug of the thiazide class, that acts by inhibiting the kidneys ability to retain water. Due to the frequent use, hydrochlorothiazide is present in sewage waters. The aim of this work was to investigate photocatalytic activity of TiO_2 Degussa P25 in the degradation of hydrochlorothiazide under simulated sunlight irradiation. Results were compared with the kinetics of direct photolysis degradation. It has been observed that the degradation rate is strongly related to the catalyst content, substrate concentration and initial pH value of the solution. Degradation was monitored by HPLC–PDA technique and mineralization was studied by IC and TOC techniques.

P.S.C.10

PROPERTIES OF SUMANENE UNDER INFLUENCE OF ELECTRIC FIELD

Stevan Armaković[1], Sanja J. Armaković[2], Ana J. Šetrajčić-Tomić[3], Jovan P. Šetrajčić[1]
[1]Department of Physics, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia,
[2]Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia, [3]Institute of Pharmacology, Toxicology and Clinic Pharmacology, Medical Faculty, University of Novi Sad, Novi Sad, Serbia

Using density functional theory computations we theoretically investigated the influence of finite electric field on to the fundamental properties of typical representative of buckybowls – sumanene. Due to its bowl shaped geometry sumanene exhibits interesting properties which could be improved by various approaches. Bowl shaped geometry of sumanene and its specific structural feature, bowl depth, was significantly affected by applied electric field. Dependence of quantum molecular descriptors related with stability on applied electric field was investigated also. Changes of dipole moments, which are very important for adsorption properties, were studied as well. It was demonstrated that fundamental properties of sumanene can be effectively manipulated with electric field.

P.S.C.11

IN-SITU SURFACE FUNCTIONALIZATION OF SILICA NANOPARTICLES FOR DENTAL APPLICATIONS

Ivan Stijepović[1], Daniel Čeh[1], Marija Milanović[1], Tijana Lainović[2],
Larisa Blažić[2], Vladimir V. Srdić[1]
[1]University of Novi Sad, Faculty of Technology, Department of Materials Engineering, Novi Sad, Serbia, [2]University of Novi Sad, Faculty of Medicine, Department of Dentistry, Novi Sad, Serbia

Silica nanoparticles were synthesised by neutralisation of highly basic sodium-silicate solution (Water glass, Alumina Factory-Birac, Zvornik). *In-situ* surface functionalization was performed during neutralisation by adding poly(ethylene glycol)-methacrylate (PEGMA) while keeping pH=7. Mass ratio of silica and PEGMA was varied to establish optimal conditions for the synthesis. As-obtained nanopowders were characterized by dynamic light scattering (DLS) and Fourier-transformed infrared spectroscopy (FT-IR) to confirm surface modification and attachment of PEGMA chains to silica particles.

P.S.C.12

EFFECT OF PORES GEOMETRY OF ALUMINA CERAMICS MECHANICAL BEHAVIOR SUBJECTED TO THERMAL SHOCK

Nataša Z. Tomić, Marija Dimitrijević, Bojan Međo, Radmila Jančić–Heinemann,
Marko Rakin, Radoslav Aleksić
Faculty of Technology and Metallurgy, University of Belgrade, Beograd

In this study different pores geometries have influence on mechanical behavior of porous ceramic materials. The pores were modeled and simulated using three dimensional finite element method. Chosen geometry was similar to shapes observed in specimen’s SEM micrographs obtained by image analysis.The effect of pore morphology was analized, and their roles in determination of stress contentration induced by thermal shock. The effect of position of pores in material on stress distribution was studied. This investigation is important to obtain knowledge of critical pore geometry in the structure compared to those observed on the surface of the specimen.

Keywords: ceramics, alumina, FEM, abaqus, thermal shock, image analysis.

P.S.C.13

CdS QUANTUM DOTS SENSITIZATION OF TiO_2 NANOTUBES USING MERCAPTO SILANE AS A BINDING REAGENT

Andjelika Bjelajac[1], Veljko Djokić[2], Rada Petrović[2], Jelena Radević[2],
Jovana Ćirković[3], Jovan M. Nedeljković[4], Djordje Janaćković[2]
[1]Innovation Center of Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [3]Institute for Multidisciplinary Research, University of Belgrade, Belgrade, Serbia, [4]Vinca Institute of Nuclear Sciences, Belgrade, Serbia

Highly oriented ~ 90 nm wide titania nanotubes were obtained by anodization technique and they were further used as substrates for the ex-situ deposition of the cadmium sulfide quantum dots for the subsequent use as photoanodes in quantum dots sensitized solar cell. During the synthesis of quantum dots colloidal, the stabilization was done with mercapto silane, which is a bifunctional binding reagent. The aim of this study was to optimize the concentration of mercapto silane and to investigate the effect of aging and storage temperature of the stabilized colloidal. Using scanning electron microscopy with energy dispersive X-ray detector, the small quantity (0.04 at%) of CdS deposit on TiO_2 was detected. However using diffuse reflectance spectroscopy it was proved that even that small amount of CdS is enough to cause the absorbance blue shift of TiO_2 from 414 nm to 505 nm.

P.S.D.1

INVESTIGATION OF COAGULATION ACTIVITY OF FAVA BEAN EXTRACTS

Dragana Kukić, Marina Šćiban, Jelena Prodanović
University of Novi Sad, Faculty of Technology, Novi Sad, Serbia

Removal of water turbidity and color in form of suspended and colloidal material is usually achieved by coagulation and flocculation processes. Lately, natural coagulants have been investigated for this usage. The aim of this study was to investigate extracts of fava bean seeds (*Vicia faba* L.) obatained by extraction with distilled water and NaCl as coagulants.
Experiments were conducted in order to determine optimal coditions for achieving the best coagulation activity in synthetic turbid water. Investigation of the effect of ionic strength showed that the presence of NaCl does not affect coagulation activity. Results also showed that pH of water has no influence on coagulation activity in a wide range. Appling different doses of coagulant in water of different initial turbidity showed that the best coagulation activity is achieved by adding dose of 0.125 ml/l.

P.S.D.2

CONDITIONS OF ADSORPTION OF HEAVY METAL IONS FROM WATER BY SUGAR BEET SHREDS

Marina Šćiban, Dragana Kukić, Jelena Prodanović, Mirjana Antov, Darjana Ivetić
Faculty of Technology, Novi Sad, Serbia

In this paper, the influence of initial pH value of solution on adsorption of copper ions onto sugar beet shreds (SBS) has been considered. SBS can be used for different purposes, among others, for adsorption of heavy metal ions from water, instead expensive activated carbon. SBS are locally available in large quantities as a by-product, near sugar factories. For the successful usage of SBS it is necessary to determine the conditions under which the best results will be achieved. Several factors will have an impact on the efficiency of adsorption, for example dose of adsorbent, contact time, pH of solution, temperature, ionic strength, etc. Except of pH value of metal ions solution, an impact on adsorption efficiency has also the type of agent for pH adjustment. It has been found that the adsorption of copper ions can be carried out equaly efficient in a wide range of pH values from 4 to 9.

P.S.D.3

COAGULATION EFFICIENCY OF NATURAL COAGULANTS OBTAINED FROM COMMON BEAN UNDER DIFFERENT CONDITIONS

Jelena M. Prodanović, Marina B. Šćiban, Mirjana G. Antov, Dragana V. Kukić, Vesna M. Vasić
Faculty of Technology, University of Novi Sad, Novi Sad, Republic of Serbia

Coagulation and flocculation are commonly used steps in the water and wastewater treatment. The intensive investigations of natural coagulants have been conducted in the last years in order to replace chemical coagulants in water and wastewater treatment, since they have some serious disadvantages. In this work natural coagulant was extracted from 50 g/l of ground common bean with 0.5 mol/l NaCl. Proteins from this crude extract were precipitated by adding ammonium-sulphate and the precipitate was dissolved in 5 ml of 0.1 mol/l phosphate buffer (pH 7.5). The dialysis was conducted in order to remove salt ions. Obtained crude extract and dialysate were used as coagulants in model waters prepared using tap water and water from one artesian well. Both coagulants decreased turbidity of model waters.

Keywords: Natural coagulants, common bean, purification.

Acknowledgement: This research was supported by the grant number III 43005 from the Ministry of Education, Science and Technological Development of the Republic of Serbia.

P.S.D.4

TENSILE AND IMPACT PROPERTIES OF HYBRID WOOD COMPOSITES

Srdjan Perišić, V. Radojević, M. Petrović, M. Zrilić, D. Trifunović, D. Stojanović, R. Aleksić
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

This paper investigated the processing of hybrid Wood-Plastic Composites (WPC), the moisture resistance, tensile and impact properties. Hybrid composite panels of WPC reinforced with metal grid were made by “hot pressing “method. The hybrid composites were built by using WPC pellets consisting of 60% wood and 40% polyethylene PE, and the reinforcement with metal layers. Influence of composite structure and the moisture absorption on tensile and the impact properties was investigated. The tensile and impact tests revealed that modulus of elasticity and absorbed energy of deformation increased with a number of metal layers and decrease after moisture absorption.

Keywords: Hybrid Wood-plastic composites; Compression molding; Moisture absorption; Tensile strength; Bending strength; Impact testing.

P.S.E.1

EVALUATION OF CALCIUM PHOSPHATE COATING ELECTRODEPOSITED ON AZ31 ALLOY SURFACE BY LARGE AMPLITUDE SINUSOIDAL VOLTAMMETRY (LASV)

Filip Pastorek[1], Miroslav Omasta[2], Stanislava Fintová[3], Branislav Hadzima[1]
[1]Research Centre of the University of Žilina, Žilina, Slovak Republic, [2]University of Žilina, Faculty of Mechanical Engineering, Department of Materials Engineering, Žilina, Slovak Republic, [3]Institute of Physics of Materials of the AVČR, v. v. i., Brno, Czech Republic

Corrosion properties evaluation of magnesium alloy (AZ31) coated with calcium phosphate was performed. Calcium phosphate was prepared by potential controlled electrodeposition method using large amplitude sinusoidal voltammetry and compared with potentiostatic method. In vitro corrosion studies were carried out using electrochemical impedance spectroscopy and potentiodynamic polarization in simulated body fluid (SBF) at 37 °C. Calcium phosphate coatings improved the corrosion properties of the AZ31 magnesium alloy; however, the coating prepared by LASV performed better results than the constant-potential coating.

Acknowledgments: The research is supported by the project “Research centre of the University of Žilina”, ITMS 26220220183.

P.S.E.2

CERAMICS IN THE MAGNESIUM PHOSPHATE – CALCIUM PHOSPHATE SYSTEM

Margarita A. Goldberg, V.V. Smirnov, M.R. Kasimova, O.S. Antonova,
L.I. Shvorneva, S.V. Kutsev, S.M. Barinov
A.A. Baikov Institute of Metallurgy and Material Science RAS, Moscow, Russia

One could increase bioresorption rate of calcium phosphate materials for bone defects regeneration due to partial substitution of Ca^{2+} by Mg^{2+}. Magnesium ions present in native bones and influence on its mineralization processes. This paper deals with synthesis of powders and sintering of materials in the calcium phosphate – magnesium phosphate system with 0, 5, 10, 20 and 40 wt.% Mg^{2+} substitution. Synthesis was carried out by precipitation from aqueous solution method, (Ca+Mg)/P ratio was 2/1. Powders were investigated by X-Ray, IR-spectroscopy and SEM methods. Sintering was conducted in the 1200 – 1350 ^{o}C temperature rage. Due to interaction between magnesium phosphate and calcium phosphate the liquid phase formed and contributed in the dense ceramic state achievement. The authors are grateful to the RFBR grant 14-08-31204-mol-a for the financial support.

P.S.E.3

PLLA-STARCH COMPOSITES WITH CALCIUM PHOSPHATES FOR MEDICINE

Alexander S. Fomin[1], I.V. Fadeeva[1], E.V.Trofimchuk[2], E.V. Polupudnova[1],
N.I. Nikonorova[2], M.A. Goldberg[1], S.M. Barinov[1]
[1]Institution of Russian Academy of Sciences A.A. Baikov Institute of Metallurgy and Material Science RAS, Moscow, Russia, [2]M.V. Lomonosov Moscow State University, Chemistry Facility, Moscow, Russia

There are several polymer thin films applications as membranes in dentistry and for wound healing in medicine. At present, investigations are focused on the materials that possess induction ability to rapid growth of epithelial cells on the wound surface, which leads to faster healing of the wound surface. Particularly, the ability of Ca^{2+} ions to stimulate the proliferation of fibroblasts has been shown. Thus, the investigations of materials based on bioresorbable polymers, such as poly-L-lactide acid (PLLA) and starch with incorporation of calcium phosphates are of great interest. This paper deals with materials with interpenetrating nanopores formed in PLLA films by crazing mechanism. These pores were filled by starch and calcium phosphate composite. The materials obtained were studied by complex of different methods: SEM, X-Ray diffraction, tensile strength study and others.

P.S.E.4

THE PHASE CHANGE UNDER THE GAMMA-IRRADIATION IN ZIRCONIA CERAMICS

Olga S.Antonova[1], V.V. Smirnov[1], G.P. Kochanov[1], A.A. Zanin[2], L.I. Shvorneva[1], S.M. Barinov[1]
[1]Baikov' Institute of Metallurgy and Materials Science RAS, Moscow, Russia
[2]D. Mendeleev University of Chemical Technology of Russia, Moscow, Russia

Ceramics based on zirconia are used as bio-constructs with high requirements for durability and long life. The fine-grained structure and high content of tetragonal phase are important requirements for these materials. The aim of this work is investigation of the gamma-irradiation treatment influence in the sintering process on the ZrO_2-based material phase composition formation depending on the dose. The sintering was conducted in two steps with introduction of γ -irradiation operation between them. As a source of γ-radiation ^{60}Co was used (dose rate 0.177 Gy/s according to ferrosulphate dosimeter). After each operation phase composition was monitored by X-ray diffraction. Definition and calculation of the phases ratio were carried out for the main peaks of ZrO_2 various modifications. *This work is supported by the Russian Foundation for Basic Research, Grant No. 14-03-31557.*

P.S.E.5

EXPERIMENTAL ANALYSIS OF PMMA BLOCK SURFACE DURING AXIAL LOADING ON INSERTED STRAIGHT AND ANGLED DENTAL IMPLANTS USING DIGITAL IMAGE CORRELATION METHOD

D. Šarac[1], N. Mitrović[2], I. Tanasić[3], M. Milošević[1],
Lj. Tihaček-Šojić[3], Žarko Mišković[2], P. Popović[4]
[1]University of Belgrade, Innovation Center of Faculty of Mechanical Engineering, Serbia, [2]University of Belgrade, Faculty of Mechanical Engineering, Serbia, [3]University of Belgrade, School of Dental Medicine, Serbia, [4]University of Belgrade, Vinča Institute of Nuclear Sciences, Serbia

Dental implants are frequently used for treatment of partially edentulous jaws. Overloading of dental implants is causing greater deformations of marginal bone, which can lead to bone loss and implant failure. In order to better understand load transfer on implant supporting structure, experiment with two identical dental implants in Poly(methyl-methacrylate) (PMMA) was performed. Implants were placed in straight and angled position in PMMA block. Loading force was axial, increasing gradually up to 500 N. Aramis system based on Digital Image Correlation method was used to record PMMA block surface deformation during axial loading. Horizontal and vertical strains were measured, labelled as ε_x and ε_y, respectively. Maximum vertical tensional strains, 0.05-0.13 %, were found at the straight sample, in upper region of model surface. Maximum vertical compressive strains were found in the bottom region of the angled implant – 0.22-0.35 %. Main differences between models, in horizontal direction, are positioned near the implant axis of the angled sample where tensional strains were developed with values of 0.15-0.28 %. Higher strain values on PMMA surface occurs when angled implant is used. It can be concluded that straight implants are causing lower strain values on the PMMA block surface when axial force is applied.

P.S.E.6

SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF Co(III) AND Pd(II) COMPLEXES WITH 2-(DIPHENYLPHOSPHINO)BENZALDEHYDE GIRARD T HYDRAZONE CHLORIDE

Milica R. Milenković[1], B.R. Čobeljić[1], K. Adaila[1], M.T. Milenković[2], K.K. Andjelković[1]
[1]Faculty of Chemistry, University of Belgrade, Belgrade, Serbia, [2]Department of Microbiology and Immunology, Faculty of Pharmacy, University of Belgrade, Serbia

Complexes of Co(III) and Pd(II) with the condensation derivative of 2-(diphenylphosphino)benzaldehyde and Girard T reagent were synthesized, characterized, and their antimicrobial activity was evaluated. The ligand and both the complexes were characterized by elemental analysis, IR and NMR spectroscopy and X-ray crystallography. In both the complexes deprotonated ligand was coordinated to the metal through the phosphorus, the imine nitrogen and the carbonyl oxygen atom. In octahedral Co(III) complex two molecules of ligands were coordinated to metal ion, while square-planar environment of Pd(II) complex was constituted with one molecule of tridentate ligand and chloride in the fourth coordination place. Both the complexes and ligand showed moderate antibacterial activity.

P.S.E.7

CORROSION RESISTANCE OF AZ31 MAGNESIUM ALLOY COATED BY BIOCOMPATIBLE CALCIUM PHOSPHATE

Branislav Hadzima[1], Filip Pastorek[1], Miroslav Omasta[2]
[1]Research Centre of the University of Žilina, Žilina, Slovak Republic, [2]University of Žilina, Faculty of Mechanical Engineering, Department of Materials Engineering, Žilina, Slovak Republic

Investigation of CaP electrodeposition process on the AZ31 magnesium alloy surface was performed. Surface layer formation was evaluated by electrochemical tests supported by photodocumentation. Several stages of calcium phosphate formation were observed and described using light microscopy and chemical composition of the layer was evaluated by scanning electron microscopy. The corrosion protection increase after particular electrodeposition steps and long-term immersion corrosion tests were evaluated by electrochemical impedance spectroscopy in 0.9% NaCl.

Acknowledgments: The research is supported by the project “Research centre of the University of Žilina”, ITMS 26220220183 (80%) and the part of the results of this work is supported by international project No. APVV-SK-CZ-2013-0046 (20%).

P.S.E.8

SURFACE PROPERTIES IMPROVEMENT OF AZ31 MAGNESIUM ALLOY BY SHOT PEENING AND DCPD COATING

Filip Pastorek, Branislav Hadzima
Research Centre of the University of Žilina, Žilina, Slovak Republic

The influence of a surface pre-treatment by shot peening on corrosion properties of magnesium alloy Mg-3Al-1Zn coated by calcium phosphate layer is evaluated. Shot peening was performed on grinded surface by ceramic balls (φ 850 μm) at different Almen intensities. The effect of shot peening on surface properties was evaluated by microhardness and surface roughness measurements. The calcium phosphate layer was prepared by electrodeposition. Corrosion tests were performed in 0.9% NaCl solution by electrochemical impedance spectroscopy. The results showed that the usage of shot peening process followed by DCPD electrodeposition improves the properties of the AZ31 surface.

Acknowledgments: The research is supported by the project “Research centre of the University of Žilina”, ITMS 26220220183.

P.S.E.9

FATIGUE CRACK INITIATION MECHANISMS OF AZ91 MAGNESIUM CAST ALLOY DURING FATIGUE TESTING

Libor Trško[1], Stanislava Fintová[2], František Nový[1,3]
[1]Research Centre of the University of Žilina, Žilina, Slovak Republic, [2]Institute of Physics of Materials Academy of Sciences of the Czech Republic, v. v. i., Brno, Czech Republic, [3]University of Žilina, Faculty of Mechanical Engineering, Department of Materials Engineering, Žilina, Slovak Republic

AZ91 cast magnesium alloy specimens were subjected to the fatigue tests with the aim to indentify the mechanisms of the fatigue crack initiation in the low (LCF), high (HCF) and ultra-high cycle (UHCF) fatigue region. Based on the SEM observations of polished specimens gauge lengths two different mechanisms of the fatigue crack initiation were observed. In the case of the LCF region the fatigue cracks initiation took place on the created slip bands. In the HCF and UHCF region no slip bans were observed. In this case only broken primary $Mg_{17}Al_{12}$ intermetallic particles and cracks on interface between $Mg_{17}Al_{12}$ intermetallic particles and solid solution matrix were observed.

Acknowledgments: The research is supported by the projects “Research centre of the University of Žilina”, ITMS 26220220183 and project of Ministry of Education of the Czech Republic no. 7AMB14SK064.

P.S.E.10

INTERACTION OF NANOPARTICLES AND BIOLOGICAL FLUIDS

Zorica Ajduković[1], Nenad Ignjatović[2], Nenad Petrović[1], Jelena Rajković[3],
Dragana Kenić Marinković[1], Stevo Najman[4], Dragan Mihailović[5], Dragan Uskoković[2]
[1]Faculty of Medicine, Clinic of Stomatology, Department of Prosthodontics, University of Niš, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Department of Biology and Ecology Faculty of Science and Mathematics, University of Niš, Serbia, [4]Faculty of Medicine, Institute of Biomedical Research, University of Niš, Serbia, [5]Faculty of Medicine, Institute of pathology, University of Niš, Serbia

Recent studies have shown that the behavior of nanoparticles in *in vivo* conditions is not solely dependant on their physical properties, such are size and shape. The surface of nanoparticles in biological fluids interacts with biomoleculs such are proteins, adsorbs these moleculs, and leads to formation of nanopartical-biomoelcular comlex known as “protein corona”. This protein corona changes the properties of nanoparticles and their behavior *in vivo*. In this work three types of nanomaterial based on Hap and polymers were incubated in rats plasma, and the identification and quantification of proteins in protein corona that had formed around these nanoparticles, was done by means of electrophoresis and mass spectrophotometery.

Keywords: nanoparticles, biological fluids, spectrophotometery.

P.S.E.11

SIMULTANEOUS INFLUENCE OF DOPED Sr^{2+} IONS AND GRAIN SIZE DECREASING ON THE MECHANICAL PROPERTIES, IN VITRO DIFFERENTIATION OF MESENCHYMAL STEM CELLS AND IN VIVO BEHAVIOR OF HAP BASED BIOCERAMICS

Djordje Veljović[1], D. Marković[2], M. Kovačević-Filipović[2],
D. Djurdjević[3], V. Danilović[4], Dj. Janaćković[1]
[1]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Faculty of Veterinary Medicine, University of Belgrade, Belgrade, Serbia, [3]Institute for Medical Research, Military Medical Academy, Belgrade, Serbia, [4]School of Dental Medicine, University of Belgrade, Belgrade, Serbia

The aims of this study were to investigate the simultaneous influence of Sr^{2+} doped ions and the grain size of bioceramic implant materials based on hydroxyapatite (HAP) and β-tricalcium phosphate (β-TCP) on the mechanical properties, biocompatibility and structure/quality of tissue-material interfaces after *in vivo* tests, and also on the proliferation and osteogenic differentiation of mesenchymal stem cells from synovial fluid of dogs. Starting HAP powders composed of nanosized particles (50-150 nm), doped with Sr^{2+} ions and undoped, synthesized by modified precipitation synthesis, were pressed and processed by single- and two step sintering at various combining of processing conditions. Processed materials with and without Sr^{2+} ions, composed of grains of micron- and nano-size were imbedded in rabbit calvaria bone, and analysis after 4 and 8 weeks. The same samples were used as substrate for proliferation and osteogenic differentiation of mesenchymal stem cells. It was concluded that the doped Sr^{2+} ions and processing conditions significantly affected the pore number and shape, the grain size and finaly fracture toughness of the sintered bioceramics. An *in vivo* investigation and further histological analysis showed non-cytotoxic effects for all types of bioceramics, while the attachment between soft and hard tissue and investigated materials were improved with addition of Sr^{2+} ions and with decreasing of grain size to the nano dimensions. It was also announce that doped Sr^{2+} ions and grain size affected differentiation of mesenchymal stem cells.

Author Index

Bismarck, A		13
Bjelajac, A.	abjelajac@tmf.bg.ac.rs	105
Blanuša, J.		91
Blažić, L.		104
Blokhina, I.A.	missis.blohina@yandex.ru	7,8
Bobrysheva, N.P.	n_bobrysheva@mail.ru	16
Bogun, L.		14
Bošković, M.		91
Bras, W.		4
Broz, P.		13,18
Brusentseva, T.	brusentseva@itam.nsc.ru	95
Budinski-Simendić, J.	jarkamer@gmail.com	19,75
Bufan, B.		41
Buh, J.		29
Burzić, Z.		101
Bychkov, S.		89
Čalka, A.	acalka@uow.edu.au	50
Calleja, E.		34
Calleja, J.M.		34
Caron, J.		22
Carraro, C.		92
Čeh, D.		104
Cerovski, V.Z.		100
Chabaat, M.	mchabaat@yahoo.com, mchabaat@usthb.dz	17
Chemysheva, E.		34
Chhor, K.		52
Chin, R.		2
Choi, J.		38
Christen, J.		34
Chumarev, V.	chumarev@mail.ru	81,83
Ćirković, J.		105
Čobeljić, B.R.		111
Collins, S.M.		23
Cooper, J.R.		82
Cornei, N.A.	ncornei@uaic.ro	61,83
Craus, M.-L.		61,83
Crete, D.-G.		6
Ćurković, L.	lidija.curkovic@fsb.hr	79,99
Cvjetićanin, N.	nikcvj@ffh.bg.ac.rs	62,66
Dahmen, U.	UDahmen@lbl.gov	4
Dalakova, N.V.		16
Danilov, V.I.	dvi@ispms.tsc.ru	85

Putić, S.		98
Qiu, N.		27
Rac, O.	olga.rac@pwr.edu.pl	76
Radanović, M.M.	mirjana.lalovic@dh.uns.ac.rs	60
Radević, J.		105
Radić, N.		9
Radičević, R.		75
Radmilović, V.R.	VRRadmilovic@tmf.bg.ac.rs	4,11,90,92
Radmilović, V.V.	vukradmilovic@tmf.bg.ac.rs	11,92
Radojević, V.		94,102,107
Radovanović, F.		98
Radović, I.	iradovic@tmf.bg.ac.rs	94
Radulović, K.		100
Rajić, V.		31
Rajković, J.	jelena.rajkovic@gmail.com	113
Rakin, M.		104
Raković, D.	rakovicd@etf.rs, drakovic@sbb.rs	91
Rede, V.	vera.rede@fsb.hr	99
Reinecker, M.		13
Ringe, E.		23
Ristić, R.	ramir.ristic@fizika.unios.hr	82
Rodić, D.		87
Rodić, M.V.	marko.rodic@dh.uns.ac.rs	60
Rogan, J.R.		68
Rogl, G.	gerda.rogl@univie.ac.at	13
Rogl, P.F.	peter.franz.rogl@univie.ac.at	13,14,18,89
Rokhlin, L.L.		36
Rossouw, D.		23
Royanian, E.		13
Rudolf, R.	rebeka.rudolf@um.si	8
Ryba, T.		18
Sacharevych, M.		93
Sajfert, V.		91
Sakoman, M.		79
Salamakha, L.	salamakhaleonid@rambler.ru	14,88,89
Salčinović Fetić, A.		80
Sale, M.		51
Salmeron, M.	mbsalmeron@lbl.gov	21
Sanin, V.	svn@ism.ac.ru	10
Sanina, N.A.	sanina@icp.ac.ru	32
Šarac, D.		110

Sato, K.	satok@mail.dendai.ac.jp	100
Schattschneider, P.	schattschneider@ustem.tuwien.ac.at	25
Schwarzbauer, J.		78
Šćiban, M.B.	msciban@uns.ac.rs	106,107
Selmenskih, N.		83
Selutin, A.A.		16
Senna, M.	senna@applc.keio.ac.jp	49,62
Sestan, A.		12
Šetrajčić, I.J.	seki_1976@yahoo.com	87
Šetrajčić, J.P.	jovan.setrajcic@df.uns.ac.rs	87,103
Šetrajčić-Tomić, A.J.	setrajcic@nadlanu.com	87,103
Shcherba, I.	ishcherba@gmail.com	93
Shekunova, T.O.	tasiok@mail.ru	99
Shpotyuk, O.	shpotyuk@novas.lviv.ua	97
Shvorneva, L.I.		108,109
Siegel, R.W.	sieger@rpi.edu	1
Simendić, B.		75
Simić, D.	simic_danica@yahoo.com	101
Sinclair, R.	bobsinc@stanford.edu	2
Singer, M.		63
Škapin, S.D.	sreco.skapin@ijs.si	67
Slokar, Lj.		80
Smirnov, V.V.	smirnov2007@mail.ru	108,109
Sobolev, N.A.		9
Sologub, O.	oksana.sologub@univie.ac.at	14,88,89
Song, J.		45
Sorokin, M.V.		6
Sosikov, V.A.	vaso@icp.ac.ru	77
Spasojević, V.		91
Špírková, M.	spirkova@imc.cas.cz	15,88
Spreitzer, M.		35
Srdanov, V.I.		100
Srdić, V.V.		96,104
Stajčić, A.	astajcic@tmf.bg.ac.rs	98
Stajić-Trošić, J.		98
Stamenić, Z.		96
Stanković, A.	ana.stankovic@itn.sanu.ac.rs	31,64
Starkov, I.		89
Stevanović, M.	magdalena.stevanovic@itn.sanu.ac.rs	38,71
Stevanović, S.I.		68
Stijepović, I.	ivan.stijepovic@gmail.com	96,104
Stiufiuc, R.		43
Stöger, B.		14
Stojadinović, S.		9

ACKNOWLEDGEMENTS

Sponsored by:

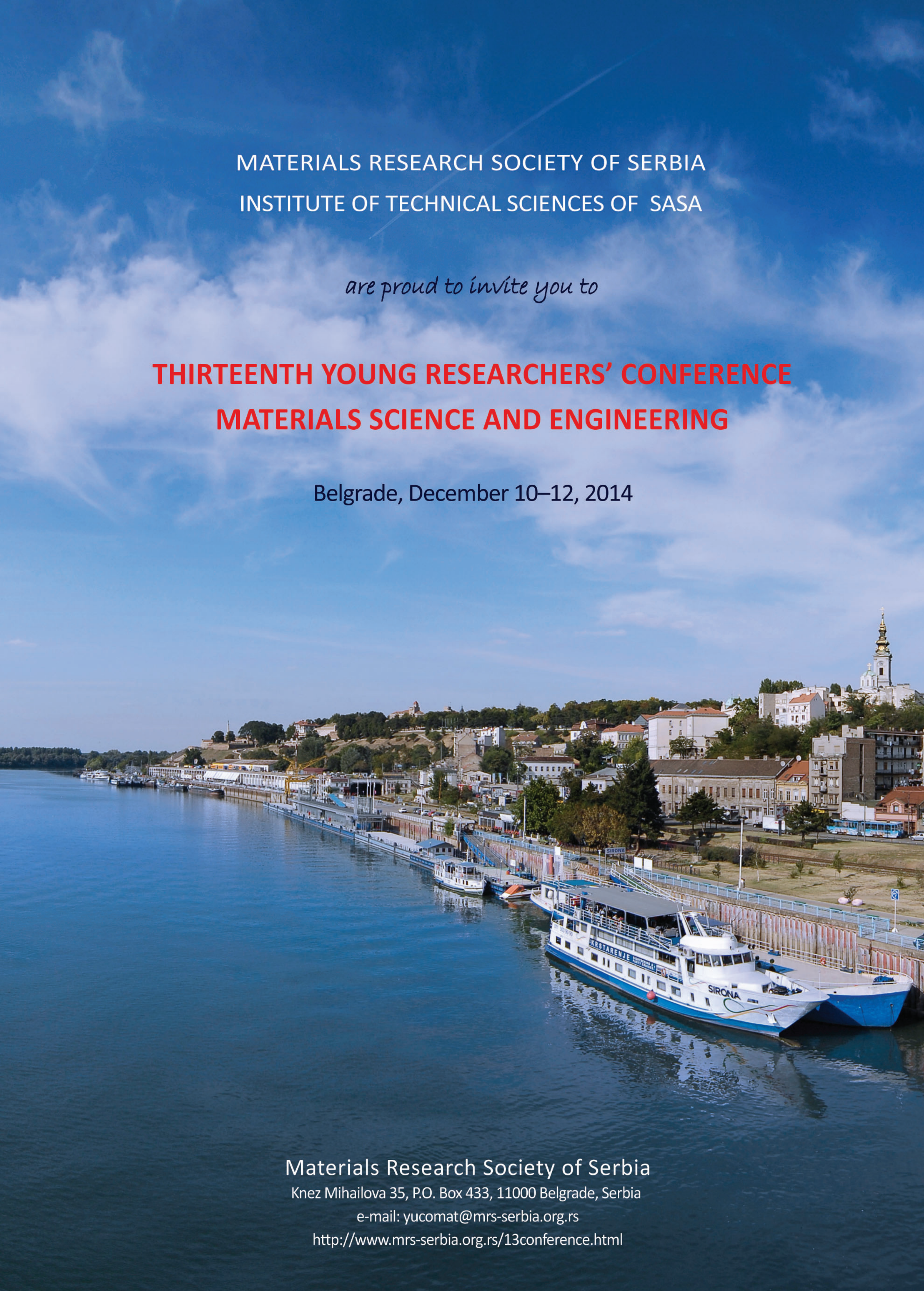
FEI™

ANALYSIS
LABORATORY EQUIPMENT

Media partner:

INSTM ®

Scientific Social Community
Социальная Научная Сеть



MATERIALS RESEARCH SOCIETY OF SERBIA
INSTITUTE OF TECHNICAL SCIENCES OF SASA

are proud to invite you to

THIRTEENTH YOUNG RESEARCHERS' CONFERENCE MATERIALS SCIENCE AND ENGINEERING

Belgrade, December 10–12, 2014

Materials Research Society of Serbia
Knez Mihailova 35, P.O. Box 433, 11000 Belgrade, Serbia
e-mail: yucomat@mrs-serbia.org.rs
http://www.mrs-serbia.org.rs/13conference.html