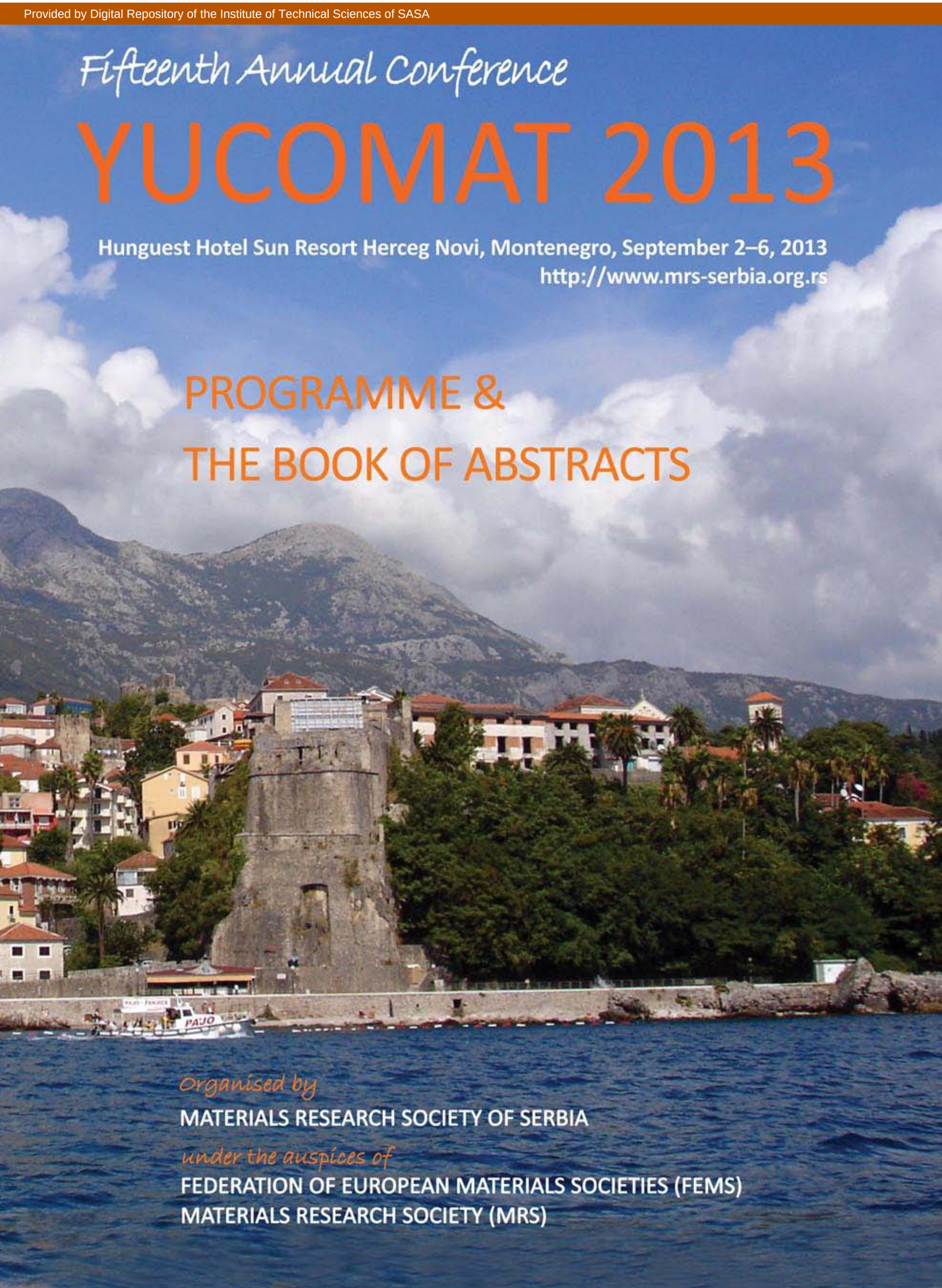

Fifteenth Annual Conference

YUCOMAT 2013

Hunguest Hotel Sun Resort Herceg Novi, Montenegro, September 2–6, 2013
http://www.mrs-serbia.org.rs

PROGRAMME & THE BOOK OF ABSTRACTS

Organised by
MATERIALS RESEARCH SOCIETY OF SERBIA
under the auspices of
FEDERATION OF EUROPEAN MATERIALS SOCIETIES (FEMS)
MATERIALS RESEARCH SOCIETY (MRS)

FIFTEENTH ANNUAL CONFERENCE

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WELCOME SPEECH BY THE PRESIDENT OF MRS-SERBIA

My Esteemed Colleagues,

Allow me to welcome you to the 15th YUCOMAT with this brief address. Since 1995, when we met for the inaugural YUCOMAT conference at a different venue in this very same Montenegrin coastal town, we have kept the ball rolling and each conference, in my humble opinion, has been a step forward compared to all the previous ones. The combination of an inspiring setting, the beautiful climate and top-notch scientific presentation from an array of internationally recognized speakers makes this conference quite a unique experience at this part of the globe.

Traditionally, I would mention a few numbers to illustrate the successful organization during the opening speech and this year will not be an exception. This year's YUCOMAT is nowhere different from the previous years' ones in terms of its size, with 128 posters and 80 lectures (30 of which are plenary) that are scheduled to be presented by participants from 38 countries of the world during the 5 days of the conference.

I would like to use this opportunity to mention a few other important things as well. Firstly, much has been said about a sudden increase in popularity of a century old Gordon Research Conferences in the past decade and their rapid expansion into a plethora of scientific fields. This has been due to their being drastically different from the massive conferences organized by big scientific societies, during which dozens or more lectures are presented simultaneously, offering little opportunities for befriending fellow scientists in a relaxed setting, a context that has been proven as the one leading to most prolific networking. The principle of presenting one lecture at a time and encouraging discussions in a scenic setting, inspiring for the body and soul alike, has been the one fostered by the organizers of YUCOMAT too since the earliest days of this conference. Therefore, do not skip the welcoming reception that is to be held by the swimming pool tonight at 19.30, numerous coffee hours interspersed throughout the day on the terrace in front of the lecture hall or chats with fellow scientists all across the nice pockets of this resort, at the promenade, at the beach or even in the sea. It has not been uncommon to catch a glimpse of attendees having a fun talk with guitar and wine well into the wee hours of the morning at times. All of these are vital aspects of a good scientific meeting. Also, consider joining other participants for a bout tour around the Bay on Thursday afternoon or a trip to the city of Dubrovnik on Wednesday afternoon. For, as we see, in these scenic settings and a relaxed atmosphere, our minds connect best around the kernels of ideas that define our lives and science alike.

Secondly, this year's analysis of worldwide economies conducted by the World Economic Forum came to conclusion that out of 142 countries surveyed, Serbia occupies an inglorious 2nd place in giving in to the brain drain effect. It is saddening to learn that dozens of thousands of highly educated Serbian-born individuals have chosen to start a career in science and technologies abroad. This emigration of the most talented young researchers is particularly saddening as the very same study realized that Serbia is comparatively "technologically ready", alongside having a decent infrastructure and education, while its low innovation index puts it at the very bottom of the world rankings. In other words, grounds do exist for scientific and technological progress, but minds and efforts in the right direction do not.

Brain drain is, of course, a systemic problem that cannot be healed overnight. The torn ties between basic science centers and industry, relatively low financial compensation for both young and experienced scientists and the increasing reliance of high-quality scientific projects on expensive equipment and kits that are hardly affordable to Serbian research centers are some of the reasons. Low industrial capacity and obsolete production regimens, necessitating the import from abroad of most hi-tech goods and causing technological and economic dependence on more developed countries, could also be included in the list of reasons. The amelioration of this negative trend will obviously require a coordinated effort of not only scientists and technologists, but also economists, educators and, in fact, the entire populace of a country. What we, as materials scientists, could do is to launch initiatives to revitalize the torn ties between basic science and industry and also nationally and internationally present the most excellent scientific works that have originated in our milieu. This is, in fact, one of the central purposes of this conference. Science is a way of life and if we succeed in disseminating the passion for it, its quality in this country will spontaneously rejuvenate. At least so we, the organizers of this conference and the MRS-Serbia leadership, believe. A strong educational background has been a trait of YUCOMAT ever since its inception and this year too we will give a particular emphasis to the presentation of our young researchers and award them for the best doctoral thesis and for the best oral and poster presentations.

Lastly, a foreign investor visiting my office in May asked me what is so special about this part of the world and what it is that we know how to do best. What we are best at, I said, is being a bridge – an intercultural one, more specifically. This is where the Western Roman Empire bordered the Eastern one a millennia and a half ago and where the Ottoman Orient met the Western culture for five centuries. During the Cold War era, moreover, we provided a rare free zone where scientists from the Eastern Bloc and from the western countries could congregate and exchange ideas in person. Today we have a chance to act as yet another bridge with a potential to alleviate an impending crisis: a bridge between rich and poor. Protests all over the globe have been raging throughout the past years and the dissatisfaction over the growing gap between these two social classes has aggravated many. The country to which our MRS has been affiliated, Serbia, has crossed a path from a relatively prosperous and affluent to the most impoverished in Europe. Yet, being familiar with both sides, in this case the coasts of prosperity and poverty, can be truly advantageous, as it may allow us to conceive of and build a very stable bridge between the affluent and the underprivileged. Therefore, we wish this conference to be a place of gathering of intellectuals from both developed and underdeveloped regions of the world and we love to believe that each time practical knowledge is being exchanged between them, this bridge is being strengthened a bit more. In such a manner, YUCOMAT wishes to contribute to healing the gulf between the wealthy and the poor, which, now we know, will increasingly threaten the stability of our whole planet in the years to come. Small, sustainable, eco-friendly technologies, easily transferable from one setting to another should be the ideal that a developing country such as our own should stream to and we, the conference organizers, are committed to the mission of facilitating their development and integration into our society to the best of our means.

This is all to say that in spite of the enjoyable times spent at YUCOMAT, we should be aware that all of us are assigned the task to do something creative to ameliorate the existing imbalances and promote welfare for the future generations of humanity, both locally and globally, to the best of our capacities. No greater gift could be left to them than relishing in the joys of scientific exploration of the world. Therefore, I wish this to be yet another YUCOMAT that brings the joy of science and friendship to us all. Let us enjoy in all good that materials science and we, its stewards and spokespersons, have to offer!

To wrap things up, on behalf of the MRS-Serbia Officers, the Organizing Committee, the International Advisory Board and Sasha, our Conference Secretary, which I all greatly acknowledge for their efforts in putting up this entire meeting, I would like to express delight over the great amount of interest in participation at this year's YUCOMAT.

Dragan Uskoković

President of MRS-Serbia

MRS-Serbia

President: Dragan Uskoković
Vice-presidents: Slobodan Milonjić, Velimir Radmilović, Dejan Raković
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Conference Secretary: Aleksandra Stojičić

Conference Technical Committee

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

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 2-6, 2013, at the Hunguest Hotel Sun Resort, in Herceg Novi, Montenegro. Participants will also be accommodated there. The conference will begin on Monday, September 2nd, at 09.00 and end on Friday, September 6th, 2013, at 13.00.

REGISTRATION: Registration, registration fee payment, conference materials distribution, etc, will take place at the conference desk (Conference Secretariat) open on Sunday, September 1, Monday, September 2, and Tuesday, September 3, 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, September 1, 2013

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

Monday, September 2, 2013

08^{00}-09^{00}	**Registration**
09^{00} -9^{30}	**OPENING CEREMONY** - Introduction and Welcome
9^{30}-13^{00}	**First Plenary Session**
13^{15}	**Photo Session**
15^{00}-18^{15}	**Symposium A, Conference Hall**
15^{00}-19^{00}	**Symposium B, Small Hall**
19^{30}-21^{00}	**Cocktail Party**

Tuesday, September 3, 2013

09^{00}-12^{30}	**Second Plenary Session**
15^{00}-18^{30}	**Symposium C, Conference Hall**
15^{00}-18^{30}	**Symposium E, Small Hall**
20^{00}-22^{00}	**Poster Session I** (Symposium A)

Wednesday, September 4, 2013

09^{00}-12^{30}	**Third Plenary Session**
14^{00}-19^{00}	**Excursion to Dubrovnik, Croatia**
20^{00}-22^{00}	**Poster Session II** (Symposium B)

Thursday, September 5, 2013

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

Friday, September 6, 2013

09^{00}-12^{30}	**Fifth Plenary Session**
12^{30}-13^{00}	**Awards and Closing of the Conference**

FIRST PLENARY SESSION

Monday, September 2, 2013

Session I: 09^{30}-13^{00}
Chairmen: R. Sinclair and V. Radmilović

09^{30}-10^{00} **ATOMIC-LAYER ENGINEERING AND PHYSICS OF CUPRATE SUPERCONDUCTORS**
I. Božović
Brookhaven National Laboratory, Upton, NY, USA

10^{00}-10^{30} **ADVANCED MATERIALS FOR INFORMATION TECHNOLOGY - CHALLENGES TO MATERIALS SCIENCE AND ENGINEERING**
E. Zschech
Fraunhofer Institute for Nondestructive Testing, Dresden, Germany

10^{30}-11^{00} **THE 787 BATTERY CRISIS: A MATERIALS PERSPECTIVE**
Th.J. Richardson
Lawrence Berkeley National Laboratory, Berkeley, California, USA

Break: 11^{00}-11^{30}
Chairmen: I. Božović and R. Dunin-Borkowski

11^{30}-12^{00} **NEW OPPORTUNITIES AND CHALLENGES IN CHROMATIC ABERRATION CORRECTED AND IN SITU TRANSMISSION ELECTRON MICROSCOPY**
R.E. Dunin-Borkowski, L. Houben, J. Barthel, A. Thust, M. Luysberg, Ch.B. Boothroyd, M. Duchamp, A. Kovács
Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons and Peter Grünberg Institute, Forschungszentrum Jülich, Jülich, Germany

12^{00}-12^{30} **ENVIRONMENTAL TRANSMISSION ELECTRON MICROSCOPY (ETEM)**
R. Sinclair[1,2], Ch.-J. Chung[1], S.Ch. Lee[1], A.L. Koh[2]
[1]Department of Materials Science and Engineering, Stanford University, Stanford, California, USA, [2]Stanford Nanocharacterization Laboratory, Stanford University, Stanford, California, USA

12^{30}-13^{00} **ATOMISTIC VIEW OF FRICTIONLESS SLIDING IN GOLD THIN FILMS**
V.R. Radmilović[1], A. Gautam[2], C. Ophus[2], F. Lançon[3], U. Dahmen[2]
[1]University of Belgrade, Faculty of Technology and Metallurgy, Nanotechnology and Functional Materials Center, Belgrade, Serbia, [2]National Center for Electron Microscopy, LBNL, Berkeley, California, USA, [3]Laboratoire de Simulation Atomistique (L_Sim), SP2M, INAC, CEA, Grenoble, France

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

SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

Conference Hall

Session I: 15^{00}-18^{15}
Chairpersons: S. Milonjić and V. Uskoković

15^{00}-15^{15} **ROUTES AND PATHWAYS TO SMALL PARTICLES BASED ON HYDROXYAPATITE**
N. Ignjatović[1], S. Vranješ-Djurić[2], Ž. Mitić[3], D. Janković[2], D. Uskoković[1]
[1]Centre for Fine Particles Processing and Nanotechnologies, Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Laboratory for Radioisotopes, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia, [3]University of Niš, Faculty of Medicine, Department of Pharmacy, Niš, Serbia

15^{15}-15^{30} **OSTEOBLASTIC INTERACTIONS WITH THE TOPOGRAPHICALLY DISTINCT POLY(E-CAPROLACTONE)/HYDROXYAPATITE THIN FILMS**
V. Uskoković, T.A. Desai
Therapeutic Micro and Nanotechnology Laboratory, Department of Bioengineering and Therapeutic Sciences, University of California, San Francisco, CA, USA

15^{30}-15^{45} **HIGH SURFACE AREA GOLD MICRO-ELECTRODES FOR SENSING AND FUEL CELL APPLICATIONS**
M. Di Lorenzo
Department of Chemical Engineering, University of Bath, Bath, UK

15^{45}-16^{00} **SYNTHESIS AND CHARACTERIZATION OF COLLOIDAL MANGANESE CARBONATE AND OXIDE PARTICLES BY BIOMIMETICALLY INDUCED NANOSTRUCTURED PROCESSES**
S.D. Škapin[1], I. Sondi[2], D. Suvorov[1]
[1]Advanced Materials Department Jožef Stefan Institute, Ljubljana, Slovenia, [2]Faculty of Mining, Geology and Petroleum Engineering, University of Zagreb, Zagreb, Croatia

16^{00}-16^{15} **EDXS/EELS/TEM ANALYSES OF SMALL AMOUNTS OF HEAVY RARE EARTHS (Dy,Tb) IN Nd–Fe–B-BASED MAGNETS**
S. Šturm, M. Soderžnik, P. McGuiness, S. Kobe
Department for Nanostructured Materials, Jožef Stefan Institute, Ljubljana, Slovenia

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A.N. Mansurova, V.M. Chumarev, R.I. Gulyaeva, E.N. Selivanof, V.A. Kovrov
Institute of Metallurgy of the UB RAS, Ekaterinburg, Russia

16^{30}-16^{45} **MICROSTRUCTURE OF CAST HEUSLER ALLOYS**
P. Diko[1], V. Kavečanský[1], S. Piovarči[1], M. Radušovská[1], T. Ryba[2], R. Varga[2]
[1]*Institute of Experimental Physics, Slovak Academy of Sciences, Košice,* [2]*Institute of Physics, UPJS Kosice, Košice, Slovakia*

16^{45}-17^{00} **PREPARATION AND CHARACTERIZATION OF Pt/TiO_2 CATALYST ELABORATED ON SILICON WAFER FOR CO OXIDATION CATALYST APPLICATION**
M.-D. Phan[1,2*], S. Donet[1], Ch. Thieuleux[2]
[1]*Laboratory for Innovation in New Energy Technologies and Nanomaterials- LITEN CEA, Grenoble, France,* [2] *Laboratory of Chemistry, Catalysis, Polymers and Processes (UMR 5265) – CPE, Lyon, France*

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Chairpersons: M. Špírková and A.N. Streletskii

17^{30}-17^{45} **ATOMIC FORCE MICROSCOPY AS A POWERFUL TOOL OF SURFACE NANO- AND MICROSCALE CHARACTERIZATION**
M. Špírková
Institute of Macromolecular Chemistry AS CR, v.v.i., Prague, Czech Republic

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[1]*N.N.Semenov Institute of Chemical Physics RAS, Moscow, Russia,* [2]*Moscow State University, Chemical Department, Leninskie gory, Moscow, Russia*

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Siberian State Industrial University, Novokuznetsk, Russia

SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

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G. Rogl[1,2,], A. Grytsiv[1], P. Rogl[1], E. Bauer [2]
[1]Institute of Physical Chemistry, University of Vienna, Wien, Austria, [2]Institute of Solid State Physics, TU-Wien, Wien, Austria

15^{15}-15^{30} **NEW COMPOUNDS REPt$_3$B$_x$: FORMATION AND PHYSICAL PROPERTIES**
L. Salamakha[1], E. Bauer[1], H. Michor[1], G. Hilscher[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

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O. Sologub[1,2], L. Salamakha[1], P. Rogl[2], E. Bauer[1], G. Giester[3]
[1]Institute of Solid State Physics, Vienna University of Technology, Vienna, Austria, [2]Institute of Physical Chemistry, University of Vienna, Vienna, Austria, [3]Institute of Mineralogy and Crystallography, University of Vienna, Vienna, Austria

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National Research Center "Kurchatov Institute" Moscow, Russian Federation

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[1]Technological Institute for Superhard and Novel Carbon Materials, Moscow, Troitsk, Russia, [2]Institute of Spectroscopy of RAS, Moscow, Troitsk, Russia

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S. Djouder, M. Chabaat
Built & Env. 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} **PREPARATION OF STYRENE-(ETHYLENE-BUTYLENE)-STYRENE (SEBS) BASED COMPOSITE POLYELECTROLYTE MEMBRANES FOR FUEL CELL APPLICATIONS**
K. Polat, M. Şen
Hacettepe University, Department of Chemistry, Polymer Chemistry Division, Beytepe, Ankara, Turkey

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[1]Research Group of Structural nad Phase Analysis, Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic, [2]Institute of Materials Science and Engineering, Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic, [3]S.A.M.-Metallizing Company, Ltd., Brno, Czech Republic

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S. Stojadinović[1], N. Radić[2], R. Vasilić[3], P. Stefanov[4], Z. Dohčević-Mitrović[5], B. Grbić[2]
[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, [3]Educons University, Faculty of Environmental Governance and Corporate Responsibility, Sremska Kamenica, Serbia, [4]Institute of General and Inorganic Chemistry, Bulgarian Academy of Sciences, Sofia, Bulgaria, [5]University of Belgrade, Institute of Physics, Belgrade, Serbia

18^{00}-18^{15} **NEW PRECIPITATION STREGTHENING ALUMINIUM MATRIX COMPOSITES BASED ON Al-Mn-Cu-Zr SYSTEM FOR HIGH TEMPERATURE APPLICATIONS**

M.V. Gorshenkov, N.A. Belov, S.D. Kaloshkin, V.V. Tcherdintsev

National University of Science and Technology «MISIS», Moscow, Russia

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R.R. Altunin[1,2], S.M. Zharkov [1,2]

[1]L.V. Kirensky Institute of Physics of Russian Academy of Sciences, Krasnoyarsk, Russia,
[2]Siberian Federal University, Krasnoyarsk, Russia

18^{30}-18^{45} **WATERBORNE POLYURETHANE DISPERSIONS: PREPARATION AND CHARACTERIZATION**

R. Poręba, M. Serkis, M. Špírková

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

18^{45}-19^{00} **NORMAL AND SLIDING ADHESIVE CONTACT OF ROUGH ELASTIC BODIES**

B. Galanov, I. Valeeva

Institute for Problems of Materials Science, NASc of Ukraine, Kiev, Ukraine

SECOND PLENARY SESSION

Tuesday, September 3, 2013

Session II: 09^{00}-12^{30}
Chairmen: E. Olsson and W. Jäger

09^{00}-09^{30} **HIGH RESOLUTION TEM/STEM BY MEANS OF ADVANCED INSTRUMENTATION**
M. Haider, H. Müller, P. Hartel
CEOS GmbH, Heidelberg, Germany

09^{30}-10^{00} **PREDICTING AND MEASURING THE STRUCTURE OF MATERIALS ON THE NANOSCALE**
C. Ophus
National Center for Electron Microscopy, Lawrence Berkeley National Laboratory, Berkeley, CA, USA

10^{00}-10^{30}. **QUANTITATIVE HIGH RESOLUTION ENVIRONMENTAL TRANSMISSION ELECTRON MICROSCOPY FOR CATALYST CHEMISTRY**
S. Takeda, H. Yoshida, Y. Kuwauchi, T. Uchiyama
Institute of Scientific and Industrial Research, Osaka University, Ibaraki, Osaka, Japan

Break: 10^{30}-11^{00}
Chairmen: M. Haider and S. Takeda

11^{00}-11^{30} **IN-SITU ELECTRON HOLOGRAPHY**
E. Snoeck[1], C. Gatel[1], L. de Knoop[1], L.A. Rodriguez[1, 2], C. Magen[2], M. Hytch[1]
[1]*CEMES-CNRS, Toulouse, France,*
[2]*LMA-INA, Universidad de Zaragoza, Zaragoza, Spain*

11^{30}-12^{00} **IMAGING AND MANIPULATING NANOPARTICLES AND NANOCLUSTERS IN NANOSTRUCTURED FUNCTIONAL MATERIALS**
E. Olsson
Department of Applied Physics, Chalmers University of Technology, Gothenburg, Sweden

12^{00}-12^{30} **TRANSMISSION ELECTRON MICROSCOPY OF DIFFUSION-INDUCED PHENOMENA IN III-V SEMICONDUCTORS**
W. Jäger
Institute of Materials Science, Christian-Albrechts-Universitaet zu Kiel, Kiel, German

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

SYMPOSIUM C: NANOSTRUCTURED MATERIALS

Conference Hall

Session I: 15^{00}-18^{30}
Chairmen: N.V. Kamanina and P. Diko

15^{00}-15^{15} **ADVANTAGED NANOSTRUCTURED MATERIALS FOR OPTOELECTRONICS: BULK AND INTERFACE FEATURES**
N.V. Kamanina[1,2,3*]
[1]Vavilov State Optical Institute, St. Petersburg, Russia, [2]Saint-Petersburg Electrotechnical University ("LETI"), St. Petersburg, Russia, [3]Saint-Petersburg Technical University ("IFMO"), St. Petersburg, Russia

15^{15}-15^{30} **INFLUENCE OF Gd AND Sm SUBSTITUTIONS ON PROPERTIES OF YBCO BULK SUPERCONDUCTORS**
D. Volochova, S. Piovarči, M. Radušovská, V. Antal, J. Kovac, P. Diko
Institute of Experimental Physics SAS, Košice, Slovak Republic

15^{30}-15^{45} **POSITRON ANNIHILATION LIFETIME SPECTROSCOPY IN APPLICATION TO GeS_2–Ga_2S_3 CHALCOGENIDE GLASSES**
H. Klym[1], A. Ingram[1], O. Shpotyuk[3]
[1]Lviv Polytechnic National University, Lviv, Ukraine, [2]Opole University of Technology, Opole, Poland, [3]Scientific Research Company "Carat", Lviv, Ukraine

15^{45}-16^{00} **COORDINATE-DEPENDENT DIFFUSION PHOSPHOROUS IN GERMANIUM IN THE In0.56Ga0.44P/Ge NANOGETEROSTRUCTURE**
S.P. Kobeleva, S.Y. Yurchuk, I.M. Anfimov, I.V. Schemerov, R.K. Kolesnikov
National Technological University "MISiS", Moscow, Russia

16^{00}-16^{15} **NANOPARTICLES OF CHROMIUM DIOXIDE WITH COHERENT REVERSAL**
M.G. Osmolowsky[1], O.M. Osmolowskaya[1], E.L. Dzidziguri[2], D.I. Arkhipov[2]
[1]Saint-Petersburg State University, Chemistry Department, St.-Petersburg, Russia, [2]National University of Science and Technology "MISIS", Moscow, Russia

16^{15}-16^{30} **NANO - AND SUBMICROCRYSTALLINE Cu - BASED ALLOYS WITH Cr, Zr AND Hf AFTER SEVERE PLASTIC DEFORMATION**
S.V. Dobatkin, D.V. Shangina, N.R. Bochvar
A.A. Baikov Institute of Metallurgy and Materials Science, Russian Academy of Sciences, Moscow, Russia

16^{30}-16^{45} **MECHANOCHEMICALLY INDUCED STRUCTURAL CONVERSIONS IN METAL SALTS OF GLUCONIC ACID**
D. Rybin[1], G. Konygin[1], V. Porsev[1], E. Elsukov[1], V. Boldyrev[2]
[1]Physical-Technical Institute of the Ural Branch of the Russian Academy of Sciences, Izhevsk, Russia, [2]Novosibirsk State University, Novosibirsk, Russia

16^{45}-17^{00} **INITIAL STAGE OF MECHANICAL ALLOYING IN $Si_{70}Fe_{30}$ AND $Si_{99}Fe_1$ BINARY SYSTEMS**
V.E. Porsev, D.A. Kolodkin, A.L. Ulyanov, E.P. Elsukov
Physical-Technical Institute, Izhevsk, Russia

Break: 17^{00}-17^{30}
Chairmen: E.P. Elsukov and S. Marković

17^{30}-17^{45} **LOCAL ATOMIC STRUCTURE AND MAGNETIC PROPERTIES OF MECHANICALLY ALLOYED AND ANNEALED CEMENTITE**
E.P. Elsukov
Physical-Technical Institute UrB RAS, Izhevsk, Russia

17^{45}-18^{00} **Cu-Fe-C NANOCOMPOSITES PREPARED BY MECHANOSYNTHESIS IN AN INERT AND ORGANIC MEDIA**
M.A. Eryomina, S.F. Lomayeva, E.P. Elsukov, A.L. Ulyanov
Physical-Technical Institute Ural Branch of the Russian Academy of Sciences, Izhevsk, Russia

18^{00}-18^{15} **THE SOL-GEL DERIVED HYBRID NANOMATERIALS BASED ON TITANIA AND CELLULOSE FIBERS WITH THE COMPLEX OF SPECIFIC PROPERTIES**
O.L. Galkina[1], A. Sycheva[2], A. Blagodatski[3], G. Kaptay[4,5], V.L. Katanaev[3,6], A.V. Agafonov[1]
[1]Institute of Solution Chemistry of the Russian Academy of Sciences, Ivanovo, Russia, [2]Materials Science Research Group, Hungarian Academy of Sciences, Miskolc, Hungary, [3]Institute of Protein Research, Russian Academy of Sciences, Pushchino, Russia, [4]Department of Nanotechnology, University of Miskolc, Miskolc-Egyetemvaros, Hungary, [5]Bay Zoltan Applied Research Nonprofit Ltd, Miskolc, Hungary; [6]Department of Pharmacology and Toxicology, University of Lausanne, Switzerland

18^{15}-18^{30} **ROOM-TEMPERATURE SUPERCONDUCTIVITY IN AEROSOL GENERATED NiO NANOPARTICLES**
Iu.G. Morozov[1], D. Ortega[2], O.V. Belousova[1], M.V. Kuznetsov[2]
[1]Institute of Structural Macrokinetics and Materials Science Russian Academy of Sciences, Chernogolovka, Russia, [2]University College London, London, UK

SYMPOSIUM E: BIOMATERIALS

Small Hall

Session I: 15^{00}-18^{30}
Chairmen: D. Raković and N. Ignjatović

15^{00}-15^{15} **SELOL-LOADED MAGNETIC NANOCAPSULES: A NOVEL DRUG DELIVERY SYSTEM FOR CANCER THERAPY**
E. Mosiniewicz-Szablewska[1], P.C. Morais[2], P. Suchocki[3,4], A.C. Tedesco[5]
[1]Institute of Physics, Polish Academy of Science, Warsaw, Poland, [2]Institute of Physics, University of Brasília, Brasília, Brazil, [3]Department of Drug Analysis, Warsaw Medical University, Warsaw, Poland, [4]Department of Pharmaceutical Chemistry, Drug Institute, Warsaw, Poland, [5]Department of Chemistry, University of Sao Paulo, Sao Paulo, Brazil

15^{15}-15^{30} **POROUS SCAFFOLDS IN HYDROXYAPATITE – CALCIUM CARBONATE SYSTEM FOR BONE TISSUE ENGINEERING**
M.A. Goldberg[1], V.V. Smirnov[1], S.M. Barinov[1], L.I. Shvorneva, N.S. Sergeeva[2], I.K. Sviridova[2], V.A. Kirsanova[2], S.A. Akhmedova[2]
[1]Institution of Russian Academy of Sciences A.A. Baikov Institute of Metallurgy and Material Science RAS, Moscow, Russia, [2]Moscow Herzen Research Oncological Institute, Moscow, Russia

15^{30}-15^{45} **ON MACROSCOPIC QUANTUM PHENOMENA IN BIOMOLECULES AND CELLS: FROM LEVINTHAL TO HOPFIELD**
D. Raković[1], M. Dugić[2], J. Jeknić-Dugić[3], M. Plavšić[4], S. Jaćimovski[5], J. Šetrajčić[6,*]
*[1]University of Belgrade, Faculty of Electrical Engineering, Serbia, [2]University of Kragujevac, Faculty of Science, Department of Physics, Serbia, [3]University of Niš, Faculty of Science, Department of Physics, Serbia, [4]University of Belgrade, Faculty of Technology and Metallurgy, Serbia, [5]Academy of Criminalistic and Police Studies, Belgrade, Serbia, [6]University of Novi Sad, Faculty of Sciences, Department of Physics, Vojvodina – Serbia, *Academy of Sciences and Arts of the Republic of Srpska – B&H*

15^{45}-16^{00} **COMPOSITE BIOMATERIALS BASED ON SILICON NITRIDE AND BIOGLASS**
F. Frajkorová, M. Boháč, E. Bartoníčková, M.T. Palou
Brno University of Technology, Faculty of Chemistry, Czech Republic

16^{00}-16^{15} **MESOPOROUS SILICA MATERIALS FOR DRUG DELIVERY**
A. Kiwilsza[1,2], J. Mielcarek[3], A. Pajzderska[1], J. Wąsicki[1]
[1]Division of Radiospectroscopy, Faculty of Physics, Adam Mickiewicz University, Poznan, Poland, [2]NanoBioMedical Center, Poznan, Poland, [3]Department of Inorganic and Analytical Chemistry, University of Medical Sciences, Poznan, Poland

16^{15}-16^{30} **THE MICROSTRUCTURE AND FRACTURE BEHAVIOR OF COMMERCIALLY PURE ULTRAFINE GRAIN TITANIUM FOR BIO-MEDICAL APPLICATION**
V.I. Danilov, L.B. Zuev, G.V. Shlyakhova, Yu.P. Sharkeev, A.Yu. Eroshenko
Institute of Strength Physics and Materials Science, SB RAS, Tomsk, Russia

16^{30}-16^{45} **MORPHOLOGY OF NANOFIBROUS MATERIALS IN MEDICINAL APPLICATIONS**
J. Širc, R. Hobzova, J. Michalek
Institute of Macromolecular Chemistry AS ČR v.v.i., Prague, Czech Republic

16^{45}-17^{00} **OSTEOGENIC POTENTIAL OF FRESHLY ISOLATED CELLS OF ADIPOSE-DERIVED MESENCHYMAL FRACTION APPLIED WITH NANOPARTICLES**
S. Najman[1], D. Petrović[2], I. Vučković[2], J. Živković[1], S. Stojanović[1], N. Ignjatović[3], D. Uskoković[3]
[1]University of Niš, Faculty of Medicine, Institute of Biology and Human Genetics, Niš, Serbia; [2]University of Niš, Faculty of Medicine, Clinic of Stomatology, Department of Maxillofacial Surgery, Niš, Serbia; [3]Institute of Technical Sciences of SASA, Belgrade, Serbia

Break: 17^{00}-17^{30}
Chairmen: J. Širc and A. Politov

17^{30}-17^{45} **MECHANOCHEMICAL TECHNOLOGIES OF TAMPING MATERIALS AND WATER SHUTOFF AGENT FOR PETROLIUM INDUSTRY AND FLOOD CONTROL**
A. Politov, A. Telin
Institute of Solid State Chemistry and Mechanochemistry, Novosibirsk, Russia

17^{45}-18^{00} **GEOPOLYMER MATERIALS BASED ON THE ELECTRIC ARC FURNACE SLAG**

I. Nikolić[1], I. Janković-Častvan[2], V.V. Radmilović[2], Lj. Karanović[3], S. Marković[4], S. Mentus[5], 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]Institute of Technical Sciences of SASA, Belgrade, Serbia, [5] University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia

18^{00}-18^{15} **IDENTIFICATION OF CHEMICAL AND HEALTH RISKILY PHTHALATE PLASTICIZERS IN THE POLYETHYLENE TEREPHTHALATE BOTTLES FOR WATER PACKAGING**

M.M. Lazić[1], D.M. Jašin[1], N. Stanojković [2]

[1]Technical College of Applied Sciences in Zrenjanin, Zrenjanin, Serbia, [2]Institute of Public Health, Novi Sad, Serbia

18^{15}-18^{30} **THE ROLE OF METAKAOLIN FINENESS ON PROPERTIES OF CEMENTITIOUS MIXTURES**

M. Boháč, M. Palou, E. Bartoníčková, F. Frajkorová, T. Opravil, F. Pticen

Brno University of Technology, Faculty of Chemistry, Brno, Czech Republic

THIRD PLENARY SESSION

Wednesday, September 4, 2013

Session III: 09^{00}-12^{30}
Chairmen: L. Forró and F.-H. Lin

09^{00}-09^{30} **TOXICITY STUDY OF NANOMATERIALS**
L. Forró
Laboratory of Physics of Complex Matter, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Swiss

09^{30}-10^{00} **CERIUM OXIDE NANOPARTICLES FOR ANTIOXIDANT THERAPY PERSPECTIVES**
E. Traversa
Division of Physical Sciences and Engineering, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

10^{00}-10^{30} **STRUCTURE AND STABILITY OF PROTEINS INTERACTING WITH NANOPARTICLES**
L. Calzolai**,** G. Ceccone, F. Rossi
European Commission, Joint Research Centre Institute for Health and Consumer Protection, Ispra, Italy

Break: 10^{30}-11^{00}
Chairmen: E. Traversa and R.A. Andrievski

11^{00}-11^{30} **PREPARATION AND EVALUATION OF GADOLINIUM HEXANEDIONE NANOPARTICLES AS A STEM CELL TRACKER**
F.-H. Lin
Institute of Biomedical Engineering, National Taiwan University, Taipei, Taiwan

11^{30}-12^{00} **NANOPHOSPHORS WITH PERSISTENT LUMINESCENCE FOR *IN VIVO* OPTICAL IMAGING**
B. Viana[1], A. Bessière[1], D. Gourier[1], Th. Maldiney[2], J. Seguin[2], D. Scherman[2], C. Richard[2]
[1]Ecole Nationale Supérieure de Chimie de Paris (Chimie-ParisTech) Laboratoire de Chimie de la Matière Condensée de Paris; CNRS, UMR 7574, Paris, Paris, France, [2]Unité de Pharmacologie Chimique et Génétique et d'Imagerie; UMR 8151 CNRS; U 1022 Paris, France; Chimie-ParisTech, Paris, France

12^{00}-12^{30} **CONSOLIDATED NANOMATERIALS IN EXTREME CONDITIONS**

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

FOURTH PLENARY SESSION

Thursday, September 5, 2013

Session IV: 09^{00}-12^{30}
Chairmen: D. Pavuna and D.D. Perovic

09^{00}-09^{30} **SOLAR FUELS MATERIALS ENGINEERING**
D.D. Perovic
Department of Materials Science and Engineering, University of Toronto, Toronto, Canada

09^{30}-10^{00} **IN-SITU MECHANICAL AND ELECTRICAL PROBING OF INDIVIDUAL NANOSTRUCTURES IN THE ELECTRON MICROSCOPE**
E. Spiecker
Center for Nanoanalysis and Electron Microscopy (CENEM), Materials Science and Engineering Department, University of Erlangen-Nürnberg, Erlangen, Germany

10^{00}-10^{30} **ON CRITICAL RESISTANCE AND SUPERCONDUCTOR TO INSULATOR TRANSITION (SIT) IN HIGH-T_c CUPRATES**
G. Dubuis[1,2], A.T. Bollinger[1], D. Pavuna[2], I. Božović[1]
[1]*Condensed Matter Physics and Materials Science Department, Brookhaven National Laboratory, Upton, NY, USA,* [2]*Physics of Complex Matter – CREAM – ICMP - FSB – EPFL - station 3, Swiss Federal Institute of Technology, Lausanne EPFL, Switzerland*

Break: 10^{30}-11^{00}
Chairmen: E. Spiecker and G. Solórzano

11^{00}-11^{30} **PROBING PLASMONIC PROPERTIES IN NOBLE METALLIC NANOSTRUCTURES USING MONOCHROMATED ELECTRON ENERGY-LOSS SPECTROSCOPY (EELS)**
A.L. Koh
Stanford Nanocharacterization Laboratory, Stanford University, CA, USA

11^{30}-12^{00} **INTERFACE DIFFUSION –CONTROLLED PHASE TRANSFORMATIONS IN NANOMATERIALS**
G. Solórzano
Department of Materials Science and Engineering, PUC-Rio, Brazil

12^{00}-12^{30} **HOW DOES MICROSTRUCTURE EVOLVE IN PEROVSKITES?**
S.-J.L. Kang
Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea

FIFTH PLENARY SESSION

Friday, September 6, 2013

Session V: 09^{00}-12^{30}
Chairmen: E. Zschech and M. Senna

09^{00}-09^{30} **ATOMIC STRUCTURE OF NANOPARTICLES AND THEIR SURFACES**
J.M. Zuo[1], W. Gao[1], J. Wu[1,2], H. Yang[2]
[1]Department of Materials Science and Engineering and Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA, [2]Department of Chemical Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA

09^{30}-10^{00} **INTRIGUING PHENOMENA AT THE BOUNDARY BETWEEN METAL OXIDE - ORGANIC FINE PARTICLES UNDER MECHANICAL STRESSING AND THEIR INDUSTRIAL APPLICATION**
M. Senna
Faculty of Science and Technology, Keio University, Japan

10^{00}-10^{30} **NOVEL BULK MATERIALS FOR THERMOELECTRIC ENERGY RECOVERY**
P.F. Rogl
Institute of Physical Chemistry, University of Vienna, Wien, Austria

Break: 10^{30}-11^{00}
Chairmen: D. Suvorov and P.F. Rogl

11^{00}-11^{30} **THE CHALLENGES FOR THE SYNTHESIS OF PRESENT AND FUTURE CONTEMPORARY ELECTROCERAMICS**
D. Suvorov
Advanced Materials Department, Jožef Stefan Institute, Ljubljana, Slovenia

11^{30}-12^{00} **STRUCTURAL AND ELECTROCHEMICAL PROPERTIES OF SELECTED POLYANIONIC CATHODE MATERIALS USED IN BATTERIES**
R. Dominko
National Institute of Chemistry, Laboratory for Materials, Ljubljana, Slovenia

12^{00}-12^{30} **OPERANDO BROADBAND DIELECTRIC SPECTROSCOPY OF LITHIUM-ION BATTERIES FROM LOW FREQUENCIES TO MICROWAVES**

J.C. Badot[1], K.A. Seid[1,2], O. Dubrunfaut[2], D. Guyomard[3], B. Lestriez[3]
[1]Laboratoire de Chimie de la Matière Condensée de Paris, Chimie ParisTech, CNRS, France, [2]Laboratoire de Génie Electrique de Paris, SUPELEC, UPMC Univ Paris 06, Univ Paris-Sud, CNRS, France, [3]Institut des Matériaux Jean Rouxel (IMN), Université de Nantes, CNRS, France, [1,3]Réseau sur le Stockage Electrochimique de l’Energie (RS2E), FR CNRS 3459, France

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

POSTER SESSION I

Tuesday, September 3, 2013, 20^{00}-22^{00}

SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

P.S.A.1. **CHARACTERIZATION OF DEFECTS IN Yb:CALGO A MATERIAL FOR HIGH POWER ULTRAFAST LASER**
A. Jaffres[1], B. Viana[1], P. Loiseau[1], P. Georges[2], F. Druon[2]
[1]LCMCP, Chimie-Paristech, Paris, France
[2]Laboratoire Charles Fabry, Institut d'Optique, Palaiseau, France

P.S.A.2. **EXPERIMENTAL INVESTIGATION OF SHOCK WAVE PROCESSES IN SOLID AND LIQUID PARAFFIN AND DOCOSANE**
V.A. Sosikov, A.V. Utkin
Institute of Problems of Chemical Physics RAS, Chernogolovka, Russia

P.S.A.3. **SURFACE CHARACTERIZATION OF ACTIVE CARBON MATERIAL PREPARED FROM TREE WASTE BY HYDROTHERMAL CARBONIZATION PROCESS**
V. Dodevski[1], B. Kaluđerović[1], S. Krstić Mušović[1], R. Aleksić[2], D. Brković[2]
[1]Vinča Institute of Nuclear Sciences, Mater. Sci. Dpt., University of Belgrade, Belgrade, Serbia, [2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.A.4. **PRODUCTION OF NON-STOICHIOMETRIC “SUPERALKALI” CLUSTERS Li_nCl_{n-1} BY MASS SPECTROMETRY**
F. Veljković, J. Djustebek, M. Veljković, B. Pajkić, S. Veličković
Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

P.S.A.5. **APPLICATION OF PTR-MS MEASUREMENTS OF VOLATILE ORGANIC COMPOUNDS (VOC) IN MEDICAL SCIENCE**
A. Stojić[1], M. Perišić[1], M. Todorović[1], Ž. Nikitović[1], A. Jotić[2], N. Lalić[2], Z.Lj. Petrović[1]
[1]Institute of Physics, University of Belgrade, Belgrade, Serbia, [2]Institute of Endocrinology, Faculty of Medicine, Univesity of Belgrade, Belgrade, Serbia

P.S.A.6. **THERMODYNAMIC MODELLING OF THE MATERIAL PROPERTIES FOR Al-Cu-Mg ALLOYS**
B. Zlatičanin[1], M. Filipović[2]
[1]Faculty of Metallurgy and Technology, Podgorica, Montenegro,
[2]Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.A.7. **THE STUDY OF PROPERTIES OF ZIRCONIUM TUNGSTATE OBTAINED THE HYDROTHERMAL SYNTHESIS**
E.S. Dedova[1], V.S. Shadrin[2], S.N. Kulkov[1,2]
[1]Institute of Strength Physics and Materials Science SB RAS, [2]National Research Tomsk State University, Tomsk, Russia

P.S.A.8. **SYNTHESIS AND CHARACTERIZATION OF COPPER(II) COMPLEX WITH THE SCHIFF BASE OF SALICYLALDEHYDE AND AMINOGUANIDINE**
M.V. Rodić, M.M. Radanović, Lj.S. Vojinović-Ješić, V.M. Leovac
Faculty of Sciences, University of Novi Sad, Serbia

P.S.A.9. **SYNTHESIS OF MESOPOROUS SILICA CORE-SHELL PARTICLES FOR ENZYME IMMOBILIZATION**
M.P. Nikolić[1,2], V.V. Srdić[2]
[1]Department of Chemical Engineering, Faculty of Agronomy, University of Kragujevac, Čačak, Serbia, [2]Department of Materials Engineering, Faculty of Technology, University of Novi Sad, Novi Sad, Serbia

P.S.A.10. **THE INFLUENCE OF THE DEPOSITING CURRENT DENSITY ON THE MAGNETIC CHARACTERISTICS OF AMORPHOUS ALLOY POWDER NiCoCu**
Z. Vuković, M. Plazinić, J. Živanović, S. Đukić, A. Maričić
Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia

P.S.A.11. **$La_{0.5}Pr_{0.2}Pb_{1-X}Sr_XMnO_3$: SYNTHESIS AND CORRELATION BETWEEN CHEMICAL COMPOSITION, MICROSTRUCTURE AND MAGNETORESISTANCE**
M.-L. Craus[1,2], A. Islamov[2], N. Cornei[3], E. M. Anitas[2,4], C. Mita[3], D. Luca[5]
[1]National Institute of Research and Development for Technical Physics, Iasi, Romania, [2]Joint Institute of Nuclear Research, Dubna, Russia; [3]"Al.I.Cuza" University, Iasi, Romania, [4] "Horia Hulubei" National Institute for Physics and Nuclear Engineering, Bucharest-Magurele, Romania; [5]"Gh.Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering, Romania

P.S.A.12. **PREPARATION AND CHARACTERIZATION Pt CATALYST ON Ru DOPED TIN OXIDE SUPPORT FOR OXYGEN REDUCTION**
Lj.M. Gajić-Krstajić[1], N.R. Elezović[2], B.M. Babić[3], V. Radmilović[4], N.V. Krstajić[4]
[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, Belgrade, Serbia, [4]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.A.13. **FORMATION AND MORPHOLOGY OF INTERMETALLIC PHASES AND EUTECTIC IN IRON COATED THICK ALUMINIUM SUBSTRATES**
L. Klakurková[1,2], L. Čelko[1,2], K. Slámečka[1,2], M. Juliš[1,2], M. Hrčková[1,2], J. Švejcar[1,2]
[1]Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic, [2]Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic

P.S.A.14. **NORMALIZED DISTRIBUTION COEFFICIENT AS A NOVEL METHOD FOR CAST IRONS MATRIX HETEROGENEITY ASSESSMENT**
Z. Pavloušková[1,2], B. Pacal[2], K. Stránský[2], O. Man[1,2], L. Klakurková[1,2], J. Švejcar[1,2]
[1]Research Group of Structural and Phase Analysis, Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic, [2]Institute of Materials Science and Engineering, Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic

P.S.A.15. **PHASE ANALYSIS OF ALUMINIDE DIFFUSION COATINGS PRODUCED BY ALUMINIZING OF NICKEL AND NICKEL-BASED ALLOYS**
T. Podrábský[1,2], M. Juliš[1,2], L. Čelko[1,2], L. Klakurková[1,2], S. Hutařová[1,2]
[1]Research Group of Structural and Phase Analysis, Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic, [2]Institute of Materials Science and Engineering, Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic

P.S.A.16. **SYNTHESIS OF F-DOPED $LiFePO_4$ VIA PRECIPITATION METHOD**
M. Milović[1], F.R. Vukajlović[2], D. Jugović[1], M. Mitrić[2], B. Jokić[3], N. Cvjetićanin[4], A.S. Milošević[2], Z.S. Popović[2], D. Uskoković[1]
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P.S.A.17. **CRYSTAL STRUCTURE REFINEMENT OF Li_2FeSiO_4 CATHODE MATERIAL**
D. Jugović[1], M. Mitrić[2], M. Milović[1], B. Jokić[3], 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 Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.A.18. **CARBON COATED $LiFePO_4$ CATHODE MATERIAL OBTAINED BY FREEZE-DRYING METHOD**
M. Kuzmanović[1], D. Jugović[1], M. Mitrić[2], B. Jokić[3], N. Cvjetićanin[4], D. Usković[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.19. **$LiFePO_4$ NANOCRYSTALS SYNTHESIS BY HYDROTHERMAL REDUCTION METHOD**
Z. Stojanović[1], M. Kuzmanović[1], M. Tadić[2], R. Dominko[3], D. Usković[1]
[1]Centre for Fine Particles Processing and Nanotechnologies, Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Condensed Matter Physics Laboratory, Vinča Institute, University of Belgrade, Belgrade, Serbia, [3]National Institute of Chemistry, Ljubljana, Slovenia

P.S.A.20. **ELECTROCHEMICAL STUDIES OF THE MICROSTRUCTURAL CORROSION OF Al-Cu15-Mg ALLOY**
B. Zlatičanin[1], S. Kovačević[2]
[1]University of Montenegro, Faculty of Metallurgy and Technology, Podgorica, Cetinjski put bb, Montenegro, [2]Central School of Chemical Technology Spasoje Raspopović, Podgorica, Montenegro

P.S.A.21. **A COMPARATIVE STUDY OF STUCTURAL AND OPTICAL PROPERTIES OF Eu^{3+}- DOPED $GdVO_4$ SYNTHESIZED BY THREE DIFFERENT METHODS: FROM BULK TO NANOPARTICLES**
T.V. Gavrilović, D.J. Jovanović, M.D. Dramićanin
Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia

P.S.A.22. **ACTIVATED CARBON PRODUCTION FROM COTTON WASTE FIBERS**
R. Ničić, O. Mladenović, M. Smelčerović, D. Djordjević
University of Niš, Faculty of Technology, Leskovac, Serbia

P.S.A.23. **PREPARATION AND CHARACTERIZATION ALUMINA CERAMIC FIBERS OBTAINED VIA ELECTROSPINNING**
M.M. Dimitrijević, S.A. Ben Hasan, A. Kojović, Đ. Veljović, R. Jančić-Heinemann, D. Stojanović, R. Aleksić
University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.A.24. **SBR/CSM/BIOGENIC SILICA RUBBER BLEND COMPOSITE**
G. Marković[1], M. Marinović-Cincović[2], V. Jovanović[3], S. Samaržija-Jovanović[3], J. Budinski-Simendić[4]
[1]Tigar, Pirot, Serbia; [2]University of Belgrade, Institute of Nuclear Science Vinča, Belgrade, Serbia, [3]Faculty of Natural Science and Mathematics, University of Priština, Serbia, [4]University of Novi Sad, Faculty of Technology, Novi Sad, Serbia

P.S.A.25. **INFLUENCE OF DIFERENT MODULUS OF ELASTICITY OF COMPOSITE ADHERENDS ON STRESS DISTRIBUTION IN THE CASE OF STEP JOINT**
A.O. Houssein[1], Z. Bojanić[2]
[1]Al jabel Algharbi university, Faculty of Engineering - Jadoo, Libya,
[2]Mechanical Faculty, Belgrade University, Serbia

P.S.A.26. **STRUCTURAL CHARACTERIZATION OF SUBMERGED GRANULAR PACKINGS**
Z.M. Jakšić[1], J.R. Šćepanović[1], I. Lončarević[2], Lj. Budinski-Petković[2], S.B. Vrhovac[1], A. Belić[1]
[1]Institute of Physics Belgrade, University of Belgrade, Zemun, Belgrade, Serbia,
[2]Faculty of Engineering, Novi Sad, Serbia

P.S.A.27. **PHYSICAL MECHANISMS OF RAIL STEEL FATIGUE LIFE INCREASE BY ELECTRON BEAM TREATMENT**
V.E. Gromov, V.A. Grishunin, S.V. Konovalov, I.V. Lushina, V.I. Myasnikova
Siberian State Industrial University, Novokuznetsk, Russia

P.S.A.28. **ELECTRON BEAM TREATMENT OF STAINLESS STEEL SURFACE: FATIGUE LIFE INCREASE AND NANOSIZE CARBIDES FORMATION**
V.E. Gromov, V.V. Sizov, S.V. Vorobyov, V.I. Myasnikova, I.V. Lushina, S.V. Konovalov
Siberian State Industrial University, Novokuznetsk, Russia

P.S.A.29. **SURFACE RELIEF AND STRUCTURE OF ELECTROEXPLOSIVE COMPOSITE SURFACE LAYERS OF THE MOLYBDENUM–COPPER SYSTEM**
D.A. Romanov, O.V. Olesjuk, E.A. Budovskikh, V.E. Gromov
Siberian State University of Industry, Novokuznetsk, Russia

P.S.A.30. **NANOSIZE STRUCTURE FORMATION UNDER STEEL THERMOMECHANICAL STRENGTHENING**
V.E. Gromov, M.M. Morozov, T.N. Markova, S.V. Konovalov, I.A. Komissarova, I.V. Lushina
Siberian State Industrial University, Novokuznetsk, Russia

P.S.A.31. **ISOCITRIC ACID PRODUCTION BY YARROWIA LIPOLYTICA YEAST**
S.V. Kamzolova, V.A. Samoilenko, R.K. Allayarov, I.G. Morgunov
G.K. Skryabin Institute of Biochemistry and Physiology of Microorganisms, Russian Academy of Sciences, Pushchino, Moscow region, Russia

P.S.A.32. **MECHANOCHEMICAL MODIFICATION OF GLAUCONITE, DIATOMITE AND VERMICULITE TO OBTAIN SORBENTS**
F.Kh. Urakaev[1], A.B. Assilov[2], B.D. Balgysheva[2], G.S. Kuanysheva[2], V.S. Shevchenko[1]
[1]Sobolev Institute of Geology and Mineralogy SB RAS, Novosibirsk, Russia, [2]al-Farabi Kazakh National University, Almaty, Kazakhstan

P.S.A.33. **DIELECTRIC AND FERROELECTRIC MEASUREMENTS OF TITANATE-FERRITE COMPOSITE CERAMICS**
B. Mojić[1], V. Saravanan K.[2], J. Vukmirović[1], I. Stijepović[1], P. Vilarinho[2], V.V. Srdić[1]
[1]Department of Materials Engineering, Faculty of Technology, University of Novi Sad, Serbia, [2]Department of Materials and Ceramics Engineering, University of Aveiro, Portugal

P.S.A.34 **INVESTIGATION OF ATOMIZATION LIQUID METALS OF SUPERSONIC GAS**
P. Tomić[1], M. Davidović[2], Z. Nedić[3], M. Kutin[2], S. Sredić[4]
[1]Environment Protection Fund of Republic Srpska, Banja Luka, RS, BiH, [2]Institute Gosa, Belgrade, Serbia, [3]University of Belgrade, Faculty of Physical Chemistry, Serbia, [4]Institute of Mining Prijedor, RS, BiH

P.S.A.35. **THE CONFINEMENT RESONANCES IN THE PHOTOIONIZATION OF ENDOHEDRAL FULLERENES**
A.R. Tančić[1], M. Davidović[2]
[1]Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia, [2]Goša Institute for Research and Development, Belgrade, Serbia

P.S.A.36. **THERMAL STABILITY AND MECHANISM OF CRYSTALLIZATION OF $Fe_{81}B_{13}Si_4C_2$ AMORPHOUS ALLOY**
M.M. Vasić[1], D.M. Minić[2], V.A. Blagojević[1], R.R. Piticescu[3], D.M. Minić[1]
[1]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, [2]Military Technical Institute, Belgrade, Serbia, [3]National R&D Institute for Non-ferrous and Rare Metals, Pantelimon, Ilfov, Romania

P.S.A.37. **PHASE FORMATION AT ALUMINOTHERMIC REDUCTION OF TANTALUM OXIDE AND MANGANESE TANTALATE**
V.M. Chumarev, A.N. Mansurova, R.I. Gulyaeva,
Institute of Metallurgy of the UB RAS, Ekaterinburg, Russia

P.S.A.38. **POLYCARBONATE-BASED POLYURETHANE ELASTOMERS: RELATION BETWEEN STRUCTURE AND PROPERTIES II**
Z. Hrdlička[2], R. Poręba[1], A. Kuta[2], M. Špírková[1]
[1]Nanostructured Polymers and Composites Department, Institute of Macromolecular Chemistry AS CR, v.v.i., Prague, Czech Republic, [2]Department of Polymers, Institute of Chemical Technology Prague, Prague, Czech Republic

P.S.A.39. **SYNTHESIS AND CHARACTERIZATION OF BARIUM TITANATE SOLS AND THEIR APPLICATION FOR FILMS FABRICATION BY INK-JET PRINTING**
J. Vukmirović[1], B. Bajac[1], Dj. Tripković[1], N. Samardžić[2], B. Mojić[1], G. Stojanović[2], V.V. Srdić[1]
[1]Department of Materials Engineering, Faculty of Technology, University of Novi Sad, Serbia, [2]Department of Microelectronics, Faculty of Technical Sciences, University of Novi Sad, Serbia

P.S.A.40. **PYROLYSIS OF OIL SHALE AND BITUMINOUS MARLSTONE KEROGENS IN AN OPEN SYSTEM - INFLUENCE OF TEMPERATURE ON THE YIELD AND COMPOSITION OF LIQUID PYROLYSATES**
G. Gajica[1], K. Stojanović[2], B. Jovančićević[2], A. Šajnović[1], A. Kostić[3]
[1]Center of Chemistry, IChTM, Belgrade, Serbia, [2]University of Belgrade, Faculty of Chemistry, Belgrade, Serbia, [3]University of Belgrade, Faculty of Mining and Geology, Belgrade, Serbia

P.S.A.41. **MANAGE AND CONTROL OF CONSTRUCTION PROCESSES IN ALBANIA AND BALKANS**
I. Dervishi[1], J. Kacani[1], V. Kasemi[2]
[1]Polytechnic University of Tirana, Albania; [2]University "Ismail Qemali" of Vlora, Albania

P.S.A.42. **USE POLYMERIC COMPOSITIONS OF FUNDS IN TOURIST SEA**
A. Hajderi[1], V. Kasemi[2], S. Alizoti[2]
[1]Department of Mechanic and Transport, "Aleksander Moisiu" University, Durres, Albania, [2]University "Ismail Qemali" of Vlora, Albania

POSTER SESSION II

Wednesday, September 4, 2013, 20^{00}-22^{00}

SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

P.S.B.1. **ALTERNATING CURRENT/DIRECT CURRENT ELECTRICAL PROPERTIES OF CARBON NANOFIBER/EPOXY RESIN COMPOSITES**
A.G. Bannov[1], N.F. Uvarov[1,2], G.G. Kuvshinov[1,3]
[1]Novosibirsk State Technical University, Novosibirsk, Russia, [2]Institute of Solid State Chemistry, Siberian Branch of Russian Academy of Science, Novosibirsk, Russia, [3]Department of Environmental Engineering, General and Inorganic Chemistry, Sochi State University, Sochi, Russia

P.S.B.2. **MODELING OF INTERFACES IN SOLID-STATE SUPERCAPACITORS WITH COMPOSITE CARBON NANOSTRUCTURE ELECTRODES**
A.V. Andreeva, A.L. Despotuli
Institute of Microelectronics Technology and High Purity Materials, Russian Academy of Sciences, Chernogolovka, Moscow region, Russia

P.S.B.3. **ION TRANSPORT MODELING ON BLOCKING HETEROJUNCTIONS**
A.L. Despotuli, A.V. Andreeva
Institute of Microelectronics Technology and High Purity Materials, Russian Academy of Sciences, Chernogolovka, Moscow region, Russia

P.S.B.4. **$CaCu_3Ru_4O_{12}/CaCu_3Ti_4O_{12}/CaCu_3Ru_4O_{12}$ FUNCTIONALLY GRADED ELECTRONIC CERAMICS**
S. Marković[1], S.D. Škapin[2], D. Suvorov[2], D. Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Jožef Stefan Institute, Ljubljana, Slovenia

P.S.B.5. **STRUCTURE AND PHISICAL-MECHANICAL PROPERTIES OF METAL-MATRIX COMPOSITES Al-Al_4C_3**
S.A. Vorozhtsov, S.N. Kulkov
Institute of Strength Physics and Material Sciences SB RAS, National Research Tomsk State University, Tomsk, Russia

P.S.B.6. **INVESTIGATION OF NONIONIC SURFACTANTS INFLUENCE ON TOPOLOGY OF COPPER STRUCTURES OBTAINED BY LASER-INDUCED CHEMICAL LIQUID PHASE DEPOSITION (LCLD)**
E. Khairullina, V. Kochemirovsky, S. Safonov
Saint Petersburg State University, Saint Petersburg, Russia

P.S.B.7. **LASER-INDUCED COPPER DEPOSITION IN CONDENSED MATTER**
E. Shishkova, V. Kochemirovsky, I. Tumkin
Saint-Petersburg State University, Faculty of Chemistry, Saint-Petersburg, Petrodvorets, Russian Federation

P.S.B.8. **SYNTHESIS OF FINE-DISPERSED BORON CARBIDE POWDER USING CARBON NANOFIBERS**
K.D. Dyukova, Ju.L. Krutskii, A.G. Bannov, V.V. Shinkarev
Novosibirsk State Technical University, Novosibirsk, Russia

P.S.B.9. **FUNCTIONALLY-IMPROVED CHALCOGENIDE-CHALCOHALIDE GLASSES WITH EMBEDDED NANOINHOMOGENEITIES**
M. Vakiv[1], H. Klym[1], O. Shpotyuk[1,2], A. Ingram[3], L. Shpotyuk[1]
[1]Lviv Scientific Research Institute of Materials of SRC "Carat", Lviv, Ukraine, [2]Institute of Physics of Jan Dlugosz University, Czestochowa, Poland, [3]Opole University of Technology, Opole, Poland

P.S.B.10. **ELECTRON STRUCTURE, VALENSE STATE, X-RAY SPECTRA AND SURFACE MORFHOLOGIES OF THE NEW CeM_2P_2 (M=Fe, Co, Ni) COMPOUNDS**
I.D. Shcherba[1], D. Usković[2], M.V. Sacharevych[3], B.M. Jatcyk[4]
[1]Institute of Technology, University of Pedagogy, Krakow, Poland, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Lviv National University by Ivan Franko, Lviv, Ukraine, [4]University of Forestry and Wood Technology, Lviv, Ukraine

P.S.B.11. **CHALCOGENIDE THIN FILM SUBSTRATE FOR PROTEIN BIOCHIP APPLICATION**
A.S. Vasileva[1], A.V. Belykh[2], E.N. Borisov[1], V.V. Burylev[1], A.S. Tverjanovich[1], Yu.S. Tveryanovich[1]
[1]Department of Chemistry, Saint-Petersburg State University, Petrodvoretz, St. Petersburg, Russia, [2]JSC HoloGrate, St. Petersburg, Russia

P.S.B.12. **INTRODUCING FRACTALS TO MECHANICS OF FRACTURE. INSTABILITIES IN VISCOELASTIC AND DUCTILE FRACTURE**
M.P. Wnuk
College of Engineering and Applied Science, University of Wisconsin, Milwaukee, USA

P.S.B.13. **OPTICAL AND MAGNETIC PROPERTIES OF $ZnGeAs_2$ + Mn**
M. Romčević[1], N. Romčević[1,*], W. Dobrowolski[2], L. Kilanski[2], E. Dynowska[3], I.V. Fedorchenko[3], S.F. Marenkin[3]
[1]Institute of Physics, University of Belgrade, Belgrade, Serbia, [2]Institute of Physics PAS, Warsaw, Poland, [3]Kurnakov Institute of General and Inorganic Chemistry RAS, Moscow, Russia

P.S.B.14. **THE INCORPORATION OF VANADIUM INTO OLIVINE $LiFePO_4$/C: IMPROVEMENT OF LITHIUM INTERCALATION FROM BOTH ORGANIC AND AQUEOUS ELECTROLYTE**
M. Vujković[1], D. Jugović[2], M. Mitrić[3], I. Stojković Simatović[1], N. Cvjetićanin[1], S. Mentus[1,4]
[1]University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Institute for Nuclear Sciences Vinča, Belgrade, Serbia, [4]Serbian Academy of Sciences and Arts, Belgrade, Serbia

P.S.B.15. **STUDY OF MODIFIED TiN COMPOSITES SUITABLE FOR HIGH-TEMPERATURE APPLICATIONS**
E. Bartoníčková, F. Frajkorová, M. Boháč, J. Havlica
Materials Research Centre, Faculty of Chemistry, Brno University of Technology, Brno, Czech Republic

P.S.B.16. **PHASE BEHAVIOUR OF BINARY MIXTURES COMPOSED OF BANANA-SHAPED AND CALAMITIC MESOGENS**
M. Cvetinov[1], D.Ž. Obadović[1], M. Stojanović[1], A. Vajda[2], K. Fodor-Csorba[2], N. Eber[2]
[1]Department of Physics, University of Novi Sad, Novi Sad, Serbia, [2]Institute for Solid State Physics and Optics, Wigner Research Centre for Physics, Hungarian Academy of Sciences, Budapest, Hungary

P.S.B.17. **HEAT TREATMENT EFFECT ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF LOW CARBON CrMnMo ALLOY STEEL**
R. Dziurka[1], J. Pacyna[1], T. Tokarski[2], E. Głowacz[1]
AGH University of Science and Technology, [1]Faculty of Metals Engineering and Industrial Computer Science, [2]Faculty of Non-Ferrous Metals, Kraków, Poland

P.S.B.18. **INFLUENCE OF MoO_3 ON CORDIERITE CERAMICS SINTERING AND CRYSTALLIZATION**
N. Djordjević[1], A. Mihajlović[2], A. Peleš[3], N. Obradović[3], V. Pavlović[3]
[1]Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade, Serbia, [2]Institute of Nuclear Sciences Vinča, University of Belgrade, Belgrade, Serbia, [3]Institute of Technical Sciences of SASA, Belgrade, Serbia

P.S.B.19. **INFLUENCE OF ONE ACTIVATED COMPONENT ON THE SINTERING PROCESS OF THREE PHASE SYSTEM**

N. Obradović[1], A. Peleš[1], N. Djordjević[2], S. Marković[1], M. Mitrić[3], V. Pavlović[1]

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P.S.B.20. **SOFT MAGNETIC PROPERTIES OF MnZn FERRITE PREPARED BY PIM ROUTE**

N. Mitrović[1], B. Zlatkov[2], S. Djukić[1], A. Kalezić -Glišović[1], S. Randjić[1], H. Danninger[3]

[1]Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia, [2]Volkswagen Aktiengesellschaft, Wolfsburg, Germany, [3]Institute of Chemical Technologies and Analytics, Wien, Austria

P.S.B.21. **INFLUENCE OF MECHANICAL BALL MILLING ACTIVATION ON THE PROPERTIES OF TITANIUM CARBIDE**

M.V. Grigoriev, S.P. Buyakova, S.N. Kulkov

Institute of Strength Physics and Materials Science of the Siberian Branch of RAS, Tomsk, Russia

P.S.B.22. **PHOSPHORUS SEGREGATION IN GRAIN BOUNDARIES OF VVER-1000 REACTOR VESSEL STEEL STUDIED BY AES AND TEM**

Z.V. Lavrukhina, A.N. Khodan, M.A. Saltykov, O.O. Zabusov, B.A. Gurovich

National Research Centre "Kurchatov Institute", Moscow, Russian Federation

P.S.B.23. **INTERPLAY BETWEEN THE STRUCTURAL AND MAGNETIC PROBES IN ELUCIDATION OF THE STRUCTURE OF NOVEL 2D LAYERED $V_4O_4(OH)_2(O_2CC_6H_4CO_2)_4$·DMF**

I. Djerdj

Ruđer Bošković Institute, Zagreb, Croatia

P.S.B.24. **GROWTH AND SPECTROSCOPIC CHARACTERIZATION OF $Y_3Al_5O_{12}$ - YAG SINGLE CRYSTALS**

Z.Ž. Lazarević, S. Kostić, N.Ž. Romčević

Institute of Physics, University of Belgrade, Zemun, Belgrade, Serbia

P.S.B.25. **IMPACT OF MATERIAL ON TORSIONAL VIBRATIONS OF CRANKSHAFT**

A. Hajderi[1], V. Kasemi[2], P. Veizi[3]
[1]Department of Mechanic and Transport, "Aleksander Moisiu" University, Durres, Albania, [2]University "Ismail Qemali" of Vlora, Albania, [3]Agricultural University of Tirana, Albania

P.S.B.26. **PHASE TRANSFORMATIONS OF IRON AND NICKEL SULFIDES WITH CALCIUM OXIDE UNDER HEATING IN INERT AND REDUCING ATMOSPHERES**

R.I. Gulyaeva, E.N. Selivanov, A.D. Vershinin
Institute of Metallurgy, Ural Branch, Russian Academy of Sciences, Yekaterinburg, Russia

P.S.B.27. **EFFECTS OF DOPANT RATIO AND ALKALI METALS ON OPTICAL PROPERTIES OF Y_2O_3:Yb^{3+}/Ho^{3+} NANOPARTICLES**

V. Lojpur, M.G. Nikolić, M.D. Dramićanin
Vinča Institute of Nuclear Science, University of Belgrade, Belgrade, Serbia

P.S.B.28. **LUMINESCENCE TEMPERATURE SENSING USING Zn_2SiO_4:Mn^{2+}PHOSPHOR PARTICLES**

M. Medić, M.G. Nikolić, D. Jovanović, Ž. Antić, V. Lojpur, M.D. Dramićanin
Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

P.S.B.29. **APPLICATION OF PEACH SHELLS FOR THE REMOVAL OF METHYLENE BLUE AND BRILLIANT GREEN**

S. Marković[1], A. Stanković[1], Z. Lopičić[2], M. Stojanović[2], D. Uskoković[1]
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P.S.B.30. **ON THE SPIN COHERENT STATES REGARDED AS THE BOSON NONLINEAR COHERENT STATES**

D. Popov[1], J.P. Šetrajčić[2], V. Sajfert[3]
[1]University „Politehnica", Department of Physical Foundations of Engineering, Timisoara, Romania, [2]University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina – Serbia, [3]University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Zrenjanin, Vojvodina – Serbia

P.S.B.31. **VOID DEVIATIONS IN NANOSTRUCTURED GLASSY MATERIALS CHARACTERIZED WITH POSITRON ANNIHILATION TECHNIQUE**

O. Shpotyuk[1,2], A. Ingram[3], L. Shpotyuk[1], M. Vakiv[1]
[1]Lviv Scientific Research Institute of Materials of SRC "Carat", Lviv, Ukraine, [2]Institute of Physics of Jan Dlugosz University, Czestochowa, Poland, [3]Opole University of Technology, Opole, Poland

P.S.B.32. **ON THE VIBRON DRESSING IN THE ONE-DIMENSIONAL MACROMOLECULAR CHAINS CAUSED BY THE INTERACTIONS WITH ACOUSTIC PHONON MODES**
Z. Ivić[1], D. Čevizović[1,2]
[1]*The Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia,* [2]*Joint Institute for Nuclear Research, Dubna, Russia*

P.S.B.33. **INSTRUMENTED IMPACT TESTING OF HYBRID THERMOPLASIC ARAMID FABRICS REINFORCED WITH CARBON NANOTUBES**
V. Obradović, D.B. Stojanović, D.D. Trifunović, I. Živković, V. Radojević, P.S. Uskoković, R. Aleksić
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.B.34. **STRUCTURE AND PROPERTIES OF POLYVINYL BUTYRAL BASED NANOCOMPOSITES**
V.V. Radmilović, D. Stojanović, P. Uskoković, R. Aleksić, V.R. Radmilović
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.B.35. **SONOCATALYTIC DEGRADATION OF METHYLENE BLUE DYE USING A NANOSIZED ZINC OXIDE POWDER PREPARED VIA SONOCHEMICAL METHOD**
A. Stanković, Lj. Veselinović, S. Marković, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

P.S.B.36. **Ga EFFECTS ON GLASS FORMING ABILITY IN MIXED $Ga_x(As_{0.4}Se_{0.6})_{100-x}$ AND $Ga_2(As_{0.4}Se_{0.6})_{98-y}Te_y$ SYSTEMS**
Ya. Shpotyuk[1,2], B. Bureau[1], C. Boussard-Pledel[1], V. Nazabal[1], I. Polovynko[2]
[1]*Verres et Céramiques, UMR 6226 Sciences Chimiques de Rennes, Université de Rennes, Campus de Beaulieu, Rennes, France,* [2]*Faculty of Electronics of Ivan Franko National University of Lviv, Lviv, Ukraine*

P.S.B.37. **ORDERED SUB-NANO-STRUCTURES ON OXIDES SURFACE OVER PLASMA TREATMENT FOR IT APPLICATION AND HEALTH**
N.A. Kulagin[1], J. Dojčilović[2], I. Dojčinović[3]
[1]*Ukrainian with Germany Joint Venture "Firma SIFA", Kharkov, Ukraine,* [2]*Faculty of Physics, University of Belgrade, Belgrade, Serbia,* [3]*Center Plasma, Belgrade, Serbia*

P.S.B.38. **SYNTHESIS OF MATERIALS FOR ION-CONDUCTING AND ELECTROCATALYTICAL MEMBRANES AS WELL AS CATHODE AND OTHER STRUCTURAL ELEMENTS OF SOFC**
M.V. Kuznetsov[1], Iu.G. Morozov[2], I.V. Shishkovsky[3]
[1]Materials Chemistry Research Centre, Dept of Chemistry, University College London, London, UK, [2]Institute of Structural Macrokinetics and Materials Science RAS (ISMAN), Chernogolovka, Russia, [3]Samara Branch of Lebedev Physical Institute, Samara, Russia

P.S.B.39. **ELECTROSPUN CORE-SHELL FIBERS FOR SELF-HEALING OF THERMOPLASTIC POLYMER COMPOSITE**
I. Radović, V. Radojević, P.S. Uskoković, D.B. Stojanović, A. Kojović, R. Aleksić
University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.B.40. **SIMULATION OF THE VARIATION IN TEMPERATURE IN A MATERIAL WITHOUT AND WITH DEFAULT**
K. Gherfi, M. Chaour, S. Boulkroune
Unité de Recherche Appliqué en Sidérurgie Métallurgie, URASM/CSC; BP 196, Annaba, Algerie

P.S.B.41. **THE USE OF SEC-MALS TO STUDY THE DEGRADATION OF PULLULAN AND HYALURONIC ACID**
V. Simulescu, S. Obruča, M. Pekař
Centre for Materials Research, Faculty of Chemistry, Brno University of Technology, Brno, Czech Republic

P.S.B.42. **TEMPERATURE DEPENDENCE OF ELECTRICAL AND MAGNETIC PROPERTIES OF NiCoCu ALLOY POWDER**
M. Spasojević[1], B. Nedeljković[2], S. Djukić[2], S. Randjić[2], N. Mitrović[2], Z. Ristanović[2]
[1]Faculty of Agronomy, University of Kragujevac, Čačak, Serbia, [2]Faculty of Technical Sciences Čačak, University of Kragujevac, Čačak, Serbia

POSTER SESSION III

Thursday, September 5, 2013, 20^{00}-22^{00}

SYMPOSIUM C: NANOSTRUCTURED MATERIALS

P.S.C.1. **ON SURFACE TENSION EFFECT IN NANOMECHANICS**
E.M. Gutman
Dept of Materials Engineering, Ben-Gurion University of the Negev, Beer-Sheva, Israel

P.S.C.2. **ROOM-TEMPERATURE FERROMAGNETISM IN AEROSOL GENERATED Zn/ZnO NANOPARTICLES**
M.V. Kuznetsov[1], O.V. Belousova[2], D. Ortega[2], Iu.G. Morozov[2]
[1]University College London, London, UK, [2]Institute of Structural Macrokinetics and Materials Science Russian Academy of Sciences, Chernogolovka, Russia

P.S.C.3. **LOW-TEMPERATURE ELECTRICAL RESISTIVITY OF GRAPHENE**
V. Egorushkin[1], N. Melnikova[2], A. Ponomarev[1], N. Bobenko[1]
[1]Institute of Strength Physics and Materials Science Siberian Branch of Russian Academy of Sciences, Tomsk, Russia, [2]V.D. Kuznetsov Siberian Physical Technical Institute of Tomsk State University, Tomsk, Russia

P.S.C.4. **ADSORPTION PROPERTIES OF SUMANENE TOWARDS COMMON AIR POLLUTANTS**
S. Armaković[1], S.J. Armaković[2], T. Grujić[1], J.P. Šetrajčić[1]
[1]University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina, Serbia,[2]University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Novi Sad, Vojvodina, Serbia

P.S.C.5. **STRUCTURE AND PROPERTIES OF SUBMICROCRYSTALLINE LOW CARBON STEEL AFTER EQUAL CHANNEL ANGULAR PRESSING**
S.V. Dobatkin[1], P.D. Odessky[1], G.I. Raab[2]
[1]A.A.Baikov Institute of Metallurgy and Materials Science, RAS, Moscow, Russia, [2]Ufa State Aviation Technical University, Ufa, Russia

P.S.C.6. **INITIAL STAGE OF MECHANICAL ALLOYING IN $Al_{99}{}^{57}Fe_{1}$ BINARY POWDER SYSTEM**
D.A. Kolodkin, A.L. Ulyanov, A.V. Protasov, E.P. Elsukov
Physical-Technical Institute, Izhevsk, Russia

P.S.C.7. **OPTICAL PARTICULARITIES OF WHOLE EXTRA-THIN MOLECULAR FILMS**
A.J. Šetrajčić-Tomić[1], D. Rodić[2], I.J. Šetrajčić[2], S.S. Pelemiš[3], J.P. Šetrajčić[2]
[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk 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

P.S.C.8. **SURFACE CHARACTERISATION OF MECHANOCHEMICALY ACTIVATED CARBON CLOTH**
A. Djukić[1], J. Grbović Novaković[1], Z. Stojanović[2], I. Milanović[1], R. Vujasin[1], S. Milošević[1], Lj. Matović[1]
[1]Laboratory of Materials Sciences, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia

P.S.C.9. **HYDROTHERMAIL SYNTHESIS AND CHARACTERIZATION OF BiFeO$_3$**
M. Čebela, M. Prekajski, J. Pantić, M. Omeraševič, B. Matović
Laboratory of Materials Sciences, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

P.S.C.10. **ELECTRON-BEAM SURFACE TREATMENT OF TITANIUM ALLOYS BY PLASMA FROM AN ELECTRICAL EXPLOSION OF CARBON FIBERS**
Yu.F. Ivanov, V.E. Gromov, N.A. Soskova, Yu.A. Denisova, A.D. Teresov, E.A. Petrikova, E.A. Budovskikh, S.V. Raikov, E.S. Vaschuk
Institute of High Current Electronics, Siberian Branch of Russian Academy of Sciences, Tomsk, Russia, National Research Tomsk Polytechnic University, Tomsk, Russia, Siberian State University of Industry, Novokuznetsk, Russia

P.S.C.11. **KINETICS FORMATION OF TiSi$_2$(C54) STABLE SILICIDE PHASES AT THERMOION DEPOSITION OF TI ON MONOCRYSTALLINE SI**
S.I. Bogdanov*, V.F. Mazanko, I.I. Bogdanov, F.V. Mazanko
G.V. Kurdyumov Institute for Metal Physics, N.A.S., Kyiv, Ukraine

P.S.C.12. **CRYSTALLIZATION BEHAVIOUR OF GLASS IN THE SYSTEM $Li_2O\cdot Al_2O_3\cdot GeO_2\cdot P_2O_5$**
S.D. Matijašević[1], M.B. Tošić[1], S.R. Grujić[2], V.D. Živanović[1], J.N. Stojanović[1], J.D. Nikolić[1], S.V. Smiljanić[2]
[1]Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.C.13. **ADSORPTION AND CATALYTIC INVESTIGATION OF MANGANESE OR COPPER DOPED ZnO NANOPARTICLES**
K.I. Milenova[1], P.M. Nikolov[2], N. Kasabova[2]
[1]Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria, [2]University of Chemical Technology and Metallurgy, Sofia, Bulgaria

P.S.C.14. **ELECTRODEPOSITION OF ANISOTROPIC METAL NANOPARTICLES**
E.R. Ivanović
Faculty of Agriculture, University of Belgrade, Zemun-Belgrade, Serbia

P.S.C.15. **CORRELATION BETWEEN STRUCTURAL CHANGES AND CHANGES IN MAGNETIC PROPERTIES OF NANOSTRUCTURAL Ni POWDER PERFORMED UNDER THERMAL CONDITIONS**
O. Pešić[1], B. Jordović[1], J. Stevanović[2], D. Sretenović[3], A. Maričič[1]
[1]Faculty of Technical Sciences, University of Kragujevac, Čačak, [2]Institute for Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, [3] Technical School of Professional Studies, Čačak, Serbia

P.S.C.16. **THERMOELECTRIC POWER IN GRAPHENE MONOLAYER**
S.K. Jaćimovski [1], D.I. Raković [2], J.P. Šetrajčić [3,*]
*[1]Academy of Criminalistic and Police Studies, Belgrade, Serbia, [2]University of Belgrade, Faculty of Electrical Engineering, Serbia, [3]University of Novi Sad, Faculty of Sciences, Department of Physics, Vojvodina – Serbia, *Academy of Sciences and Arts of the Republic of Srpska – B&H*

P.S.C.17. **EFFECT OF ELECTRODEPOSITION PARAMETERS AND ANNEALING TEMPERATURE ON MICROSTRUCTURE, MAGNETIC AND ELECTRICAL PROPERTIES $Ni_xFe_zW_z$ ALLOYS**
L. Ribić-Zelenović[1], N. Ćirović[2], P. Spasojević[3] A. Maričić[2]
[1]University of Kragujevac, Faculty of Agronomy, Čačak, Serbia, [2]University of Kragujevac, Faculty of Technical Sciences, Joint Laboratory for Advanced Materials of SASA, Čačak, Serbia, [3]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.C.18. **MAGNETIC PROPERTIES AND HARDNESS OF ELECTRODEPOSITED $Ni_xFe_yW_z$ ALLOY**
N. Ćirović[1], P. Mašković[2], L. Ribić-Zelenović[2], M. Spasojević[2]
[1]University of Kragujevac, Faculty of Technical Sciences, Joint Laboratory for Advanced Materials of SASA, Čačak, Serbia, [2]University of Kragujevac, Faculty of Agronomy, Čačak, Serbia

P.S.C.19. CORRELATION OF RELATIVE PLASTIC DEFORMATION DEGREE AND THERMOELECTROMOTIVE FORCE

I. Miličević[1], R. Slavković[1], A. Damnjanović[2]
[1]University of Kragujevac, Faculty of Technical Sciences, Čačak, Serbia, [2]Technical School of Professional Studies, Čačak, Serbia

SYMPOSIUM E: BIOMATERIALS

P.S.E.1. **TWO-STEP SINTERING, PHASE TRANSFORMATIONS, ELECTRICAL AND MECHANICAL PROPERTIES OF NANOSTRUCTURED BIOCERAMIC MATERIALS BASED ON HYDROXYAPATITE**
M.J. Lukić[1], Lj. Veselinović[1], Č. Jovalekić[2], S.D. Škapin[3], S. Marković[1], D. Uskoković[1]
[1]Centre for Fine Particles Processing and Nanotechnologies, Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Center for Multidisciplinary Studies, University of Belgrade, Serbia, [3]Jožef Stefan Institute, Ljubljana, Slovenia

P.S.E.2. **SELENIUM NANOPARTICLES FOR BIOMEDICAL APPLICATION**
N. Filipović, M. Stevanović, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

P.S.E.3. **RADIATION SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL APPLICATION OF NOVEL COPOLYMERIC SILVER/POLY(2-HYDROHYETHYL METACRYLATE/ITACONIC ACID) NANOCOMPOSITE HYDROGELS**
E. Suljovrujić, M. Mićić, T. Vukašinović Milić, D, Miličević
Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

P.S.E.4. **SELF-ASSEMBLED MICELLAR NANOPARTICLES OF A NOVEL BLOCK COPOLYMER BASED ON POLY-[2-(DIISOPROPYLAMINO)ETHYL METHACRYLATE (PDPA) CORE AND *N*-(2-HYDROXYPROPYL)METHACRYLAMIDE (HPMA) CORONA FOr pH-TRIGGERED DRUG RELEASE**
E. Jäger, F. Surman, A. Jäger, C. Rodriguez Emmeneger, Z. Sedlákova, P. Štepánek
Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, v.v.i., Prague, Czech Republic

P.S.E.5. **ANTIMICROBIAL ACTIVITY OF SOME NEW PLATINUM(IV) COMPLEXES**
I. Radojević[1], J. Vujić[2], O. Stefanović[1], M. Cvijović[2], Lj. Čomić[1], S. Trifunović[3]
[1]Department of Biology and Ecology, Faculty of Science, University of Kragujevac, Kragujevac, Serbia, [2]Faculty of Agronomy, University of Kragujevac, Ĉaĉak, Serbia, [3]Department of Chemistry, Faculty of Science, University of Kragujevac, Kragujevac, Serbia

P.S.E.6. **POLY (ETHYLENE OXIDE)/GRAPHENE/KERATIN NANOCOMPOSITES OBTAINED BY THE FUNCTIONALIZATION OF GRAPHENE ASSISTED ULTRASONIC IRRADIATION**
M. Grković[1], D. Stojanović[1], A. Kojović[1], I. Balać[2], S. Strnad[2], R. Aleksić[1], P.S. Uskoković[1]
[1]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Faculty of Mechanical Engineering, University of Maribor

P.S.E.7 **THE VIBRON EXCITATION TRANSFER BETWEEN TWO NEIGHBORING CHAINS IN ALPHA-HELICAL PROTEINS**
D. Čevizović[1,2]
[1]The Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia, [2]Joint Institute for Nuclear Research, Dubna, Russia

P.S.E.8. **ADVANCED COATINGS FOR MEDICAL IMPLANTS**
B. Butruk, P. Zietek, M. Trzaskowski, T. Ciach
Warsaw University of Technology, Faculty of Chemical Engineering, Warsaw, Poland

P.S.E.9. ***IN VITRO* ANTITUMORAL ACTIVITY OF PLATINUM(II) COMPLEXES WITH *O,O'*-DIALKYL ESTERS OF (*S,S*)-ETHYLENEDIAMINE-*N,N’*-DI-2-(4-METHYL)PENTANOIC ACID AGAINST MDA-MB-361, MDA-MB-453, JURKAT AND K562 CELL LINES**
J.M. Vujić[1], G.N. Kaludjerović[2], T.P. Stanojković[3], S.R. Trifunović[4]
[1]Faculty of Agronomy, University of Kragujevac, Čačak, Serbia, [2]Institut für Chemie, Martin-Luther-Univerität Halle-Wittenberg, Halle, Deutschland, [3]Institute for Oncology and Radiology of Serbia, Belgrade, Serbia, [4]Department of Chemistry, Faculty of Science, University of Kragujevac, Kragujevac, Serbia

P.S.E.10. **COMPARISON OF BIOCOMPATIBILITY OF THREE MATERIALS BASED ON POROUSE APATITE**
M. Aleksić[1], A. Žabar[1], J. Rajković[1], P. Vasiljević[1], Lj. Djordjević[1], Ž. Mitić[2], S. Najman[2]
[1]University of Niš, Faculty of Science and Mathematics, Department of Biology and Ecology, Niš, Serbia, [2]University of Niš, Faculty of Medicine, Institute of Biology and Human Genetics, Niš, Serbia

P.S.E.11. **BIOCOMPOSITES BASED ON HYDROXYAPATITE AND MONETITE**
O. Sych, N. Pinchuk, V. Skorokhod
Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine, Kyiv, Ukraine

P.S.E.12. **SILVER/HYDROXYAPATITE COATING ON PURE AND ANODIZED TITANIUM OBTAINED BY PULSED LASER DEPOSITION**

S. Eraković[1], A. Janković[1], C. Ristoscu[2], L. Duta[2], N. Serban[2], A. Visan[2], I.N. Mihailescu[2], G.E. Stan[3], M. Socol[3], O. Iordache[4], I. Dimitrescu[4], C.R. Luculescu[2], Dj. Janaćković[1], V. Mišković-Stanković[1]
[1]Faculty of Technology and Metallurgy, Belgrade, Serbia, [2]National Institute for Lasers, Plasma and Radiation Physics, Magurele, Romania, [3]National Institute of Materials Physics, Magurele, Romania, [4]National Institute for Textile and Leather, Bucharest, Romania

P.S.E.13. **CLICK CHEMISTRY FOR ATTACHMENT OF TARGETING MOIETIES TO POLYMER DRUG CARRIERS**

R. Pola, M. Pechar, K. Ulbrich
Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, v.v.i., Prague, Czech Republic

P.S.E.14. **ANALYSIS OF INFLUENCE OF STRAIN IN DRAWING PROCESS ON CORROSION PROPERTIES OF WIRES USED IN CARDIOLOGY**

J. Przondziono[1], W. Walke[2], J. Szymszal[1]
[1] Faculty of Materials Engineering and Metallurgy, Silesian University of Technology, Katowice, Poland, [2] Faculty of Biomedical Engineering, Silesian University of Technology, Zabrze, Poland

P.S.E.15. **IRON OXIDE NANOPARTICLES: SYNTHESIS, FUNCTIONALIZATION, AND POTENTIAL APPLICATION IN HYPERTHERMIA TREATMENT**

N. Jović[1], V. Spasojević[1], M.P. Calatayud[2], G.F. Goya[2]
[1]Vinča Institute of Nuclear Sciences, Laboratory of Theoretical and Condensed Matter Physics, University of Belgrade, Belgrade, Serbia, [2]Instituto de Nanociencia de Aragón and Departamento de Fisica de la Materia Condensada, Universidad de Zaragoza, Zaragoza, Spain

P.S.E.16. **CYTOTOXICITY ACTIVITY OF *O,O'*-DIALKYL ESTERS OF (*S,S*)-ETHYLENEDIAMINE-*N,N'*-DI-2-(4-METHYL)PENTANOIC ACID AND CORRESPONDING PALLADIUM(II) COMPLEXES AGAINST SOME TUMOR CELL LINES**

J.M. Vujić[1], G.N. Kaluđerović[2], T.P. Stanojković[3], S.R. Trifunović[4]
[1]Faculty of Agronomy, University of Kragujevac, Čačak, Serbia, [2]Institut für Chemie, Martin-Luther-Univerität Halle-Wittenberg, Halle, Deutschland, [3]Institute for Oncology and Radiology of Serbia, Belgrade, Serbia, [4]Department of Chemistry, Faculty of Science, University of Kragujevac, Kragujevac, Serbia

P.S.E.17. **ANTIOXIDANT AND ANTI-CANCER POTENTIALS OF *LAVATERA THURINGIACA* L. EXTRACTS**
P.Z. Mašković[1], M. Radojković[2], V. Veličković[3], S. Solujić[4]
[1]Faculty of Agronomy, University of Kragujevac, Čačak, Serbia, [2]Department of Biotechnology and Pharmaceutical Engineering, Faculty of Technology, University of Novi Sad, Novi Sad, Serbia, [3]Food Catering School, Čačak, Serbia, [4]Faculty of Science, University of Kragujevac, Kragujevac

P.S.E.18. **SUITABILITY OF CONTACT AFM IN INVESTIGATION OF RGP CONTACT LENSES**
I. Djuričić[1], I. Hut[1], B. Bojović[2], D. Stamenković[3], I. Mileusnić[1], A. Debeljković[1], Dj. Koruga[1]
[1]NanoLab, Faculty of Mechanical Engineering, University of Belgrade, Serbia, [2]Department of Production Engineering, Faculty of Mechanical Engineering, University of Belgrade, Serbia, [3]Optix, d.o.o, Zemun, Serbia

P.S.E.19. **EARLY DETECTION OF EPITHELIAL TISSUES CANCER BASED ON OPTO-MAGNETIC IMAGING SPECTROSCOPY AND ARTIFICIAL INTELLIGENCE ALGORITHMS**
I. Hut[1], A. Dragičević[1], B. Jeftić[1], G. Nikolić[1], I. Djuričić[1], M. Marjanović[2], L. Matija[1]
[1]Biomedical Engineering, Faculty of Mechanical Engineering, University of Belgrade, Serbia, [2]Faculty of Dental Medicine, University of Belgrade, Serbia

P.S.E.20. **POTENTIODYNAMIC TESTS OF X10Cr-Ni 18-8 STEEL IN ARTIFICIAL PLASMA**
W. Walke[1], J. Przondziono[2]
[1]Faculty of Biomedical Engineering, Silesian University of Technology, Zabrze, Poland, [2]Faculty of Materials Engineering and Metallurgy, Silesian University of Technology, Katowice, Poland

P.S.E.21. **METAL ION RELEASE FROM TITANIUM AND COBALT-BASED ALLOY FOR DENTAL APPLICATION**
I.D. Dimić[1], N.S. Tomović[1], I.Lj. Cvijović-Alagić[2], M.P. Rakin[3], B.M. Bugarski[3]
[1]University of Belgrade, Innovation Centre of the Faculty of Technology and Metallurgy, Belgrade, Serbia, [2]University of Belgrade, Institute of Nuclear Sciences „Vinča“,Belgrade, Serbia, [3]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.E.22. **NANOPARTICLES Ca/Co-HAp IN THE TREATMENT OF WEAKENED BONES JAW TEGMENTA**

Z. Ajduković[1], N. Ignjatović[2], N. Petrović[1], J. Rajković[3], D. Kenić-Marinković[1], S. Najman[4], D. Uskoković[2]
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P.S.E.23. **EFFECT OF AMNIOTIC FLUID ON SWELLING AND CONTROLLED RELEASE PROPERTIES OF HYDROGELS BASED ON ITACONIC ACID**

M.M. Babić, J.S. Jovašević, J.M. Filipović, S.Lj. Tomić
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.E.24. **SCANNING ELECTRON MICROSCOPY STUDY OF CHANGES IN NANOPARTICLES SURFACE UNDER *IN VITRO* SIMULATED PHYSIOLOGICAL CONDITIONS**

S. Stojanović[1], Ž. Mitić[2], S. Najman[1], N. Ignjatović[3], D. Uskoković[3]
[1]University of Niš, Faculty of Medicine, Institute of Biology and Human Genetics, Niš, Serbia; [2]University of Niš, Faculty of Medicine, Department of Pharmacy, Niš, Serbia; [3]Institute for Technical Sciences of the SASA, Belgrade, Serbia

P.S.E.25. **GRAFT-COPOLYMERS OF CHITOSAN AND LACTIDE: SOLID-STATE SYNTHESIS AND APPLICATION FOR TISSUE ENGINEERING**

T. Demina, T. Akopova, A. Zelenetskii
Enikolopov Institute of Synthetic Polymer Materials, Russian Academy of Sciences, Moscow, Russia

Abstracts

Oral Presentation

PL.S.I.1.

ATOMIC-LAYER ENGINEERING AND PHYSICS OF CUPRATE SUPERCONDUCTORS

I. Božović
Brookhaven National Laboratory, Upton, NY, USA

We use atomic-layer-by-layer molecular beam epitaxy (ALL-MBE) to synthesize atomically perfect films, multilayers and superlattices of cuprates and other complex oxides. In this talk, I will review our recent experiments on such films and superlattices that probe the basic physics of high-temperature superconductivity (HTS).

Some key questions in HTS physics - about the dimensionality, relevant interactions, the roles of (in)homogeneity and fluctuations – are answered as follows.

(i) A single CuO_2 plane can be superconducting, with T_c higher than in the bulk.
(ii) HTS and anti-ferromagnetism separate on the scale of 1 Å in space and 1 eV in energy, while the pseudo-gap and HTS states mix on the 1,000 Å length scale ("Giant Proximity Effect").
(iii) Charge-density waves, static or fluctuating, occur in underdoped cuprates but not at optimum doping; HTS cuprates can be quite homogeneous.
(iv) *In-plane* charge excitations are strongly coupled to *out-of-plane* lattice vibrations.
(v) Strong *phase* fluctuations drive the SC transition, but 10-15 K above T_c they fade out.

Torchinsky et al., *Nature Materials* (2013); Dean et al., *Nature Materials* 12, 47-51 (2013); X. Shi et al., *Nature Materials* 11, 850-4 (2012); Bollinger et al., *Nature* 472, 458 (2011); Bilbro et al., *Nature Physics* 7, 298 (2011); Morenzoni et al., *Nature Comm.* 2, 272 (2011); Sochnikov et al., *Nature Nanotech.* 5, 516 (2010); Logvenov et al., *Science* 326, 699 (2009); Gozar et al., *Nature* 455, 782 (2008); Gedik et al., *Science* 316, 425 (2007); Bozovic et al., *Nature* 422, 873 (2003); Abbamonte et al., *Science* 297, 581 (2002).

PL.S.I.2.

ADVANCED MATERIALS FOR INFORMATION TECHNOLOGY – CHALLENGES TO MATERIALS SCIENCE AND ENGINEERING

E. Zschech
Fraunhofer Institute for Nondestructive Testing, Dresden, Germany

Both information theory and physics build the fundament for information technology (IT). More than ever before, the dramatic productivity enhancement of the IT requires applications with significantly increased electrical and optical functionality. The IT hardware relies on the continuous shrinking of feature sizes in electronic and photonic devices, but also on the introduction of new materials and design concepts. Materials and particularly functional nanomaterials are playing a key role for performance improvement and for novel multifunctional applications. It is expected that nanoscale materials will fundamentally change products and manufacturing processes over the next two or three decades.

An overview of current status, recent developments and research activities in the field of materials used for IT, with a particular emphasis on future scenarios, will be provided. Latest results in materials science and engineering as well as for a wide range of applications in industry will be covered, including synthesis of thin film and nanoscale materials, their structure and properties.

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. It is expected to lead to an industry paradigm shift due to its numerous benefits. 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. Managing materials compatibility and internal mechanical stress is a key task to ensure high performance and high reliability of products manufactured in advanced nodes of CMOS-based semiconductor technology. The role of materials science and engineering for the deployment of new technologies like 3D IC integration will be demonstrated.

PL.S.I.3.

THE 787 BATTERY CRISIS: A MATERIALS PERSPECTIVE

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In January, 2013, all Boeing 787 aircraft were removed from service due to safety concerns arising from a series of incidents involving the lithium ion batteries used to provide backup power for important operational functions. This is the first large-scale use of lithium ion batteries in a commercial airliner. The materials chosen to build these batteries and their specific design features led directly to the observed failures, and could easily have been predicted and avoided. Details of the materials and design will be discussed. After four months of investigation and retrofitting of the existing aircraft, they are flying again. The “fix” applied to obtain permission to return to service will be also be described and evaluated.

PL.S.I.4.

NEW OPPORTUNITIES AND CHALLENGES IN CHROMATIC ABERRATION CORRECTED AND IN SITU TRANSMISSION ELECTRON MICROSCOPY

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Transmission electron microscopy (TEM) has been revolutionised in recent years by the introduction of new hardware such as field-emission electron guns, aberration correctors and *in situ* stages and by the development of new techniques, algorithms and software that take advantage of increased computational speed and the ability to control and automate modern electron microscopes. Chromatic aberration (C_C) correction of the TEM objective lens, in particular, promises to provide improved spatial resolution and interpretability when compared with the use of spherical aberration (C_S) correction alone, primarily as a result of improvements to the temporal damping envelope of the objective lens, especially at lower accelerating voltages. In this talk, I will present a selection of recent results obtained from low-dimensional and self-assembled materials using a Titan Ultimate transmission electron microscope equipped with a high brightness electron gun, a monochromator and a combined objective lens spherical and chromatic aberration corrector. I will also outline prospects and challenges for recording local variations in magnetic induction and electrostatic potential in nanomagnets and semiconductor devices with improved sensitivity and spatial resolution using off-axis electron holography. The results will be used to illustrate the following benefits of C_C correction in the TEM. First, the reduced dependence of image resolution on energy spread in a C_C corrected TEM offers benefits for conventional bright-field and dark-field imaging as a result of the decreased influence of inelastic scattering on spatial resolution. Second, less refocusing is necessary when moving between regions of different specimen thickness, which promises to be advantageous for electron tomography of thick specimens. Third, C_C correction allows large energy windows and objective aperture sizes to be used to achieve close-to-atomic-resolution energy-filtered TEM. Fourth, combined C_S and C_C correction of the Lorentz lens of the TEM allows images to be recorded in magnetic-field-free conditions, with the conventional microscope objective lens switched off, with a spatial resolution of better than 0.5 nm. When combined with electron tomography, advances in specimen preparation, off-axis electron holography and automated image acquisition, these instrumental and methodological developments promise to lead to new and improved approaches for characterizing the positions, chemical identities, electronic structures, magnetic moments and electrostatic potentials of individual atoms, ultimately in three dimensions. They also offer the prospect of making use of combined C_S and C_C correction in transmission electron microscopes that are equipped with much larger objective lens pole-piece gaps, in order to allow structural and chemical imaging without substantial loss of spatial resolution while subjecting the specimen to multiple stimuli and making use of new types of detector, to achieve a true laboratory in the electron microscope.

PL.S.I.5.

ENVIRONMENTAL TRANSMISSION ELECTRON MICROSCOPY (ETEM)

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One of the most dramatic changes recently in *in situ* TEM publications has been an approximate doubling in their number. This is mostly associated with the advent of specialty specimen holders for gaseous and liquid environments as well as the installation of several new ETEM's worldwide [1]. This technique will be reviewed and recent applications discussed. Our own studies have focused on simple reactions with a single pure gas.

Hydrogen storage is promising for possible future energy applications, and so the reaction of hydrogen gas with candidate materials has fundamental importance. Following prior work on hydrogenation of magnesium/palladium thin films [2], we have extended this investigation to the hydrogenation of magnesium films with palladium nanoparticles. The formation of magnesium hydride in the ETEM is demonstrated, as is the utility of a new vacuum transfer specimen holder.

Likewise, the oxidation of matter is a basic process with broad implications. Here we demonstrate *in situ* observations of the oxidation of carbon nanotubes being developed as field emission sources for X-ray medical imaging purposes. The oxidation mechanism is quite different than had been previously proposed but is easily demonstrated by the ETEM [3].

In both these studies, a protocol has been established whereby any possible influence of the imaging electron beam is avoided, and our procedures will be discussed.

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PL.S.I.6.

ATOMISTIC VIEW OF FRICTIONLESS SLIDING IN GOLD THIN FILMS

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While macroscopic friction phenomena are well known, we have very little or almost no understanding of friction phenomena at atom scale. In this study, the structure of an incommensurate 90°<110> tilt grain boundary in gold was characterized by atomic resolution aberration-corrected electron microscopy and compared with atomic simulations. This boundary is incommensurate because the repeat periods of the (001) and (110) planes of the two grains that are aligned across the interface are in the ratio of $1:\sqrt{2}$. The boundary was imaged using a freestanding bicrystal thin film prepared by physical vapor deposition of high purity gold onto a sacrificial {100} Ge substrate. The non-symmetric, non-periodic structure of this boundary can be described by Aubry hull functions, which plot atomic relaxations at the core of the boundary relative to an unrelaxed structure. By measuring the hull functions from atomic resolution images, we were able to make quantitative comparisons of experimental observations with molecular static simulations of this boundary and correlate its atomic structure with frictionless sliding conditions.

O.S.A.1.

ROUTES AND PATHWAYS TO SMALL PARTICLES BASED ON HYDROXYAPATITE

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Nanoparticles based on hydroxyapatite (NPs) have many useful physicochemical and biological properties, such as easy preparation and modification, as well as biocompatibility, which make them suitable for transport and unloading of various pharmaceuticals. Hydroxyapatite nanoparticles coated with bioresorbable polymers have been successfully used as carriers of antibiotics and vitamins in bone tissue engineering.

In this study, we have investigated the synthesis of nanoparticles of hydroxyapatite and hydroxyapatite coated with chitosan and the chitosan-poly-D,L-lactide-co-glycolide polymer blend. The influence of the processing technique on the structure and characteristics of the obtained particles was studied by X-ray diffraction (XRD), particle size distribution analysis (PSD), Fourier transform infrared spectroscopy (FTIR), zeta potential analysis (ZP) and scanning electronic microscopy (SEM). In applied research, an appropriate radioisotope (Iodine-125) was selected and it was used to label particles. The *in vivo* biodistribution of ^{125}I-labeled particles were studied in healthy Wistar rats following intravenous administration.

The XRD, FT-IR and ZP analyses have confirmed that the hydroxyapatite particles with d50=72 nm are coated with chitosan and the chitosan-poly-D,L-lactide-co-glycolide polymer blend. ^{125}I-labeled particles showed completely different behaviour *in vivo*: hydroxyapatite particles have the highest liver accumulation 10 min after injection but rapid excretion from the body without residual radioactivity 24 hours after injection; chitozan coated hydroxyapatite particles have the highest accumulation in the liver 10 min after injection with considerable amount (almost 50 %) retained 24 hours later; hydroxyapatite particles coated with the chitosan-poly-D,L-lactide-co-glycolide polymer blend have the highest uptake in the lungs 10 minutes after injection and moderate retention in the same organ 24 hours later.

O.S.A.2.

OSTEOBLASTIC INTERACTIONS WITH THE TOPOGRAPHICALLY DISTINCT POLY(ε-CAPROLACTONE)/HYDROXYAPATITE THIN FILMS

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Methods used to synthesize advanced materials can be roughly divided to two categories: top-down and bottom-up. Both of these approaches to synthesis of fine structures suffer from inherent weaknesses, such as relative robustness, expensiveness and massive equipment in the case of the former and difficult integration of products into device components in the case of the latter. Probing of the middle-ground synergies between the two, which may help to overcome each other's downsides, are thus of vital importance for the field of materials science and engineering and present an important aspect of this study. Topographical cues for an optimal cell/material interface are also a significant consideration in the design of biomaterials at the molecular scale. Studied was the effect of the topographic variations of poly(ε-caprolactone)/hydroxyapatite (PCL/HAp) films on viability, proliferation, migration and osseogenesis of fibroblastic and osteoblastic cells cultured on them. To that end, we compared three different micropatterned PCL/HAp films: flat and textured, the latter of which included films comprising periodically arranged and randomly distributed topographic features. PCL/HAp films were fabricated by the combination of a bottom-up, soft chemical synthesis of the ceramic, nanoparticulate phase and a top-down, photolithographic technique for imprinting fine, microscale features on them. Scanning electron microscopy and X-ray diffraction were used for morphological and structural characterization of the films. Cell viability tests based on quantifying the mitochondrial activity were used to assess the biocompatibility of the films *in vitro*, while real-time polymerase chain reaction analysis was performed to look at the effect of topography on the expression of osteogenic markers that included collagen type I, osteocalcin, osteopontin, alkaline phosphatase and the transcription factor, Runx2.

O.S.A.3.

HIGH SURFACE AREA GOLD MICRO-ELECTRODES FOR SENSING AND FUEL CELL APPLICATIONS

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Nanoporous gold (nPG) electrodes are a novel and very promise material, because of their very large specific surface area, high electrocatalytic activity, conductivity, biocompatibility and ease with which they can be functionalized [1-2].

In my group we implement a fast (up to 20 seconds) easy and low-cost fabrication protocol that involves the direct electroplating of a nPG film onto the surface of gold micro-electrodes *via* a hydrogen bubble template.

The resulting electrodes show very high electro-oxidation activity towards glucose, with sensitivity up to 5 μM, which makes it suitable for healthcare applications. We have also achieved the electro-adsorption of redox enzymes, such as glucose oxidase and laccase, onto the nPG electrode surface that allows the direct electron transport from the enzyme redox centre to the electrode. We are currently testing these bio-electrodes for power generation in a microfluidic enzymatic biofuel cell.

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O.S.A.4.

SYNTHESIS AND CHARACTERIZATION OF COLLOIDAL MANGANESE CARBONATE AND OXIDE PARTICLES BY BIOMIMETICALLY INDUCED NANOSTRUCTURED PROCESSES

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A novel precipitation processes, effectuated through catalytic decomposition of urea by using enzyme urease in a solution of manganese salt, was employed to precipitate colloidal nanostructured spherical and micron-sized manganese carbonate particles. The obtained precipitates were additionally, by thermally control process, transformed into structurally and morphologically different manganese oxides solids including MnO, Mn_2O_3 and Mn_3O_4. The effects of various experimental conditions on their formation such as the temperature, aging time, in air and reducing atmosphere were investigated. The structure and morphology of the obtained precipitates were investigated using X-ray diffraction (XRD) and scanning electron microscope (FESEM), the particle size by dynamic light scattering (DLS) technique and the specific surface area and porosity by BET method. It was found that the formation of different manganese oxides exhibiting novel surface properties and unusual and fascinating morphologies can be obtained from biomimetically precipitated manganese carbonate after thermal process. The results of this study may lead to conceptually new method for the synthesis of high-performance nanostructured manganese carbonate and oxide solids of desirable structural, morphological and surface properties.

O.S.A.5.

EDXS/EELS/TEM ANALYSES OF SMALL AMOUNTS OF HEAVY RARE EARTHS (Dy,Tb) IN Nd–Fe–B-BASED MAGNETS

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The heavy rare earths (HREs) that partially replace the Nd in the grain-boundary diffusion process have a large, positive influence on the coercivity of the whole Nd–Fe–B-based magnet. Therefore, their reliable quantification is essential for optimising hard-magnet processing. However, the analysis of HREs (Dy, Tb) in small amounts in hard magnets on the nanoscale is challenging, not only because of the limitations due to the analytical detection limits, but also because of the strong signal overlap that is found in EDXS and EELS. In this study we report on the possible pitfalls of the related measurement techniques. The study yielded a step-by-step procedure for correctly assessing the true concentration of the HREs in a TEM by applying a correlated EDXS and EELS analytical procedure.

O.S.A.6.

STRUCTURE AND PROPERTIES OF THE CERMET ON THE BASIS OF NiO-Fe_2O_3-Cr_2O_3-Cu SYSTEM

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Inert anodes based on NiO-Fe_2O_3-Cr_2O_3-Cu system was produced by solid phase synthesis and analyzed by differential scanning calorimetry, X-ray diffraction and X-ray spectral microanalysis. The dependences of structure and properties of the cermet from the particle size of the initial components of the charge, compacting pressure of samples and synthesis temperatures were revealed. Phase composition of the cermets consists of the solid solution of $NiFe_2O_4$-$NiCr_2O_4$ spinel and metallic copper. Samples of cermets were tested by electrolysis. Changes in the composition and structure of the composite anode during electrolysis were caused by the interaction with the oxide-fluoride KF-NaF-AlF_3-Al_2O_3 melt and with the oxygen evolved at the anode. (Work was financially supported by the Ministry of Education and Science of the Russian Federation (GK № 14.515.11.0017) and Integration Project (12-I-3-2056)).

O.S.A.7.

MICROSTRUCTURE OF CAST HEUSLER ALLOYS

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Heusler alloys seem to be the material of choice for many applications, due to their tunable electronic structure, which makes the design of desirable properties, ranging from half-metallic ferromagnets over completely compensated ferrimagnets to nonmagnetic semiconductors and even superconductors, possible. In the last few years, new areas of applications emerged, comprising environmental technologies, as thermoelectrics and solar cells. Very recently, the discovery of topological insulators, a new quantum state of matter, opened the door to technologies of the future with unimagined possibilities for Heusler compounds. In this contribution the structure of Heusler alloys of Ni2MnGa, Ni2MnSn, Ni2ZrSn, Ni2ZrSb, Ni2ZrGe, Co2MnAl type solidified in an arc melting furnace, after casting to copper mould and after melt spinning was studied by optical and electron microscopy 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 a cellular solidification in all cases of casting. Preferential orientation of grown crystals in melt spinned samples was characterised by EBSD analyses.

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O.S.A.8.

PREPARATION AND CHARACTERIZATION OF Pt/TiO_2 CATALYST ELABORATED ON SILICON WAFER FOR CO OXIDATION CATALYST APPLICATION

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From the surface of planar silicon wafer, some catalyst systems are elaborated on silicon surface using MOCVD process. Among them, the system which contained the Platinum nano-particles (diameter < 5nm) distributed on a porous TiO_2 anatase thin film is considered as the most interesting system due to it sensibility and it reactivity as a carbon monoxide oxidation catalyst at temperature range of 70°C-200°C.The characterization results showed the influence of catalyst preparation step (TiO_2 deposition, Pt deposition, platinum particle size, metal loading..) into the final reactivity of catalytic system.

O.S.A.9.

ATOMIC FORCE MICROSCOPY AS A POWERFUL TOOL OF SURFACE NANO- AND MICROSCALE CHARACTERIZATION

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Atomic force microscopy (AFM) was found to be very powerful tool for the surface characterization of complex systems, so that current nano- and micro-scale characterization of complex polymer and related systems is unimaginable without AFM analysis. AFM analysis of continuous polymer and polymer-based materials (biopolymers, organic inorganic nanocomposites), either 2D films i.e., *material surface property determination*, or 3D products after previous treatment (either freeze-fracturing or cryo-cutting), i.e., *material 'bulk' property determination* will be discussed. In the case of particulate material, AFM allows gaining the info about *particle shape, size, heterogeneity*, etc. on the conditions that the particles are small enough (size of nm up to units of μm). In the case of bigger particles (grainy and sandy materials), information about local *surface roughness, homogeneity***,** possible *treatment efficiency* is available from AFM analysis.

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O.S.A.10.

DEFECT STRUCTURE AND REACTIVITY OF NANOSIZED MoO_3, PREPARED BY MECHANOCHEMICAL METHOD

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The regularities of MoO_3 nanoparticles formation under mechanical activation and its chemical properties were analyzed. Mechanical activation was carried out in the vibrating mill in inert atmosphere with/without liquid additives (hexane). The structure of activated samples was investigated by the methods of XRD, SEM, AFM, ESR, Raman spectroscopy, DTG and adsorption. Mechanical activation of MoO_3 leads to the formation of MoO_3 nano dimension particles (close to 60 nm), dislocation, points defects (Mo^{5+}, “weak” Mo=O bonds, etc.), and amorphous phase. The kinetics of different defects formation and its thermal stabilities were compared. Reactivity was checked in the reaction with hydrogen, water and solid Mg. The amorphous phase is dissolved in water. The properties of “weak” Mo=O bonds was checked under the reaction with H_2. This work was partly supported by RFBR (nn 12-03-00651a and 13-03-01124a), and Program No 8 of Grants of Presidium RAS.

O.S.A.11.

FORMATION OF NANOSIZE STRUCTURE PHASE STATES ON Ti SURFACE BY ELECTROEXPLOSIVE CARBOBORATING

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The formation of structural-phase states in Ti surface layer during electroexplosive carboborating was carried out by methods of scanning and transmission diffraction electron microscopy. The electroexplosive carboborating leads to a significant (up to 12 times) increase in microhardness of the titanium irradiated surface. The analysis of the coating structure (~10 μm) has revealed the presence of the following phases: graphite in the quasiamorphous state, nanosized (5-50 nm) precipitations of titanium boride of TiB composition, β-titanium, α-titanium crystals of plate morphology (40-350 nm), titanium carbide particles (15-25 nm) located in the α-Ti structure.

This work has been performed by the partial financial support of RFBR grant (project No11-02-91150-GFEN_a) and Government task No 2.4807.2011.

O.S.B.1.

NEW P- AND N-TYPE SKUTTERUDITES WITH ZT>1 AND PRACTICALLY IDENTICAL THERMAL EXPANSION AND MECHANICAL PROPERTIES

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Thermoelectric (TE) conversion of waste heat into useful electricity faces a number of challenges. It demands not only optimised thermal and electrical transport properties resulting in a high figure of merit ZT and a high thermal-electric conversion efficiency η over a wide temperature range, but also sufficient mechanical integrity to survive continuous heating/cooling cycles. Thermal expansions of the material as well as mechanical properties play an important role; their values should be as similar as possible for p- and n-type alloys to avoid stresses when used in a TE device. In this paper multifilled p-and n-type Fe/Ni substituted Sb-based skutterudites with ZT>1 and η>13% are presented, showing, in contrary to hitherto investigated skutterudites, for the first time practically identical thermal expansion coefficients and elastic moduli.

O.S.B.2.

NEW COMPOUNDS REPt$_3$B$_x$: FORMATION AND PHYSICAL PROPERTIES

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In this work we report on the new $CaTiO_3$-type $REPt_3B_x$ compounds which were obtained in single-phase conditions in the systems {Eu, Yb, Lu}-Pt-B. While $YbPt_3B_x$ and $LuPt_3B_x$ phases form directly from the melt, the single phase Eu-type perovskite was obtained after heat treatment of alloys at 750 ºC for two weeks. Precise lattice parameters calculations from X-ray powder diffraction data revealed a different degree of B filling of the $AuCu_3$-type octahedral sites in {Eu,Yb,Lu}Pt_3B_x. Specific heat, magnetic susceptibility and electric resistivity have been measured for ytterbium and europium platinum boride in the temperature region between 0.4 and 300 K; $LuPt_3B_x$ was used as non-magnetic analogue for physical properties evaluations. Measurements revealed a strong influence of Kondo interactions in case of Yb. For Eu compound magnetic ordering was observed around 40 K.

O.S.B.3.

PHASE EQUILIBRIA AND CRYSTAL STRUCTURE OF COMPOUNDS IN THE RE BORIDE SYSTEMS WITH NOBLE METALS (RE = Ce, Eu, Yb)

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Phase equilibria were determined in the systems {Ce, Eu, Yb}-Pt-B at 750 ºC and Ce-Ir-B at 800 ºC in the RE-poor concentration ranges employing X-ray single crystal and powder diffraction. The formation of 9, 9 and 5 compounds have been observed in the Ce, Eu and Yb platinum boride systems respectively. Both {Ce, Eu}-Pt-B systems exhibited some similarities with the RE-Ni-B due to the formation of an abundance of compounds structurally derived from the $CaCu_5$-type while the Yb-Pt-B system at 750 ºC showed different type of phase relationships. Initial evaluation of phase relations and crystal structure of compounds in the Ce – Ir – B system confirmed the existence of 4 ternary phases. Structural features of the new ternary borides and phase relationships in the ternary systems RE-Pt-B (RE=Ce, Eu, Yb) and Ce-Ir-B will be discussed.

O.S.B.4.

THE MECHANISM AND KINETICS OF PHOSPHORUS SEGREGATION IN THE GRAIN BOUNDARIES OF PRESSURE VESSEL STEEL AT 280 – 320 °C

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In the temperature range 280 - 320 °C the phosphorus segregation in grain boundaries is one of the factors influencing safety and service life of nuclear power reactors. Grain boundary segregations (GBS) of phosphorus lead to the temper embrittlement of steel and deteriorate the strength and other mechanical properties of a reactor pressure vessel. It was found that the theoretical model of GBS by Langmuir-McLean not correctly describes the experimental results at temperatures below 400 °C. This mainly follows from the fact that volume diffusion is very small at low temperatures, however experimentally measured kinetics of GBS exceeds the estimates made in the framework of Langmuir-McLean model. For this reason the aim of the present work was an experimental study of phosphorus GBS at low temperatures and the quantitative description of segregation process taking into account a real structure of steel: presence of phase inclusions and dislocation network. We used a unique experimental data on the kinetics of GBS for the time up to up to $2 \cdot 10^5$ hours (~ 23 years), which made it possible to offer a more adequate models that take into account the real structure of steel were process of phosphorus segregation consists of several stages: phosphorus segregation in grain boundaries, phosphorus segregation at the interface of carbide precipitates, phosphorus segregation in the dislocation networks and redistribution of phosphorus between these structural components due to grain boundary diffusion and diffusion in dislocation networks. It is shown that the proposed theoretical models describe the experimental kinetics of phosphorus segregation with sufficient accuracy and can be used for evaluation the degradation of mechanical properties of reactors pressure vessel steels.

O.S.B.5.

RAMAN “FINGERPRINT” OF THE LONSDALEITE

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We report the results of the Raman study of the polycrystalline powder of the graphite-diamond– lonsdaleite system. We show that the Raman spectrum is proportional to the phonon density of states of the diamond– lonsdaleite system. So the Raman observation of modes at 670, 990, 1120, 1225 and 1306 (the shoulder) cm $^{-1}$ is an indicator of the presence of lonsdaleite layers. The 1225 line is prominent in the spectrum and it is the “fingerprint” of lonsdaleite in the diamond –lonsdaleite system. TEM and X-ray diffraction analysis confirmed formation of layered graphite- diamond –lonsdaleite structure with very thin stacking layers of diamond and lonsdaleite. From X-ray diffraction data the number of layers of diamond and lonsdaleite is approximately equal.

O.S.B.6.

MAGNETIC AND STRUCTURAL PROPERTIES OF ANTIMONATES AND NIOBATES OF 3d-ELEMENTS WITH DOUBLE PEROVSKITE STRUCTURE

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The multiferroic behaviour of $Sr_2B,B,,O_6$ double perovskites has been attracted great interest due to their potential magneto-electronic applications. The focused combination of various d- and p-elements in B positions of crystal structure provides an opportunity to create new variants of electronic ordering and regulates the properties of ceramics. Here, we present the results of synthesis the bulk $Sr_2MSb(Nb)O_6$ (M − Sc, Cr, Mn, Fe) and its solid solutions in diamagnetic Sr_2AlSbO_6. The characterization of samples by XRD, SEM, TGA/DSC, XPS and magnetic susceptibility methods has demonstrated the undoubted presence of the temperature-dependent distortions of structure and local ordering regions of 3d-atoms. Moreover, the various characters of exchange interactions and the coexistence of these atoms in low- and high spin states are very important factors for understanding of the complex properties of such ceramics.

O.S.B.7.

KINEMATICS DRIVING FORCES OF A DAMAGE ZONE IN A BRITTLE MATERIAL

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In this study, kinematics of the Damage Zone (DZ) or the so-called Fracture Process Zone (FPZ) which often precedes the crack during its propagation and characterized by few degrees of freedom (elementary movements) such as translation, rotation, isotropic expansion and distortion are considered. On the basis of a stress field distribution obtained by the use of a Semi-Empirical Approach (SEA), which relies on the Green's functions, these driving forces corresponding to the mentioned degrees of freedom are formulated within the framework of the plane problem of elastostatics. Thus, expressions for translation (J), isotrope expansion (M), distorsion (N) and interactions effects representing the active parts of crack driving forces known as energy release rates are formulated in a purely theoretical context.

A number of theoretical models have been proposed for the description of a stress field and kinetics of a damage zone. The traditional one identifies the DZ as a plastic zone and uses the well developed technique of the plasticity theory for the determination of its size, shape, energy release rates etc… According to recent experimental results, some damage patterns do not yield any model of plasticity and the shape of the DZ can be difficult to model. Then, a plasticity critera is not adequate for damage characterization. However, elastoplastic solution is currently employed due to the lack of other approaches.

Throughout this study, a Semi Empirical Method (SEM) is proposed for evaluating the stress field and the different energy release rates. This approach is based on the representation of displacement discontinuities by means of the Green’s function theory. This latest has been used in a purely theoretical context. Herein, we suggest a more realistic model (arbitrary orientations of discontinuities rather than rectilinear ones) for which the result can be obtained using the experimental data and thus avoiding the difficulties of analytical solutions.

O.S.B.8.

PREPARATION OF STYRENE-(ETHYLENE-BUTYLENE)-STYRENE (SEBS) BASED COMPOSITE POLYELECTROLYTE MEMBRANES FOR FUEL CELL APPLICATIONS

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SEBS (styrene-(ethylene-butylene)-styrene) is a triblock copolymer exhibiting both thermoplastic and elastomeric properties. In case of functionalization via sulfonic acid groups (SO_3H) with a suitable method, a proton conductive polyelectrolyte membrane (PEM) for use in fuel cell applications could be prepared by a SEBS triblock copolymer.

In this study, SEBS films were prepared by extrusion and then hot-pressing of three different blends of SEBS, PP and Wax having mixing ratios of 35% SEBS, 24% PP, 40% Wax, 1% Stabilizer as the first blend, 35% SEBS, 10% PP, 54% Wax, 1% stabilizer as the second blend with a code of 35S and 67.5% SEBS, 5% PP, 27% Wax, 0.5% stabilizer as the third blend with a code of 68S, respectively. First blend was not utilized because of its high shrinking tendency at the end of hot-pressing. Proton conductivity was achieved by sulfonation with 0.9 M chlorosulfonic acid at different reaction times resulting in polyelectrolyte membranes having different sulfonation degrees.

The hardness of the proton conducting membranes was observed to increase with the sulfonation degree, and no deformation or disintegration occurred in the microstructure of the membranes, which was by SEM characterization. All proton conducting sides were found to be homogeneously dispersed within the membrane as a result of Confocal Raman Spectroscopy analysis. Resulting polyelectrolyte membrane thicknesses were 60 µm for 35S (second blend) and 125 µm for 68S (third blend).

Value of proton conductivity of 35S at 25 ºC ranged between 6 and 19 mS/cm which disappeared when the temperature of the cell was increased to 75-80 ºC. This was attributed to the drying of 35S membranes at the operating temperature of fuel cell. As to 68S, only 45 min (87.3 % sulfonation) and 60 min (76.4 % sulfonation) sulfonated membranes gave high proton conductivity values of 432 and 405 mS/cm at 25 ºC respectively, and they remained at the operating temperature of the cell on 26 and 44.2 mS/cm level without drying which was very close to Nafion117 (37mS/cm).

O.S.B.9.

INFLUENCE OF TECHNOLOGICAL PARAMETERS ON A QUALITY OF ATMOSPHERIC PLASMA SPRAYED COATINGS

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This work is focused on evaluation of quality of hard Al_2O_3+TiO_2 coatings produced by means of atmospheric plasma spraying (APS) technique. The different technological process parameters like plasma torch distance and angle, gas flow rate, voltage and current, and particle size was used to coating deposition. Above mentioned parameters were monitored during spraying using Tecnar Accuraspray G3C (direct powder velocity - DPV) unit. Main interest of the contribution was focused on a quality of resulting coating microstructure, where the amount of unmelted particles, microcracks and porosity at inter-splat regions were in detail. Based on the results gained from DPV system, light microscopy and scanning electron microscope equipped with energy dispersive microanalyzer will be decided, which technological parameters provide the most optimal conditions for deposition of Al_2O_3+TiO_2 coating by means of APS technique.

O.S.B.10.

VANADIUM DOPED TiO_2 COATINGS FORMED BY PLASMA ELECTROLYTIC OXIDATION AS A PHOTOCATALYST FOR DEGRADATION OF ORGANIC POLLUTANTS

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In this paper, we have investigated photocatalytic properties of vanadium doped TiO_2 coatings formed by plasma electrolytic oxidation (PEO) of titanium in water based solution containing 10g/L $Na_3PO_4 \cdot 12H_2O$ + 0.5 g/L NH_4VO_3. Photocatalytic activity of obtained coatings was compared to photocatalytic activity of pure TiO_2 coatings formed in 10g/L $Na_3PO_4 \cdot 12H_2O$. Morphology, topography, phase structure, and elemental compositions of vanadium doped TiO_2 coatings were studied by AFM, SEM-EDX, XRD, and XPS techniques. The photocatalytic activity was evaluated by monitoring the degradation of methyl orange under simulated sunlight conditions. Photocatalytic activity of vanadium doped TiO_2 coatings increases with PEO time and shows notable photoactivity enhancement with respect to pure TiO_2 coatings. The increase of photocatalytic activity with PEO time is a consequence of raising number of new vanadium doped TiO_2 centers within thicker layers, which is in accordance with photoluminescence measurements. The valence band photoelectron spectra and diffuse reflectance spectroscopy showed that vanadium doped TiO_2 coatings exhibit significant red shift with respect to pure TiO_2 coatings.

O.S.B.11.

NEW PRECIPITATION STREGTHENING ALUMINIUM MATRIX COMPOSITES BASED ON Al-Mn-Cu-Zr SYSTEM FOR HIGH TEMPERATURE APPLICATIONS

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Aluminium matrix composites reinforced with B_4C are used as neutron absorber materials for the transport and storage of spent nuclear fuels in the nuclear industry. In service the Al-B_4C composites may experience long-term exposure at elevated temperatures (250 to 350°C). Commercial aluminum composites commonly used 2000, 6000 and 7000 series matrix alloys, which have limited strength at elevated temperatures, due to an overaging effect where rapid coarsening of the strengthening precipitates occurs. In the present work the new precipitation strengthening aluminium composites based on Al-Mn-Cu-Zr system were obtained by mechanical alloying and subsequent termomechanical treatment. Nanostructure formation of the aluminium alloys (grain size 50 nm) after mechanical alloying were observed using TEM. Subsequent termomechanical treatment didn’t change the composites structure. Precipitation strengthening and precipitate coarsening of $Al_3(Sc,Zr)$ (with dimensions 10 nm) and $Al_{20}Cu_2Mn_3$ in the composite materials during the aging process at elevated temperatures were investigated.

O.S.B.12.

IN SITU TRANSMISSION ELECTRON MICROSCOPY INVESTIGATION OF SOLID-STATE SYNTHESIS IN Al/Au NANOFILMS

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In situ transmission electron microscopy and electron diffraction investigations of the processes of solid-state synthesis in Al/Au thin bilayer films were carried out. The sample heating was carried out in the column of a JEOL JEM-2100 transmission electron microscope. During the heating the electron diffraction patterns were recorded which allow one to control the change of the phase composition. The heating temperature was changed from room temperature up to 650ºC, with the heating rate up to 120ºC/min. It was found that the process of solid-state synthesis started at about ≈100ºC. Two crystal phases Al_2Au (Fm-3m) and $AlAu_2$ (I4/mmm) were simultaneously observed at a temperature of 140±5°C. Only Al_2Au phase was observed when reaching the temperature of 235±5ºC and higher –up to 300ºC.

O.S.B.13.

WATERBORNE POLYURETHANE DISPERSIONS: PREPARATION AND CHARACTERIZATION

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A set of waterborne polyurethane dispersions (PUD) via acetone process with different cationic groups content as well as polyurethane (PU) films made from PUDs were prepared and characterized. Isocyanate-terminated prepolymers (ionomers) from polycarbonatediol, α-dihydroxycarboxylic acid and diisocyanate were prepared. Chain extension reactions were carried out using either aliphatic diol or diamine and neutralization step by means of tertiary amine. Substitution of organic solvent by water followed by phase inversion allows formation of different nanometer-size spherical PU particles. After water evaporation from PUDs, transparent or slightly opaque elastic PU films were prepared. Atomic force microscopy revealed that micrometer-size agglomerates formed from individual particles with 60 up to 130 nm diameter are very well detectable on the PU film surfaces.

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O.S.B.14.

NORMAL AND SLIDING ADHESIVE CONTACT OF ROUGH ELASTIC BODIES

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The new models of normal and sliding adhesive contact between rough elastic bodies are proposed. Roughness is simulated by the Winkler-Fuss nonlinear elastic layer which resists to compressive and tensile stresses. Mechanical properties of this layer are defined by the statistical adhesion theories for nominally flat rough surfaces which are based on the DMT (Derjaguin-Muller-Toporov), JKR (Johnson-Kendall-Roberts) and Maugis (JKR-DMT transition) theories for contact of individual asperities. In other words, surface roughness is considered as the surface layer with mechanical properties different from the bulk properties. The contact of solids is described by the nonlinear boundary integral equations with non-monotonic operators. Their solutions determine the reduction of effective thickness of rough layer, contact stresses and contact region. The model equations have a simple and visible mechanical sense. Suggested model approach can be applied to the investigation of adhesive contact of rough elastic solids with complicated nominal geometry: non convex solids, in cases of multiply connected contact regions consisting of several separate parts and multi-body contact. In report the numerical implementation, analysis and discussion of the models are given. In particular the reduction of effective thickness of rough layer, contact stresses (normal and shear) for the different shapes of punches (conical, parabolic et al.) and different kind of roughness are presented. Investigations of dependences for the normal and friction forces on the approach of bodies (and the friction forces on the normal forces) for different types of roughness are given also. Proposed models of adhesion of rough elastic bodies show that not only material properties of contact bodies but also micro-geometric parameters of roughness together with macro-geometric parameters of interacting bodies influence significantly their adhesion and contact characteristics.

PL.S.II.1.

HIGH RESOLUTION TEM/STEM BY MEANS OF ADVANCED INSTRUMENTATION

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Over the last decade the development of high performance instruments has made a huge step towards high resolution and high stability which gave the scientists the instruments they were aiming for. This progress was mainly stimulated by the successful development of Cs-correctors for high resolution in TEM as well as in STEM. The attainable resolution of modern TEM and STEMS is not the only driving force anymore for future instrumental developments. Today, almost all manufacturers offer various Cs-corrected fixed-beam and scanning TEMs in the energy range between 60kV and 300kV. Due to the high stability of the Cs-corrected S/TEMs in combination with the precise measurement and control of the residual aberrations these Cs-corrected S/TEMs are not anymore only image taking devices. These instruments are rather tools for measurements of structures and compositions at the atomic level. After the proof of the advantages of the compensation of the spherical aberration by means of a hardware corrector this type of equipment became almost mandatory for high resolution microscopy in materials science. Meanwhile many variants of Cs-correctors have been developed and installed. From advanced hexapole correctors for ultra high resolution at various voltages from 20 kV up to 300 kV and in the future even up to 1.2 MeV.

The improvement of resolution of TEMs and STEMs has lead to a resolving power capable of distinguishing atom distances around half the diameter of a hydrogen atom and, in addition, advanced aplanatic systems have opened the capability to achieve high resolution over a large field of view. The resolution limit is set by the vanishing contrast at highest spatial frequencies with the consequence if one requests an improved contrast at somewhat lower spatial frequencies one has to aim again for higher resolution. In addition, the scattering amplitude of atoms is lower at larger scattering angles and, therefore, an improved contrast would be advantageous and this can only be achieved by an improved resolving power. Hence, even if the achievable resolution is already sufficiently high a further enhancement of the attainable contrast is still necessary for certain applications. Any further instrumental development should not be evaluated from the developer’s point of view but by a sensible analysis of the scientific needs and envisioned benefits. The needs have to be stated by the scientists asking for “better” instruments.

The ongoing projects and how the goals of these projects should be achieved will be described. The currently running projects are dealing with the improvement of resolution for various applications and very different energies. One project concentrates on the low energy regime (SALVE) and a second one aiming for the opposite end of the energy scale at 1.2 MeV (FIRST). New areas for future developments might come from various new imaging and exploration modes like electron tomography, dynamic EM, Lorentz micrscopy, phase contrast electron microscopy. All of these imaging modes need for further advancements improved instruments or at least new components.

PL.S.II.2.

PREDICTING AND MEASURING THE STRUCTURE OF MATERIALS ON THE NANOSCALE

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Many of the greatest challenges for materials science occur at the atomic scale. When considering extremely small structures, the discrete nature of surfaces or interfaces becomes increasingly important as continuum approaches break down. Predicting and modeling nanoscale structures and interactions requires robust, multiscale modeling techniques. First principles methods such as density functional theory or molecular dynamics are often required to fully understand the system in question. We examine several model nanoparticle systems including Pt precipitates embedded in a sapphire matrix, Au-Ag and Pd-Rh decahedral particles, monodisperse Al-Li-Sc core-shell precipitates, and Al-Mn-Be quasicrystal precipitates and approximates. In each case, multiple modeling techniques are combined with electron microscopy in an effort to create predictive structural models. We also present some examples of thermodynamic and kinetic models for phase transformations of nanoscale materials. In each case, the models are compared to aberration-corrected transmission electron microscopy experiments.

PL.S.II.3.

QUANTITATIVE HIGH RESOLUTION ENVIRONMENTAL TRANSMISSION ELECTRON MICROSCOPY FOR CATALYST CHEMISTRY

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We demonstrate the potential of recently developed environmental transmission electron microscopes (ETEMs) for quantitative in-situ microscopy at the atomic scale, especially for the chemistry of nanoparticulate metal catalysts in gases. Given the ETEMs that can work robustly to accumulate observation data in controlled environments, the issues associated with the application of ETEM to catalyst chemistry were addressed using systematic, numerical and statistical ETEM analyses. We established a structural evolution diagram that summarizes the structure of catalysts under electron irradiation as a function of the electron current density φ and the electron dose, D. By extrapolating to $\varphi=0$, $D = 0$, we could deduce the intrinsic catalysis structure (without electron irradiation) in various environments, including reaction environments. By numerically and statistically analyzing a substantial number of ETEM images of nanoparticulate metal catalysts, we established a morphology phase diagram that summarizes how the majority of metal nanoparticles change their morphology systematically as a function of the partial pressures of gases. Using these quantitative analyses, we could analyze Cs-corrected ETEM images of the catalysts. The surfaces of metal nanoparticles were structurally reconstructed under reaction conditions, via interactions with gas molecules. Gas molecules were observed on the surfaces of catalysts under reaction conditions using high-resolution ETEM.

PL.S.II.4.

IN-SITU ELECTRON HOLOGRAPHY

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Electron holography (EH) is an interferometric method which allows the amplitude and the phase shift of the high energy electron wave to be recorded. As the e-beam phase shift is sensitive to the electrostatic and magnetic fields the beam has interacted with, measuring it gives access and map all these fields with the spatial resolution of the TEM. It then allows measuring locally physical quantities responsible for such fields as electric charges and magnetization. Few examples will be presented. In addition, *in-situ* experiments permit to study how these quantities are modifying under the application of an external constrain (electric or magnetic field, temperature…). *In-situ* magnetization reversal and low temperature electron holography experiments performed on magnetic nanostructures and *in-situ* field emission of a carbon nanotube will illustrate such *in-situ* electron holography capabilities.

PL.S.II.5.

IMAGING AND MANIPULATING NANOPARTICLES AND NANOCLUSTERS IN NANOSTRUCTURED FUNCTIONAL MATERIALS

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One example of an important application area of nanoparticles is abatement of toxic gases. The consumption of fossil fuels of diesel or lean-burn gasoline engines needs to be reduced due to economical and environmental aspects. However, existing standard three-way catalysts cannot reduce the NO_x species that are formed during use. They are harmful and are, for example, responsible for acid rain, forming ground-level ozone (which in turn is the major constituent of smog) and are also increasing the risk of respiratory allergies. It is therefore important to remove the NO_x species by exhaust gas after-treatment. Noble metal particles are used for the abatement of the toxic NO_x. The ratio between low-coordinated (step) and high-coordinated (terrace) sites on the catalytic activity is one important aspect when studying the mechanisms responsible for the catalytic activity. An estimate can be determined by construction of Wulff shapes of the metal particles in the size range determined experimentally. High resolution electron microscopy provides direct information about the size and spatial distribution of the catalyst particles on the support. In situ microscopy and manipulation give access to additional information that further contributes to the understanding of active mechanisms of the catalytic reactions and degradation of properties during use. Examples from different systems will be presented.

PL.S.II.6.

TRANSMISSION ELECTRON MICROSCOPY OF DIFFUSION-INDUCED PHENOMENA IN III-V SEMICONDUCTORS

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Analytical methods of transmission electron microscopy (TEM) can be applied to derive information on diffusion mechanisms and transport of point defects during foreign-atom diffusion in single-crystalline III-V compound semiconductors from analyses of diffusion-induced extended defects. A brief summary will be given of investigations for the model case of zinc diffusion in GaP (1-3) and GaSb (1) for which the characteristic diffusion-induced microstructure phenomena in the diffusion front regions consist of the formation of dislocations and of voids connected with Ga precipitate particles (typical dimensions ≤ 50nm). Energy-dispersive X-ray spectroscopy (EDXS) in TEM (3) and in-situ TEM annealing experiments (4) performed on precipitate particles indicate that Zn atoms segregate to extended defects during Zn diffusion. Scanning TEM high-angle annular dark-field tomography combined with EDXS on precipitates allows obtaining 3-dimensional information about interface morphology and local fluctuations in density and composition (5). When zinc diffusion is performed under conditions leading to so called 2-step Zn concentration profiles, the near-surface crystal regions contain predominantly voids faceted on {111} and on {001} planes, dislocation networks, and, for GaP, crystalline precipitates of a cubic Zn_3P_2 equilibrium phase. Polarity analyses near larger {111} facets of voids by large-angle convergent beam electron diffraction (6) reveal atom arrangements that differ from voids connected to a precipitate particle. The comparison with studies for GaAs (7) and InP (8) indicates the general nature of such diffusion-induced phenomena at high-concentration Zn diffusion in III-V semiconductors. Such studies have led to progress in understanding anomalous diffusion profile shapes and phenomena of device doping anomalies under conditions for which no extended defects are formed (2, 9).

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O.S.C.1.

ADVANTAGED NANOSTRUCTURED MATERIALS FOR OPTOELECTRONICS: BULK AND INTERFACE FEATURES

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Based on the chemical and physical modification of the bulk and surface optical materials properties using carbon nanoobjects, some questions of the mechanisms responsible for the nanostructurization process have been postulated. Transmittance and reflective spectral shifts, changes in both the photorefractive and the photoconductive parameters, as well as in the polarization characteristics of the organic optical materials have been considered. The features of the surface relief modified by oriented carbon nanotubes have been discussed. It is showing that the nanoobjects-modified materials can be employed in telecommunication, display technologies, in biology and medicine.

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O.S.C.2.

INFLUENCE OF Gd AND Sm SUBSTITUTIONS ON PROPERTIES OF YBCO BULK SUPERCONDUCTORS

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The $YBa_2Cu_3O_{7-\delta}$ (YBCO, Y123) bulk single-grain superconductors doped with $GdBa_2Cu_3O_y$ (Gd123) or $SmBa_2Cu_3O_z$ (Sm123) were prepared by the Top-seeded melt-growth process. The growth conditions of the samples were optimized for different dopant concentrations. The homogeneity of dopant distribution in the bulks was characterized by WDS line microanalyses. The critical temperature, T_c increases with increasing dopant concentration in the studied range. Peak effect in the field dependences of critical current density, $J_c(B)$ at 77 K was observed. The optimum dopant concentration was found for the best critical current density, J_c and trapped magnetic field, B_{Zmax}.

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O.S.C.3.

POSITRON ANNIHILATION LIFETIME SPECTROSCOPY IN APPLICATION TO GeS_2–Ga_2S_3 CHALCOGENIDE GLASSES

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GeS_2–Ga_2S_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. Their rare-earth ions solubility is greatly increased through the incorporation of gallium, which makes some structural modifications of the GeS_2 network. Atomic arrangement in such ChG can be studied with numerous techniques (X-ray diffraction, etc.), while number of probes available to study atomic-deficient distribution is rather limited, especially at a sub-nanometer scale. 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 free-volume structure of GeS_2-Ga_2S_3 ChG within two-states model.

The PAL spectra were recorded with conventional fast-fast coincidence system (ORTEC) of 230 ps resolution at the temperature T = 22 ^{o}C and relative humidity RH = 35 %. Two identical samples were used to build a sandwich structure needed for PAL measurements. The measured PAL spectra of ChG were processed with standard LT 9.0 computer program, the obtained curve being fitted by two components with τ_1, τ_2 lifetimes and I_1, I_2 intensities (I_1+I_2=1). Introducing a third component into the envelope of the fitting curves did not improve decomposition goodness significantly. Therefore, 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 using a formalism of two-states trapping model.

Since (τ_1, I_1) component has no strong physical meaning within accepted two-state positron trapping model, we focused our further analysis on second (τ_2, I_2) component, where τ_2 lifetime is directly related to a size of free-volume entity (trapping center) and the intensity I_2 is proportional to the number of such "defects". At values of PAL fitting parameters for $80GeS_2$-$20Ga_2S_3$ system (τ_1 = 0.234 ns, I_2 = 0.67, τ_2 = 0.481 ns, I_2 = 0.33), bulk positron lifetime τ_b is near 0.28 ns and average lifetime τ_{av}. is 0.32 ns. It is shown that the size of free-volume trapping centers in the $80GeS_2$-$20Ga_2S_3$ system is higher than in the $80GeSe_2$-$20Ga_2Se_3$ glasses (τ_2 = 0.439 ns), weak increases of I_2 intensities testify growing behaviour in the number of corresponding free-volume entities. Other positron trapping parameters for Ge-Ga-S system (κ_d = 0.73 ns^{-1}, $(\tau_2 - \tau_b)$ = 0.20 ns, τ_2/τ_b = 1.7 and η = 0.17) are similar to Ge-Ga-Se glasses. In addition, taking into account obtained values of lifetime τ_b, Ge-Ga-S systems cannot be considered as belonging to typical pseudo-binary systems with structurally independent boundary components (GeS_2 and Ga_2S_3).

O.S.C.4.

COORDINATE-DEPENDENT DIFFUSION PHOSPHOROUS IN GERMANIUM IN THE In0.56Ga0.44P/Ge NANOGETEROSTRUCTURE

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A variety of published data on mechanisms of diffusion of P in Ge indicates a strong dependence of the diffusion processes on the defect structure of Ge. Presented in this paper is the experimental and theoretical analysis of the distribution of P in Ge(Ga) in the nanoheterostructure In0,5Ga0,5P/Ge for first cascade of multijunction solar cell. The theoretical analysis is based on the Malkovich coordinate-dependent diffusion mechanism which takes into account both diffusion and drift components of the P flow. We identified parameters of the model, which lead to formation of the two-stage P profile and conditions where the formation of the "frozen" profile, in which the depth of the p-n junction (about 130 nm, p-n junction was formed at 635 ºC) is practically independent of the time of the diffusion process.

O.S.C.5.

NANOPARTICLES OF CHROMIUM DIOXIDE WITH COHERENT REVERSAL

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The chromium dioxide nanopowders are ferromagnetic material with half-metallic conductivity. The coercivity of CrO_2 is predominantly controlled by the anisotropy of the shape of needle-like particles. This oxide is used in magnetic recording and in new areas of magneto-electronics. Any variant of applications is based on single-domain of particles, its coherent reversal and 100% spin polarization. The regulation of magnetic characteristics can be achieved by varying of the shape of the particles in the heteroepitaxial growth process under hydrothermal conditions. Our model of the crystallization of CrO_2 particles shows that the size and parameters of nucleus are crucial for optimal magnetic behavior of nanoparticles. The commensurability of nucleus size and thickness of particle leads to the formation of the domain-nonmagnetic nucleus-domain states within one needle.

O.S.C.6.

NANO - AND SUBMICROCRYSTALLINE Cu - BASED ALLOYS WITH Cr, Zr AND Hf AFTER SEVERE PLASTIC DEFORMATION

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Nano- and submicrocrystalline copper alloys: Cu-Cr with the content of Cr - 0.75%, 9.85% and 27%, Cu-0.18% Zr and Cu-0.7%Cr-0.9% Hf, were investigated after high pressure torsion (HPT) and equal channel angular pressing (ECAP). Hardening of Cu-Cr alloys after HPT depends on grain refinement and quantity of a Cr phase in alloys. With increase in Cr content from 0.75 to 27% the size of grains decreases from 190-200 to 30-50 nm. In Cu-0.7%Cr-0.9%Hf alloy hardening take place due to grain refinement, allocation of a Cr phase and Cu_5Hf particles. Additives of Hf led to increase of strength, thermal stability and reduction of the size of grains to 120 nm. The regularities received at studying of copper alloys after HPT were confirmed after ECAP. SPD and heating application to studied Cu alloys allows receiving very favorable combination of strength and conductivity.

O.S.C.7.

MECHANOCHEMICALLY INDUCED STRUCTURAL CONVERSIONS IN METAL SALTS OF GLUCONIC ACID

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The physical mechanisms of the deformation-induced molecular polymorphous transformations in nano-dispersed bioinorganic compounds (potassium, sodium and calcium gluconates) are discussed in this work. Integrated study using direct structural and structure-sensitive spectroscopic methods as well as quantum-chemical calculations allowed obtaining the data on polymorphous transformations, taking place during mechanical activation. The relationship between kinetics of such transformations and formation of nano-dispersed state in molecular crystals is also established.

The reported study was partially supported by RFBR, research project No. 12-02-01316-a.

O.S.C.8.

INITIAL STAGE OF MECHANICAL ALLOYING IN $Si_{70}Fe_{30}$ AND $Si_{99}Fe_1$ BINARY SYSTEMS

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Comprehensive study of the initial stages of solid-state reactions in binary systems, in which one of the components is present in a prevailing amount, yields useful information on the mechanism of mechanical alloying (MA). Based on the results obtained for the $Si_{99}Fe_1$ system, one may propose a model for the initial stage of the mechanical alloying of Si and Fe that comprises the formation of nanocrystalline and amorphous Si at the particle surface and in the close-to-boundary distorted zones of interfaces, penetration of Fe atoms along the grain boundaries, and the formation of Si–Fe clusters in the interfaces, these clusters having a local Fe atoms environment typical of a deformed α-$FeSi_2$ phase. MA process in $Si_{70}Fe_{30}$ is characterized by two-way direction, i.e. the penetration of Si atoms into Fe and vice versa is observed, provided that the nanocrystalline state in Fe and Si particles is realized. In the Si particles the clusters having a local Fe atoms environment typical of a deformed α-$FeSi_2$ phase are formed. In the Fe particles the clusters typical for FeSi and β-$FeSi_2$ phases are observed. This work was partially supported by Russian Foundation for Basic Research (project no. 12-02-31910-mol_a).

O.S.C.9.

LOCAL ATOMIC STRUCTURE AND MAGNETIC PROPERTIES OF MECHANICALLY ALLOYED AND ANNEALED CEMENTITE

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The structure of cementite, which is one the most important structural constituent of steels and cast irons, has been analyzed in a great number of papers during more than eighty-year history of its study. Nevertheless, to date there are no unambiguous viewpoints on the localization of C atoms in the unit cell and its influence on magnetic properties of cementite. X-ray diffraction, Mössbauer spectroscopy and magnetic measurements were used to study cementite produced by mechanical alloying and followed by annealing.

The cementite prepared by mechanical alloying is in a nanostructural state and is characterized by strong lattice microdistortions and large line width of Mössbauer spectrum. Being in the strained state, C atoms occupy not only prismatic, but also octahedral interstices. This structure is called here the deformed cementite $(Fe_3C)_D$. At the annealing temperature 775 K C atoms are localized only in the prismatic interstices. This local structure is characterized by the low values of the lattice microdistortions and line width in the Mössbauer spectrum of cementite. We call this structure the non-distorted cementite Fe_3C. At all the stages of the local atomic structure evolution the cementite has an orthorhombic lattice (space group P_{nma}). The Fe_3C and $(Fe_3C)_D$ are characterized by close magnetic moments per Fe atom and average hyperfine interaction parameters. Under other conditions being equal, the coercivity H_C of the Fe_3C cementite can be three times higher than that of the $(Fe_3C)_D$ cementite due to a larger magnetocrystalline anisotropy constant. The work has been supported by the Russian Fund for Basic Research (project No. 13-03-00039).

O.S.C.10.

Cu-Fe-C NANOCOMPOSITES PREPARED BY MECHANOSYNTHESIS IN AN INERT AND ORGANIC MEDIA

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The structure, phase composition and the kinetics of formation of iron carbides in copper matrix under high energy milling are studied. Copper – 30 vol.% iron carbide nanocrystalline powders were prepared in a planetary ball mill by two methods: mechanical alloying (MA) of copper, iron and graphite powders in an inert atmosphere, and milling of copper and iron in liquid organic medium (xylol). The results of X-ray diffraction, Mössbauer spectroscopy, optical and electron microscopy have shown that at an early stage of the mechanical alloying the formation of a supersaturated solid solution of iron in copper takes place, regardless of the used type of carbon precursor. For longer milling times (t_{MA}= 24-48 h) in copper-iron-graphite system the mixture of highly disordered Fe_3C, Fe_5C_2 and Fe_7C_3 carbides is formed. After thermal treatment (T_{an}= 600ºC and 800ºC, t_{an}= 1 h) crystalline Fe_3C is only formed. Copper matrix retains a nanocrystalline structure with a grain size of 60-150 nm. Use of xylol leads to reduce the grain size of copper matrix to 30 nm after heat treatment at 800ºC. In this case, the cementite formation occurs after heat treatment and at longer milling (t_{MA}= 96 h) due to the interaction of carbon and nanocrystalline iron.

This study was supported financially by the RFBR (Project № 13-03-00039).

O.S.C.11.

THE SOL-GEL DERIVED HYBRID NANOMATERIALS BASED ON TITANIA AND CELLULOSE FIBERS WITH THE COMPLEX OF SPECIFIC PROPERTIES

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The significant interest is in obtaining new types of photoactive materials based on titanium dioxide, which, on the one hand, would allow to extend the range of its practical application, and, on the other hand - to derive new fundamental knowledge about the influence of the structure of materials on their photocatalytic and biological activity. Of importance are developments devoted to obtaining "smart textiles" showing a self-cleaning ability from organic pollutions under the influence of light as well as high bactericidal activity. The present work reports the new method of obtaining TiO_2-modified cotton fibers possessing high photocatalytic activity and antibacterial properties. For obtaining titania particles a low-temperature sol – gel synthesis has been used, which leads to the TiO_2 formation of anatase – brookite modification in solution bypassing the calcination stage. Further treatment of cellulose fiber by nanocrystalline titania hydrosol with 1,2,3,4 – butanetetracarboxylic acid (BTCA) as cross-linking agent shows a strong fixation of nanoparticles on the surface of a cotton fiber by covalent bonding. The physical and chemical properties of hybrid nanomaterials have been investigated by Fourier-transform infrared spectroscopy, thermogravimetric analysis, low-temperature adsorption/desorption of nitrogen and scanning electron microscopy. It has been established that TiO_2 nanoparticles are cross-linked to the surface of a cotton fiber by the formation of transverse ester bonds with BTCA. The cotton fibers processed this way exhibit high self-cleaning properties and maintain them even after five cycles of washing. The antibacterial properties have also been investigated. The TiO_2-modified fibers have bacteriostatic effect, inhibiting the growth of bacterial culture and can be potentially used as an aid in the fight against pathogen microorganisms.

O.S.C.12.

ROOM-TEMPERATURE SUPERCONDUCTIVITY IN AEROSOL GENERATED NiO NANOPARTICLES

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Well-defined cubic-shaped Nickel oxide nanoparticles (6-24 nm in sizes) were prepared via the levitation-jet aerosol method. The analysis of the magnetization curves of the particles revealed that the saturation magnetization at room temperature usually reached values under 1 emu/g. All the curves also showed an unexpected differential susceptibility with a minimum below the high-field magnetization region. We have proposed a procedure to subtract the different magnetic components present in the samples in result a non-apparent diamagnetic contribution correlated to the specific surface area has been found. Given the unexpected origin of this diamagnetic contribution, we have hypothesized about the possible occurrence of a surface-mediated room-temperature superconductive state.

O.S.E.1.

SELOL-LOADED MAGNETIC NANOCAPSULES: A NOVEL DRUG DELIVERY SYSTEM FOR CANCER THERAPY

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Magnetic polylactic-co-glycolic (PLGA) nanocapsules, loaded with maghemite (γ-Fe_2O_3) nanoparticles and Selol (a Selenium-based anticancer drug), were successfully prepared by the precipitation method. DC magnetization, AC susceptibility and EPR measurements, show a typical superparamagnetic behavior above the blocking temperature $T_B \sim 120$ K. The antitumor effect of nanocapsules was evaluated using neoplastic murine melanoma (B16-F10), oral squamous carcinoma (OSCC) and murine (4T1) and human (MCF-7) breast cell lines. Further exposure of these cells to an alternating magnetic field increased the antitumor effect of nanocapsules. The results show that the Selol-loaded magnetic nanocapsules could be applied as a novel drug delivery system for cancer therapy.

O.S.E.2.

POROUS SCAFFOLDS IN HYDROXYAPATITE – CALCIUM CARBONATE SYSTEM FOR BONE TISSUE ENGINEERING

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Bone tissue engineering is a method of bone defects treatment. It is based on the use of porous scaffold with cultivated growing factors and steam cells for bone regeneration support. This method requires the material of porous scaffold with resorption (degradation) rate to be similar to bone formation *de novo.* Materials in the hydroxyapatite (HA) – calcium carbonate (CC) system – are promising for scaffold materials. It has been shown that the solubility of materials increases with the growth of the CC content. In this paper a technology of the porous scaffold and biological tests in vitro and in vivo are described. Porous scaffold were carried out by gelatin slurry dispersion in sunflower oil media due to an effect of immiscible fluids. Porous scaffold were sintering in the CO_2 atmosphere at the temperature 680°C. According to the X-Ray data, porous scaffold contained carbonate-hydroxyapatite (CHA) and CC phases. IR-spectroscopy data shown adsorption bands of PO_4^{3-}, CO_3^{2-} and OH^- groups, and confirmed formation of CHA and CC. According to the scanning electron microscopy data, scaffold had a spherical shape with the radius approximately 500 μm. There was a bimodal pore sizes distribution: 5-10 μm and 100-300 μm. Solubility tests were carried out in a saline solution by the ionometry method and a confirmed solubility dependence on the CC content. Also, an X-Ray investigation of the scaffold dissolved in the saline solution shown that both CHA and CC phases were solved with a predomination of CC. In vitro investigation was carried out on a standard MTT-test. It was shown that materials are non-toxic for cells, support adhesion, spreading and proliferation of human fibroblasts. In vivo tests were performed on a female rats shin bone implantation. Animals were killed at 3, 6 and 12 weeks. Pure CC and 6 wt.% CHA porous scaffold were used as control materials. It was shown that the resorption rate increase with CC content: 6 wt.% CHA < 40%CC/60%CHA < 70%CC/30%CHA <80 %CC/20%CHA < 100%CC. Materials in the HA-CC system showed osteoconductive properties and provided the complete closing of bone defects by the porous bone tissue with a focus hematopoietic from 3 weeks after operation. Further gradual resorption was observed, and scaffold materials substituted by the young bone tissue with the recovery of hematopoietic. *This study was supported by the Russian Foundation for Basic Research, no. 11-08-00596a and agreement № 8299 of the federal target program "Scientific and scientific-pedagogical personnel of innovative Russia" for 2009 - 2013 years.*

O.S.E.3.

ON MACROSCOPIC QUANTUM PHENOMENA IN BIOMOLECULES AND CELLS: FROM LEVINTHAL TO HOPFIELD

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In the context of the macroscopic quantum phenomena of the second kind we hereby seek for a solution-in-principle of the long standing problem of the polymer folding, which was considered by Levinthal as (semi)classically intractable. To illuminate it, we applied quantum-chemical and quantum-decoherence approaches to conformational transitions. Our analyses imply the existence of novel macroscopic quantum biomolecular phenomena, with far reaching implications regarding chain folding and biomolecular recognition processes, which cannot be considered kinetically understood based on (semi)classical predictions. For instance, biomolecular chain folding in an open environment might be considered as a subtle interplay between energy and conformation eigenestates of this biomolecule, governed by quantum-chemical and quantum-decoherence laws. On the other hand, within an open biological cell a system of N identical (non-interacting and dynamically non-coupled) biomolecular proteins and their biomolecular targets might be considered as corresponding spatial quantum ensemble of N identical biomolecular processors, providing spatially distributed quantum solution to a single corresponding biomolecular chain-folding key-lock recognition process – whose density of conformational states might be represented as Hopfield-like quantum-holographic associative neural network too. Thus, to generalize, a series of coupled environment-driven (compositionally/chemically or thermally/optically) intra-cellular, membrane, and extra-cellular local biochemical reactions might be considered globally as a series of correspondingly coupled intra-cellular, membrane, and extra-cellular distributed Hopfield-like quantum-holographic associative neural network layers – providing an equivalent global quantum-informational alternative to standard molecular-biology local biochemical approach in biomolecules and cells (and higher hierarchical levels of organism, as well).

O.S.E.4.

COMPOSITE BIOMATERIALS BASED ON SILICON NITRIDE AND BIOGLASS

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Effort to spend qualitative life forces to look for new materials suitable for replacement of damaged human tissues. The traditional metal implants are replaced by materials that composition and structure are closer to the human body, such as ceramic materials due to their excellent mechanical properties and biocompatibility. Special attention is paid to the bioactive materials able to create fast joint to the surrounding tissue. The present paper deals with preparation of dense and porous composites biomaterials based on silicon nitride and bioglasses. The microstructure, chemical composition, mechanical properties and the bioactivity will be fundamental for consideration of the suitability of materials for bioapplications. The work is devoted to novel biomaterials which combine the excellent mechanical properties of silicon nitride with high bioactivity of the bioglasses.

O.S.E.5.

MESOPOROUS SILICA MATERIALS FOR DRUG DELIVERY

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Mesoporous silicas are a class of materials with very good sorption properties that –combined with high biocompatibility and low toxicity – makes them ideal to be implemented inside the human body. In our study two different matrices with hexagonally arranged pores (SBA-15 5.5 nm and MCM-41 2.4 nm) were applied as nanocontainers for several types of channel blockers used in vascular disorders. The process of encapsulation was performed from the solution and in vacuum environment. Obtained systems were studied by: low temperature sorption analysis, thermoanalytical DSC and TG methods, X-ray diffractometry SAXS and WAXS, TEM and SEM electron microscopies, FTIR-Raman and NMR spectroscopies in order to find how the chemico-physical properties and molecular dynamics of loaded drugs are changed under confinement.

O.S.E.6.

THE MICROSTRUCTURE AND FRACTURE BEHAVIOR OF COMMERCIALLY PURE ULTRAFINE GRAIN TITANIUM FOR BIO-MEDICAL APPLICATION

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It is common knowledge that ultrafine grain metals and alloys display enhanced functional and mechanical properties; moreover, these materials exhibit a specific deformation behavior. The formation of nano- and submicrocrystalline structure in commercially pure titanium is expected to make it suitable for a range of applications. Commercially pure titanium has some advantages over titanium alloys used to manufacture dental medical implants, since it contains no alloying additions liable to cause toxic effects and allergic reactions. Thus, commercially pure titanium offers an alternative to titanium alloys. The study was made for commercially pure ultrafine grain titanium, which was obtained by multi-stage *abc*-pressing and cold rolling with subsequent annealing at 570 K. As-treated material had an ultrafine grain structure, with equiaxial components having characteristic size of 200 nm. Using the techniques of atomic force, raster and transmission electron microscopy, the structure of the deformed sample was examined. The results obtained by the three methods show a close agreement. Material characteristics are as follows: conventional yield limit 1000 MPa; ultimate strength 1200 MPa and specific elongation to fracture 6 %. As-treated material samples were tested in uniaxial tension. It was found that the meso-scale deformation process involves formation of fold-like bands. By comparison with the characteristic size of structure components the depth of bands is greater by 3…5 times and their width, by 1…2 orders of magnitude. The formation of a well-defined neck is a forerunner of imminent fracture, which becomes manifest on the descending branch of the deformation curve only. The density of folds within the neck is twice as large relative to the rest of the sample, while the size of structure components in the fractured sample changes only insignificantly. Several percent (~ 5 %) of non-uniaxial components is found to occur in the location of fracture; these have dimensions 100×400 nm. Sample fracture occurs along large-angle boundaries.

O.S.E.7.

MORPHOLOGY OF NANOFIBROUS MATERIALS IN MEDICINAL APPLICATIONS

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Medicinal applications such as cell therapy, wound dressings, skin regeneration or corneal transplants require special demands on the structure of used materials. Beside the biocompatibility, permeability and mechanical properties, the morphology is the most important attribute of the constructs. Specific surface area, volume and size of the pores have considerable effect on the cell adhesion, growth and proliferation. In case of the incorporated pharmaceutically active substances their release is also influenced by the internal structure of nanofibers.

Various polymeric nanofibers have been prepared by needle-less electrospinning as porous synthetic nonwovens. Scanning electron microscopy was used to observe the samples, to evaluate the fiber diameters and to reveal eventual arthefacts in the nanofibrous structure. BET nitrogen adsorption/desorption measurements were employed to measure the specific surface areas. Mercury porosimetry was used to determine total porosities and to compare pore size distributions of the prepared samples. Experiments based on the soaking of nanofibers into the non-solving liquid were used to measure total porosities. Various techniques brought valuable results; however, each method has some disadvantages and limitations. According to the found results, morphological characterization of nanofibrous materials requires a complex approach and evaluation of the results of various methods.

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O.S.E.8.

OSTEOGENIC POTENTIAL OF FRESHLY ISOLATED CELLS OF ADIPOSE-DERIVED MESENCHYMAL FRACTION APPLIED WITH NANOPARTICLES

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The aim of this study was to investigate the osteogenic potential of freshly isolated adipose tissue-derived mesenchymal stromal/stem cells (ASCs) in bone regeneration of rabbit calvaria defects. ASCs were applied together with calcium phosphate-poly-DL-lactide-co-glycolide (CP-PLGA) nanoparticles that are mixed in an appropriately prepared blood clot (BC). Parallelly were analysed defects filled with fragmented adipose tissue (FAT) instead of ASCs, with CP-PLGA in BC, and only with nanoparticles. Bone density in defects was measured after I, III and VI weeks, and histological examination was done after IV and VIII weeks after filling defects. Approach to assisted osteoregeneration which is based on the use of fresh non-induced ASCs has proven to be promising due to the favorable effect on bone regeneration and simplicity of their application.

O.S.E.9.

MECHANOCHEMICAL TECHNOLOGIES OF TAMPING MATERIALS AND WATER SHUTOFF AGENT FOR PETROLIUM INDUSTRY AND FLOOD CONTROL

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Institute of Solid State Chemistry and Mechanochemistry together with RN-UfaNIPIneft Ltd develop new materials for water isolation of oil layers and enlargement of oil recovery. These materials are received from cheap natural minerals and also from waste of industrial production and agriculture. On the one hand, the basis of such materials is made of substances, which already successfully being applied in oil industry. For example, inorganic gels made from sodium silicate can be produced from river sand for one stage according mechanochemical technologies. On the other hand, new hybrid organic – inorganic gels have been produced on the basis of the modified natural polymers and materials such as rice husk and a peat. Except obvious advantages, namely low cost, ecological safety and possibility of receiving these oil agents near oil- wells in field conditions, new mechanical properties of such materials have been found. One supposes that new properties of oil materials get at introduction in them micro dimensional particles. So, it results in plastic inorganic gel that didn't collapse under mechanical stress, but it possessed fluidity, like plastic cement. This new, unusual and demanded property allows working with hybrid gel at elevated pressure. These new materials will be also useful for reclamation work and flood control.

O.S.E.10.

GEOPOLYMER MATERIALS BASED ON THE ELECTRIC ARC FURNACE SLAG

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The remelting of iron and steel scrap in the electric arc furnaces generates the non-hazardous waste – electric arc furnace slag (EAFS), which can be disposed of to appropriate landfills. Currently, this slag found its application in conventional concrete production to improve its mechanical, chemical and physical properties, as an additive to asphalt base mixture and in cement production. In this study we have investigated the effect of alkaline dosage on the strength and thermal resistance of EAFS based geopolymers. The results have shown that these materials are mainly amorphous with some crystal phases remained from the undisolved EAFS such as larnite, gehlenite, wuestite, monticellite, calcite.

Compressive strength of these materials is strongly influenced by the alkaline dosage. An increase of NaOH concentration in the interval of 7-10 M leads to the increase of geopolymer's strength. The maximal compressive strength of EAFS based geopolymer was obtained using the 10 M NaOH. Further increase of alkaline dosage to the value of 13 M NaOH results in the slight decrease of the geopolymer strength. Additionally, depending on the synthesis parameters, EAFS based geopolymers exhibit improved durability in high temperature environments in comparison with conventional cement based materials. All investigated samples exhibit a shrinkage which is attributed to the change of porosity. The mass loss due to the loss of water was also observed.

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O.S.E.11.

IDENTIFICATION OF CHEMICAL AND HEALTH RISKILY PHTHALATE PLASTICIZERS IN THE POLYETHYLENE TEREPHTHALATE BOTTLES FOR WATER PACKAGING

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Phthalate esters plasticizers are chemical riskily substances that influence on health safety. Phthalate esters plasticizers migration from the coloured and transparent plastic bottles made of polyethylene terephthalate (PET) widely used for mineral water and soft drink packaging was detected to control their healt safety. The testing was carried out in Institute of Public Health in Novi Sad, in the department of Laboratory services, in the laboratory for food and common usage products control, with model solutions distilled water during 24h at 20±2°C according to standard procedures. Phthalate plasticizers migration in the coloured and transparent PET samples was not detected. According to present Act on conditions dealing with health safety of common usage goods that can be put on market (Official Gazette SFRY 26/83) the samples are safe for the health.

O.S.E.12.

THE ROLE OF METAKAOLIN FINENESS ON PROPERTIES OF CEMENTITIOUS MIXTURES

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Paper describes properties of Portland cement mixtures with various fractions of metakaolin. Metakaolin of high reactivity was chosen as a reference material. Fractions of metakaolin were blended with Portland cement using replacement level 10% of metakaolin for all mixtures. Strength development after 1, 2, 7 and 28 days of curing was monitored on mortar samples. The role of fineness of metakaolin on microstructure of the resulting binder and especially interfacial transition zone with fine aggregate was studied. Heat flow over period of 48 hours was measured by isothermal calorimeter. Rheological properties mainly setting, workability and thixotropy or rheopexy of fresh pastes were tested by rotational rheometer. Aim of the paper was to find relation between metakaolin fineness and its application for high-performance concrete as a highly reactive filler or fine aggregate.

PL.S.III.1.

TOXICITY STUDY OF NANOMATERIALS

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A major contribution of nanotechnology to our life is the controlled synthesis of a large variety of nanomaterials. Due to their unique physico-chemical properties these nanostructures are set to be of great benefit for many applications within engineering, electronics, alternative energy or nanomedicine. Although the expectations are large concerning the improvement of our everyday life due to the engineered nanomaterials, there is a forecasted expansion of their manufacturing, which makes likely that intentional and unintentional human and environmental exposure will increase in the near future. As a result there is a growing worry related to their possible health hazards, as some of them strongly resemble to asbestos.

Motivated by this issue, we have investigated the acute cellular toxicity associated with four model nanomaterials, namely carbon nanotubes, boron nitride nanotubes, titanium dioxide nanofilaments and graphene oxide *in vitro* using a multitude of techniques. Our findings highlight an important role of distinct physico-chemical properties such as the shape in case of carbon based nanomaterials, the surface modification and geometry (length, width) relevant to the toxicity of titanium dioxide nanofilaments and the tortuosity in determining the toxic potential of boron nitride nanotubes. In addition to the identified nanomaterial characteristics, we pinpoint that the target cell type is also a critical determinant of the cellular response, which is variable between different cell types and is likely linked to their physiological function.

Acknowledgment: The work is performed in collaboration with Lenke Horvath, Arnaud Magrez and Beat Schwaller.

PL.S.III.2.

CERIUM OXIDE NANOPARTICLES FOR ANTIOXIDANT THERAPY PERSPECTIVES

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Nanotechnology is offering unprecedented tools to medicine over the last few years. The extensive use of nanoparticles for therapy and/or diagnostics has unveiled a new generation of nano-biomaterials for medical applications. The general trend is towards the development of bioactive rather than bio-inert materials, with materials directly triggering or participating to cellular reaction pathways. Nanostructured oxides play also an important role in this scenario, and not only as inert materials as one would expect. Recently, cerium oxide nanoparticles (nanoceria) have been recently reported to show outstanding biomedical activity, acting as well tolerated anti-age and anti-inflammatory agents, and potential pharmacological applications due to redox changes in the Ce oxidation state (Ce^{4+}/Ce^{3+}) that trigger the abatement of intracellular reactive oxygen species (ROS), hindering the oxidative stress cytotoxic effects. The search for reliable and effective antioxidant therapy is a focus of current pharmacological research, since many serious diseases imply oxidative stress. However, the comprehension of the biological antioxidant mechanisms of nanoceria is at an early stage and controversial results are reported in the literature. This talk will summarize our recent studies on the antioxidant effects of nanoceria. It was found that nanoceria reduce the oxidative status and the extent of damage-induced apoptosis, including DNA-damaging agents, metabolic inhibitors, X-ray exposure, UV irradiation and oxidations.

PL.S.III.3.

STRUCTURE AND STABILITY OF PROTEINS INTERACTING WITH NANOPARTICLES

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The behavior and toxicological properties of nanoparticles (NP) in biological systems depends heavily on their interactions with proteins. On the other hand, the structure, stability and biological properties of the proteins that interact with the nanoparticles are strongly affected by this interaction. Unfortunately, the mechanisms of interaction and their structural consequences are very difficult to analyse. Here we show how various biophysical techniques can be used to study the protein-nanoparticles interaction. In particular will show how techniques used in structural biology can be adapted to study the changes in structure and stability of proteins upon interaction with nanoparticles. By using synchrotron radiation circular dichroism spectroscopy it is possible to detect changes in the secondary structure and stability of proteins upon interaction with nanoparticles [1]. In some cases it is also possible to identify the protein-nanoparticle interaction domain by using high resolution Nuclear Magnetic Resonance spectroscopy [2].

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PL.S.III.4.

PREPARATION AND EVALUATION OF GADOLINIUM HEXANEDIONE NANOPARTICLES AS A STEM CELL TRACKER

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Stems cells are multipotent cells which are capable of self-renewing and differentiating into multipotent cell lineages. The therapeutic application of stem cells in many diseases has been widely studied in the past few years. However, the actual function and movement of stem cells after injection into human body remains unknown. In order to determine the function and movement of therapeutic stem cells, it is crucial to develop a technique to trace these therapeutic stem cells.

MRI is the most utilized modality for tracking stem cells in vivo because of its safety and 3-dimensional capabilities. Gadolinium is one of the most effective MRI contrast agent in clinical. The purpose of this study is to synthesize Gd nanoparticles, which can permeate cell membrane for labeling the cells as a cell tracker.

Gadolinium hexanedione (GdH), which was synthesized by complexion of Gd3+ with 3,4-hexanedione, was used as the nanoparticle matrix. By the combination of GdH matrix and emulsifying wax, GdH nanoparticles (GdH-NPs) were obtained from oil-in-water microemulsion technique. The stem cells were labeled by culture with hydrophobic GdH-NPs and detected by MRI.

From the result of this study, the size of synthesized particles was about 100 nm. GdH-NPs were biocompatible when the concentration was under 300µg/ml. Moreover, GdH-NPs had greater ability of image enhancement than the commercialized Gd-DTPA. The TEM image of labeled stem cells showed that GdH-NPs was accumulated in the cells by endocytic pathway. The accumulation behavior of GdH-NPs and Gd-DTPA were analyzed by ICP-MS and GdH-NPS showed a better labeling ability than Gd-DTPA. Labeled stem cells showed better signal in the result to cellular MRI. In order to evaluate possible adverse effect of GdH-NPs, we examined the immunophenotypes of labeled cells and the immunophenotypes of stem cells labeled with GdH-NPs showed no difference with control group.

In this study, GdH NPs are synthesized with a nano-scale size and show a good biocompatibility. In conclusion, GdH-NP has a great potential as a stem cell tracker in the near future.

PL.S.III.5.

NANOPHOSPHORS WITH PERSISTENT LUMINESCENCE FOR *IN VIVO* OPTICAL IMAGING

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Optical imaging constantly demands more sensitive tools intended for biomedical research and medical applications. Near-infrared persistent luminescence nanoparticles have recently been introduced to enable highly sensitive *in vivo* optical detection and complete avoidance of tissue autofluorescence. However, the first generation of persistent luminescence nanoparticles had to be excited *ex vivo,* prior to systemic administration, which prevented long-term imaging in living animal. We recently introduce a novel generation of optical nanoprobes, whose persistent luminescence can be activated *in vivo* through living tissues using highly penetrating low energy photons from the red region of the visible spectrum. The mechanisms of the persistence could be explained with the structure/properties relationship. Furthermore surface functionalization of this photonic probe can be adjusted to favor multiple challenging biomedical applications such as tumor-targeting. The advantages and the problems of the optical imaging using persistent luminescence in nanophosphors will be presented.

PL.S.III.6.

CONSOLIDATED NANOMATERIALS IN EXTREME CONDITIONS

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The specific features of nanomaterials such as numerous interfaces, segregations and residual stresses availability define their high level of physical/mechanical properties. However, the nonequilibrium state of these subjects tends to take part a great attention to their stability. This report analyses the possibility to use the consolidated nanomaterials in extreme conditions such as high temperatures, radiation and corrosion environments. The thermal stability of nanostructures and reinforced nanoinclusions, effect of irradiation by ions and neutrons as well as behavior at oxidation are discussed in detail. 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.1.

SOLAR FUELS MATERIALS ENGINEERING

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The objective of this research program is to realize a new class of photocatalysts made of earth abundant, low cost, sunlight stable and non-toxic materials that can generate solar fuels such as methanol or methane in an 'artificial photosynthetic' process akin to the way plants and some bacteria use sunlight to transform carbon dioxide and water in photosynthesis. Such a material has been referred to as an 'artificial leaf'.

The research program considers the optimal combination of materials properties including variations of elemental composition, bulk and surface structure, physical size and shape, extrinsic and intrinsic defects, optical absorption, electron, hole, and ionic transport, exciton transport and diffusion length, surface adsorption and surface diffusion, to enable fast, selective and efficient photo-transformation of carbon dioxide and water to solar fuels such as methane or methanol.

The material of choice for a practical solar fuels photocatalyst is based upon a combination of metal oxide nanomaterials. The wide ranging chemical and physical properties of metal oxides that make them attractive for the development of a practical solar fuels heterostructured photocatalyst require proper alignment of electronic band energy levels of key metal oxides deemed useful for CO2 reduction.

A solution to the current energy and climate problems may be to take a lesson from nature's photosynthetic apparatus, whereby the leaves of trees and plants, grasses and crops are able to sequester carbon dioxide and water from the atmosphere and in the presence of sunlight convert the mixture into energy-rich carbohydrates, with simultaneous release of oxygen to sustain life on earth. If a practical solar-driven process could be found for converting carbon dioxide to energy-rich fuels such as methane or methanol using solar light, with an overall efficiency comparable to or greater than plants, then with just ~0.2 % coverage of the earth's surface, it should be possible to produce 20 TW of energy. This should help to satisfy the global energy demand with the added advantage of helping to maintain atmospheric carbon dioxide concentrations at current levels.

PL.S.IV.2.

IN-SITU MECHANICAL AND ELECTRICAL PROBING OF INDIVIDUAL NANOSTRUCTURES IN THE ELECTRON MICROSCOPE

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For the successful use of nanostructures in functional devices a fundamental understanding of their physical properties in relation to their structure is indispensable. In-situ electron microscopy techniques offer great opportunities for directly measuring physical properties of individual nanostructures and, at same time, studying their structure at high magnification thus enabling to establish structure-property relations at small length scales. In this presentation three examples will be addressed. First, mechanical testing of nanoscaled silica particles by in-situ nanoindentation in the TEM will be shown to be highly valuable for not only studying but also tailoring the elastic and plastic properties of this important glass material. Secondly, in-situ STM-TEM studies of the resistive switching of individual metalorganic nanowires with potential use in memory devices will be described and routes toward a direct correlation with local measurements of charge transfer will be discussed. Finally, in-situ SEM studies of electrical conductivity across Ag nanowire networks used as transparent electrodes in organic solar cells will be presented. Here, the great potential of using voltage contrast in SE imaging for studying charge transport across individual nanowire junctions will be highlighted.

PL.S.IV.3.

ON CRITICAL RESISTANCE AND SUPERCONDUCTOR TO INSULATOR TRANSITION (SIT) IN HIGH-T_c CUPRATES

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Following systematic probing of low energy electronic structure and superconducting properties of strained high-T_c thin films [1], we have studied the field effect in cuprates and observed striking superconductor-insulator transition (SIT) in $La_{2-x}Sr_xCuO_4$ films (see Figure) [2].

As we reviewed recently [3], in several p-type cuprates, the SIT occurs at the critical sheet resistance approximately equal to the quantum resistance of pairs, $R_Q = h/4e^2 = 6.5$ k□. In a relatively broad range of temperatures and doping levels near the quantum critical point, the sheet resistance shows universal behavior and scaling characteristic of two-dimensional quantum phase transition.

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PL.S.IV.4.

PROBING PLASMONIC PROPERTIES IN NOBLE METALLIC NANOSTRUCTURES USING MONOCHROMATED ELECTRON ENERGY-LOSS SPECTROSCOPY (EELS)

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The plasmon resonances of metallic nanostructures have received considerable attention of late owing to their wide range of applications from medicine to energy. Using monochromated EELS, we find that the plasmon resonance modes in chemically-synthesized silver nanoparticles can be influenced by changes in nanoparticle geometry and arrangement. As the diameter of these particles decreases from 20 nm to less than 2 nm, the resonance exhibits a 0.5 eV blue-shift, with particles smaller than 10 nm showing a substantial deviation from classical predictions. We used the electron beam in scanning transmission electron microscopy (STEM) to manipulate pairs of silver nanoparticles and simultaneously employed EELS to observe the plasmonic properties of the nanoparticles before and after contact. Alternative fabrication techniques to systematically control the orientation and separation of nanostructures will also be discussed. These experimental findings are supported by simulations and analytical modeling techniques.

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PL.S.IV.5.

INTERFACE DIFFUSION –CONTROLLED PHASE TRANSFORMATIONS IN NANOMATERIALS

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Grain boundary diffusion –controlled transformations are examined. Under this category we consider discontinuous precipitation (DP), discontinuous dissolution (DD) and diffusion induced grain boundary migration (DIGM) phenomena. We briefly describe first the discontinuous mode of precipitation (DP) in metallic polycrystalline systems where, upon aging heat treatments, supersaturated solid solutions decomposes by the action of moving grain boundaries, acting as fast diffusion paths for solute atoms redistribution, leave behind a depleted matrix and a lamellar or rod precipitate product growing in a cooperative fashion. From a fundamental point of view, these are among the most intriguing solid-solid transformations: their full analysis involves consideration of interacting friction, capillary and chemical forces all focused on a moving grain boundary. In this regard, discontinuous transformations products differ from those controlled by volume (lattice) diffusion, most of which can be modeled, at least to first order, on the basis of a local equilibrium hypothesis. In contrast, the non-equilibrium aspects of discontinuous transformation are central to its description. From the experimental point of view, through analysis in different alloy systems, we have concluded that the high –resolution dedicated STEM, in its several modes of operation, is capable of yielding information of value in increasing our understanding of solid-sate transformations. In particular , the microanalysis capabilities allows the determination of diffusion data for individual moving grain boundaries and measure the residual super saturation within depleted lamellae in a DP product and thereby to infer the chemical stored energy in the material besides the interfacial and strain energy stored at the high density precipitate/matrix interfaces.

We extend the analysis of the above described phenomena taking place in a submicron grain size material and the resulting interface multiplication in the transformation product which can consume the entire matrix. Moreover we demonstrate that the combination of DP followed by continuous dissolution at high temperatures promotes a dramatic grain refinement effect, achieving a polycrystalline material with 3 orders of magnitude smaller grains.

From the practical point of view, DP in structural materials has been considered as deleterious to mechanical properties as long lived fine coherent precipitates are swept by the grain boundary reaction front. However, starting materials with high super saturation and properly engineering microstructure could develop DP and exhibit interesting physical properties. In particular, we have demonstrated that in some nano-scale grain size magnetic systems an adequate DP volume fraction generates a giant magneto resistance GMR behavior.

PL.S.IV.6.

HOW DOES MICROSTRUCTURE EVOLVE IN PEROVSKITES?

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This presentation reports our recent theoretical as well as experimental results pertaining to microstructure evolution and control in perovskites. It is shown that normal and nonnormal grain growth can, respectively, take place when the interface structure is rough (atomically ordered) and faceted (atomically disordered). The migration of a faceted interface is nonlinear with respect to the driving force, showing the presence of a critical driving force for appreciable migration. Different types of grain growth behavior are explained in terms of the coupling effects between the maximum driving force for grain growth and the critical driving force for appreciable interface migration. Microstructure tailoring in perovskies, ranging from ultra fine and duplex to single crystalline, is also demonstrated with respect to various processing parameters, such as T, Po_2 and donor doping.

PL.S.V.1.

ATOMIC STRUCTURE OF NANOPARTICLES AND THEIR SURFACES

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Nanoscience and nanotechnology is about understanding, controlling and manipulating structures of a few nanometers in size. These nanostructures are intermediate between single molecules and bulk crystals, and their properties are often different from those of molecules or large crystals. Among different forms of nanostructures, nanoparticles or clusters often present structural properties that vary dramatically with size. Determining their atomic structure is thus critical to our understanding of their formation and unique physical properties. Metal nanoparticles of 1-20 nm in sizes are often used as synthetic catalysts in chemical reactions with high turnover and selectivity. For example, petroleum industries use transition metals and their alloys to catalyze reactions for reforming and cracking hydrocarbon molecules. Au, which is chemically inert at macroscopic sizes, has been found to be catalytically active when its size is down to a few nanometers in diameter.

This talk will report what we have leant from atomic resolution electron imaging, diffraction, and spectroscopy about the surface of nanocrystals, the interfaces and core-shell nanoparticles. In each case, we will show surprisingly rich interfacial phenomena and how the electron probe is used to extract surface and interfacial properties. The last part of the talk includes a look into the future and opportunities in in-situ study of chemical reactions. The work presented here is the result of several Ph.D. students' research and collaborations with several research groups. Their contribution and help is greatly acknowledged. The research was supported by DOE BES and NSF DMR.

PL.S.V.2.

INTRIGUING PHENOMENA AT THE BOUNDARY BETWEEN METAL OXIDE - ORGANIC FINE PARTICLES UNDER MECHANICAL STRESSING AND THEIR INDUSTRIAL APPLICATION

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When a metal oxide like SnO_2 or TiO_2 is subjected to mechanical stressing with organic powders such as fluoropolymers or amino acids, oxidative decomposition of organics, catalyzed by metals, and partial anion exchange between oxygen of the oxides and fluorine or nitrogen from organic counterparts take place simultaneously. The phenomena serve as new technology of producing various functional particles with many applications, among others, by utilizing their absorption ability of various photon energies. Case studies with anion exchange mechanisms and antibacterial photocatalytic activities will be given, after surveying general needs for fine particle surface modification for the purpose of functionalization.

PL.S.V.3.

NOVEL BULK MATERIALS FOR THERMOELECTRIC ENERGY RECOVERY

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Most industrial and transportation processes worldwide waste more than 50% of the fuel energy, leading to vast amounts of wasted thermal energy. Thermoelectric (TE) materials are able to directly convert thermal energy into electrical energy (Seebeck effect, TE generator) and reversibly electrical energy into thermal energy (Peltier effect, TE heat pump or Peltier cooling). The potential of a material for TE applications is determined by the dimensionless figure of merit, ZT. TE devices need p- and n-type performing TE semiconductors. Recent advancements in TE materials have created the potential to harness waste energy and to convert it to much better energy conversion efficiencies (>10%) than in past applications.

Besides an introduction into thermoelectrics, the presentation will cover recent advances in TE-performance of novel non-toxic bulk materials (Skutterudites, Clathrates, Half-Heusler alloys) particularly for automotive applications for the intermediate range of temperatures 500-900 K. Advances have been made in understanding (i) the thermal stability and formation of TE materials, (ii) the filling process of structural voids in the skutterudite lattice, (iii) the incorporation of transition metals into clathrate frameworks and (iv) the techniques such as band gap tuning, phonon engineering and nanostructuring as part of the strategy to develop outstanding TE-devices.

PL.S.V.4.

THE CHALLENGES FOR THE SYNTHESIS OF PRESENT AND FUTURE CONTEMPORARY ELECTROCERAMICS

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In recent time, the most remarkable progress of ceramic electro-components having increased functionality and miniaturization are made of lead-free materials. This materials are of lower price and mostly used for higher working frequencies (i.e. $\geq$ 500 MHz). In most cases, miniaturization has been achieved by use of finer raw materials, thinner layers and appearance of well defined microstructure formed after sintering. Increased functionality of the components made thereof results from combination of various electrical characteristics of the materials, which might be combined with other types of ceramics. Processing is the most critical step of today's contemporary electroceramics, which enables full exploration of the property of these materials. Even today, the well known multilayer technology is most widely used to design different combination of dielectric, magnetic, semiconductor and insulating ceramics. However, there are several limitations of this technology with respect to the thickness that can be achieved. The most important challenge in the production of MLC is to obtain the dielectric layers thinner than 300 nm. On the other hand, miniaturized 3-D module circuits are produced by embedding the passive and active components in a ceramic and polymer substrate. It is believed that this technology shows a huge potential in designing future wireless devices. In this respect, nanosized ceramic powders are becoming indispensable for the continuation of miniaturization. New and contemporary processes are based on the use of nanosized raw materials, which enable production of well crystalized powders with the average size ranging from a few nm to several hundreds of nm. An example of such synthesis is the hydrothermal process. Even more challenging technology is the self-assembly of nanoparticles used for building up super molecule and lattice structure.

In this presentation, several contemporary synthetic technics for the production of elctroceramic will be described and discussed.

PL.S.V.5.

STRUCTURAL AND ELECTROCHEMICAL PROPERTIES OF SELECTED POLYANIONIC CATHODE MATERIALS USED IN BATTERIES

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In last 15 years we are witnesses of the rising interest into the polyanionic based cathode materials. After pioneering work in Goodenough lab and great success of $LiFePO_4$ many different polyanionic based cathode materials were proposed. The common future of most of materials is covalently bonded oxygen within polyanionic structure what make those materials inherently safer compared to oxide based cathode materials. Based on heavier molecular weight, the theoretical capacity is ranging from about 100 mAh/g for pyrophosphates up to 220 mAh/g for borates. However there is a family of polyanionic cathode materials based on the orthosilicate structure with a theoretical capacity over 330 mAh/g if both lithium atoms can be reversibly exchanged from the structure.

Polyanionic based cathode materials enabled effective use of the redox couple Fe(III)/Fe(II) through inductive effect. Differences in the electronegativity of polyanions was demonstrated to be important way to tune redox potential, since oxidation voltage for redox couple Fe(III)/Fe(II) can differ for more than 1 V if we compare oxidation potential for borates and flourosulphates. Additional fine tuning of the cell potential can be done within different structures having the same composition.

Different approaches in the synthesis of new polyanionic based cathode materials and directions for materials with improved kinetics will be presented based on our recent work in this field.

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PL.S.V.6.

OPERANDO BROADBAND DIELECTRIC SPECTROSCOPY OF LITHIUM-ION BATTERIES FROM LOW FREQUENCIES TO MICROWAVES

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The fruitful contribution of Broadband Dielectric Spectroscopy (BDS) to study hierarchical materials applied to batteries electrodes has been previously shown. The BDS measurement was up to now ex situ measurement, on dry electrode. They provide a fundamental insight into the conduction properties at all scales of the materials before being integrated in a real battery. An innovative device (measurement cell) has been developed to make synchronized BDS measurements and electrochemical cycling. The frequency range is about 1 kHz - 5 GHz. In this work, data acquisitions were made on dry electrode and then on an electrode wetted with an electrolyte, after the first charge, the first discharge, and several cycles. The new device opens thus important prospects to determine the evolutions of the multi-scales electrical properties during electrochemical cycling.

Poster Presentation

P.S.A.1.

CHARACTERIZATION OF DEFECTS IN Yb:CALGO A MATERIAL FOR HIGH POWER ULTRAFAST LASER

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A crucial issue in the field of high power lasers is the management of thermal effects, leading to mechanical distortions, thermal lenses and optical losses of the laser crystal. A suitable candidate for such application should combine a weak quantum defect and good thermo-mechanical properties in order to limit the heat production in the laser material. In this context, Yb:$CaGdAlO_4$ is a promising new laser material with a very high thermal conductivity allowing high-power diode pumping. Reducing thermal load is important to reach high power and therefore within this context, it is important to prepare high purity material and fully characterize the defects. In this project we are preparing advanced materials for high technologies (different laser configurations). The characterizations concern the structural and optical properties, spectroscopy, and laser characterization.

P.S.A.2.

EXPERIMENTAL INVESTIGATION OF SHOCK WAVE PROCESSES IN SOLID AND LIQUID PARAFFIN AND DOCOSANE

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Structure of compression front and mechanism of havoc under tension at shock-wave action are determent by shock-waves parameters and condition of medium. It is of interest to investigate features of material response character on external influence at transition through melting temperature. The most clearly these changes can be observed in the metals. For example, above melting temperature two wave structure caused by elastic-plastic properties of metal vanishes away, the kinetic of spall destruction changes principally. Organic material behavior features investigated to a much less extent. The aim of this work is experimental investigation of shock-wave processes in solid and liquid paraffin and docosane.

Homogenized paraffin and docosane were chosen as objects of investigation. Paraffin is a mixt of saturated hydrocarbon molecules from C_{18} to C_{35} while docosane is saturated hydrocarbon $C_{22}H_{46}$. Compression pulse amplitude was changed from 0.2 to 2 GPa. Registration of free surface speed was made with VISA+R laser interferometer. It was shown that phase transition of paraffin from solid to liquid state does not lead to appearance of any features on wave profiles. It was registered that spall strength of paraffin in solid state is equals of about 20 Mpa and in liquid state it is equals of about 15 MPa. Insignificant difference can be observed either in the formation of spall pulse: its edge is much steeper in liquid form than in solid. Significantly different results were achieved in experiments with docosane. Registered spall strengths in solid and liquid state are the same and equals to about 20 MPa. In liquid phase speed profiles are similar to paraffin profiles, but in solid state the fact of dramatic change of compression pulse edge structure can be observed. In solid state with pressure less than 1 GPa can be seen two wave form with forerunner. Moreover the edge of the pulse “blurs” because of anomal compressibility. It means at first that solid docosane has an elastic property which leads to formation of forerunner. At second it means that at low pressures its compressibility is anomalous which excluded opportunity of shock-wave formation.

P.S.A.3.

SURFACE CHARACTERIZATION OF ACTIVE CARBON MATERIAL PREPARED FROM TREE WASTE BY HYDROTHERMAL CARBONIZATION PROCESS

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Hydrothermal carbonization process is a promising technique for the synthesis of carbon materials. Also, it could be utilized for chemical activation of carbon material. Tree waste, as a precursor, is an environmental friendly renewable resource. We examined new type of a precursor for active carbon fibrous material – Platanus orientalis seeds. Phosphoric acid is used as an activating agent. Hydrothermal carbonization of planetree seeds were performed in a glass reactor at 260ºC for 20h.

Characterization of obtained active carbon material was carried out by nitrogen adsorption-desorption isotherms measured at 77K using a Mc Bain balance. Functional surface groups were determinated by FTIR analysis.

P.S.A.4.

PRODUCTION OF NON-STOICHIOMETRIC “SUPERALKALI”CLUSTERS Li_nCl_{n-1} BY MASS SPECTROMETRY

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Non-stoichiometric clusters are challenging to characterize experimentally and theoretically, because they may lie at the core of current search for novel materials with unique structural, electronic, optical, magnetic, and thermodynamic properties. The most remarkable property of these clusters is their enormously low ionization energies and this is the reason for calling them “superalkalies”. On the other hand, these clusters of great significance since they can mimic characteristics of alkali metals and maintain their structural and electronic integrities when assembled with other species. In this work, the applicability of the thermal ionization source of modified design for obtaining Li_nCl_{n-1} ($n \geq 3$) clusters has been investigated.

P.S.A.5.

APPLICATION OF PTR-MS MEASUREMENTS OF VOLATILE ORGANIC COMPOUNDS (VOC) IN MEDICAL SCIENCE

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PTR-MS (Proton Transfer Mass Spectrometer) is a non-invasive method that allows the analysis of human breath are identified metabolic disorders, and even the initial stages of diseases such as diabetes, cancer or lung disease of the digestive tract.

Diabetes mellitus is a complex metabolic disease in which the change in the level of glucose in the blood (glucose), and related metabolites are relatively fast. These changes also have a strong impact on the development of damage to the blood vessels in this disease, which in turn lead to irreversible changes in major organs and the development of disability. At the same time, the current monitoring capabilities of the metabolic state in diabetes, despite numerous achievements, does not provide the optimal level of monitoring of changes glucemy and other important metabolites, both in terms of accuracy and in terms of long-term applicability of the options in patients who have a need for frequent checking. Therefore, the detection of volatile substances in the expiatory air can be used to correlate the glycemic levels with the related metabolites emerged as a very useful diagnostic tool.

In our study we have included 30 patients with type 1 (group A) and 30 patients with type 2 diabetes (group B) and satisfactory metabolic control (glycosylated hemoglobin, HbA1c <8%). The patients were without accompanying respiratory diseases and diseases that could independently affect glycemic regulation. Patients were admitted to the research unit in the morning fasting state and without interfering therapy applications.

In each patient we performed the oral glucose tolerance test (oral glucose tolerance test (OGTT)). In short, after taking samples for analysis of basal (0 min), each patient would drink a liquid with 75 g glucose in 2 minutes. Then the samples were taken at 30, 60, 90 and 120 minutes after glucose load.

In this study the first detailed analysis of the association of levels of methyl nitrate and related volatile substances in exhaled air in a controlled model of change in serum glucose (OGTT) were performed for both types of diabetes.

The results can be the basis for the development of new diagnostic tools in the field of glycemic control, metabolic control, insulin resistance and endothelial function in diabetes.

P.S.A.6.

THERMODYNAMIC MODELLING OF THE MATERIAL PROPERTIES FOR Al-Cu-Mg ALLOYS

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The current paper concentrates on Al-based alloys and describes the scientific background used for the calculation of materials properties for these alloys. Aluminium alloys form one of the most widely used groups of materials in existence. The properties which can be calculated are wide ranging, including thermo-physical and physical properties. It is very useful to be able to predict materials properties and behaviour in multi-component alloys. The current work forms part of the development of a more generalized software package (JMatPro) for the calculation of wide ranging of materials properties. By JMatPro's property models a complete set of physical and mechanical properties can be calculated. The present paper describes a general methodology to calculate properties such as the fraction solid transformed, enthalpy, specific heat (C_p) etc. for multi-component alloys.

P.S.A.7.

THE STUDY OF PROPERTIES OF ZIRCONIUM TUNGSTATE OBTAINED THE HYDROTHERMAL SYNTHESIS

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Zirconium tungstate ZrW_2O_8 with an isotropic negative thermal expansion over a wide temperature range from -273 to 770°C is of a great scientific and technological interest. The structure and properties of zirconium tungstate prepared by the hydrothermal method were studied. It has been shown that the synthesized powder consists of needle-like particles with average transverse size approximatly equal to 200 nm. By means of *in situ* high-temperature X-ray diffraction it have been shown that there was a phase transition from a low-temperature α-modification of zirconium tungstate to the high β-phase at 150 ° C. By using the Rietveld method to refine structure it was calculated the atomic coordinates and interatomic distances for these modifications of ZrW_2O_8. It was shown that the synthesized material has a negative thermal expansion in the temperature range from 20 to 800 ^{0}C.

P.S.A.8.

SYNTHESIS AND CHARACTERIZATION OF COPPER(II) COMPLEX WITH THE SCHIFF BASE OF SALICYLALDEHYDE AND AMINOGUANIDINE

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Since only a few complexes of salicylideneaminoguanidine (SalAG) have been synthesized and considering the fact that both ligand precursors have wide range of biological activity, it seems worthwhile to examine the properties of the new transition metal complexes with this Schiff base. Here we present the synthesis, physico-chemical and structural characterization of a square-planar Cu(II) complex with SalAG as primary and N_3^- ion as secondary ligand. The chelate ligand is coordinated as a monoanion, in a tridentate ONN mode, via oxygen atom of phenolic hydroxyl and nitrogen atoms of azomethine and imino groups of the aminoguanidine fragment. This results in the formation of two chelate rings: a six-membered (pyridoxilidene) and a five-membered (aminoguanidine).

P.S.A.9.

SYNTHESIS OF MESOPOROUS SILICA CORE-SHELL PARTICLES FOR ENZYME IMMOBILIZATION

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Core/shell particles were formed by assembling the primary silica nanoparticles synthesized by neutralization of highly basic sodium silicate solution, on the surface of monodispersed silica core (average size 0.4 μm). The core particles were prepared by hydrolysis and condensation of tetraethylorthosilicate. To improve assembling of primary silica particles on the surface of silica core particles, the latter were functionalized with poly(diallyldimethylammonium chloride) (PDDA). The obtained particles have mesoporous, relatively uniform and continuous silica shell and were prepared without pore-forming agents. The pore size and volume are easily adjustable by controlling the formation of primary silica nano-particles during synthesis of core/shell particles. Invertase from Saccharomyces cerevisiae was immobilized into mesoporous silica shell and immobilized catalyst was used used for sucrose hydrolysis and production of inverted sugar.

P.S.A.10.

THE INFLUENCE OF THE DEPOSITING CURRENT DENSITY ON THE MAGNETIC CHARACTERISTICS OF AMORPHOUS ALLOY POWDER NiCoCu

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Alloy powder NiCoCu was obtained by the process of electro-deposition using the ammonium solution with titanium electrode at the following current densities: $j = 50\ mA/cm^2$, $100\ mA/cm^2$, $200\ mA/cm^2$, $300\ mA/cm^2$ *and* $400\ mA/cm^2$. XRD analysis was applied to establish the powder composition which contained. The powder was the phase of nickel, cobalt and copper solid solution with nanocrystals, whose size depended on the depositing current density; combined with amorphous phase embedded among nanocrystal grains. The magnetization of the fresh powder reaches maximum value at the current density of 100 mA/cm^2 as was determined by the thermomagnetic measurements, Freshly made powder contains significant percentage of free volume, point-like and linear defects, and mechanical micro-strains, which presence has a negative effect on the level of powders' magnetization. After structural relaxation of the powder, the increase in magnetization becomes proportional to depositing current density. The magnetization level in the powder ranges from 10.3% at 50 mA/cm^2 to 387.3% at 400 mA/cm^2. Kiri temperature is defined for all powder samples at the magnetic field magnitude of 100 kA/m.

P.S.A.11.

$La_{0.5}Pr_{0.2}Pb_{1-X}Sr_XMnO_3$: SYNTHESIS AND CORRELATION BETWEEN CHEMICAL COMPOSITION, MICROSTRUCTURE AND MAGNETORESISTANCE

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We synthesized the $La_{0.5}Pr_{0.2}Pb_{0.3-x}Sr_xMnO_3$ manganites by ceramic technology. The samples contain only one phase, Pm3m or R-3c, depending on ratio between the Pb and Sr concentrations. Magnetic properties and transport characteristics were investigated and small-angle X-ray and neutron scattering (SAXS/SANS) measurements were also performed. The aims of our investigations are determination of the parameters which influence the microstructure and magnetic/transport characteristics and establishing their relations with the results from SANS experiments. At temperatures higher than Curie temperature, from SANS measurements, we have shown the presence of small magnetic domains. The spatial organization and the sizes of these nanomagnetic domains determine the magnetoresistance of the samples.

P.S.A.12.

PREPARATION AND CHARACTERIZATION Pt CATALYST ON Ru DOPED TIN OXIDE SUPPORT FOR OXYGEN REDUCTION

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Platinum nanocatalyst on Ru doped tin oxide support (Ru-SnO_2) was synthesized and characterized as a catalyst for oxygen reduction reaction in 0.5 mol dm^{-3} $HClO_4$ solution, at 25°C. Ru doped tin oxide support was synthesized by sol-gel procedure. Synthesized support was characterized by BET (Brunauer, Emmett, Teller), X-ray diffraction, HRTEM (high resolution transmission electron microscopy) and cyclic voltammetry techniques. Specific surface area of the support determined from nitrogen adsorption/desorption isothermal curves was 141 m^2 g^{-1}. XRD spectra contained mainly SnO_2 belonging peaks. The corresponding crystallite size for Ru-SnO_2, determined by Scherrer's equation was 4nm.

Platinum nanocatalyst at Ru-SnO_2 support was synthesized by borohydride reduction method and characterized by X-ray and TEM techniques. Homogenous Pt nanoparticles distribution over the support, without pronounced particle agglomeration was confirmed. The average Pt particle size was 5.3 nm. Electrochemically active surface area of the catalyst was determined from adsorption/desorption charge of hydrogen atoms, after double layer charge correction, taking into account the reference value of 210 μC cm^{-2} for full monolayer coverage with adsorbed hydrogen species.

The oxygen reduction reaction at Pt/Ru-SnO_2 catalyst was studied by cyclic voltammetry and linear sweep voltammetry at rotating disc electrode. Two different Tafel slope were observed: one close to 60 mV dec^{-1} in low current density region, and other close to 120 mV dec^{-1} at high current densities region, as it was already reported in literature for oxygen reduction at pure polycrystalline Pt, as well as at Pt nanoparticles in acid solutions. The specific activities, expressed in terms of kinetic current densities per electrochemically active surface area, as well as per mass of Pt loaded, at the constant potential of practical interest, were compared to carbon supported (Vulcan XC-72) catalyst. Pt/Ru-SnO_2 catalyst exhibited similar catalytic activity for oxygen reduction reaction like carbon supported one. The durability of the catalysts was evaluated by repetitive cycling up to 1.4 V vs RHE. Better stability of Pt/Ru-SnO_2 catalyst compared to Pt on carbon support was confirmed by determination of the loss of platinum electrochemically active surface area after potential cycling tests.

P.S.A.13.

FORMATION AND MORPHOLOGY OF INTERMETALLIC PHASES AND EUTECTIC IN IRON COATED THICK ALUMINIUM SUBSTRATES

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The contribution is focused on formation and growth of intermetallic phases and eutectic in iron coated aluminium alloy systems. The 99.5Fe powder was used to produce the coating, by means of high velocity oxyfuel spraying, onto 5mm thick 99.5Al sheet surface. As-sprayed samples were annealed in the range of 600 - 800°C in ambient atmosphere. Based on temperature height an isothermal dwell was from several minutes up to a few hours. Isothermal annealing below the melting point of aluminium-iron eutectic resulting in a formation of iron-aluminides within the iron coatings. Nevertheless, with increasing temperature, exceeding the melting point of eutectic, iron diffuse into the aluminius substrate and eutectic alloy with various morphologies start to form. The microstructure of produced alloys was obtained by scanning electron microscope. Layer thickness and morphology measurements were evaluated by means of image analysis. Chemical compositions were estimated using energy dispersive microanalysis.

P.S.A.14.

NORMALIZED DISTRIBUTION COEFFICIENT AS A NOVEL METHOD FOR CAST IRONS MATRIX HETEROGENEITY ASSESSMENT

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This contribution deals with the comparison of different methods of alloying elements' concentration measurement based on energy dispersive spectroscopy and also with the suitability of particular methods of quantitative assessment of heterogeneity of the spheroidal graphite cast iron matrix. The segregation curves construction and distribution coefficient formulation is also discussed. Based on a basis, which is to be achieved by means of evaluation of large experimental data sets, is the evaluation of applicability of homogenization annealing of spheroidal graphite cast iron with the aim to eliminate segregation of silicon, and mainly nickel, as pearlite- and carbide-forming agent at the border of eutectic cell. The result is an optimized homogenization annealing schedule maximizing the suppression of silicon and nickel segregation while taking into account the minimization of financial expenses and risk of grain coarsening. For quantitative evaluation of the distribution of alloying elements the notion "normalized distribution coefficient" is newly introduced.

P.S.A.15.

PHASE ANALYSIS OF ALUMINIDE DIFFUSION COATINGS PRODUCED BY ALUMINIZING OF NICKEL AND NICKEL-BASED ALLOYS

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Diffusion coatings based on nickel-aluminides were formed on nickel, nickel – 20 wt.% chromium and Inconel 713LC substrates using powder liquid aluminizing method followed by two-stage heat treatment in argon-flow atmosphere. Two main layers consists of nickel-aluminide intermediate phases between the deposited coating and nickel-based substrate were formed, until the second stage of annealing temperature (1000°C) have been reached. These total layers thickness during the isothermal dwell slowly increases. Moreover, in the case of chromium containing substrates, the third separate layer starts to form. It seems that the chromium content significantly influences nickel-aluminide layers formation. Independently on the substrates for coating deposition used the Al_3Ni_2, AlNi and $AlCr_2$ phases (last mentioned chromium containing ones) were identified. The microstructures of coating substrate interfaces were obtained by scanning electron microscope. Layer thickness measurements were measured by means of image analysis. Chemical compositions were estimated using energy dispersive microanalysis. Qualitative and quantitative X-ray diffraction completed by Rietveld analysis for phase determination were also used.

P.S.A.16.

SYNTHESIS OF F-DOPED $LiFePO_4$ VIA PRECIPITATION METHOD

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Fluorine-doped, olivine-structured $LiFePO_4$ suitable for cathode material in rechargeable lithium batteries was prepared by aqueous precipitation followed by high temperature treatment at 700°C under slightly reductive atmosphere ($Ar+5\%H_2$). The starting materials were equimolar quantities of $(NH_4)_2HPO_4$, $FeSO_4\cdot7H_2O$ and LiF. LiF served as both lithium and fluorine source. Besides the lattice parameters and the primitive cell volume reductions, compared to the undoped sample synthesized under the same conditions using $LiNO_3$ as lithium source, the Rietveld refinement also shows that fluorine ions preferably occupy specific oxygen sites. Particularly, the best refinement is accomplished when fluorine ions occupy O(2) sites exclusively. By means of up-to-date electronic structure and total energy calculations this experimental finding is theoretically confirmed. Such fluorine doping also produces closing of the gap in the electronic structure and consequently better conductivity properties of the doped compound. In addition, the morphological and electrochemical performances of the synthesized powders are fully characterized.

P.S.A.17.

CRYSTAL STRUCTURE REFINEMENT OF Li_2FeSiO_4 CATHODE MATERIAL

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Recently lithium iron orthosilicate, Li_2FeSiO_4, has been found to display attractive electrochemical properties when used as cathode material. Because its constituent elements are non-toxic, low-cost and abundant, it is also attractive system from the standpoint of environmental sustainability. Li_2FeSiO_4 compounds are known to exhibit a rich polymorphism and several crystal structures have been reported in the literature. Due to its complex polymorphism it is still a challenge obtaining a phase pure material. Here we report the properties of pure Li_2FeSiO_4 obtained by solid-state reaction at 750 °C. It was found that Li_2FeSiO_4 crystallizes in monoclinic $P2_1/n$ space group. In this structure one set of LiO4 tetrahedra are arranged in edge sharing pairs with FeO4 tetrahedra, while the other set of LiO4 tetrahedra forms edge sharing pairs with itself. In addition, galvanostatically cycled material was characterized in terms of structural and transport properties.

P.S.A.18.

CARBON COATED LiFePO$_4$ CATHODE MATERIAL OBTAINED BY FREEZE-DRYING METHOD

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One of the most perspective cathode materials for the application in the Li-ion batteries is LiFePO$_4$. It has high theoretical specific capacity, good cycle life and technically suitable flat voltage of 3.45 V versus Li. However, its main disadvantages are low electronic and ionic conductivities which can be overcome by particle size minimization and/or carbon coating. Here is presented the freeze-drying method for the preparation of carbon coated LiFePO$_4$ particles. It involves freezing of a precursor solution, vacuum drying and final calcination of as-dried powder under slightly reductive atmosphere. The main advantage of this preparation process is mixing at the atomic level which provides more homogeneous precursor. Water solutions containing Li$^+$, PO$_4^{3-}$ and Fe^{2+} ions with the addition of various organic compounds as a carbon source were used as the precursor solutions. The as-prepared powders were fully characterized by means of X-ray powder diffraction, scanning electron microscopy, particle size analyzer and galvanostatic cycling.

P.S.A.19.

LiFePO$_4$ NANOCRYSTALS SYNTHESIS BY HYDROTHERMAL REDUCTION METHOD

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The nanocrystals of LiFePO$_4$ a cathode material for Li-ion batteries were synthesized by simple one – pot combined colloidal hydrothermal reduction approach. The influences of surfactant ratios on nanocrystal formation are investigated. Also extent of surface modification and agglomeration is assessed. The electrochemical performance of material is investigated on as prepared samples and on samples with carbonized surface layer. The XRD, TEM, SEM, FTIR, laser diffraction PSA, magnetic measurements and galvanostatic cycling are performed characterization techniques.

P.S.A.20.

ELECTROCHEMICAL STUDIES OF THE MICROSTRUCTURAL CORROSION OF Al-Cu15-Mg ALLOY

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The microstructure of Al-Cu15-Mg alloy was first determined by scanning electron microscope. Large precipitates (Al_2CuMg) were located at grain boundaries and small particles were present in grains. The electrochemical response of sites containing precipitates were then investigated using the electrochemical microcell technique. After straining, big scattering was observed in the electrochemical response. The most active places corresponded to the corrosion potential around -0.150mV. In the absence of severe damage in the matrix, the corrosion potential was more anodic. Local polarisation curves carried out in sites containing large precipitates and no defects induced by straining were very close to those obtained in grains far from precipitates. The aluminium alloys show only slight selective corrosion phenomena and from corrosion point of view aluminium alloys are an attractive alternative for steel.

P.S.A.21.

A COMPARATIVE STUDY OF STUCTURAL AND OPTICAL PROPERTIES OF Eu^{3+}- DOPED $GdVO_4$ SYNTHESIZED BY THREE DIFFERENT METHODS: FROM BULK TO NANOPARTICLES

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The Eu^{3+}-doped $GdVO_4$ is a highly efficient red-light-emitting material owing to strong absorption of UV radiation by the VO_4^{3-} groups and efficient energy transfer from the $GdVO_4$ host to Eu^{3+} ions; it is applied in many devices, such as cathode ray tubes, fluorescent lamps, and X-ray detectors. Gadolinium ions Gd^{3+}, due to the similar ionic radii, electronic structures and electronegativities, can be easily replaced with luminescence-active rare earth ions in a wide range of concentrations, without affecting much the lattice structure.

In this work, we report the systematic comparative studies of structural (the X-ray diffractometry, XRD, scanning electron microscopy, SEM, and transmission electron microscopy, TEM) and optical properties (photoluminescence, PL, spectroscopy) of the bulk and nanoparticles of Eu^{3+}- doped $GdVO_4$ synthesized by three different methods. The standard high-temperature solid-state reaction method was used for preparing bulk material, while, respectively chemical co-precipitation and microemulsion techniques were used for preparing nanorods and nanoparticles. It is very important to note that the first time in this work the $GdVO_4$ nanoparticles are synthesized by microemulsion method.

All XRD patterns clearly show the presence of a tetragonal zircon-type $GdVO_4$ crystal structure corresponding to the reference card. No other phases were detected, indicating that Eu^{3+} ions have been effectively incorporated into the $GdVO_4$ host lattice. Large deformed (irregular) spherical particles with an average diameter in the range from 1.4 μm to 8.4 μm were observed in the bulk samples. Low magnification image of samples synthesized by chemical co-precipitation technique revealed that powders are self-organized in nanorods (diameter ~ 5 nm, length to 20 nm) bunches. The average crystallite size of nanoparticles obtained by micromulsion technique was found to be 3.9 nm and presence of spherical nanoparticles with diameter about 3 nm was also shown at nanometer level TEM images.

PL spectra of all samples consist of several characteristic emission lines corresponding to f–f transitions within the $4f^6$ configuration of the Eu^{3+} ions. The strongest emission line around 618 nm results from the $^5D_0 \rightarrow {}^7F_2$ transition; two weaker peaks at ~538 nm and ~594 nm are due to the $^5D_1 \rightarrow {}^7F_1$ and $^5D_0 \rightarrow {}^7F_1$ transitions, respectively. Only slight emission from the VO_4^{3-} group is detected, suggesting that the energy transfer from VO_4^{3-} to Eu^{3+} is very efficient.

P.S.A.22.

ACTIVATED CARBON PRODUCTION FROM COTTON WASTE FIBERS

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Activated carbons are the most commonly used adsorbents in separation and purification processes. Lately, the efforts of scientists to find alternative adsorbent to replace the costly activated carbon have been intensified. Some of the potential low-cost adsorbents for the removal of metals and organic substances are industrial waste materials. Activated carbon obtained by chemical and physical modification of waste cotton fibers from the weaving plants was used as an adsorbent. SEM measurements were carried out on a JEOL JSM - 6610LV device using a secondary electron detector. Also, as the SEM is equipped with EDS X-rays detector, characteristic X-rays of major elements (> 10 wt.%) were measured. The activated carbon used is relatively fine bulk material with heterogeneous porous particles of diverse shapes and forms. Within larger particles there are conspicuous cracks, cavities and channels that form the basis of the microporosity of materials. EDS spectrum of activated carbon shows its qualitative chemical composition, on the basis of which was established the presence of the following chemical elements: carbon, oxygen, sodium, aluminum, silicon, sulfur and calcium. This spectrum shows the distribution of X-rays by energies that are characteristic for each element. Analyses of specific surface area and pore distribution of the synthesized activated carbons were carried out by nitrogen adsorption at -196^{o}C on a Sorptomatic 1990 analyzer (Thermo Fisher Scientific Inc.). Before measurements, the samples were degassed for 12 h at 110^{o}C. Determination of the specific surface area of samples was performed by Brunauer-Emmett-Teller (BET) method, the mesopore volume and surface area were determined by Barret-Joyner-Halenda (BJH) method, and the micropore volume was obtained by using the Dubinin-Radushkevich equation. Pore volume according to Gurvich for p/p_0 of 0.98 was 0.0051 cm^3/g. Specific surface area of the sample, S_{BET}, was calculated and amounted to 2.14 m^2/g. Dubinin and Radushkevich method with its equation was used to calculate the micropore volume based on adsorption isotherms, V_{mic} =0.00085. Based on the results, it can be said that the activated carbon produced from waste cotton fibers has potential as an adsorbent.

P.S.A.23.

PREPARATION AND CHARACTERIZATION ALUMINA CERAMIC FIBERS OBTAINED VIA ELECTROSPINNING

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Alumina nanofiber is one of the most important ceramic nanomaterials, which finds many applications in mechanics, electronics, optics, etc. Alumina fibers were prepared from the aluminium chloride hydroxide /poly (vinyl alcohol)/water precursor using the electrospinning technique. The mass ratio of aluminium chloride hydroxide/ PVA was 10/1. Upon calcining the fibers at 1100°C, continuous alumina nanofibers with diameters ranging from 50 to 1500nm were obtained. The electrospinning device used to extract the fibers was Electrospinner CH-01 (Linari Engineering, Italy). The fibers were characterized using SEM, XRD and TGA/DTA methods and the corresponding fiber diameter distributions are presented.

P.S.A.24.

SBR/CSM/BIOGENIC SILICA RUBBER BLEND COMPOSITE

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Biogenic silica as filler was compounded with rubber blend based on styrene butadiene rubber (SBR) and chlorosulphonated polyethylene rubber (SBR) using conventional laboratory-sized two roll mills. For comparison purposes, commercial filler (i.e. silica) was also studied. The optimum loading of each type of filler was investigated and compared in terms of curing characteristics, tensile properties, thermal stability and rubber filler interaction. Results showed that scorch time and cure time of biogenic silica (BSi) filled rubber blends was the lowest compared to silica filled SBR/CSM composites. However, the incorporation of BSi offers the highest cure rate index. From a reinforcement perspective, the BSi filled SBR/CSM rubber blend had the highest tensile strength (24 MPa), followed by silica (20 MPa). It is worth noting that the incorporation of BSi increased the elongation at break by 3.4% whereas silica reduced the elongation at break of the SBR/CSM rubber blend composites. Further evidence of interaction was supported by the measurement of rubber-filler interaction, thermogravimetric analysis and morphological studies.

P.S.A.25.

INFLUENCE OF DIFERENT MODULUS OF ELASTICITY OF COMPOSITE ADHERENDS ON STRESS DISTRIBUTION IN THE CASE OF STEP JOINT

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Stress distribution in the case of step joint of two composite plates is analyzed using the finite element method. The influence of the different of modulus of elasticity is analyzed. 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 poisson’s ratio as well as allowable stress values. Mesh size is adapted as per the situation. Results are presented in the form of graphs. It is interesting to note that the variations of stress values in the z direction is negligible when compared with x and y directions.

P.S.A.26.

STRUCTURAL CHARACTERIZATION OF SUBMERGED GRANULAR PACKINGS

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Our investigations aim to determine the influence of a reduced gravity on the structural properties of an assembly of noncohesive beads. The structural properties of packings of ceramic spheres formed in a two-dimensional cell are studied for liquids of different densities. The density of the liquid is adjusted to higher densities by increasing the concentration of $ZnCl_2$, so that the effective gravitational force on the spheres could be varied. A high-resolution digital camera is used to take the snapshots to capture the static packing configurations of spheres in the container. Experimentally, we fokus our attention on the dependence of the “micro-structural” properties of grains (Voronoi volumes, shape-factor, Delaunay “free” volumes) on some parameters like the packing fraction and the effective gravitational force. The granular organization at local level was studied by analyzing the shape factor ζ of the local volumes associated with a natural way of subdividing the volume into local parts - the Voronoi partition. The shape factor ζ is a quantifier of the circularity of Voronoi cells associated with the individual particles. It gives a clear physical picture of the competition between less and more ordered domains of particles. We calculate the distribution of the shape-factor for packings at different reduced gravity conditions. We characterize the local organization of beads in terms of the distribution of pores. We define the pore as a part of the Delaunay triangle not occupied by the spheres (Delaunay “free” volume). We show that the microscopic texture of the packing of grains is quite sensitive to the effective gravitational force. Probability distribution of the shape-factor becomes narrower and more localized around the maximum as the effective gravity increases. In other words, the Voronoi cells become more circular at higher values of the effective gravity. The curves of “free” volume distribution are asymmetric with quite a long tail on the right-hand side, which progressively reduces by increasing the effective gravity. Shorter force chains and greater degree of branching in the force chain network, induced by higher values of the effective gravity, result in macroscopically stronger granular packing.

P.S.A.27.

PHYSICAL MECHANISMS OF RAIL STEEL FATIGUE LIFE INCREASE BY ELECTRON BEAM TREATMENT

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The investigations of phase composition, structure and defect substructure of rail steel subjected to electron beams irradiation in different regimes and multicycle fatigue loading up to fracture are carried out by methods of scanning and transmission electron microscopy. Nanosize martensite structure formation in surface layer (~10 μm) is established. The regime of rail steel surface treatment by high intensive electron beams, allowing increase the fatigue life repeatedly (by ~2.5 times) is revealed. Needlelike profile interface formation, stress concentrators dispersion and others physical mechanisms of fatigue life increase of the steel treated by electron beam are discussed.

This work has been performed by the partial financial support of FSP «Scientific and scientific pedagogical staff of innovative Russia» (Agreement No 14.B37.21.0071).

P.S.A.28.

ELECTRON BEAM TREATMENT OF STAINLESS STEEL SURFACE: FATIGUE LIFE INCREASE AND NANOSIZE CARBIDES FORMATION

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Electron-beam treatment with 20 J/cm^2 energy density of Fe-0.20C-23Cr-18Ni stainless steel increases fatigue life up to 2.1 times. Fracture surface investigations have been carried out by the methods of scanning electron microscopy and layer-by-layer analysis of structural phase states and defect substructure of steel subjected to the multicyclic fatigue tests, has been made as well by methods of transmission diffraction electron microscopy. Nanosize $(Cr, Fe)_{23}C_6$ carbides formation and physical reasons of steel fatigue life increase by electron – beam treatment have been found out.

This work has been performed by the partial financial support of FSP «Scientific and scientific pedagogical staff of innovative Russia in 2009-2013» (Agreement No 14.B37.21.0071).

P.S.A.29.

SURFACE RELIEF AND STRUCTURE OF ELECTROEXPLOSIVE COMPOSITE SURFACE LAYERS OF THE MOLYBDENUM–COPPER SYSTEM

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The surface topography and structure of copper layers exposed to multiphase plasma jets of products of electrical explosion of molybdenum and copper foils are studied using profilometry and scanning electron and light microscopy. Such treatment allows deposition of either layered coatings or alloyed composite layers. It is found that the surface layer roughness parameter is simple average profile deviation three to four µm. The thickness of some copper and molybdenum layers of coatings is fifteen to twenty µm. Electroexplosive alloying produces layers twenty-five µm thick. Sizes of copper inclusions in the molybdenum matrix near the surface of such layers vary from thirty nm to one to two µm.

P.S.A.30.

NANOSIZE STRUCTURE FORMATION UNDER STEEL THERMOMECHANICAL STRENGTHENING

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The gradient structure-phase states formation being characterized by the regular change of dislocation substructure parameters, nanosized range α-phase fragments and cementite particles on cross section of 09G2S (0.1% C, 2% Mn, 1% Si) steel H-beam subjected to thermomechanical strengthening are revealed by methods of transmission electron diffraction microscopy. The formation of nanoscale phases is possible due to a processes: the dispersing of pearlite cementite plates colonies; the dissolution of cementite plates; the decay of solid solution of carbon in the α-iron; the $\gamma \Rightarrow \alpha$ transformation under the conditions of high degree of deformation and high temperature treatment.

This work has been performed by the financial support of RFBR grant (project No11-02-91150-GFEN_a) and Government task No 2.4807.2011.

P.S.A.31.

ISOCITRIC ACID PRODUCTION BY *YARROWIA LIPOLYTICA* YEAST

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Threo-Ds-isocitric (ICA) is used as a building block for chemical synthesis, as a marker to detect the authenticity citrus juices, as an antistress, antihypoxic and immune active agent. Currently, ICA is isolated from *Sedum spectabile* plant at high price (up to 500 €/g). In this study, we developed the process of microbiological production of ICA from rapeseed oil using *Yarrowia lipolytica* yeast strains. Under optimal conditions *Y. lipolytica* produced up to 70 g/L of ICA with the yield of 80%.

This work was supported by the Ministry of Education and Science of the Russian Federation in the scope of Federal Target Program "Research and development for priority directions of science and technology complex of Russia for 2007–2013" (project no. 14.512.11.0045).

P.S.A.32.

MECHANOCHEMICAL MODIFICATION OF GLAUCONITE, DIATOMITE AND VERMICULITE TO OBTAIN SORBENTS

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Minerals (glauconite, glauconite sand, diatomite, and vermiculite) from different deposits were used as starting materials. Minerals were crushed and homogenized (including sodium dihydrogen phosphate as additives) using a steel or agate one-ball vibratory mill. To obtain a sorbent mixture of mineral and NaH_2PO_4 at different ratios (1:1, 2:1, 3:1, 4:1, respectively) were subjected to mechanical activation (MA) in a planetary mill Pulverissette 6. MA products were studied by XRD, derivatography, DTA, DSC and IR spectroscopy. Sorption capacity of sorbents studied in static and constant stirring of the model solutions with concentrations of manganese sulfate 60−1000 $\mu g/dm^3$. Increasing the sorption properties of MA samples can be explained by the formation of aqua-phosphate glasses. Aqua-phosphate glasses are new sorption centers in the structure of minerals.

P.S.A.33.

DIELECTRIC AND FERROELECTRIC MEASUREMENTS OF TITANATE-FERRITE COMPOSITE CERAMICS

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Even though single-phase multiferroics have been profoundly investigated in recent years, none of the known materials exhibit satisfactory Magneto Electric (ME) effect at room temperature. On the other hand, composite multiferroic materials (consisting of ferroelectric and ferromagnetic separate phases) offer a wide variety of design and tuning possibilities and accordingly, have drawn rising attention in recent years. In this work, $BaTiO_3$-$NiFe_2O_4$ composite ceramics with various titanate: ferrite mass ratios (1:1, 2:1, 8:1) were prepared from powders synthesized by the combination of wet chemical synthesis methods, co-precipitation and sol-gel. In order to investigate the link between the microstructure, phase composition and functional properties of the prepared ceramics, we measured ferroelectric behavior at room temperature and dielectric properties at elevated temperature (room temperature – 450 °C) and in the frequency range of 100 Hz-1 MHz. In composite samples, the dielectric constant was found to decrease while dielectric loss increases with increasing $NiFe_2O_4$ content. In addition $BaTiO_3$ phase transition temperature (Tc) was found to be shifted to lower temperatures. Measurements of ferroelectric behavior at room temperature confirmed that the saturation polarization values (Ps) of the composites rely on the titanate content, i.e. the increase of $NiFe_2O_4$ content in the samples results in lower polarization values.

P.S.A.34.

INVESTIGATION OF ATOMIZATION LIQUID METALS OF SUPERSONIC GAS

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Supersonic gas jets in confined liquid metal atomizing nozzle were applied by using the methode of characteristics. Nitrogen at operation (stagnation) pressure of (1.65 MPa) was used in the study, with the three different values of ambient pressure (1.25, 1.52 and 1.75 bar). The nozzle for all the three values is over expanded. The Mach number, at the nozzle exit for all the investigated cases was 2.64. The pressure and Mach number of the atomizing gas, at the various lattice points downstream of nozzle exit, were found. The effect of heat transfer from the liquid metal (aluminium) on the gas flow behavior was also investigated. The result showed that the stagnation temperature rise of nitrogen, caused by heat transferred from aluminium is very small and can be neglected, and hence, the flow can be assumed to be adiabatic. The results indicate that the pressure of the atomizing gas tries to adjust the higher ambient pressure, by the formation of weak oblique “lip“ shock, followed by a reflected weak oblique „edge“ shock. As the ambient pressure increases, the inward curvature of the jet boundary increases and hence, the length of the jet decreases. As the ambient pressure increases, the point at which the oblique “lip“ shock strikes, the wall moves upstream toward the nozzle exit. If the shock is to be avoided, the difference between the ambient and nozzle exit pressures must be decreased. This can be done, for fixed nozzle geometry, either by increasing the operation pressure or decreasing the ambient pressure.

P.S.A.35.

THE CONFINEMENT RESONANCES IN THE PHOTOIONIZATION OF ENDOHEDRAL FULLERENES

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In the paper are investigated the confinement resonances CR in the photoionization processes of the endohedral fullerenes. The corresponding photoionization cross sections was calculated using the quantum mechanical approach to treat the calculations of the cross section of *Xe*4*d* photoionization of *Xe*@C60, in the area of the 4d giant resonance were performed in improved version of RPA approximation. It is obtained, that the effects of the dynamical screening of the incoming radiation, by the *Cn* cage change the cross sections in DCA, compared to the results obtained in the frozen core effects on the *Xe*5*p* cross sections are presented, also.

The obtained results are very significant to get the accurate results for designing new materials in nano-domain.

P.S.A.36.

THERMAL STABILITY AND MECHANISM OF CRYSTALLIZATION OF $Fe_{81}B_{13}Si_4C_2$ AMORPHOUS ALLOY

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Iron-based metallic glasses (amorphous alloys) represent homogenous and isotropic materials with absence of the long-range order, with favourable physical and mechanical properties which make them useful for many applications. Metallic glasses are kinetically and thermodynamically metastable and tend to crystallize under certain conditions. Control of crystallization process of these materials can lead to creation of materials with targeted properties. Amorphous alloy with a composition of $Fe_{81}B_{13}Si_4C_2$, prepared using melt spinning method, was examined in terms of thermal stability and structural stabilisation caused by thermal treatment. DSC measurements at different heating rates showed series of exo- and endo-peaks in the temperature range 470-850 K corresponding to a stepwise process of thermal stabilization of the alloy. Broad exothermic peak between 470 and 650 K corresponds to stress-relieving transformations, while endothermic peak at around 680 K can be ascribed to Curie temperature based on results of thermomagnetic measurements. Complex exothermic peak at around 800 K corresponding to stepwise crystallization process was deconvoluted using Gaussian-Lorentzian cross-product function into three steps, ascribed to formation of α-Fe(Si), Fe_3B and Fe_2B phase respectively. Kinetics and mechanism of crystallization of individual iron phases were examined including determination of kinetic triplets. Similar and relatively high values of activation energy were observed for all crystallization steps indicating similar crystallization mechanisms which probably include simultaneous movement of large number of atoms. Determination of the correct form of the conversion function showed that autocatalytic Šesták-Berggren model best describes all crystallization steps.

P.S.A.37.

PHASE FORMATION AT ALUMINOTHERMIC REDUCTION OF TANTALUM OXIDE AND MANGANESE TANTALATE

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The work is devoted to study of phase formation at aluminothermic reduction of tantalum oxide and manganese tantalate in conditions of continuous heating in inert atmosphere up to 1673 K. Processes of reduction of tantalum oxide and manganese tantalate are investigated by thermogravimetric analysis, differential scanning calorimetry, X-ray diffraction and X-ray spectral microanalysis. Reduction of these oxides is occurred with formation of intermediate oxide products such as tantalum dioxide for tantalum oxide and $MnTaO_4$ for manganese tantalite. The dependence of phase composition of products at the interaction of tantalum oxide and manganese tantalate from amount of aluminum in initial mixture is studied. Elemental compositions of phases forming as a result of products interaction are determined. (Work was financially supported by Project of the Presidium of the Russian Academy of Sciences (N 12-P-1019)).

P.S.A.38.

POLYCARBONATE-BASED POLYURETHANE ELASTOMERS: RELATION BETWEEN STRUCTURE AND PROPERTIES II

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The paper focuses on novel polyurethane elastomers based on aliphatic polycarbonate macrodiol and aliphatic diisocyanate (PC-PU), and extends our results given at Yucomat 2012. The all-aliphatic PC-PUs were found to possess superior mechanical properties. In this paper, relation between mechanical properties and the structure of our PC-PUs and industrial grade of TPU is investigated. The research is kindly supported by Grant Agency of the Czech Republic (Czech Science Foundation, project no. P108/10/0195).

P.S.A.39.

SYNTHESIS AND CHARACTERIZATION OF BARIUM TITANATE SOLS AND THEIR APPLICATION FOR FILMS FABRICATION BY INK-JET PRINTING

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In recent years, ink-jet printing is more often used for fabrication of ceramic thick films, which have broad application in microelectronics. This low cost technique is suitable for fast and precise printing of electric circuits with complex forms. By ink-jet printing droplets of prepared sol (ink) are deposited at predetermined locations on a substrate. It is well known that sol characteristics determine the performances of the final product, therefor this research is focused on preparation of different barium titanate ($BaTiO_3$) sols suitable for use in ink-jet printing. Stability of the sols with variation of the processing parameters was investigated. As precursors for $BaTiO_3$ sols barium-carbonate and tetrabutyl-orthotitanate were used, with glacial acetic acid as solvent. In addition, formamide was added to precursor sols in different concentrations to prevent coagulation and particle growth. Viscosity, surface tension and particle size distribution measurements, as well as infrared spectroscopy (FTIR) and differential thermal analysis (DTA) were used for the characterization of the precursor sols. The prepared sols were printed on previously cleaned substrates using a commercial ink printing device. After heat treatment continuous films were formed. The structure and morphology of the deposited films were evaluated by X-ray diffraction (XRD), scanning electron microscopy (SEM) and atomic force microscopy (AFM).

P.S.A.40.

PYROLYSIS OF OIL SHALE AND BITUMINOUS MARLSTONE KEROGENS IN AN OPEN SYSTEM - INFLUENCE OF TEMPERATURE ON THE YIELD AND COMPOSITION OF LIQUID PYROLYSATES

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The influence of temperature on the yield and composition of liquid pyrolysates obtained by pyrolysis of oil shale kerogen and bituminous marlstone kerogen from Aleksinac Basin has been investigated. Pyrolyses were performed in an open system, under nitrogen for 4 hours at temperatures: 200°C, 300°C, 400°C, 425°C, 450°C, 500°C, 550°C and 600°C. It was found that the minimum temperature necessary for the primary degradation of kerogen is 400°C. The highest yield of liquid pyrolysate was obtained at 550°C (for oil shale) and 600°C (for bituminous marlstone), as a consequence of differences in kerogen content and type. In all the experiments, for the yield of liquid hydrocarbons two maxima were observed, the first at 425°C, and the second one at 600°C. The dominant hydrocarbons in liquid pyrolysates are *n*-alkanes, which have typical oil distributions.

P.S.A.41.

MANAGE AND CONTROL OF CONSTRUCTION PROCESSES IN ALBANIA AND BALKANS

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Albania and all Balkan countries have had significant social-economic development in the recent 20 years, which are associated with the implementation of Major Engineering and Construction Projects such as: Highways, Ports, Airports and Power plants, to enable their integration in Balkan Region and European Community. Due to inadequate management and control, many of these Projects realized in Albania have had several problems: such as time delaying, costs excess and quality reduction. So the realization of these Projects besides providing necessary funds requires professionists with outstanding skills that have the mission to estimate, assesses and manage the construction processes. In this regard, is necessary the implementation in Albania and Balkan countries of "Project Management" techniques by this professionals to have a satisfactory optimization of all Engineering and Construction Phases. This paper analyzes the importance of Management and Control of Construction processes by studying all the technique to increase Quality, reduce Costs and Risks, and respect the Terms and Deadlines on Major Engineering and Construction Project in Albania and Balkans.

P.S.A.42.

USE POLYMERIC COMPOSITIONS OF FUNDS IN TOURIST SEA

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Albania in recent years is spending more time on building structures shipping as one of the areas with the largest investments in the context of Corridor VIII. The introduction and the use of polymer composites, and other materials in the building light marine tourism resources, increase quality of service and comfort in this area. Precisely in our work we bring some concrete applications in the manufacturing process of the touristic marine vehicles on craft processes in Vlora, intake of polymeric materials in the structures of existing marine resources as a material with the best features associated with low specific weight, durability to corrosion, comfort and appearance of their best.

P.S.B.1.

ALTERNATING CURRENT/DIRECT CURRENT ELECTRICAL PROPERTIES OF CARBON NANOFIBER/EPOXY RESIN COMPOSITES

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A study of the electrical conductivity and permittivity of carbon nanofiber/epoxy composites and their dependence on frequency and filler volume fraction was carried out. Nested cone carbon nanofibers were used as the filler. Filler volume fraction was varied over a broad frequency range. It was attempted to generalize the experimental data based on theoretical equations proposed earlier for describing the alternating current and direct current electrical properties of "conductor-insulator" composites. The general rule of mixtures and two-exponent phenomenological percolation equation were examined for a description of the conductivity and permittivity of carbon nanofiber/epoxy composites as a function of filler volume fraction and frequency. It has been suggested that electrical properties may considerably depend on the shape of the filler.

P.S.B.2.

MODELING OF INTERFACES IN SOLID-STATE SUPERCAPACITORS WITH COMPOSITE CARBON NANOSTRUCTURE ELECTRODES

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The double electric layer solid-state supercapacitors (SCs) of micron-size with high frequency-capacitance characteristics are required for development of many high-tech. directions. The atomic structure of interface region between solid electrolyte and electrode determines the SC performance. In the frame of new nanoionic fundamentals the ways for the creation of coherent and semi-coherent interfaces in SCs with carbon based composite electrodes and high quantum capacitance are discussed. The atomic structure models of interfaces between advanced superionic conductor and composite electrode, including electronic conductor and advanced carbon nanostructures such as graphene and/or ropes of single wall carbon nanotubes are presented.

P.S.B.3.

ION TRANSPORT MODELING ON BLOCKING HETEROJUNCTIONS

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In nanoionics, for detailed description of ion-transport processes in non-regular potential relief (direct problem) and interpretation of ion-transport processes and characteristics of nanosystems (inverse problem) a new structure-dynamic approach is moved forward. On this basis the computational modeling of processes in the area of ideally polarized (blocking) heterojunctions of the solid electrolyte/electronic conductor (SE/EC) is performed. The approach includes: (i) a structure-dynamic model; (ii) choice of «hidden» state variables, permitting to describe the ion-transport processes; (iii) physico-mathematical formalism based on the concept of a detailed balance and a kinetic equation. The modeling results in terms of «hidden» variables for frequency (time) behavior of the SE/EC capacitance and impedance are compared with the known experimental data.

P.S.B.4.

$CaCu_3Ru_4O_{12}/CaCu_3Ti_4O_{12}/CaCu_3Ru_4O_{12}$ FUNCTIONALLY GRADED ELECTRONIC CERAMICS

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Materials exhibiting a high dielectric constant with low sensitivity to temperature variation have great technological significance. Recently, the colossal permittivity of ~10^4–10^5 in the kilohertz region at room temperature, and good stability over the temperature range from 100 to 600 K was discovered for compounds of general formula $AC_3B_4O_{12}$, where $CaCu_3Ti_4O_{12}$ (CCTO) has remarkable interest. However, it was found that CCTO ceramic-electrode interfaces have an impact on electrical properties; actually, energy barriers could be induced by low ceramic-electrode contact resulting in the decrease of permittivity. The ceramic-electrode contact problem could be solved by introducing interlayer material with crystal structure and close lattice parameters as CCTO and with metallic cation (at B position) as it'll be further used for electrode.
In this work, materials used for preparation of electronic ceramics were CCTO and $CaCu_3Ru_4O_{12}$ (CCRO). The role of CCRO was to decrease the strains at the CCTO-electrode interfaces. CCTO and CCRO powders were prepared by precipitation, and successive calcinations to obtained single phased materials. The synthesized powders were characterized by XRD, FE–SEM and TEM techniques. The sinterability of CCTO and CCRO powders was investigated by heating microscopy. Powders were uniaxially pressed into pellets (ø 6 mm) and sintered up to 1100 ^{o}C, with 2, 5, 10 and 20 ^{o}/min. The recorded densification curves were used for: (1) estimation of linear coefficient of thermal expansion (CTE), and furthermore, (2) for choosing sintering conditions for fabrication of functionally graded CCRO/CCTO/CCRO ceramics. The microstructure of prepared FGMs was examined by FE–SEM method. The electrical properties of FGMs were investigated in medium frequency (MF) and microwave (MW) regions. For the MF measurements, Au electrodes were deposited at CCRO surfaces of FGMs. Measurements were done in frequency interval 42 Hz – 5 MHz, in air atmosphere, during cooling from 400 to 25 °C; an applied *ac* voltage was 1 V. The resonance measurements in the 10 MHz – 67 GHz range were done in a conventional set up (without electrodes). Electrical properties of the FGMs were correlated to the microstructure and sample–electrode interfaces.

P.S.B.5.

STRUCTURE AND PHISICAL-MECHANICAL PROPERTIES OF METAL-MATRIX COMPOSITES Al-Al_4C_3

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In the paper metal-matrix composites based on aluminum, reinforced by nanoparticles of aluminum carbide (Al_4C_3) were studied. Composites were produced by hot pressing method. The results of X-ray analysis, the fine crystal structure parameters and microstructure of the materials Al-Al_4C_3 were given. The mechanical properties of materials when tested in compression and three-point bending were studied. Was found that increasing the volume fraction of nanoparticles Al_4C_3 in aluminum matrix leads to improved mechanical characteristics of the composite.

P.S.B.6.

INVESTIGATION OF NONIONIC SURFACTANTS INFLUENCE ON TOPOLOGY OF COPPER STRUCTURES OBTAINED BY LASER-INDUCED CHEMICAL LIQUID PHASE DEPOSITION (LCLD)

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The interest in LCLD is due to the prospects of application of method in microelectronics, as it allows maskless manufacture of metallic structures on the surface of dielectrics. Focused laser beam initiates local chemical reduction at the interface solution-dielectric to give metallic copper. But under the action of radiation can take place side reactions, leading to formation of carbon oxides. It is the main reason for the formation of defects in the deposited structures. One of the possible ways to reduce negative effect of gas bubbles is facilitation their separation from the surface of dielectric. This can be achieved by using surfactants. In this work were considered non-ionic surfactants. As a result, qualitative dependence of the topology of the deposited structures on the HLB value of surfactants was obtained. That is improving topology structures with decreasing HLB value of surfactant.

P.S.B.7.

LASER-INDUCED COPPER DEPOSITION IN CONDENSED MATTER

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The interest in laser-induced chemical deposition of metal from solution stems from the prospects of its use in microelectronics due to the ability to create localized metal structures on dielectric surfaces. Scanning a surface with a focused laser beam in an electrolyte solution leads to locally initiated chemical reduction of copper. All previous work in this area were carried out only with the use of solutions. This paper deals with the deposition of copper structures on the surface without the use of an solution. Such a result can be achieved by modifying the dielectric surface gelled compositions based on solutions of copper plating. According to results was first proved in principle the possibility of reactions of laser-induced deposition in condensed matter. Further improvements in this technology will create a new method of forming electronic components.

P.S.B.8.

SYNTHESIS OF FINE-DISPERSED BORON CARBIDE POWDER USING CARBON NANOFIBERS

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The fine-dispersed powders of boron carbide were synthesized using the elemental boron and carbon nanofibers in an induction furnace. The synthesis was carried out in the time range 2–40 minutes in argon atmosphere. The study of the exposure time influence on composition, crystallite size and particle size of the obtained boron carbide powder was carried out. The morphology of powders obtained and their phase composition were characterized by X-ray diffraction, scanning electron microscopy and transmission electron microscopy. The results showed that increase of reaction time leaded to slightly growth particle size as well as crystallite sizes while the phase composition of samples did not change.

P.S.B.9.

FUNCTIONALLY-IMPROVED CHALCOGENIDE-CHALCOHALIDE GLASSES WITH EMBEDDED NANOINHOMOGENEITIES

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Progress in the application of chalcogenide and chalcohalide glasses and glass-ceramics (glassy materials with embedded crystalline nanoparticles) with improved functionality owing to enhanced non-linear optical susceptibilities relies considerably on the correct understanding of their structural organization at both atomic-specific and atomic-deficient (free volume) levels. Positron annihilation lifetime spectroscopy is known to be one of the most promising tools for characterization of structurally-intrinsic free-volume inhomogeneities in such materials on a subnanometer scale. In this report, we discuss the possibilities of this method to probe nanoinhomogeneities in two kinds of chalcogenide-based solids, the mechanochemically-milled chalcogenides (such as arsenicals of realgar- or pararealgar-type) embedded in a polymer matrix and (Ge-Ga-S)-CsCl glass-ceramics.

P.S.B.10.

ELECTRON STRUCTURE, VALENSE STATE, X-RAY SPECTRA AND SURFACE MORFHOLOGIES OF THE NEW CeM_2P_2 (M=Fe, Co, Ni) COMPOUNDS

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High-energy spectroscopy has been used to study the electronic structure and valence state of new ternary intermetallic CeM_2P_2 (M=Fe, Co, Ni**)** compounds which crystallize in the $ThCr_2Si_2$ types. The calculations of electron energy bands E(k) and partial DOS for compounds were performed by the semi- relativistic linear muffin-tin orbital method without considerations of spin-orbit interactions. Effective filling numbers of electrons in different bands of components in CeM_2P_2 (M=Fe, Co, Ni**)** compounds have been calculated. Analysis of the results of calculations showed that the degree of occupation of *spd*-valence orbital of components varies and differs considerably from of external electrons in isolated atoms. The occupancy of *d*-orbital of M in the CeM_2P_2 compounds was shown to be significantly larger than in an isolated state. The electron configuration of P in compounds can be described as $s^{1.4}p^{2.8}$. L_{III} – absorption spectra Ce in the ternary CeM_2P_2 (M=Fe, Co, Ni**)** compounds were obtained at 78 K and 300 K using a tube spectrometer equipped with an RKD -01 coordinate detector. The mixed valence state of Ce was obtained in the investigated compounds.

Surface morphologies CeM_2P_2 (M=Fe, Co, Ni**)** compounds are investigated by scanning tunneling microscopy (NT-MDT). The range scanning was 100 um x 100 um and 2 um x 2 um. The surface topography, distribution of grain diameter and area were obtained. The distribution of grain diameter and area of the CeM_2P_2 (M=Fe, Co, Ni**)** compounds is established. The picture of the distribution of the stiffness of the samples (amplitude and phase fluctuations) is obtained.

P.S.B.11.

CHALCOGENIDE THIN FILM SUBSTRATE FOR PROTEIN BIOCHIP APPLICATION

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Diagnostic of pathogen in the human biological liquids by biochip technology is intensively developed methodic now. The main and the most important part of biochip is the absorbing layer. Adsorption properties of chalcogenide films to protein (rat monoclonal antibodies) were tested. The films were prepared as by conventional thermal deposition technique as by pulsed laser deposition technique. Two methods were used for forming in the films the two dimensional map of adsorbing places for probe testing. One is using photoresist properties of chalcogenide films another is using photo induced oxidation of chalcogenide films. It is shown good selectivity of the developed structures to protein markers.

P.S.B.12.

INTRODUCING FRACTALS TO MECHANICS OF FRACTURE. INSTABILITIES IN VISCOELASTIC AND DUCTILE FRACTURE

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Classical mechanics including mechanics of fracture is often unsatisfactory when a solution predicts a singularity and the need arises to interpret the underlying physical meaning or lack thereof. A customary practice to deal with the singularity problem is to exclude a small region near the singular point, for which a different constitutive law – usually non-elastic – is postulated. This approach is adequate provided that the stress field outside the singular region is dominated by the elastic behavior. An alternative approach that successfully resolves problems containing singularities is the averaging process, also known as the quantization procedure – or – equivalently, application of the global criteria for the attainment of the critical state. Example of continuum theory of this kind is the J-controlled HRR asymptotic stress and strain fields embedded within the K-dominated asymptotic field. Here J stands for Rice's integral and K is Irwin's stress intensity factor used in linear elastic fracture mechanics (LEFM).

In last decade some new approaches such as quantized fracture mechanics and fractal fracture mechanics have been developed. These techniques necessitate implementation of the novel mathematical tools – as reviewed in the present paper.

Early stages of fracture and the pre-fracture deformation states associated with a stable propagation of a subcritical crack in viscoelastic and/or ductile solids are described in some detail. The initial stable growth of crack manifests itself as a sequence of the local instability states, while the onset of catastrophic fracture corresponds to attainment of global instability, following an analogy with the buckling phenomenon in shells.

P.S.B.13.

OPTICAL AND MAGNETIC PROPERTIES OF $ZnGeAs_2$ + Mn

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Diluted magnetic semiconductors are widely accepted materials for applied electronics, but alloys and compounds on that basis with new desirable properties are still intensively studied. From well – known III – V semiconductors a new class of materials of II – IV – V_2 type is developed such as $ZnGeP_2$, $CdGeP_2$, $CdGeAs_2$, $ZnGeAs_2$ etc. These materials have attracted great attention when it was noticed that Mn doping leads to appearance of room temperature ferromagnetism.

In this paper we studied semimagnetic semiconductor $Zn_{1-x}Mn_xGeAs_2$ with different amounts of Mn in the range of $0 \leq x \leq 0.182$.Electrical properties of this system depend on composition. It was found that this material has p – type conductivity, a high concentration of free carriers (10^{19} – 10^{20} cm^{-3}) and relatively low Hall mobility ($\mu \leq 12$ $cm^2/(Vs)$). The room temperature ferromagnetism in this alloy was registered for $x \geq 0.078$. The highest Curie temperature $T_C = 367$ K for this class of compounds was obtained for sample with x = 0.182. The observed ferromagnetism is connected with the MnAs phase separations present in the alloy. Optical properties of p – type $Zn_{1-x}Mn_xGeAs_2$ for $0 \leq x \leq 0.182$ were investigated by Raman spectroscopy at room temperature. Phonons of $ZnGeAs_2$are experimentally determined and they are in excellent agreement with those theoretically predicted. Existence of MnAsnano-clusters was confirmedin the sample with the highest concentration of Mn. MnAs was found in α and β phases and their vibrational frequencies are obtained experimentally.

P.S.B.14.

THE INCORPORATION OF VANADIUM INTO OLIVINE $LiFePO_4$/C: IMPROVEMENT OF LITHIUM INTERCALATION FROM BOTH ORGANIC AND AQUEOUS ELECTROLYTE

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The simple and fast (malonic acid+glycine)-assisted gel-combustion process, followed by a heat treatment at 750°C under reductive atmosphere, is found to be a very effective way for the synthesis of (V-doped $LiFePO_4$)/C composites. The Rietveld refinement confirms that vanadium incorporation into olivine structure was accompanied by the formation of iron phosphide conducting phase. The coulombic capacity and rate capability of (V-doped $LiFePO_4$)/C composite, in both organic and aqueous electrolyte solutions, were significantly improved relative to an undoped sample, as revealed by both galvanostatic cycling and cyclic voltammetry. The average discharging capacities of ~5mol.%V-doped $LiFePO_4$/C composite in an aqueous $LiNO_3$ solution were 91, 73 and 35 mAh g^{-1} at 1, 10 and 100 C, respectively, with no perceivable capacity fade upon 100 charging/discharging cycles.

P.S.B.15.

STUDY OF MODIFIED TiN COMPOSITES SUITABLE FOR HIGH-TEMPERATURE APPLICATIONS

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Titanium nitride is nowadays industrially widespread due to its high anti-corrosive and electrical properties. TiN is also suitable candidate for desirable high temperature applications (i.e. electrocatalysts, contact or sensors). Paper concerns of the TiN based cermets preparation via modified precipitation and sol-gel reactions that enable decreasing of the necessary costs for TiN coatings or dense ceramics production. Investigation of morphology (SEM), phase and chemical composition (XRD, XPS and Raman study) of prepared TiN particles are discussed as key parameters for understanding of relation between type of synthesis of the particles and required mechanical properties of prepared coatings and their dense ceramic counterparts.

P.S.B.16.

PHASE BEHAVIOUR OF BINARY MIXTURES COMPOSED OF BANANA-SHAPED AND CALAMITIC MESOGENS

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In this work, we present phase sequences of five binary mixtures composed of different concentrations of banana-shaped mesogen exhibiting nematic phase and calamitic mesogen exhibiting smectic phases. Mixtures were studied by polarising optical microscopy and X-ray diffraction on non-oriented samples. Semi empirical quantum chemical calculations were performed as well. Nematic phase is observed in all mixtures, reaching its widest temperature range and lowest melting point at the concentration of 60 wt% of banana-shaped compound. Supression of the smectic phases is evident in the mixtures with high concentration of the banana-shaped compound. Due to obtained results, we conclude that mixture with 60 wt% of banana-shaped compound is a potential candidate for practical application in the display industry which is based on super twisted nematic technology.

P.S.B.17.

HEAT TREATMENT EFFECT ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF LOW CARBON CrMnMo ALLOY STEEL

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The effect of heat treatment on the microstructure and mechanical properties of low carbon CrMnMo alloy steel was studied. Investigated alloy steel is a model steel of a similar alloying composition as the microalloyed construction steels. The aim of the work was to determine, simply and accurately, the possibility of modifying properties of these steels by the heat treatment. The critical temperatures were determined by use of the L78 R.I.T.A. (Rapid Intensive Thermal Analysis) dilatometer made by Linseis. The changes in microstructure were investigated by light microscopy (Axiover 200MAT), and scanning electron microscopy (HITACHI SU-70). The hardness measurements were performed with the Vickers HPO250 apparatus and the impact strength was obtained from Charpy impact test. Obtained information may be used to design new technologies of heat treatment for such steels also the new approach to their allocation can be assumed.

P.S.B.18.

INFLUENCE OF MoO_3 ON CORDIERITE CERAMICS SINTERING AND CRYSTALLIZATION

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The influence of MoO_3 on the process of cordierite ceramics preparation, $2MgO-2Al_2O_3-5SiO_2$ (MAS) was researched by sintering followed binary systems: MgO/MoO_3 (sintered at 850 ºC and 1000 ºC), Al_2O_3/Bi_2O_3 and SiO_2/Bi_2O_3 (sintered at 850 ºC and 1000 ºC). 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, scanning electron microscopy and EDS analysis. It has been found that MoO_3, beside liquid phase, forms intermediary unstable compounds with MgO and Al_2O_3. The following research is planned to investigate the effect of 5 % mass of MoO_3 on the electrical properties of cordierite ceramics.

P.S.B.19.

INFLUENCE OF ONE ACTIVATED COMPONENT ON THE SINTERING PROCESS OF THREE PHASE SYSTEM

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According to its low temperature thermal expansion coefficient, low dielectric constant, also good mechanical properties, cordierite, $2MgO\cdot 2Al_2O_3\cdot 5SiO_2$, represents a very attractive high-temperature ceramic material. In this study, cordierite was prepared by solid state reaction of the MgO, Al_2O_3 and SiO_2 mixture. One of the components from the mixture, SiO_2, was mechanically activated in a high energy ball mill during 5 and 10 minutes. The applied pressure before the sintering process was 2 t/cm^2. Sintering process of mixtures containing non-activated and activated SiO_2 powder was performed at 1350 ^oC for 4h in the air atmosphere. The phase composition of starting oxides and sintered samples was analyzed by the X-ray diffraction method. Particle size analysis was performed to investigate the differences between starting components. Scanning electron microscopy was done to analyze the microstructure of both components and sintered samples. This paper investigates the influence of one mechanically activated SiO_2 component on the densities of green bodies as well as on the sintered samples, along with electrical properties of cordierite ceramics.

P.S.B.20.

SOFT MAGNETIC PROPERTIES OF MnZn FERRITE PREPARED BY PIM ROUTE

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MnZn ferrites attracted attention due to a wide range of relative magnetic permeability values (from 10^3 to 10^4 and therefore low magnetic losses) as well as due to increased 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). Furthermore, excellent corrosion resistance and chemical stability enable their application in extreme exploitation conditions.

Recently, a variety of preparation routes have been examined for MnZn ferrite production: mechanochemical processing, chemical co-precipitation method, sol-gel or microemulsion. This paper deals with MnZn ferrites produced by Powder Injection Moulding (PIM) technology. This technology can produce a number of ferrites in very shorter time compared to the classic method, i.e. it offers large scale manufacturing of small and geometrically complex parts. Soft magnetic properties of the MnZn ferrite sample prepared by PIM method and afterwards sintered in air (3.5 hours at 1340 ^{O}C) were presented.

Magnetic properties were measured on toroidal samples by hysteresis graph (B-H curve at different excitation magnetic fields up to 6 kA/m and at different frequencies up to 1 kHz).

Relative magnetic permeability as well as magnetic power losses was analyzed as frequency 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 components. The results obtained were compared with the data for other technologies of preparing MnZn ferrite samples from available literature. It is shown that the PIM samples reach magnetic properties values comparable to those obtained by conventional methods.

P.S.B.21.

INFLUENCE OF MECHANICAL BALL MILLING ACTIVATION ON THE PROPERTIES OF TITANIUM CARBIDE

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Structural changes after mechanical activation of non-stoichiometric titanium carbide TiC_x powder in the ball mill have been investigated. It is shown that particles of titanium carbide consist of two phases with different atomic ratio of carbon to titanium $TiC_{0.68}$ $TiC_{0.53}$. It was found that the average particle size is decrease from 6 to 2 μm, which leads to an increase in the specific surface of TiC powder from 0.6 m^2/g to 3.4 m^2/g. It was revealed that mechanical treatment of titanium carbide powder leads to a decreaseing in the coherent-scattering region and increaseing the level of residual microstresses crystal lattice.

P.S.B.22.

PHOSPHORUS SEGREGATION IN GRAIN BOUNDARIES OF VVER-1000 REACTOR VESSEL STEEL STUDIED BY AES AND TEM

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An understanding of the changes arising from the long-term operation of the nuclear power reactor materials is a fundamental basis of its security and reliability. The phosphorus segregation in grain boundaries within the temperature range of 280-320 °C is the main cause of the temper brittleness development in reactor vessel steel. AES and analytical TEM were applied for the studies of the steel samples after they have been exposed at specified temperature for over 130 thousands of hours. We've studied such nano scale elements as the grain boundaries, carbide inclusions and dislocation networks and its impact on the mechanism of phosphorus segregation and kinetics under conditions when phosphorus diffusion inside the grain volume is insignificant. These findings have enabled to estimate quantitatively the grain boundaries diffusion and phosphorus redistribution and the balance throughout the system. Intergrain segregation kinetics at temperatures <320 °C has been modeled and quantified.

P.S.B.23.

INTERPLAY BETWEEN THE STRUCTURAL AND MAGNETIC PROBES IN ELUCIDATION OF THE STRUCTURE OF NOVEL 2D LAYERED $V_4O_4(OH)_2(O_2CC_6H_4CO_2)_4 \cdot DMF$

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The title compound has been synthesized under solvothermal conditions by reacting vanadium(V) oxytriisopropoxide with terephthalic acid in N,N-dimethylformamide. A combination of synchrotron powder diffraction, infrared spectroscopy, scanning and transmission electron microscopy, thermal and chemical analysis elucidated the chemical, structural and microstructural features of new 2D layered inorganic-organic framework. Due to the low-crystallinity of the final material, its crystal structure has been solved from synchrotron X-ray powder diffraction data using a direct space global optimization technique and subsequent constraint Rietveld refinement. [$V_4O_4(OH)_2(O_2CC_6H_4CO_2)_4 \cdot DMF$] crystallizes in the monoclinic system (space group $P2/m$ (No. 10)); cell parameters: a = 20.923(4), b = 5.963(4), c = 20.425(1) Å, β = 123.70(6)º, V = 2120.1(9) Å^3, Z = 2. The overall structure can be described as an array of parallel 2D layers running along [-101] direction, consisting of two types of vanadium oxidation states and coordination polyhedra: face-shared trigonal prisms (V^{4+}) and distorted corner-shared square pyramids (V^{5+}). Both configurations form independent parallel chains oriented along the 2-fold symmetry crystallographic b-axis mutually interlinked with terephthalate ligands in a monodentate mode perpendicular to it. The morphology of the compound exhibits long nanofibers, with the growth direction along the layered [-101] axis. The magnetic susceptibility measurements show that the magnetic properties of $V_4O_4(OH)_2(O_2CC_6H_4CO_2)_4 \cdot DMF$ can be described by a linear antiferromagnetic chain model, with the isotropic exchange interaction of J = −75 K between the nearest V^{4+} neighbours of S = 1/2.

P.S.B.24.

GROWTH AND SPECTROSCOPIC CHARACTERIZATION OF $Y_3Al_5O_{12}$ - YAG SINGLE CRYSTALS

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During the crystals growth process it is possible, according to the Czochralski`s method, to influence the shape of the liquid/solid interface through the growth parameters, such as both the growth and crystal rotation rate, as well as the temperature gradient. It also has a great effect on the growth mechanism affecting crystals characteristics. During the growth of $Y_3Al_5O_{12}$ - YAG crystals there appear faces on the liquid/solid interface parts parallel to facets (211) and (110). The mechanism of the crystals growth is different as the sections where faces appear and where they do not appear. These sections have various parameters of lattice causing strain in the crystals. Laser rods of high quality could be obtained by cutting crystals of a large diameter out of parts without strain. In our experimental work we found the conditions in which the facets scarcely appeared or are completely avoided. YAG single crystals were grown by the Czochralski technique under an argon atmosphere. The conditions for growing YAG single crystals were calculated by using a combination of Reynolds and Grashof numbers. The critical crystal diameter and the critical rate of rotation were calculated from the hydrodynamics of the melt. Raman and IR spectra of YAG single crystal were recorded in the range 50-1200 cm^{-1} and 40-4000 cm^{-1}, respectively. The obtained results were discussed and compared with published data.

P.S.B.25.

IMPACT OF MATERIAL ON TORSIONAL VIBRATIONS OF CRANKSHAFT

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In this study, it was shown how change the main indicators of torsional vibrations of the crankshaft, in the case when his material change. In the study it was taken the crankshaft of diesel engine with 4 cylinders in line, in which the material is changing from steel in cast iron, due to the technological possibilities of production. For study of torsional vibration of crankshaft system in the first, it is carried the construction of equivalent reduced scheme with five discs and four shafts. Reduced inertia moments of discs are determined for each crank of crankshaft, received and the impact of group connected rode and piston mass. Reduced rigidities of crank are determined by theoretical methods through recommended empirical formulas and the experimental determination for correction. For this, it is built corresponding stand and are performing tests for 4 crankshaft, prepared by cast iron. From obtained results, it is determined average value of rigidity for each crank. The results show that rigidity of crank for the same crankshaft varies up to 8%, while the change between crankshafts goes up 12%. Experimental results show that the best approximation give formulas Zullxer and Zimanenco. At the end it is calculated frequency and vibration form, using Tole-Holxer method. From calculations, it results that the frequencies are 23% smaller, while the vibration form varies slightly. In this case the change of the material makes that frequency to be in the area of revolutions of engine and can worsen the level of torsional vibration, therefore it should check the resonance areas and vibration amplitude.

P.S.B.26.

PHASE TRANSFORMATIONS OF IRON AND NICKEL SULFIDES WITH CALCIUM OXIDE UNDER HEATING IN INERT AND REDUCING ATMOSPHERES

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The X-ray diffraction, combined thermogravimetry, calorimetry, and mass-spectrometry methods were used in the present study. The phase transitions were studied under continuous heating of iron and nickel sulphides, together with calcium oxide in a flow of argon or carbon monoxide. It is shown that the oxysulphide compounds (CaFeSO and $Ca_3Fe_4S_3O_6$) along with other phases are formed by heating of FeS-CaO and FeS-Ni_3S_2-CaO systems in argon. The direct metal reduction from nickel sulphide with carbon monoxide application is activated by addition of calcium oxide and iron sulphide into the reaction mixture composition. The reduction of nickel and iron from a FeS-Ni_3S_2-CaO mixture by solid carbon proceeds at the temperature range of 850 – 1200^0C with liquid phase formation. It is shown that the processes of sulphides reduction with addition of calcium oxide occur without SO_2 gassing. The research results can be used for development of nonferrous metallurgy technologies and new ecology friendly processes.

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P.S.B.27.

EFFECTS OF DOPANT RATIO AND ALKALI METALS ON OPTICAL PROPERTIES OF Y_2O_3:Yb^{3+}/Ho^{3+} NANOPARTICLES

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Nanopraticles of Y_2O_3 doped with different concentration ratio of dopants Yb/Ho (1, 2, 5, 10 i 15) were synthesized *via* polymer-complex solution method and additionally thermally treated for either 1.5 or 18 h. All powders exhibit target crystal structure and phase composition which is confirmed by XRPD analysis. Morphology of samples recorded on TEM, revealed agglomerated particles with size of about 30-50 nm for samples calcined 1.5 h and 18h, respectively. Emission intensities and decay lifetimes were measured and investigated in a function of dopant concentration and thermal treatment time. Incorporation of alkali metals in host matrix is a new way for improvement optical properties of materials. Among them, Li^+ ion has the smallest cationic radius in the periodical table of elements, which is favorable for their movement and site occupation in the host lattice. Sample with ratio of Yb/Ho 5 was co-doped with two different concentrations of Li^+ (1 and 5 at %). Obtained results imply that sample with higher concentration of Li^+ have much stronger emission intensities and represents more effective up-converted material.

P.S.B.28.

LUMINESCENCE TEMPERATURE SENSING USING Zn_2SiO_4:Mn^{2+}PHOSPHOR PARTICLES

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The search for materials suitable for luminescence thermometry is current interest from both fundamental knowledge and applications. Phosphor thermometry is temperature measurement technique that utilizes changes of phosphors luminescence properties with temperature in materials where changes of electron radiative transitions are strongly affected. Fluorescence intensity ratio (FIR) method is based on the intensity ratio between two emission lines or areas in the luminescence spectrum. In this report we show temperature dependence of luminescence of a well known green phosphor Zn_2SiO_4:Mn^{2+}. Zn_2SiO_4 powders doped with divalent manganese ions are prepared using polymer-assisted salted sol-gel method. Characteristic green emission from Mn^{2+} $^4T_1(G) \rightarrow {}^6A_1(S)$ transition is observed, centered at about 527 nm. Both emission intensity and emission decay change considerably in the temperature range from 300 K to 673 K. These dependences are explained on the bases of luminescence thermal quenching theory and sensitivity of the methods (sensing via emission intensity and sensing via emission decay) are assessed.

P.S.B.29.

APPLICATION OF PEACH SHELLS FOR THE REMOVAL OF METHYLENE BLUE AND BRILLIANT GREEN

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Increased industrial, agricultural and domestic activities resulted in the production of large amount of wastewater containing a number of toxic materials which continuously polluting the available fresh water. Sorption is an effective method for water decontamination. Various types of pollutants such as metal ions, dyes, and a number of other organic and inorganic compounds and bio-organisms could be removed by different types of sorbents. Important properties of good sorbent material are high specific surface area and fast kinetics for the removal of pollutants. Natural materials such as oil palm fibers and shells, waste apricot and pitch, olive-seeds waste, peach stones, almond shells, walnut shells, hazelnut shells, kaolin, bentonite, zeolites, coal, etc., possess large capacities for removing of the water pollutants. The main advantages of these materials are wide availability, low cost and environmental safety.

The peach shells (PS) were used as the raw material for removing of non-degradable toxic dyes from water solutions. Methylene blue (MB) and brilliant green (BG) were used as representatives of dyes which commonly are pollutant from the textile industry. The peach shells were milled in vibromill and sieved to desired sizes: (1) 100–500 μm, and (2) < 100 μm. The phase composition of the prepared particles fractions was identified by XRD. The BET specific surface area was determined from N_2 adsorption/desorption experiments. The particles morphology was characterized by SEM, while the particle size distribution was measured by laser light-scattering particle size analyzer. In a typical experiment, 50 mg of PS particles as the sorbent was mixed on a magnetic stirrer with 50 ml of dye aqueous solution with the initial concentration of 5, 10 and 20 ppm, at room temperature. At time intervals of 5 to 120 minutes aliquots was withdrawn, centrifuged, and pollutant concentration was measured. The concentration of MB and BG in the solution before and after sorption by PS was calculated according to the absorbance value at 665 nm (for MB) and 624 nm (for BG) determined by UV measurements performed on a UV–Vis spectrophotometer in the wavelength range of 300–800 nm. Capacity of MB and BG sorption by prepared PS particles was found to be above 86 % after 120 minutes.

P.S.B.30.

ON THE SPIN COHERENT STATES REGARDED AS THE BOSON NONLINEAR COHERENT STATES

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As it is well-known, the more natural basis to study the magnetic problems in nanostructures [1–3] is provided by spin coherent states (SCSs) $| z; S >$ which are defined through Perelomov's procedure, i.e. by applying the spin displacement operator to the ground state $| 0; S >$, defined such that $S_z | 0; S > = S | 0; S >$. In the paper we have show that the SCSs can be regarded as the boson nonlinear coherent states, i.e. as the eigenstates of an nonlinear operator $A = (2S - N)^{-1/2}$ in the Barut-Girardello manner: $A | z; S > = z | z; S >$, where N is the particle number operator. This approach allows to use the commutation relations of the boson operators a^+ and a in order to calculate some expectation values by appliying the IWOP technique (Integration Within an Ordered Product of Operators).

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P.S.B.31.

VOID DEVIATIONS IN NANOSTRUCTURED GLASSY MATERIALS CHARACTERIZED WITH POSITRON ANNIHILATION TECHNIQUE

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Positron annihilation technique (PAT) in lifetime measuring (LM) and Doppler broadening of annihilation radiation (DBAR) modes are considered as promising tools to characterize time-dependent evolution of intrinsic free-volume voids in nanostructured glasses. At the example of glassy As/Ge-S/Se it is shown that time-dependent processes of void agglomeration/expansion, fragmentation/refining and disappearing/contraction are principal stages of their evolution, while a competitive channel of coordination defect formation associated with void charging are revealed only in a vicinity of near-stoichiometric compositions. These LM/DBAR data are put in strong correlation with direct fingerprints of the observed changes determined by fundamental optical absorption edge of the affected materials. This approach allows meaningful model of relaxation-driven evolution in the void structure of nanostructured glasses giving a unified insight on their chemical nature.

P.S.B.32.

ON THE VIBRON DRESSING IN THE ONE-DIMENSIONAL MACROMOLECULAR CHAINS CAUSED BY THE INTERACTIONS WITH ACOUSTIC PHONON MODES

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We present a study of the physical properties of vibrational excitation in the one-dimensional macromolecular chains, caused by the interaction with acoustical phonon modes. The influence of the temperature and the basic system parameters on the vibron dressing have been analyzed by employing the simple mean-field approach based on the variational extension of the Lang-Firsov unitary transformation. Our calculation predicts a region in system parameter space where it is possible of the coexistence of the partially dressed and fully dressed vibron states.

P.S.B.33.

INSTRUMENTED IMPACT TESTING OF HYBRID THERMOPLASIC ARAMID FABRICS REINFORCED WITH CARBON NANOTUBES

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The eight samples of polyurethane/p-aramid multiaxial fabric forms (Colon fabrics) were impregnated with 10 wt.% poly (vinyl butyral) (PVB)/ethanol solution with the addition of pristine multiwalled carbon nanotubes (MWCNT). All composite samples consisted of four pieces of the impregnated fabrics. The MWCNT/PVB content was 0, 0.1, 0.5 and 1 wt.%. The four samples of the fabrics with different MWCNT/PVB content were modified with γ-aminopropyltriethoxysilane (AMEO silane)/ethanol solution. The physical and mechanical properties of the prepared composite samples were analyzed by high speed impact tester. The results showed that 1 wt.% MWCNT/AMEO/PVB sample yielded a 42% improvement in the maximum impact force compared to the unmodified PVB sample. The nanotubes (MWCNT) were added in order to improve the mechanical properties of the materials for ballistic protection.

P.S.B.34.

STRUCTURE AND PROPERTIES OF POLYVINYL BUTYRAL BASED NANOCOMPOSITES

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It is well known that structure of polymer based nanocomposites is a function of fillers (type and volume fraction) and polymer matrix. Objective of this research was to investigate the effect of carbon nanostructures, such as: single wall carbon nanotubes (SWCNT), multi wall carbon nanotubes (MWCNT) and graphene, on the structure and properties of polyvinyl butyral (PVB) based nanocomposites. Nanocomposite films and fibers were obtained by spin coating and electrospinning, respectively. Structure and morphology of nanocomposites were characterized by optical and transmission electron microscopy as well as Raman spectroscopy and UV-Vis spectrophotometry. Properties were significantly affected by different nanofillers i.e. UV-Vis absorption of samples decreased in the sequence: PVB-graphene nanocomposite, PVB-mwcnt nanocomposite, PVB-swcnt nanocomposite and pure PVB nanocomposite film. Also, with increasing film thickness, absorption in UV-Vis region increased in a non-linear (parabolic) way. Although the volume fracture of fillers were less than optimum for this system, it is still clear that the properties of these nanocomposites can be modified by appropriate selection of polymer matrix and nanofillers.

P.S.B.35.

SONOCATALYTIC DEGRADATION OF METHYLENE BLUE DYE USING A NANOSIZED ZINC OXIDE POWDER PREPARED VIA SONOCHEMICAL METHOD

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Nanostructured semiconductor materials are of great importance for various tecnological application due to their phisical and chemical properties wich are determined by the morphology and the size of the particles. Among semiconducor oxides, ZnO is one of the most important multifunctional material with its wide direct band gap energy of 3.37 eV and its excitation binding energy around 60 meV.

Nowadays, many studies focus on the application of sonochemical reactions for treatment of industrial wastewaters, and also investigated the improvements of this method by some semiconductor materials (ZnO or TiO_2) due to their high catalytic activity, stable chemical properties, safety and low cost. For a long period of time different toxic materials are used in dyeing, paper and pulp, textiles, plastics, leather, paint, cosmetics, pharmaceutical and food industries. These toxic materials usually have very complex, aromatic molecular structures which make them extremely stable and difficult to biodegrade. Sonocatalytic degradation presents a very efficient method for wastewater purification.

In this work we have investigated heterogenic sonocatalytic degradation of methylen blue (MB) aqueous solution, as a common organic pollutant, in the presence of nanosized ZnO powder as catalysts. The phase composition of sonochemicaly synthesized ZnO nanopowder was identified by XRD, particles morphology was characterized by FE–SEM, while the particle size distribution was measured by laser light-scattering particle size analyzer. The optical properties of ZnO nanocrystals were investigated by ultraviolet–visible (UV–Vis) diffuse reflectance spectroscopy (DRS). In a typical experimental procedure we used 5, 10 and 20 ppm water solution of MB containing 50 mg of nanosized ZnO powder. Prepared suspensions were treated with the ultrasound irradiation which has an output of 150 W. Concentration of the MB dye in the water solution containing ZnO nanoparticles before and after sonocatalytic degradation was calculated according to the absorbance maxima value at 665 nm characteristic for MB. The experiments were performed on a UV–Vis spectrophotometer in the wavelength range of 300–800 nm. Degradation efficiency of MB dye (for all examined concentrations) was found to be close to 100 % after ultrasound treatment in the presence of ZnO nanoparticles.

P.S.B.36.

Ga EFFECTS ON GLASS FORMING ABILITY IN MIXED $Ga_x(As_{0.4}Se_{0.6})_{100-x}$ AND $Ga_2(As_{0.4}Se_{0.6})_{98-y}Te_y$ SYSTEMS

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Se-Te glasses are known to be important candidates for biomedical sensing application exploring mid- and far IR spectral domain. Being performed as optical fibers doped with rear-earth ions, these glasses significantly extend their functionality due to numerous transitions appeared in the range up to 10 μm. To ensure high intrinsic solubility resulting in structural homogeneity of atomic distribution within a glassy matrix, these rear-earth ions should be added along with some co-dopants such as Ga. That is why the problem of Ga incorporation in glassy-like Se-Te networks is of especial importance for both glass materials scientists and manufacturers. In this work, we studied network-forming ability of Ga-doped chalcogenide glasses within two important cut-sections allowing high IR transparency – $Ga_x(As_{0.4}Se_{0.6})_{100-x}$ (x = 0, 1, 2, 3, 4, 5) and $Ga_2(As_{0.4}Se_{0.6})_{98-y}Te_y$ (y = 0, 10, 15, 20, 30). Stoichiometric As_2Se_3 was used as basic glass-forming compound in the both systems, the Ga and Te additives being varied to modify the structure of final alloys, which occurs to be glassy or partially-crystallized in dependence on chemical composition. The chemically-governed processes of nucleation followed by further extraction of Ga_2Se_3 crystalline phase (crystallites agglomeration) are considered as most possible atomistic imperfections destroying covalent-bonding network arrangement of the studied glassy systems.

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P.S.B.37.

ORDERED SUB-NANO-STRUCTURES ON OXIDES SURFACE OVER PLASMA TREATMENT FOR IT APPLICATION AND HEALTH

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Results of study of change in properties of oxides and appearing ordered one- and two-level structures with size of about $10^{-6} – 10^{-10}$ m on surface of the selected materials over plasma flow have been presented this contribution. Ordered and quasi-ordered nano- and sub-nano-structures were studied after high intensity plasma treatment of $Sr_xTi_yO_z$, $A_{[}B_yC_zO_r$, Ti_xO_y, V_xO_y and α-Al_2O_3 (sapphire) crystals which are well known materials for health and IT applications. Two different plasma accelerators with short and long impulse were taking into account during investigations [1, 2]. Examples images are given on Figs. 1, 2. Change in oxidation state of the component or/and doped ions comparing by variation of the crystal stoichiometry relation and conductivity or spectral properties opens wide perspectives for creation of novel type nano-devices. Fitted results show the change in electronic structure of ceramic or amorphous systems of crystallites with size of about 0.1 - 5 nm on the surface of the oxides over treatment in compression different plasma flow, sufficiently change in surface adhesion and adsorption. The last ones open wide area for health application.

Nature of novel state of materials with crystalline, ceramic or amorphous surface and properties of nano-scale samples were discussed, too [2-3]. Novel nano-scale size structures may be effectively used as materials and object for health supported opportunity and IT devices [4].

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P.S.B.38.

SYNTHESIS OF MATERIALS FOR ION-CONDUCTING AND ELECTROCATALYTICAL MEMBRANES AS WELL AS CATHODE AND OTHER STRUCTURAL ELEMENTS OF SOFC

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Materials for the different structural elements of ceramic fuel cells were synthesized by using self-propagating high-temperature synthesis (SHS) (for the micro-sized powders) and levitation-jet aerosol synthesis (for nano-sized powders). Complex oxide powderized compositions were used for producing cathodes (La-Ni-O, La-Fe-O and La-Mn-O based compounds); electrocatalytical membranes (La-Ga-Mg-O) as well as an interconnecting elements (La-Cr-O) of solid oxide fuel cells (SOFC). By using selective laser sintering (SLS) the working samples of electrocatalytical membranes with 100-200 microns of thickness were produced from the following oxide mixtures: Ce_2O_3-Gd_2O_3; Ce_2O_3-Sm_2O_3; Sc_2O_3-ZrO_2 and Sc_2O_3-Y_2O_3-ZrO_3.

P.S.B.39.

ELECTROSPUN CORE-SHELL FIBERS FOR SELF-HEALING OF THERMOPLASTIC POLYMER COMPOSITE

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This study reports preparation and characterization of thermoplastic polymer composite with self-healing ability. Poly (methyl methacrylate) (PMMA) was chosen as a matrix material while reinforcements were core-shell fibers fabricated as vessels for carrying self-healing components. Fibers were produced using technique of coaxial electrospinning, where PMMA was the shell material, and healing agent, dicyclopentadiene (DCPD), was used as the material for the core. For description of core-shell fibers' morphology, SEM imaging was performed. Statistical analisys of SEM images gave size distribution of fibers. Healing efficiency of the system implanted in the thermoplastic matrix was investigated with fracture tests of virgin and healed samples.

P.S.B.40.

SIMULATION OF THE VARIATION IN TEMPERATURE IN A MATERIAL WITHOUT AND WITH DEFAULT

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In this article our principal study is the simulation of the variation in temperature in a solid material in absence and in presence the default, in particular a fracture on the level of surface of material, and to see how the default influences on heat transfer in a solid. The simulation is made by FLUENT software which permits us to solve the energy equation by finite volumes method.

P.S.B.41.

THE USE OF SEC-MALS TO STUDY THE DEGRADATION OF PULLULAN AND HYALURONIC ACID

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Pullulan is a polysaccharide consisting of maltotriose units, also known as α-1,4 - α-1,6-glucan. It is used in breath freshener or oral hygiene products and also as food additive. Hyaluronic acid is an anionic nonsulfated glycosaminoglycan distributed widely throughout connective, epithelial and neural tissues. It has many applications in medicine.

In our study we used SEC-MALS method (size exclusion chromatography – multi angle light scattering). This technique allows the separation of different polymeric compounds function of molecular weight, the determination of absolute molar mass averages, the calculation of polydispersity.

The aim of our work is to separate the molecules according to their size and to observe the degradation of the polymers by modifications in molar mass.

P.S.B.42.

TEMPERATURE DEPENDENCE OF ELECTRICAL AND MAGNETIC PROPERTIES OF NiCoCu ALLOY POWDER

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In this study, amorphous alloy powder NiCoCu was electrodeposited from an ammonia solution of nickel, cobalt and copper sulphates at a current density of 400 mA/cm^2. During successive heating of the powder to different temperatures under a magnetic field the effect of heating on structural changes, magnetic permeability as well as on electrical properties was observed.

Temperature dependence of the magnetic susceptibility was investigated by the modified Faraday method in the temperature region from room temperature up to 700 ^{O}C. Heating of the powder up to 460 ^{O}C resulted in the maximum increase in relative magnetic permeability of about 63 % due to structural relaxation occurring within this temperature range. Furthermore, decrease in Curie temperature of this heat treated sample in comparison with as-prepared powder sample was also observed.

Thermoelectrical measurements were exhibit the crystallization of the powder within the 580 ^{O}C to 680 ^{O}C temperature range. It has been established that the addition of 3 wt% of copper in to the $Ni_{80}Co_{20}$ alloy is followed by increase of crystallization temperature for about 80 ^{O}C.

P.S.C.1.

ON SURFACE TENSION EFFECT IN NANOMECHANICS

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The mechanical behavior of nano-materials is defined by an increasing role of surface effects with reduction of the size of particles. Even surface tension effects may control the deformation processes. At nanometer length scales, due to the increasing surface-to-volume ratio, surface effects become predominant and can significantly modify the macroscopic properties. Although some researchers recognized that surface effects could play a major role in the measured nano-mechanical properties, only few experimental results exist concerning the influence of reduced size on the mechanical properties and even less maybe found in the literature of the information for theoretical studies in this field. E,g., the definition of a surface-stress for solid interface until today remains be a main problem of the theory of solid capillarity. To overcome these difficulties we recommend a greater involvement of Guggenheim' concepts of a surface layer and electrochemical potential into surface thermodynamics. We have proposed generalization of the definition of Gibbsian 'sigma' and an analog of the Gibbs adsorption equation derived for the concept of non-zero thickness of the interfacial layer.

P.S.C.2.

ROOM-TEMPERATURE FERROMAGNETISM IN AEROSOL GENERATED Zn/ZnO NANOPARTICLES

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Zn/ZnO nanoparticles (NPs) (40-750 nm in sizes) were prepared via the levitation-jet aerosol technique in He/Ar flow with air/oxygen additives. They had different shapes from a well-defined spherical to tetrapod ones. Slight changes in the crystal structure of NPs compared with bulk Zn and ZnO were discovered. RT magnetic measurements of NPs showed a pronounced ferromagnetic (up to 0.3 emu/g in saturation magnetization) hysteresis close related with their morphologies and surface compositions. The high-temperature studies in an inert and oxidized media, also under reduced air pressure allow found that Curie temperature of NPs lies in the range 600-700 K. The possible origin of surface-mediated ‘d^0’ ferromagnetism related with the roles of Zn and O vacancies and their evolutions is discussed.

P.S.C.3.

LOW-TEMPERATURE ELECTRICAL RESISTIVITY OF GRAPHENE

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The low-temperature peculiarities of electrical resistivity of graphene may be described in the frame of the temperature Green functions (GFs) method [1]. Multiple elastic electron scattering by impurities and structural inhomogeneities of short-range order type has been taken into account when GF was calculated in graphene on a substrate similarly to our calculations of GF in disordered carbon nanotubes [2]. As a result the following expressions have been obtained for relaxation time $\frac{1}{2\tau} = \frac{1}{2\tau_{imp}}\left[1 + \frac{1-c}{N}\sum_{i=0}^{N}\alpha_i BT\right]$ and

electrical resistivity: $R(T) = \frac{m}{e^2 n}\left(\frac{1}{\tau_{imp}} + 2\pi U_0^2 \nu_0 \frac{c(1-c)}{N}\sum_i \alpha_i BT\right)$,

here c is the concentration of impurities, $\nu_0 = \frac{m}{4\pi\hbar^2}$ - the density of electronic state at the Fermi level in ideal graphene (without defects), α_I are the short-range order parameters, *N* is the number of atoms in the range of structural inhomogenities, and $B = \pi\frac{R^2 m}{\hbar^2}k \approx 0.1\ \mathrm{K}^{-1}$ - number of atoms in the range of structural inhomogenities, and $\frac{1}{\tau_{imp}} \approx 2\cdot 10^{15}s^{-1}$. Finally U_0 is the effective potential, R is the radius of the coordination sphere and m is electron mass.

The results of our calculations showed that the low-temperature behavior of the electrical resistivity is determined by elastic electron scattering on short range ordered regions. The sorption of gases changes sign of short-range order parameter. This results in the inverse temperature dependence of resistivity at low temperatures as it was found in [3, 4]. At the same time the variation of the impurities concentration does not change the type of electrical resistivity in graphene.

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P.S.C.4.

ADSORPTION PROPERTIES OF SUMANENE TOWARDS COMMON AIR POLLUTANTS

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Carbon monoxide, carbon dioxide and ammonia molecules are considered as common air pollutants and there is a constant search for adsorbents which might be used for the effective elimination of mentioned molecules from the atmosphere. Carbon nanotubes and fullerenes have been investigated widely as adsorbents of these important molecules. Sumanene is a typical representative of buckybowls and can serve as a model compound of fullerenes and nanotubes thus we decided to investigate its adsorption properties towards mentioned molecules within density functional theory. It turned out that sumanene has very competing adsorption properties comparing with fullerenes and nanotubes which increase its potential application in the field of adsorption of polluting molecules.

P.S.C.5.

STRUCTURE AND PROPERTIES OF SUBMICROCRYSTALLINE LOW CARBON STEEL AFTER EQUAL CHANNEL ANGULAR PRESSING

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It is well known that the formation of nano- and submicrocrystalline (SMC) structure can occur during severe plastic deformation (SPD). Such SMC structure provides an effective improvement of the mechanical properties. The purpose of the work was to study the structure and properties of the 0.19%C steel after equal-channel angular pressing. The ECAP of the 0.19%C steel at 400°C for 4, 8, and 12 passes at an angle of 120° between the channels led to the formation of the grain-subgrained structure with a ferrite structure element size of about 350 nm. An increase in the degree of deformation upon ECAP causes the fragmentation and spheroidization of the pearlitic cementite plates and the coalescence of subgrains in the regions of acicular ferrite and tempered martensite. The obtained structure provides a substantial strengthening (YS =730-790 MPa).

P.S.C.6.

INITIAL STAGE OF MECHANICAL ALLOYING IN $Al_{99}{}^{57}Fe_1$ BINARY POWDER SYSTEM

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The initial stage of mechanical alloying (MA) in the binary powder mixture of Al and ^{57}Fe in the atomic ratio of 99:1 was studied by X-ray diffraction and probe Mössbauer spectroscopy on the ^{57}Fe atomic nuclei. The proposed microscopic model of MA includes the nanocrystalline state formation (~ 15 nm) in fcc Al, Fe atoms penetration along the Al grain boundaries, isolated Fe atoms and Fe-Al clusters formation of the local atomic environment type in the deformed phases $FeAl_6$ and Fe_2Al_9 in the close-to-boundary distorted zones of the Al matrix. Using the data available in literature one can assume that with the Fe concentration increase in the initial mixture and consequently the number of clusters the distorted zones of interfaces transform into an amorphous phase.

P.S.C.7.

OPTICAL PARTICULARITIES OF WHOLE EXTRA-THIN MOLECULAR FILMS

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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 method of two-time, retarded, temperature dependent Green's functions [3,4], by the defined of exciton dispersion law, probability and space distribution of their possible states, were calculated and analyzed the dielectric and defined them – optical properties of these crystalline nano-structures. Research result shows that the permittivity strongly narrow and discrete, which is a consequence of resonance effects, and that depend on the thickness of the film (quantum size effects) as well as on values of boundary parameters (conformation effects). 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 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.

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P.S.C.8.

SURFACE CHARACTERISATION OF MECHANOCHEMICALY ACTIVATED CARBON CLOTH

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Adsorption on activated carbon cloth is an efficient procedure for removing pollutants from wastewaters, because this material possesses large specific area and high adsorption capacity. In this study the activated carbon cloth was modified by mechanical milling in order to improve its sorption properties. The microstructure and morphology of the sample was investigated by XRD, PSD and SEM and surface chemistry was characterized by potentiometric titrations. The result showed that microstructure and morphology was drastically changed with milling: particle sizes reduction, agglomeration and the loss of fibrous structure occurred. These changes resulted in increase of the acidic and the base groups: the number of basic groups was increased by the factor of 11 while the number of acidic groups by the factor of 1.5.

P.S.C.9.

HYDROTHERMAIL SYNTHESIS AND CHARACTERIZATION OF $BiFeO_3$

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With $Bi(NO_3)_3 \cdot 5H_2O$ and $Fe(NO_3)_3 \cdot 9H_2O$ as starting material and 8 M KOH as mineralizer, the pure-phase $BiFeO_3$ (BFO) powders were synthesized by hydrothermal method at 200 °C. The microstructure, morphology and chemical analysis of the powders were analyzed using Scanning Electron Microscopy (SEM) combined with X-ray microanalysis (by Energy Dispersive Spectrometer – EDS). The phase composition of obtained samples was determined by X-ray diffraction (XRD) analysis. It revealed that synthesized material crystallize in space group R3c with cell parameters a = b = 5.5780(10) Å and c = 13,863(3) Å. The particle size and distribution was determined by small – angle X-ray scattering (SAXS). The magnetic behavior of synthesized material is done by means of SQUID device.

P.S.C.10.

ELECTRON-BEAM SURFACE TREATMENT OF TITANIUM ALLOYS BY PLASMA FROM AN ELECTRICAL EXPLOSION OF CARBON FIBERS

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We present the results from investigating the phase composition, structure, and properties of surface layers of titanium alloys subjected to combined treatment that includes plasma alloying the electric explosion of a carbon fiber with a quantity of TiB_2 powder and subsequent irradiation with a high-intensity electron beam. The formation of a multilayer, multiphase structure in the submicro- and nanosized ranges is observed. It is shown that the properties of a alloyed layer exceed those of a bulk sample many times over.

P.S.C.11.

KINETICS FORMATION OF $TiSi_2$(C54) STABLE SILICIDE PHASES AT THERMOION DEPOSITION OF TI ON MONOCRYSTALLINE SI

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The mechanism of low-energetic radiation-stimulated diffusion at $TiSi_2$(C54) silicide thin films formation of C54 modification, obtained by thermoion deposition of Ti on Si(100) monocrystalline is investigated. The deposition of Ti ions on Si monocrystalline substrate is carried out by thermoion method with energy about 8keV. Kinetics of formation of Ti silicide layers, thickness is till ~100nm is investigated. Dependence of phase composition and thickness of nanolayers on time condensation is shown. The diffusion coefficient value of Si into titanium film of both nucleation stage and growing of crystallites of silicide phases ($D=4.5\cdot10^{-16}m^2/s$) and stage formation of $TiSi_2$ continuous layer ($D=4\cdot10^{-16}m^2/s$) is established. The value of specific electric resistance for $TiSi_2$(C54) is $\rho_v=13.5$ mkΩ·cm. Phenomenological model of formation of Ti disilicide film on monocrystalline Si at low-energetic thermoion deposition of Ti is proposed.

P.S.C.12.

CRYSTALLIZATION BEHAVIOUR OF GLASS IN THE SYSTEM $LI_2O·AL_2O_3·GEO_2·P_2O_5$

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The subject of this paper is the study of the crystallization behavior of germano-phosphate glasses from the systems Li_2O-Al_2O_3-GeO_2-P_2O_5. Based on preliminary experiments the glasses of composition $22{,}5Li_2O·10Al_2O_3·30GeO_2·37{,}5P_2O_5$ (mol%) was selected for examination. The crystallization properties were examined under isothermal crystallization conditions. In the case of four-component germano-phosphate glass the primary crystallization of $LiGe_2[PO_4]_3$ phase with crystallites dimension of 30-500 nm was detected. The structure of $LiGe_2[PO_4]_3$ crystallizes in rombohedral $R3^{-}c$(167) space group. The volume crystallization mechanism with a spherulitic growth morphology of crystals was determined on compact glass samples. The nucleation process was studied and the temperature and time dependencies of nucleation rate were defined. The homogeneous nucleation rate of these glasses are in the range $7{,}92·10^{15}$ - $6{,}93·10^{16}$ $m^{-3}s^{-1}$. For this glass compositions, an overlapping of nucleation and crystal growth range was noted.

P.S.C.13.

ADSORPTION AND CATALYTIC INVESTIGATION OF MANGANESE OR COPPER DOPED ZnO NANOPARTICLES

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Mn-doped and Cu-doped ZnO with content of the dopant less than 0.1 wt % were prepared by precipitation synthesis. For characterization of the samples AAS, XPS, XRD, IR and BET were applied. The results show that the crystallite sizes of ZnO and doped ZnO nanoparticles are within the range of 19 ÷ 50 nm. The porous structure of pure and doped with manganese or copper zinc oxide was studied using adsorption methods. The specific surface areas of the oxides were not changed significantly (24 ÷ 25 m^2/g). The existence of the porous structure determines the high value of specific surface areas for these fine dispersed materials. The copper or manganese doping leads to deep changes in the porous structure of zinc carrier. The obtained materials could be used like catalysts for purification of gas fluids. The carried out investigations related to CO oxidation reaction show higher activity of copper doped samples.

P.S.C.14.

ELECTRODEPOSITION OF ANISOTROPIC METAL NANOPARTICLES

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Nanosized particles of noble metals have attracted considerable interest in various fields of materials chemistry, because of their catalytic properties and their potential applications in microelectronics, optical, electronic and magnetic devices. The synthesis of anisotropic nanoparticles with well-defined structures has motivated experimental progress in understanding the intrinsic shape-dependent properties of metal and semiconductor nanocrystal. Silver nanodendrites have been synthesized *via* a simple, remarkably fast and scalable electrolytic process and characterized by using scanning electron microscopy, X-ray diffraction and absorption spectroscopy. The nanodendrites prepared by this method showed extension of the plasmon band through the entire visible region, indicating potential use in detection of single molecules based on enhanced Raman scattering.

P.S.C.15.

CORRELATION BETWEEN STRUCTURAL CHANGES AND CHANGES IN MAGNETIC PROPERTIES OF NANOSTRUCTURAL Ni POWDER PERFORMED UNDER THERMAL CONDITIONS

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Relative changes in magnetic permeability of nanostructural Ni powder were measured in the trail conducted under both non-isothermal and isothermal conditions whereby nanostructural Ni powder was obtained electro-chemically at 400 mA/cm^2 current density. Multiple heating and cooling of the same sample after cooling down to the temperature of 330ºC gave 105% maximal increase in magnetic permeability of the processed sample. The results analysis of the relative change in magnetic permeability under isothermal conditions at 220ºC, 240ºC, 270ºC and 300ºC suggested that the structural relaxation process is performed at two levels – fast kinetical process and slow diffusion process, respectively. The Differential Scanning Calorimetry (DSC) method showed that the crystallization process of Ni powder occurrs at temperatures of 700ºC. Analysis of the measured morphological characteristics of the powder indicated that the diameter of the particles was from 5.2nm to 11nm.

P.S.C.16.

THERMOELECTRIC POWER IN GRAPHENE MONOLAYER

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Thermoelectric power in graphene monolayer is hereby analyzed in the wide temperature range of 10–300 K, based on semiclassical Boltzmann equation and theory of linear response. The solutions of Boltzmann equation are found in the approximation of relaxation time for different relaxation mechanisms of charge carriers, with temperature dependence of the corresponding relaxation times adopted from the literature. Temperature dependence of graphene thermoelectric power is numerically found and compared with the experimentally observed data. The dependance of graphene thermoelectric power on the concentration of charge carriers is analyzed as well.

P.S.C.17.

EFFECT OF ELECTRODEPOSITION PARAMETERS AND ANNEALING TEMPERATURE ON MICROSTRUCTURE, MAGNETIC AND ELECTRICAL PROPERTIES $Ni_xFe_zW_z$ ALLOYS

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Nanostructured nickel-iron-tungsten alloy powders were produced by electrolysis from a citrate ammonia solution on an inert substrate. The effects of temperature and solution composition on polarisation characteristics and current efficiency were investigated. X-ray diffraction and scanning electron microscopy were used to study the phase structure and morphology of the alloy, respectively. The operating and kinetic parameters of the electrodeposition process were found to have a significant effect on the microstructure, morphology and physical properties of the powders. The alloy consisted of an amorphous matrix and FCC nanocrystals of the solid solution of iron and tungsten in nickel. The increases in deposition current density and tungsten content in the alloy led to a decrease in nanocrystal size as well as to increases in internal microstrain values and density of chaotically distributed dislocations. The increase in the tungsten content of the alloy resulted in an increase in corrosion stability and a decrease in magnetic permeability. Heating the alloys up to 400°C permitted structural relaxation to take place in the alloy, leading to an increase in magnetic permeability and a decrease in electrical resistivity. At temperatures above 500°C, amorphous phase crystallisation and FCC crystal grain growth occurred, resulting in a significant drop in electrical resistivity and magnetic permeability.

P.S.C.18.

MAGNETIC PROPERTIES AND HARDNESS OF ELECTRODEPOSITED $Ni_xFe_yW_z$ ALLOY

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A nanostructured $Ni_xFe_yW_z$ coating was electrodeposited from a citrate ammonia bath onto a titanium cathode at a current density of 50 to 400 $mAcm^{-2}$. The composition of the alloy was determined by atomic absorption spectroscopy. X-ray diffraction and scanning electron microscopy were used to study the microstructure and morphology of the alloys, respectively. The coating consisted of FCC-structured (Fe,W)Ni solid solution nanocrystals embedded in an amorphous matrix. The increase in deposition current density led to an increase in both the tungsten content of the alloy and the amorphous phase proportion, as well as to a decrease in FCC nanocrystal size. The coatings with a higher tungsten content produced at higher current densities exhibited higher hardness. Heating the coatings in the temperature interval 100°C-450°C resulted in an increase in their hardness with increasing temperature. At temperatures above 500°C, amorphous phase crystallisation and FCC crystal grain growth occurred, leading to a decrease in the hardness of the coatings.

P.S.C.19.

CORRELATION OF RELATIVE PLASTIC DEFORMATION DEGREE AND THERMOELECTROMOTIVE FORCE

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In this paper is experimentally determined correlation between the relative plastic deformation degree, and thermoelectromotive force (TEMF) of thermocouple, derived by mechanical amalgamation of copper coductor and variously distorted steel wire.

Experiment obtained dependence between TEMF and known size of the deformation of straight wire sample, distorted with axial strain. Thus obtained calibration curve enables to determine the size of relative plastic deformation of steel wire samples, previously distorted in circles with various radiuses.

It is shown that increase of relative plastic deformation degree of the metal, causes decrease of electron density status on fermi level. In further decrease of electron density status causes increase TEMF of thermocouple Cu – Fe, on all temperatures.

In this experiment, at the temperature of 40 ^oC is defined the size of relative plastic deformation of steel wire 2,8 mm diameter, and it is 12 %.

P.S.E.1.

TWO-STEP SINTERING, PHASE TRANSFORMATIONS, ELECTRICAL AND MECHANICAL PROPERTIES OF NANOSTRUCTURED BIOCERAMIC MATERIALS BASED ON HYDROXYAPATITE

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Hydroxyapatite based materials are still the most promising materials in the field of skeletal and dental tissue reconstruction. Improvement of their existing properties and broadening their application fields requires simultaneous achievements in synthesis and processing of advanced nanostructured materials, accompanied by understanding of basic principles governing their behaviour.

In this study, overall procedure, from synthesis, processing and characterization of dense nanostructured hydroxyapatite and biphasic calcium phosphate, is presented. The consideration of nanosintering phenomena and influence of phase transformations on sintering behaviour of nanocrystalline Ca-deficient hydroxyapatite will be given. Electrical and mechanical properties will also be determined.

P.S.E.2.

SELENIUM NANOPARTICLES FOR BIOMEDICAL APPLICATION

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Ever since its discovery, selenium has attracted the attention of many scientists due to its specific characteristics and behavior, which provided a wide range of applications for this element, from photo- and electrical industry to biology and medicine. The diverse applications are directly related with selenium chemical form, size and shape of its particles. When it comes to biomedical applications, it is well known fact that selenium is an essential micronutrient for animals and humans but with a narrow margin between beneficial and toxic effects. As a potential anticancer agent, its use requires consumption over the long term, so the toxicity of Se is always a crucial concern. Elemental selenium nanoparticles (Nano-Se) have emerged as a novel selenium source with the advantage of reduced risk of selenium toxicity, but with same bioavailability and efficacy in increasing the activities of selenoenzimes compared with other seleno-compounds. We synthesized stabile, amorphous, red spherical nanoparticles with average diameter of ~80 nm, by employing the reduction of sodium selenite with ascorbic acid in the presence of bovine serum albumin. The obtained particles were characterized by X-ray diffraction, zetasizer, electron microscopy (SEM+EDS, TEM, HRTEM), and showed good anticancer activity.

P.S.E.3.

RADIATION SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL APPLICATION OF NOVEL COPOLYMERIC SILVER/POLY(2-HYDROHYETHYL METACRYLATE/ITACONIC ACID) NANOCOMPOSITE HYDROGELS

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Silver nanoparticles (AgNPs) were fabricated via in situ reduction of silver nitrate embedded in swollen P(HEMA/IA) hydrogel, using gamma radiolysis method. Copolymeric hydrogels based on 2-hydroxyethyl methacrylate (HEMA) and itaconic acid (IA), previously synthesised by gamma radiation for wound dressing application, were used as a carrier and a stabilising agent, while ethyl alcohol was used as a free radical scavenger. The influence of different contents of IA and silver salt concentrations on the size and distribution of nanoparticles was investigated. The Ag/P(HEMA/IA) nanocomposites were characterised by high resolution scanning electron microscopy (SEM), wide-angle X-ray diffraction (WAXD), UV-Vis spectroscopy and swelling measurements. *Escherichia coli* (Gram-negative bacterium), *Staphylococcus aureus* (Gram-positive bacterium) and *Candida albicans* (fungus) were used to prove the antimicrobial properties of Ag/P(HEMA/IA) nanocomposites. The inhibition kinetics of bacteria growth was investigated by measuring the colony-forming unit (CFU). The antimicrobial effectiveness of the Ag/P(HEMA/IA) hydrogel nanocomposite was demonstrated even at small silver concentrations. P(HEMA/IA) hydrogels containing nanosilver particles was found suitable for use as wound dressing.

P.S.E.4.

SELF-ASSEMBLED MICELLAR NANOPARTICLES OF A NOVEL BLOCK COPOLYMER BASED ON POLY-[2-(DIISOPROPYLAMINO)ETHYL METHACRYLATE (PDPA) CORE AND *N*-(2-HYDROXYPROPYL)METHACRYLAMIDE (HPMA) CORONA FOR pH-TRIGGERED DRUG RELEASE

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A novel pH-triggered block copolymer of poly-[2-(diisopropylamino)ethyl methacrylate (PDPA) and *N*-(2-hydroxypropyl)methacrylamide (HPMA) herein referred to as $PDPA_{315}$-$HPMA_{40}$ (the subscripts refer to the mean degree of polymerization of each block) was successfully synthesized by reversible addition fragmentation chain transfer (RAFT) polymerization (M_n = 50.2 kDa; M_w/M_n = 1.2). The $PDPA_{315}$-$HPMA_{40}$ block copolymer self-assembled in phosphate buffer saline (PBS, pH 7.4) into regular spherical micellar nanoparticles (NPs) comprising a PDPA hydrophobic inner core (pH > pKa (PDPA) = 6.7) and a hydrophilic HPMA outer shell. The NPs were characterized in detail by static (SLS), dynamic (DLS), and electrophoretic (ELS) light scattering tecniques. The HPMA hydrophilic shell provides stability and a nearly neutral ζ-potential (ζ-potential ~ 0.0 mV) meaning a shielded NPs surface. The size of the NPs ($2R_\mathrm{H}$ = 46 nm; $R_\mathrm{g}/R_\mathrm{H}$= 0.94) and their molecular weight ($M_{w(\mathrm{NPs})} = 1.46\ x\ 10^7$ g.mol^{-1}; N_agg = ~290 chains per micelle) is in the range to avoid renal clearance ($2R_\mathrm{H}$ > 10 nm; $M_w > 10^6$ kDa) possibly providing a long blood circulation time. The dimensions are also below the cut-off size of the leaky pathological vasculature ($2R_\mathrm{H}$ < 200 nm) making them candidates for the cancer therapy based on solid tumour-specific deposition (EPR effect). Additionally, due the pKa of the PDPA (~ 6.7), drug candidates (Paclitaxel, Docetaxel) could be loaded into the NPs core (drug loading ~ 5.0 % $w_\mathrm{drug}/w_\mathrm{polymer}$) keeping their characteristics during blood circulation (simulated physiological conditions in proteins from blood plasma) and faster release them at pH 5.0 (simulated acidic cytosolic or endosomal conditions in most tumour cells). The *in vitro* results suggest that the NPs based on the novel $PDPA_{315}$-$HPMA_{40}$ pH-responsible block copolymer exhibit physicochemical properties required for practical application as carriers in tumour-targeting drug delivery *via* pH-triggered release.

P.S.E.5.

ANTIMICROBIAL ACTIVITY OF SOME NEW PLATINUM(IV) COMPLEXES

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Four new platinum(IV) complexes of general formula [$PtCl_4(R_2$-*S,S*-eddp)] have been synthesized and characterized by microanalysis, infrared and ^{1}H and ^{13}C NMR spectroscopy [1]. Antimicrobial activity of four platinum(IV) complexes is investigated against 28 species of microorganisms. Testing is performed by microdilution method and minimum inhibitory concentrations (MIC) and minimum microbicidal concentration (MMC) have been determined. The tested platinum(IV) complexes showed different degrees of antimicrobial activity in relation to the tested species. The intensity of antimicrobial action varied depending on the group of microorganisms. In general, platinum(IV) complexes demonstrated selective to moderate antimicrobial activity. Also, platinum(IV) complexes demonstrated more potent inhibitory effects on the growth of G+ bacteria than to other tested microorganisms. The significant activity demonstrated platinum(IV) complex containing butyl ester ligand against G+ bacteria. Among them the best results were observed against *Sarcina lutea*, *Staphylococcus aureus* and *Bacillus* sp (clinical isolates and standard strains). MICs values were in range from <1.953 to 3.096 µg/mL, and MMCs values were from 3.906 to 31.25 µg/mL. The tested compounds did not affect the growth of clinical isolates and standard strains of G- bacteria or their activities were very low (MICs 1000 and >1000 µg/mL). Antifungal activity of tested complexes was low. MICs values were in range from 31.25 to >1000 µg/mL, and MMCs values were from 62.5 to >1000 µg/mL.

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P.S.E.6.

POLY (ETHYLENE OXIDE)/GRAPHENE/KERATIN NANOCOMPOSITES OBTAINED BY THE FUNCTIONALIZATION OF GRAPHENE ASSISTED ULTRASONIC IRRADIATION

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This work is dedicated to the fabrication of thin films of PEO reinforced with grafted graphenes and subsequently loaded with keratin fibers. The research started with grafting graphenes in poly (ethylene oxide) by ultrasonic irradiation. This method enabled tearing long chains and leads to the formation of poly (ethylene oxide) short radicals, which decorated the graphene surface. In this way the surface of graphene was functionalized due to the increase of hydrogen bonds on surface; grafted graphene is more suitable to reinforce keratin. The ultrasonic degradation of poly(ethylene oxide) and grafted graphene was confirmed by optic microscopy, differential scanning calorimetry (DSC), Fourier transform infrared (FTIR) spectroscopy and termogravimetric analysis (TGA). Visual changes of crystalline forms of poly (ethylene oxide) by ultrasonication were given through optical microscopy. Further analysis showed that about 10 % of poly (ethylene oxide) was attached to the surface of graphene. Nanoidentation measurements confirmed improvement of mechanical properties of thin films reinforced with grafted graphene. Addition of 0.3 wt% grafted graphene improved Young's modulus for 25 %. Additionally, incorporation of 2 and 5 wt% of keratin fibers lead to the increase of modulus for about 3.5 times and for 40 times, respectively while the hardness did not significantly change.

P.S.E.7.

THE VIBRON EXCITATION TRANSFER BETWEEN TWO NEIGHBORING CHAINS IN ALPHA-HELICAL PROTEINS

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The vibron properties in alpha-helical macromolecular structure are investigated. It is assumed that vibron interacts with optical phonon modes only. Special attention was paid to mechanism of the vibron delocalization between neighboring chains in the macromolecule. The probability of this delocalization was calculated and analyzed as a function of the system parameters and temperature.

P.S.E.8.

ADVANCED COATINGS FOR MEDICAL IMPLANTS

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Development of engineering and material science allows us to construct mechanically robust prosthesis of heart and blood arteries. Unfortunately implant surfaces which contact blood are still a source of problem. Platelet which contact such artificial – foreign surface gets activated and are ready to form aggregates, either on the foreign surface or somewhere in the circulatory system. To solve this problem three types of blood contacting implant surfaces have been developed. First type of surface coating is based on the free radical grafting of hydrophilic polymers on the surface, what result in the sort of hydrophilic nano-brush of a very low surface energy. Such a low surface energy prevents small blood plasma proteins adhesion and also platelet activation. Due to especially designed process conditions free radicals are produced at the interface only, what allows precise control of the grafting. This diffusion controlled process allows producing coatings, which are non toxic in vitro and in vivo, and exhibit very low platelet activation (human blood, static and dynamic conditions) and no blood plasma proteins adhesion, and also very low friction coefficient. Second group of coatings is based on dipalmitoylphosphatidylcholine. These coatings are very similar in its structure and composition to the cell membrane. It is made of oriented phospholipids with a hydrophilic end outside. Presented type of coating is a very promising material since it resembles natural surfaces which are present in our body. This nature mimicking coating is non toxic in vitro and in vivo, exhibit almost no platelet activation in static and dynamic conditions, and no blood plasma proteins adhesion. The perfect coating for long term implant should have self healing properties and should actively release substances preventing platelet activation. There is only one such a coating possible – this is a living layer of epithelial cells. To obtain such a coating previously described systems served as a substrate to build hydrophilic spacers with attached peptides whit amino acid sequences that are recognized by actins of endothelial cells. Such a surface actively attracts cells to attach and to proliferate. Endothelial cells form a mono layer and perfectly coat implant surface forming active surface of self healing properties. Implant can be coated with endothelium before implantation or coating may occur after implanting the device into the body, platelet cells are always present in our circulatory system. As a result we obtain a hybrid implant, polymeric or metallic structure coated with patient’s living cells.

P.S.E.9.

IN VITRO ANTITUMORAL ACTIVITY OF PLATINUM(II) COMPLEXES WITH *O,O'*-DIALKYL ESTERS OF (*S,S*)-ETHYLENEDIAMINE-*N,N'*-DI-2-(4-METHYL)PENTANOIC ACID AGAINST MDA-MB-361, MDA-MB-453, JURKAT AND K562 CELL LINES

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Cisplatin entered into clinical trials in 1971 and was approved by the Food and Drug Administration (FDA) [1,2] for clinical use in 1978, presenting a major landmark in the history of successful anticancer drugs. However, due to undesirable side effects [3] such as nephrotoxicity and neurotoxicity, the synthesis of new analogues of cisplatin that would have less side effects and a broader spectrum of activity is followed [4,5]. The next generation of platinum(II)-based drugs used in the clinical treatments includes carboplatin, with similar cytotoxicity but less side effects than cisplatin, and oxaliplatin, with antiproliferative effects even in the cisplatin resistant cancers. As a result, cisplatin has become one of the bestselling anticancer drugs in the world [5]. R_2edda-type ligands (R = Et, *n*-Pr, *n*-Bu, *n*-Pe) and corresponding platinum(II) complexes were tested for *in vitro* cytotoxic activity against human breast cancer (MDA-MB-361 and MDA-MB-453), T-leukemia (Jurkat) and chronic myelogenous leukaemia (K562) cell lines. The highest activity of platinum(II) complex containing *n*-Bu ester ligand was very similar to the activity of cisplatin. Results indicate cytotoxic potential of the investigated complexes based on induction of apoptosis.

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P.S.E.10.

COMPARISON OF BIOCOMPATIBILITY OF THREE MATERIALS BASED ON POROUSE APATITE

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The aim of the study was to examine the biocompatibility of three materials: porouse apatite (PA), porouse apatite with polymer-based hydroxyethyl cellulose (PA+C), porouse apatite with polymer-based ether modified starches (PA+S). Composition of materials was determined by FTIR method. Biocompatibility has been investigated *in vivo* (subcutaneous and intramuscular implantation) and *in vitro* hemolytic assay. For hemocompatibility testing, each material was used in concentrations of 2.5, 5, 7.5 and 10 mg/ml. After two, four and eight weeks the implants were removed and processed for light and scanning electron microscopy. Histopathologic analysis indicated the presence of multinucleated giant cells, fibroblasts, well-developed fibrillar capsule and high collagen production. Hemolytic assay exibited low hemolysis: 0.005% for PA+S material (7.5mg/ml) to 1.27 % for PA material (2.5 mg/ml).

P.S.E.11.

BIOCOMPOSITES BASED ON HYDROXYAPATITE AND MONETITE

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Bioceramics based on biogenic hydroxyapatite and monetite (25, 50 and 75 wt. % of monetite) was fabricated by sintering at 800 °C in air. The biogenic hydroxyapatite and monetite was prepared from bovine bone and by chemical precipitation, respectively. According to laser grade analysis (Zetasizer 100HS, Malvern Inc., Particle Instruments) average particle size of synthesized monetite (JCPDF 75-152, monetite $CaHPO4$) was 689 nm. Prepared materials were investigated using scanning electron microscopy and x-ray diffraction analysis. Moreover, it was established that compressive strength of obtained bioceramics decreased with increasing of monetite content from 55 down to 32 MPa. The porosity of bioceramics was open, did not depend on hydroxyapatite/monetite ratio and was 40-42 %.

P.S.E.12.

SILVER/HYDROXYAPATITE COATING ON PURE AND ANODIZED TITANIUM OBTAINED BY PULSED LASER DEPOSITION

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Widely used as an implant material hydroxyapatite (HA) is best known by its excellent viability to chemically bond with hard tissue inducing osteoconductivness without any immune response from human body. In order to avoid infections of the implantation site the research effort are focused on antibacterial hydroxyapatite coatings on titanium doped with various antimicrobial agents. The improvements of antimicrobial properties of HA are gained by doping it with silver, which inhibits initial bacterial attachment onto implant surface. In this work the nano-sized HA and silver/hydroxyapatite (Ag/HA) coatings were synthesized by pulsed laser deposition on pure Ti and Ti modified TiO_2 nanotubes. The obtained coatings were characterized by SEM, EDS, ATR-FTIR, XRD and AFM studies. The antibacterial efficiencies of the deposited coatings were tested against strains *Candida albicans* and *Aspergillus niger*. The Ag/HA coatings on Ti modified with TiO_2 nanotubes showed the highest antifungal activity.

P.S.E.13.

CLICK CHEMISTRY FOR ATTACHMENT OF TARGETING MOIETIES TO POLYMER DRUG CARRIERS

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The application of azide-alkyne cycloadditions – “click” chemistry – for conjugation of two molecules of defined structure is described in increasing number of publications. Due to its high selectivity the “click” chemistry is often used in the synthesis of polymer drug conjugates, e.g. for binding of targeting peptides. In this work, we describe preparation of targeting peptides bearing *N*-terminal azide group by solid phase synthesis and attaching them to polymer backbone using several variations of click chemistry. In conclusion, the alkyne-azide cycloaddition reaction proved to be a very efficient and chemoselective method for binding of unprotected peptides to polymer drug carriers.

Acknowledgement: This work was supported by the Ministry of Education, Youth and Sports of the Czech Republic (grant No. EE2.3.30.0029).

P.S.E.14.

ANALYSIS OF INFLUENCE OF STRAIN IN DRAWING PROCESS ON CORROSION PROPERTIES OF WIRES USED IN CARDIOLOGY

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The purpose of the performed tests was evaluation of corrosion properties of wires made of X2CrNiMo17-12-2 steel to be used in cardiology. They included analysis of the influence of strain in cold drawing process and influence of surface modification by means of electrochemical polishing and chemical passivation. Potentiodynamic tests were made in artificial blood plasma. It was proved that increase of strain in wire drawing process caused decrease of resistance to electrochemical corrosion of polished as well polished and then passivated wires. It was also proved that chemical passivation process substantially increased corrosion parameters. Statistical analysis showed that there is a significant dependence between corrosion properties (polarisation resistance R_p), and strain in drawing process ε. For polished wires it has the formula $R_p=-174.9\varepsilon+968.6$, and for passivated ones: $R_p=-88.6\varepsilon+1019.1$. In both cases the level of significance $p<0{,}05$.

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P.S.E.15.

IRON OXIDE NANOPARTICLES: SYNTHESIS, FUNCTIONALIZATION, AND POTENTIAL APPLICATION IN HYPERTHERMIA TREATMENT

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In this work, the hydrophobic superparamagnetic iron oxide nanocrystals, capped with trioctylphosphine oxide (TOPO) and oleic acid (OA) molecule, were synthesized by the thermal decomposition of iron(III) acetylacetonate. In the next step, the aqueous suspensions of nanoparticles were prepared by mixing with branched polyethyleneimine (PEI) in dimethyl sulfoxide (DMSO), used as a solvent, subsequently followed by washing with milli-Q-water. The iron oxide nanocrystals were characterized by TEM and FTIR. The hydrodynamic size, ζ-potential values, as well as the specific absorption rate (SAR) values as a function of frequency and magnetic field applied were measured. Their potential to be used in magnetic hyperthermia treatment of cancer was investigated and discussed in terms of particle size and aggregate size.

P.S.E.16.

CYTOTOXICITY ACTIVITY OF *O,O'*-DIALKYL ESTERS Of (*S,S*)-ETHYLENEDIAMINE-*N,N’*-DI-2-(4-METHYL)PENTANOIC ACID AND CORRESPONDING PALLADIUM(II) COMPLEXES AGAINST SOME TUMOR CELL LINES

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Complexes with central metal ions such as palladium [1-3] have been investigated as potential antitumor agents, because of structural analogy with platinum(II) complexes. The use of palladium(II) and its complexes in medicine is limited and till now the only applicationis of palladium is as ^{103}Pd radioactive isotope in the treatment of rapidly growing high-grade prostate cancer. Palladium(II) complexes showed lower *in vitro* antitumoral activity when compared with platinum(II) complexes. This could be correlated to the more labile nature of palladium(II) relative to platinum(II) complexes [4, 5].

Cytotoxity activity of four R_2edda-type ligand precursors, *O,O'*-dialkyl esters of (*S,S*)-ethylenediamine-*N,N’*-di-2-(4-methyl)pentanoic acid dihydrochlorides (**L1**·2HCl–**L4**·2HCl; alkyl = ethyl, *n*-propyl, *n*-butyl, and *n*-pentyl, respectively), and corresponding palladium(II) complexes on human breast cancer (MDA-MB-361 and MDA-MB-453), T-leukemia (Jurkat) and chronic myelogenous leukaemia (K562) was determined. The obtained data showed that the complex with *n*-butyl group has a remarkable cytotoxic activity; IC_{50} values are similar to those of cisplatin for all tested cell lines.

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P.S.E.17.

ANTIOXIDANT AND ANTI-CANCER POTENTIALS OF *LAVATERA THURINGIACA* L. EXTRACTS

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The objective of this study was to determine antioxidant and cytotoxic efficacies of methanolic and aqueous extracts of *Lavatera thuringiaca* L. 2,2-Diphenyl-1-picrylhydrazyl (DPPH) and hydroxyl radical scavenging activities, inhibitory effect on lipid peroxidation and Fe^{3+} reducing antioxidant property have been used to investigate antioxidant properties of the extracts. Cytotoxicity of the extracts was tested on *Hep2c* and *RD* cell lines. Both extracts displayed extensive cytotoxicity to the tested cell lines. The extracts were studied for their ability to protect pBR322 DNA from damage by UV induced photolysis of H2O2. The aqueous extract, though inferior to methanolic extract in its antioxidant potential exhibited efficiency in DNA protection, while the methanolic extract failed to protect the DNA. The amount of total polyphenolics in the extracts was measured by spectrophotometric method. The methanolic extract contained higher polyphenolic contents than aqueous extract. Significant positive correlations were observed ($P< 0.05$) between results of phenolic content estimation and that of antioxidant assays. Hence, high-performance liquid chromatography analysis was performed to identify few major phenolic compounds that might be responsible for these therapeutic properties. These results indicate that rhizome of *Lavatera thuringiaca* L. possesses antioxidant and cytotoxic activities and therefore have therapeutic potential.

P.S.E.18.

SUITABILITY OF CONTACT AFM IN INVESTIGATION OF RGP CONTACT LENSES

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Rigid gas permeable (RGP) contact lenses are widely used medical device and for long time they have been used only for correction of vision. Later was proposed that contact lenses can be put to another function, to have therapeutic or diagnostic role along with optical corrections. This needs various characterizations of these medical aids. One of the best modern methods for surface investigations of the contact lenses is Atomic Force Microscopy (AFM). By this method it is possible to characterize various parameters of the surface of contact lenses, such as: topography, hardness, Young's module, lateral forces and many more. For different type of measurements it is necessary to have different AFM modes. For some investigations it is necessary to have contact mode in which sharp tip shaped probe is dragged across the sample in direct contact with the surface. Force need to be applied for the cantilever tip to be in constant contact with the surface of the material and if the forces are sufficient it is possible for the tip to damage the surface. To investigate if the damage is done when using contact mode on contact lenses materials we use tapping mode AFM on a wider surface area. If there is a damaged area it would be seen as a square-shaped indentation. If the damages on contact lens material occur when using contact AFM, and their dimension are presented in the paper.

P.S.E.19.

EARLY DETECTION OF EPITHELIAL TISSUES CANCER BASED ON OPTO-MAGNETIC IMAGING SPECTROSCOPY AND ARTIFICIAL INTELLIGENCE ALGORITHMS

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In this paper we present an approach for automatized detection of epithelial cancer, based on opto-magnetic imaging spectroscopy (OMIS) and machine learning for binary classification. According to latest epidemiological data, epithelia carcinoma (cervix, colon, mouth cavity, skin cancer and melanoma), is the most frequent malignant tumor. Our method is based on existing light-matter interaction technology (OMIS) and new algorithms for digital image processing. We have developed two algorithms based on artificial neural networks (ANN) and support vector machines (SVM) for classification of opto-magnetic imaging data regarding healthy epithelial tissue and epithelial carcinoma tissue. Here we present and discuss preliminary results and possible strategies for future development of autonomous system for cancer detection.

P.S.E.20.

POTENTIODYNAMIC TESTS OF X10Cr-Ni 18-8 STEEL IN ARTIFICIAL PLASMA

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In this study, in order to increase hemocompatibility of X10Cr-Ni 18-8 steel, application of chemical pasivation was suggested for creation of a thin oxide layer based on alloying elements. Evaluation of effectiveness of such a surface modification was made on the ground of potentiodynamic test. Anodic polarisation curves were registered with application of potentiotat VoltaLab PGP 201 with a set of electrodes, in artificial blood plasma at the temperature of 37 °C and pH = 7.2. The test were made for samples in the form of polished as well as polished and chemically passivated wire (40% HNO_3, T = 65 ^oC, t = 30 min.) subject to sterilisation in autoclave and exposure to artificial blood plasma for 8 hours. Obtained reults prove explicitly that 8-hour exposure in artificial blood plasma did not have negative effect on physical and chemical characteristics of created passive layer. It was proved that chemical passivation process improved to a great extent corrosion resistance of this steel in human blood, which has a direct influence on its hemocompatibility.

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P.S.E.21.

METAL ION RELEASE FROM TITANIUM AND COBALT-BASED ALLOY FOR DENTAL APPLICATION

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The metal ion release from the implant material occurs as a direct consequence of the corrosion process. Corrosion rate depends on the material microstructure and surface roughness, as well as on composition, temperature and pH of the chemical environment. The aim of this study was to determine the type and the amount of released metal ions from Co-based alloy (Wironit® extrahard, Bego, Germany) and commercially pure (CP) Ti (grade 2). Disk-shaped samples of commercial Co-based alloy and CP Ti (8.0 mm in diameter and 3.2 mm in thickness) were immersed in artificial saliva with different pH (4.0; 5.5 and 7.5) and incubated at 37 ºC using a thermostat. The type and amount of ions released from the metallic implant materials were determined after 1, 3 and 6 weeks of immersion using Inductively Coupled Plasma - Mass Spectrometer (Agilent ICP-MS 7500ce). The results of the study show that the amount of released metal ions is increased with the decrease of the artificial saliva pH value. Also, the amount of released ions is increased with the increase of the immersion time until the adsorption-desorption equilibrium is reached.

P.S.E.22.

NANOPARTICLES Ca/Co-HAp IN THE TREATMENT OF WEAKENED BONES JAW TEGMENTA

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The lack of bone in the jaw tegmenta inflicts major problem and leads to an inability to adequately treat stomatoprosthetic patients. If the bone tissue damage is minor, the balanced activities of osteoblasts and bone osteoclasts can repair it independently. If the damage is bigger it is necessary to support the biological potential to repair the bone, and for that reason nanoparticle biomaterial Ca / Co-HAp was used in this study. The research was done on rats with uniform anatomical and physiological characteristics. Assessment of repair and consolidation of the jaw bone tegmenta was performed by histomorphometric and SEM analysis. The best results were obtained in the experimental group of animals where the Ca / Co-Hap was mixed with autologous plasma. Following the implementation of the above mentioned nanocomposites, a significant formation of new bone was evident on the SEM analysis, as well as the rising of histomorphometric parameters of bone formation, which indicates that the Ca / Co-HAp nanocomposite is the material of choice for the rapid regeneration and repair of bone jaw tegmenta.

P.S.E.23.

EFFECT OF AMNIOTIC FLUID ON SWELLING AND CONTROLLED RELEASE PROPERTIES OF HYDROGELS BASED ON ITACONIC ACID

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Free-radical polymerization of 2-hydroxyethyl acrylate (HEA) and its copolymerization with itaconic acid (IA) can be successively utilized for the synthesis of PHEA and P(HEA/IA) copolymeric hydrogels with excellent physicochemical properties, thus showing promise for pharmaceutical and biomedical applications. This study evaluated the swelling and controlled drug release properties of such polymeric matrices in buffer of pH 6.2 and amniotic fluid as well as the thermal properties of these hydrogels. PHEA homopolymer and P(HEA/IA) copolymeric hydrogels were prepared with IA mole fractions of 0.0, 2.0, 3.5, 5.0 and 7.0. Swelling measurements were performed *in vitro*, in buffer and amniotic fluid, using gravimetric method. The drug release studies, monitored by UV-vis spectrophotometry, were also carried out *in vitro*, in buffer and amniotic fluid. Thermal properties of hydrogels were investigated by differential scanning calorimetry on samples dried after swelling in buffer and amniotic fluid. Swelling and controlled drug release properties of PHEA and P(HEA/IA) copolymeric hydrogels were affected by the presence of amniotic fluid due to the fact that most of its proteins are negatively charged as the copolymeric hydrogels. So, the interactions of identical charges affected the kinetics and mechanism of swelling and drug release. The decrease in swelling ratio as well as the slight decrease of glass transition temperature of the PHEA and P(HEA/IA) samples were noticed for hydrogels investigated after swelling in amniotic fluid. Swelling and controlled drug release kinetic parameters were determined and correlated with hydrogel’s composition, i.e. the content of itaconic acid in the samples.

P.S.E.24.

SCANNING ELECTRON MICROSCOPY STUDY OF CHANGES IN NANOPARTICLES SURFACE UNDER *IN VITRO* SIMULATED PHYSIOLOGICAL CONDITIONS

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In this study we observed the changes in surface of nanoparticles of two different nanomaterials, cobalt-substituted hydroxyapatite (CoHAp) and calcium phosphate/poly-(DL-lactide-co-glycolide) (CP/PLGA) that occurred under simulated physiological conditions *in vitro*. Both nanomaterials were incubated in an appropriate volume of Dulbecco's Modified Eagle Medium (DMEM) for 3 days at 37 ^{0}C and then the medium was removed and materials were dried. Surface changes of nanoparticles were studied by scanning electron microscopy (SEM). Results of SEM analysis show that changes in the size and shape of the nanoparticles took place. These changes can be explained by interactions of nanomaterials with DMEM. In the case of CP/PLGA it was probably the result of polymer degradation and changes in CoHAp nanoparticles were probably the result of ion exchange.

P.S.E.25.

GRAFT-COPOLYMERS OF CHITOSAN AND LACTIDE: SOLID-STATE SYNTHESIS AND APPLICATION FOR TISSUE ENGINEERING

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Modification of chitosan, a natural linear polysaccharide, possessed a high potential for biomedical applications is widely proposed to increase its solubility in different mediums as well as to extend its applicability in tissue regeneration and drug delivery systems. In this research, grafting of L,D-lactide side chains onto chitosan have been carried out in a twin-screw extruder under conditions of shear deformation and pressure. Fractional and elemental analysis in combination with IR analysis and GPC showed that processing at different chitosan/L,D-lactide molar ratio and temperature of extrusion leads to formation of graft copolymers with degree of substitution of chitosan amino groups up to 0.41 and degree of lactide polymerization up to 10. The prepared derivatives were used for fabrication of macroporous hydrogels and spherical microcarriers for tissue regeneration.

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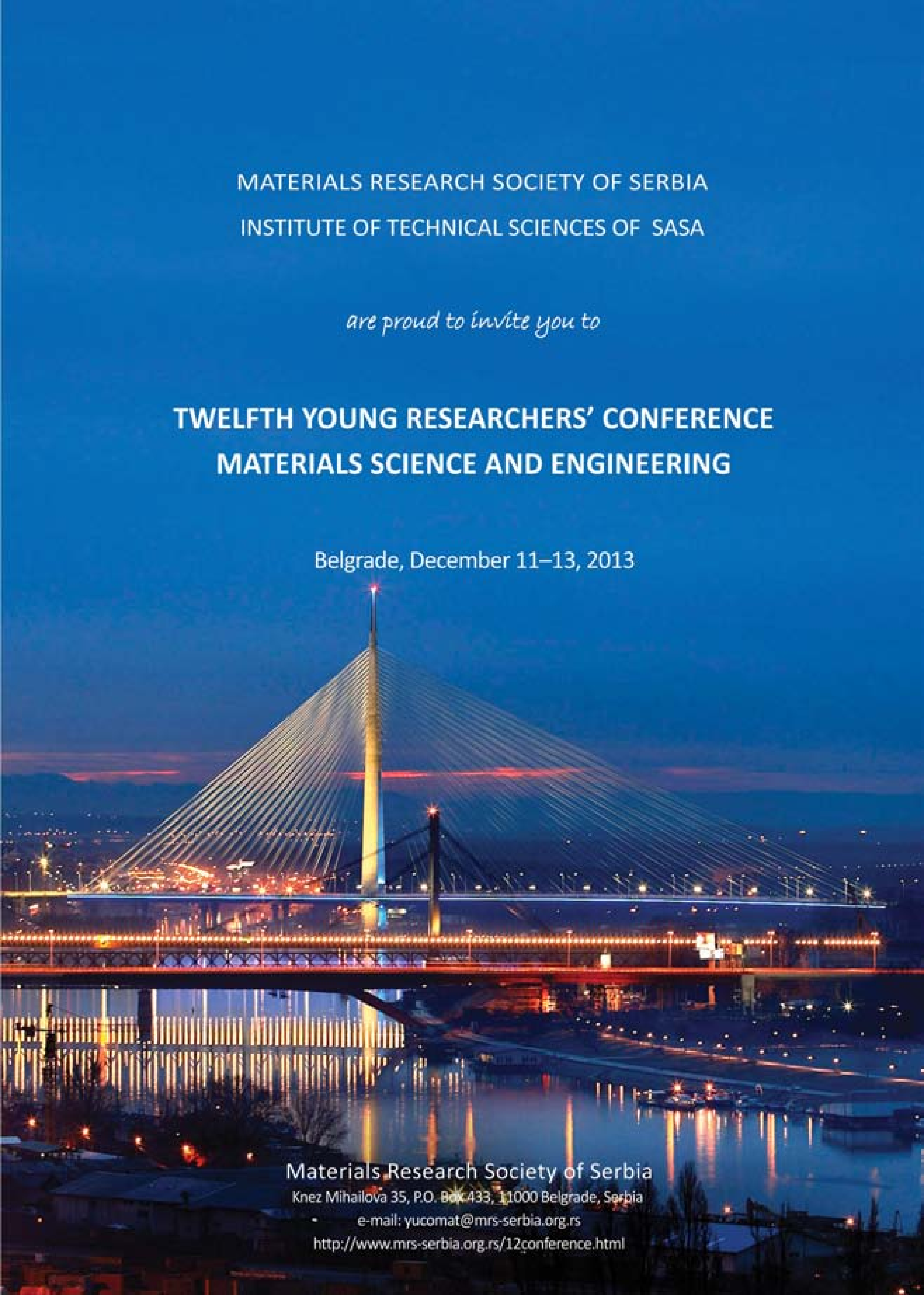

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