ELEVENTH ANNUAL CONFERENCE

YUCOMAT 2009

Hotel "Plaža", Herceg Novi, Montenegro, August 31 – September 4, 2009
http://www.mrs-serbia.org.rs

Programme
and
The Book of Abstracts

Organised by:

Materials Research Society of Serbia
and
Institute of Technical Sciences of the
Serbian Academy of Sciences and Arts, Belgrade

under the auspices of

Federation of European Materials Societies
and
Materials Research Society

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WELCOME SPEECH BY THE PRESIDENT OF MRS-SERBIA

Dear Friends and Colleagues, Welcome to YUCOMAT 2009 Conference and the fabulous town of Herceg-Novi!

Throughout the past several years, YUCOMAT Conferences have shown a steady rise in the quality of their content, and the 2009 Conference is setting the record with 3 plenary sessions, 20 invited lectures by world renowned experts, 5 symposia with 6 oral and 3 poster sessions, comprising altogether 275 presentations. The conference participants come from 37 countries of all continents. When looked at in sheer numbers, this conference presents a major achievement for a comparatively small MRS such as ours.

Some of the hottest topics of Materials Science of the modern-day will be represented at the Meeting. The versatile program of the conference gives a view at some of the most exciting research trends and challenges that Materials Scientists are dealing with today. It is also with pleasure that I notice many old and experienced scientists present here side by side with young scientists whose time of recognition and peaks in creativity are yet to come. In view of that, I encourage all of you who are experts in your fields to dedicate some time to introducing these young scientific minds to the charms of your science, including all the passions that guide your research. For, although the scientific excellence of our research methodologies is of crucial importance, it is the passion for science that all us, experienced mentors and teachers, have the duty to convey to those that follow our steps. It is the love for our science as much as the content of our knowledge that makes us successful in scientific endeavours.

Some of you have been with us year after year, and some of you are here for the first time. To provide opportunities for you to mingle with your colleagues from all over the world, we have planned each day so as to allow for maximum networking: the traditional photo session and welcome cocktail on Monday, poster sessions on Tuesday, Wednesday and Thursday evenings, a bus trip to Dubrovnik on Wednesday afternoon, a boat trip around the Bay on Thursday afternoon, a little trade fair of synthesis and characterization equipment, and numerous coffee breaks will surely give the participants lots of opportunities to socialize in fun and instructive ways alike.

A special emphasis is placed on continuing the tradition of scientific excellence in the field by awarding young scientists for their achievements. Awards for the best doctoral and master theses defended between the two conferences will be therefore given as well as those for the best oral and poster presentations. The winner in the latter categories will be announced during the Closing Ceremony on Friday.

Our Presidency and Organizing Committee, with the help from the International Advisory Board and indefatigable Sasha, the Conference Secretary, worked hard to put this meeting together. I would like to particularly thank our Vice-Presidents, Dr. Slobodan Milonjić, Prof. Dejan Raković and Prof. Velimir Radmilović, for their invaluable suggestions and an enthusiastic support.

On behalf of the MRS-Serbia officers, I wish this to be a splendid conference for all of you. Let the time spent here be filled with many enjoyable and refreshing moments. Finally, may this meeting be yet another YUCOMAT Conference that lives up to the ideal that small is beautiful.

Dragan Uskoković

IN HONOUR TO PROFESSOR DRAGAN USKOKOVIĆ

It is our great pleasure to announce that this YUCOMAT 2009 Conference is dedicated to the President of the Materials Research Society of Serbia, Professor Dragan Uskoković, for his 65th birthday.

Dragan Uskoković was born on April 3rd, 1944, in Cetinje, Montenegro, where he finished primary school (1958) and grammar school (1962). He received his BS (1967), from the Faculty of Technology and Metallurgy, University of Belgrade, and his MS (1971) and PhD (1974) degrees from the Faculty of Electronics, University of Niš. He started his research work at the Institute of Nuclear Sciences Vinča in 1968. In July of 1974, just before finishing his PhD dissertation, he joined Institute of Technical Sciences of the Serbian Academy of Sciences and Arts (SASA), where he still works as a Director of the Institute. He was elected in all scientific and university titles.

He is a long-term Member of the International Institute for the Science of Sintering, where he is currently General Secretary. He served as a Secretary, then a Regional Editor and now as a co-editor of the International Journal of Science of Sintering. In 1975 he was elected as a Corresponding Member and in 1983 as a Full Member of this Institute. He was a Coordinator of our programmes with European Union, as well as a Programme Committee Member of many international conferences and journals. He served as a referee in several international journals. He is President elect of the MRS-Serbia (formerly Yugoslav Materials Research Society, YuMRS), organizing ten YUCOMAT Conferences in Herceg Novi in past 15 years.

Until now, he published one monograph of international reputation, co-edited two books published by Plenum Press and ten books published by Trans Tech Publications. He is a co-author of the monograph *Activated Sintering* (G. V. Samsonov, M. M. Ristić), cited more than 100 times in other monographs and non-ISI publications. His 160 papers, published in the journals indexed by Thomson Scientific, received more than 880 citations and h (Hirsh) index of 16. He has presented more than 100 lectures worldwide, out of which 50 plenary lectures at different international conferences or world-leading research centers.

Professor Uskoković has supervised 11 PhD dissertations and 16 MS theses. He has headed more than 20 scientific-research projects in basic and technological research and also several international projects with leading scientific-research organizations in the world.

Finally, we would like to acknowledge the extraordinary influence of Dragan Uskoković in organization and promotion of our MRS Society. On behalf of our Society, his friends and, we believe, all participants, we wish him good health, much success and further promotion of our MRS Society.

Slobodan Milonjić
Velimir Radmilović
Dejan Raković
Vice-Presidents of MRS-Serbia

MRS-Serbia

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

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).

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Symposium C: NANOSTRUCTURED MATERIALS

Symposium D: COMPOSITES

Symposium E: BIOMATERIALS

POSTER PRESENTATIONS:

Programme

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	Composites
SYMPOSIUM E	Biomaterials

GENERAL INFORMATION

DATE AND VENUE: The conference will be held on August 31-September 4, 2009, at the Plaža Hotel, in Herceg Novi, Montenegro. Participants will also be accommodated there. The conference will begin on Monday, August 31st, at 09.00 and end on Friday, September 4th, 2009 at 13.00.

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

INSTRUCTION FOR AUTHORS: The conference will feature plenary 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 only, should be given at registration.
In POSTER SESSIONS, the authors are requested to display their papers minimum two hours before the session and to be present beside their posters during the session. Poster sessions are held in Business Club (next to the National Restaurant, looking at the beach) which is open Tuesday to Thursday 18.00-22.00.

PUBLICATION OF PAPERS: Abstracts will be included in a book of abstracts and distributed to each participant at registration. Only papers presented at the Conference will be peer reviewed and, if positive, selected papers will be published in journals Acta Physica Polonica A (by Institute of Physics, Polish Academy of Sciences, IF2007=0.340), on SCI list, and few others (we are negotiating at the moment) within the topic of these journals. Manuscripts prepared according to the guidelines for these journals, which are of good quality, comprehensible English language and with more than 50% references from the last 5 years, will have advantage. Instructions for Papers are available on the websites of each journal. Authors should submit papers prepared for a chosen journal according to the topic of the paper and the scope of the journal. The final decision in which journal the submitted papers will be published will be made by the Organizers and Editors.

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 and MSc 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.

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: Composites
Symposium E: Biomaterials

Sunday, August 30, 2009

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

Monday, August 31, 2009

08^{00}-09^{00}	**Registration**
09^{00}	**OPENING CEREMONY** - Introduction and Welcome
10^{00}-13^{00}	**First Plenary Session**
13^{30}	**Photo Session**
15^{00}-19^{00}	**Symposium A, Session I, Conference Hall**
15^{00}-19^{00}	**Symposium A, Session II, Press Hall**
19^{30}-21^{00}	**Cocktail Party**

Tuesday, September 1, 2009

09^{00}-13^{00}	**Second Plenary Session**
15^{00}-19^{30}	**Symposium B**
20^{30}-22^{00}	**Poster Session I** (Symposium A)

Wednesday, September 2, 2009

09^{00}-13^{00}	**Symposium C**
14^{00}-19^{00}	**Excursion to Dubrovnik, Croatia**
20^{30}-22^{00}	**Poster Session II** (Symposium B)

Thursday, September 3, 2009

09^{00}-13^{30}	**Third Plenary Session**
14^{00}-19^{00}	**Boat-trip around Boka Kotorska Bay**
20^{30}-22^{00}	**Poster Session III** (Symposiums C, D and E)

Friday, September 4, 2009

09^{00}-10^{30}	**Symposium D**
11^{00}-12^{30}	**Symposium E**
12^{30}-13^{00}	**Awards and Closing of the Conference**

FIRST PLENARY SESSION

Monday, August 31, 2009

Session I: 10^{00}-13^{00}
Chairpersons: D. Raković, G. Vunjak-Novaković and D. Suvorov

10^{00}-10^{30} **BIOMATERIALS FOR TISSUE ENGINEERING**
G. Vunjak-Novaković
Columbia University, New York, NY, USA

10^{30}-11^{00} **FUNCTIONALIZATION CHANGES TARGETING SITE AND THE STABILITY OF CARBON NANOTUBES INSIDE LUNG EPITHELIAL CELLS**
A. Porter
Department of Materials, Imperial College, London, UK

11^{00}-11^{30} **NEW METHODS IN MATERIALS RESEARCH USING FOCUSED ION BEAMS**
R. Hull
Department of Materials Science and Engineering, Rensselaer Polytechnic Institute, Troy, USA

Break: 11^{30}-12^{00}

12^{00}-12^{30} **ON PHYSICS AND NANOENGINEERING OF HIGH-Tc AND RELATED OXIDE FILMS**
D. Pavuna
Institute of Physics of Condensed Matter – Station 3, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

12^{30}-13^{00} **TUNABLE CERAMICS BASED ON THE $Na_{0.5}Bi_{0.5}TiO_3$ SYSTEM**
D. Suvorov, M. Spreitzer, J. König
Advanced Materials Department, Jožef Stefan Institute, Ljubljana, Slovenia

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

SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

Session I: 15^{00}-19^{00}
Chairmen: M. Drofenik, J. Kusinski and M. Kuznetsov

Conference Hall

15^{00}-15^{15} **THE PREPARATION OF SUPERPARAMAGNETIC $BaFe_{12}O_{19}$ PARTICLES BY COPRECIPITATION ROUTE**
M. Drofenik[1,2], I. Ban[1], G. Ferk[1], D. Makovec[2], D. Lisjak[2]
[1]Faculty of Chemistry and Chemical Engineering, University of Maribor, Maribor, Slovenija, [2]Jožef Stefan Institute, Ljubljana, Slovenija

15^{15}-15^{30} **THE SYNTHESIS OF IRON OXIDE-DEXTRAN NANOCOMPOSITES FOR THE APPLICATION IN HYPERTHERMIA**
I. Ban[1], M. Drofenik[1, 2], A. Hamler[3], G. Ferk[1], D. Makovec[2]
[1]Faculty of Chemistry and Chemical Engineering, University of Maribor, Maribor, Slovenija, [2]Jožef Stefan Institut, Ljubljana, Slovenija, [3]Faculty of Electronic Computing and Informatics, University of Maribor, Maribor, Slovenija

15^{30}-15^{45} **INFLUENCE OF LASER MELTING ON MICROSTRUCTURE AND PROPERTIES OF AMORPHOUS COATINGS DEPOSITED BY HIGH VELOCITY OXYFUEL DEPOSITION METHOD**
J. Kusinski[1], S. Kac[1], G. Kusiński[2]
[1]AGH - University of Science and Technology, Faculty of Metals Engineering and Industrial Computer Science, Krakow, Poland, [2]Chevron Energy Technology Company, Richmond, CA, USA

15^{45}-16^{00} **DEFECTS RESPONSIBLE FOR AFTERGLOW IN LUTETIUM SESQUIOXIDES DOPED WITH Eu^{3+}**
A. Bessière, B. Viana, H. Rétot, S. Blahuta
LCMCP-ENSCP– UMR7574, ENSCP, Paris, France

16^{00}-16^{15} **INTERACTION BETWEEN SURFACE ACTIVE SOLUTES AND SURFACES OF METAL OXIDES IN POLAR ORGANIC SOLVENTS**
M. Kosmulski, P. Próchniak, J.B. Rosenholm
Department of Physical Chemistry, Åbo Akademi University, Åbo, Finland, and Department of Electrochemistry, Lublin University of Technology, Lublin, Poland

16^{15}-16^{30} **NON-CONVENTIONAL SYNTHESIS OF MANNICH POLYOLS**
M. Ionescu
Pittsburg State University, Kansas Polymer Research Center, Pittsburg, Kansas, USA

16^{30}-16^{45} **MICROWAVE METHODS OF OBTAINING OF GRAPHITE INTERCALATION COMPOUNDS AND NANOMATERIALS ON THEIR BASE**
A.N. Mikheev
Nikolayev Institute of Inorganic Chemistry SB RAS; Research and Educational Centre, Research and Educational Complex, Novosibirsk State University, Novosibirsk, Russia

16^{45}-17^{00} **THE APPLICATION OF CONTROLLED MICROWAVE HEATING IN ORGANIC SYNTHESIS AND EXTRACTION**
N. Pankrushina[1,2], I. Nikitina[1,2], V. Boldyrev[2,3]
[1]Novosibirsk Institute of Organic Chemistry, Novosibirsk, Russia, [2]Research and Education Centre "Molecular Design and Ecologically Safe Technologies" at Novosibirsk State University, Russia, [3]Institute of Solid State Chemistry and Mechanochemistry, Novosibirsk, Russia

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

17^{30}-17^{45} **SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS OF COMPLEX OXIDE MATERIALS FOR GAS-SENSING APPLICATION**
M.L. Busurina, M.V. Kuznetsov
Institute of Structural Macrokinetics and Materials Science RAS, Chernogolovka, Moscow region, Russia

17^{45}-18^{00} **PHASE FORMATION AND MICROSTRUCTURE OF Mn(/Ba)-Fe-O-SYSTEM DURING COMBUSTION SYNTHESIS**
S.M. Busurin, Yu.G. Morozov
Institute of Structural Macrokinetics and Materials Science RAS, Chernogolovka, Moscow region, Russia

18^{00}-18^{15} **DESIGN OF NANOSTRUCTUCTURED OXIDE MATERIALS FOR TERAHERTZ OPTICS APPLICATIONS**
A.N. Khodan[1], A.P. Shkurinov[2]
[1]A.N.Frumkin Institute of Physical Chemistry and Electrochemistry RAS, Moscow, Russia, [2]Physical Department of M.V. Lomonosov Moscow State University, Moscow, Russia

18^{15}-18^{30} **EFFECT OF MECHANICAL ACTIVATION ON PHYSICAL-CHEMICAL PROPERTIES OF DRUGS**
T.P. Shakhtshneider, V.V. Boldyrev
Institute of Solid State Chemistry and Mechanochemistry, SB RAS, Novosibirsk, Russia; Research and Education Centre "Molecular Design and Ecologically Safe Technologies" at the Novosibirsk State University, Novosibirsk, Russia

18^{30}-18^{45} **CHEMICAL PROCESS FOR FABRICATION OF MICROMECHANICAL INFRARED DETECTORS**
S.F. Devyatova, O.I. Semenova, N.A. Valisheva
Novosibirsk Institute of Semiconductor Physics, Novosibirsk, Russia

18^{45}-19^{00} **SYNTHESIS OF METALLIC AND OXIDE NANO-POWDER BY ULTRASONIC SPRAY PYROLYSIS**
S. Stopić, B. Friedrich
RWTH Aachen University, IME Process Metallurgy and Metal Recycling, Aachen, Germany

Session II: 15^{00}-19^{00}
Chairpersons: N. Romčević, N. Pankrushina and E.P. Elsukov
Press Hall

15^{00}-15^{15} **EFFECT OF MECHANICAL ACTIVATION ON THE SHS OF POROUS TiNi**
O.K. Kamynina[1], I.P. Gotman[2], E.Y. Gutmanas[2], S.G. Vadchenko[1], A.E. Sytschev[1], E.N. Balikhina[1]
[1]Institute of Structural Macrokinetics and Materials Science, Russian Academy of Sciences, Chernogolovka, Moscow, Russia, [2]Faculty of Materials Engineering, Technion–IIT, Haifa, Israel

15^{15}-15^{30} **MECHANOCHEMICAL SYNTHESIS OF CO-CRYSTALS OF MELOXICAM WITH CARBOXYLIC ACIDS**
S.A. Myz[1,2], T.P. Shakhtshneider[1,2], K. Fucke[3], N.A. Tumanov[2], E.V. Boldyreva[1,2], U.J. Griesser[3]
[1]Institute of Solid State Chemistry and Mechanochemistry, SB RAS, Novosibirsk, Russia, [2]Research and Education Centre "Molecular Design and Ecologically Safe Technologies" at the Novosibirsk State University, Novosibirsk, Russia, [3]Institut für Pharmazie, University of Innsbruck, Innsbruck, Austria

15^{30}-15^{45} **MECHANOCHEMISTRY OF FLAKY–BASED NANOCOMPOSITES**
A.N. Streletskii[1], I.V. Kolbanev[1], A.B. Borunova[1], A.V. Leonov[2]
[1]N.N. Semenov Institute of Chemical Physics RAS, Moscow, Russia, [2]Moscow State University, Chemical Department, Moscow, Russia

15^{45}-16^{00} **PROSPECTS OF APPLICATION NEUTRAL AND ACTIVE REAGENTS FOR DEVELOPMENT MECHANOCHEMICAL METHODS OF ENRICHMENT AND PROCESSING MINERAL AND MAN-MADE RAW MATERIALS**
T.A. Ketegenov[1], O.A. Tyumentseva[1], F.Kh. Urakaev[2]
[1]Institute of High Technology, Kazatomprom, Almaty, Kazakhstan, [2]Institute of Geology and Mineralogy SB RAS, Novosibirsk, Russia

16^{00}-16^{15} **MECHANOCHEMICAL SYNTHESIS OF Ti-CONTAINING HYDROGEN STORAGE NANOCOMPOSITES**
O.S. Morozova[1], T.I. Khomenko[1], A.V. Leonov[2], E.Z. Kurmaev[3], Ch. Borchers[4]
[1]Institute of Chemical Physics RAS, Moscow, Russia, [2]Moscow State University, Department of Chemistry, Leninskie Gory, Moscow, Russia, [3]Institute of Metal Physics, RAS-Ural Division, Ekaterinburg, Russia, [4]Institute of Material Physics, University of Goettingen, Goettingen, Germany

16^{15}-16^{30} **SYNTHESIS OF MONODISPERSE LUMINESCENT OXIDE POWDERS UTILIZING MICROWAVE IRRADIATION**
A.S. Vanetsev, E.A. Karpukhina, O.M. Gaitko
Kurnakov Institute of General and Inorganic Chemistry RAS, Moscow, Russia

16^{30}-16^{45} **MECHANICAL ACTIVATION ASSISTED SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS OF NANOCOMPOSITE MATERIALS IN METAL-OXIDE SYSTEMS**
T.F. Grigoreva[1], T.L. Talako[2], P.A. Vitiaz[2], N.Z. Lyakhov[1], A.I. Letsko[1], M.R. Sharafutdinov[2], Yu.D. Kaminsky[2], I.A. Vorsina[2], A.P. Barinova[2]
[1]Institute of Solid State Chemistry and Mechanochemistry, Russia, [2]Powder Metallurgy Institute, Minsk, Belarus

16^{45}-17^{00} **PHYSICOCHEMICAL TRANSFORMATION OF ALUMINIUM AND QUARTZ POWDERS MIXTURE UNDER LOADING BY SPHERICAL CONVERGING SHOCK WAVES**
N.I. Taluts[1], A.V. Dobromyslov[1], E.A. Kozlov[2]
[1]Institute of Metal Physics, Ural Division of Russian Academy of Sciences, Ekaterinburg, Russia, [2]Russian Federal Nuclear Center – All-Russian Research Institute of Technical Physics, Snezhinsk, Chelyabinsk region, Russia

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

17^{30}-17^{45} **HOMOGENEOUS AND MICROHETEROGENEOUS PEROVSKITE-LIKE SYSTEMS: FORMATION, MICROSTRUCTURE AND REACTIVITY IN OXIDATION REACTIONS**
L.A. Isupova
Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

17^{45}-18^{00} **INFLUENCE OF DOPANT AND ITS PRECURSOR NATURE ON FORMATION OF DOPED APATITE-TYPE LANTHANUM SILICATES VIA MECHANICAL MILLING**

T. Kharlamova[1], S. Pavlova[1], Y. Bespalko[1], V. Sadykov[1,2], M. Chaikina[3], T. Krieger[1], O. Lapina[1], Ch. Argirusis[3,4]
[1]Boreskov Institute of Catalysis SB RAS, Russia, [2]Novosibirsk State University, Russia, [3]Institute of Solid State Chemistry and Mechanochemistry, Russia, [3]Institute for Metallurgy, Clausthal University of Technology, Germany, [4]School of Chemical Engineering, National Technical University of Athens, Greece

18^{00}-18^{15} **SYNTHESES OF SELF-STABILIZING POLYBUTADIENE-BASED POLYURETHANES**

J. Podešva, J. Kovářová
Institute of Macromolecular Chemistry, v.v.i., Academy of Sciences of the Czech Republic, Prague, Czech Republic

18^{15}-18^{30} **HYPERBRANCHED POLYMERS**

H. Galina, J.B. Lechowicz, M. Walczak
Rzeszów University of Technology, Faculty of Chemistry, Rzeszów, Poland

18^{30}-18^{45} **APPLICATIONS OF MOTT'S THEORY TO THE EXPERIMENTAL INVESTIGATION OF ELECTRICAL CONDUCTIVITY OF POLYANILINE CONTROLABLY DOPED WITH SULPHURIC ACID**

Z. Muharemović[1], I. Gazdić[2], D. Babić[3]
[1]Faculty of Medicine, Biophysics Department, Sarajevo, Bosnia and Herzegovina, [2]Faculty of Natural Science, Physics Department, Tuzla, Bosnia and Herzegovina, [3]Faculty of Natural Science, Physics Department, Zagreb, Croatia

18^{45}-19^{00} **THE EFFECT OF Gd OR Ho IMPURITIES ON THE PHYSICAL PROPERTIES OF HALF-METALLIC FERROMAGNET Co_2MnSi**

R. Tetean[1], R. Grasin[1], E. Vinteler[1], A. Bezergheanu[1], I.G. Deac, L. Chioncel[2]
[1]Faculty of Physics, Cluj Napoca, Babes-Bolyai University, Romania, [2]Institute for Theoretical Physics and Computational Physics, Graz University of Technology, Graz, Austria

SECOND PLENARY SESSION

Tuesday, September 1, 2009

Session II: 09^{00}-13^{00}
Chairmen: S.K. Milonjić, J. Mijović and M.B. Plavšić

09^{00}-09^{30} **DYNAMICS OF LIQUID CRYSTALLINE PHYSICAL GELS**
J. Mijović[1], K. Hicks[1], G. Williams[2]
[1]Othmer-Jacobs Department of Chemical and Biological Engineering, Polytechnic Institute of New York University, Brooklyn, NY, USA, [2]University of Wales at Swansea, Wales, UK

09^{30}-10^{00} **PROCESSING AND PROPERTIES OF ADVANCED COMPOSITE MATERIALS WITH NACOMPOSITE POLYMER MATRICES**
J.M. Kenny[1,2], M. Monti[2], R. Petrucci[2], L. Torre[2]
[1]Institute of Science and Technology of Polymers, CSIC, Madrid, Spain,
[2]European Centre for Nanostructured Polymers, University of Perugia, Terni, Italy

10^{00}-10^{30} **MATERIALS WITH TIME CONTROL LUMINESCENCE IN MEDICAL IMAGING**
B. Viana, A. Lecointre, A. Bessiere
LCMCP-ENSCP– UMR7574, ENSCP, Paris, France

10^{30}-11^{00} **COMBUSTION SYNTHESIS OF COMPLEX OXIDE MATERIALS: PRESENT STATE AND PERSPECTIVES OF DEVELOPMENT**
M.V. Kuznetsov
Institute of Structural Macrokinetics and Materials Science Russian Academy of Sciences (ISMAN), p/o Chernogolovka, Moscow region, Russia

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

11^{30}-12^{00} **QUANTITATIVE DESCRIPTION OF THE INTERFACE BETWEEN γ AND γ'PARTICLES IN NI-AL ALLOYS BY HREM**
H.A. Calderon[1], L. Calzado-Lopez[2], T. Mori[3]
[1]Depto. de Ciencia de Materiales, ESFM-IPN, Ed. 9 UPALM Zacatenco D.F., Mexico, [2]Universidad de la Ciudad de Mexico, Mexico DF, Mexico, [3]Materials Science Centre, University of Manchester, Manchester, UK

12^{00}-12^{30} **FAILURE MECHANISMS IN HYBRID NANOCRYSTALLINE CELLULAR MATERIALS**

G.D. Hibbard
Department of Materials Science and Engineering, University of Toronto, Toronto, ON, Canada

12^{30}-13^{00} **ALLOY STRUCTURES AT THE NANOSCALE BY ATOM-PROBE TOMOGRAPHY**

E.A. Marquis
Department of Materials, University of Oxford, Oxford, United Kingdom

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

SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATION

Session I: 15^{00}-19^{30}
Chairmen: J. Nedeljković, P. Rogl and M. Davidović

15^{00}-15^{15} **CLATHRATE TYPE I THERMOELECTRICS: $Ba_8M_x\square_y\{Ge,Si\}_{46-x-y}$ M=Mn,Fe,Co,Pd,Pt,Cu,Ag,Au,Zn**

P. Rogl[1], A. Grytsiv[1], N. Melnychenko-Koblyuk[1], N. Nasir, E. Bauer[2], E. Royanian[2]
[1]Institute of Physical Chemistry, University of Vienna, Wien, Austria, [2]Institute of Solid State Physics, Vienna University of Technology, Wien, Austria

15^{15}-15^{30} **NANOSTRUCTURED MATERIALS FOR OPTOELECTRONIC APPLICATIONS**

N.V. Kamanina[1], P.Ya. Vasilyev[1], V.I. Studeonov[1], K.Yu. Bogdanov[2], D.P. Uskoković[3]
[1]Vavilov State Optical Institute, St. Petersburg, Russia, [2]Lyceum # 1586, Moscow, Russia, [3]Institute of Technical Sciences of the SASA, Belgrade, Serbia

15^{30}-15^{45} **A SYNTHESIS TOOLBOX FOR WELL-DEFINED CATALYST COATINGS: NANOPARTICLES OF NOBLE METALS SUPPORTED ON MESOPOROUS OXIDE FILMS**

S. Sokolov, E. Ortel, T.T. Ahner, K. Weh, R. Kraehnert
Leibniz Institute for Catalysis at the University of Rostock, Branch Berlin, Germany

15^{45}-16^{00} **POWDER METALLURGY MANUFACTURING OF CARBON-FREE PRECIPITATION HARDENED HIGH SPEED STEELS**

H. Danninger[1], Ch. Harold[1], Ch. Gierl[1], H. Ponemayr[2], M. Daxelmueller[2], F. Simancik[3], K. Izdinsky[3]
[1]Vienna University of Technology, Wien, Austria, [2]Boehler Uddeholm Precision Strip GmbH, Boehlerwerk, Austria, [3]Institute of Materials and Machine Mechanics SAS, Bratislava, Slovakia

16^{00}-16^{15} **THERMAL EXPANSION AND MECHANICAL PROPERTIES OF SKUTTERUDITES**

G. Rogl[1,2,3], A. Grytsiv[1], E. Bauer[2], D. Rojs[2], H. Mueller[2], P. Rogl[1], M. Reinecker[3], J. Koppensteiner[3], M. Zehetbauer[3]
[1]Institute of Physical Chemistry, University of Vienna, Wien, Austria, [2]Institute of Solid State Physics, TU-Wien, Wien, Austria, [3]Physics of Nanostructured Materials, University of Vienna, Wien, Austria

16^{15}-16^{30} **NOVEL BORIDES IN THE SYSTEMS M-T-B. PHASE EQUILIBRIA AND CRYSTAL STRUCTURES**

O. Sologub[1], P. Rogl[1], G. Giester[2]
[1]Institute of Physical Chemistry, University of Vienna, Vienna, Austria,
[2]Institute of Mineralogy and Crystallography, University of Vienna, Vienna, Austria

16^{30}-16^{45} **PHASE RELATIONS AND ADVANCED CERAMIC IN THE SYSTEMS FORMED BY CERIUM AND RARE-EARTH OXIDES**

E.R. Andrievskaya
Frantsevich Institute for Problems of Materials Science NAS of Ukraine, Kiev, Ukraine

16^{45}-17^{00} **HETEROSTRUCTURES ON A BASE OF ADVANCED SUPERIONIC CONDUCTORS - NEW FUNCTIONAL MATERIALS FOR NANOIONIC SUPERCAPACITORS**

A.L. Despotuli, A.V. Andreeva
Institute of Microelectronics Technology RAS, Chernogolovka, Russia

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

17^{30}-17^{45} **COMPARISON OF OXIDE AND NITRIDE THIN FILMS – ELECTROCHEMICAL IMPEDANCE MEASUREMENTS AND MATERIALS PROPERTIES**

Y. Liu, C. Qu, R.E. Miller, D.D. Edwards, J.H. Fan, P. Li, E. Pierce, A. Geleil, G. Wynick, X.W. Wang
Alfred University, Alfred, NY, USA

17^{45}-18^{00} **CHANGES IN ODS SUPERALLOY MATERIALS INDUCED BY HIGH TEMPERATURE EXPOSITION IN DIFFERENT ENVIRONMENTS**

V. Jan[1], Y. Iino[2]

[1]Brno University of Technology, Brno, Czech Republic, [2]Toyota Technological Institute, Nagoya, Aichi, Japan

18^{00}-18^{15} **$BaTi_{0.975}Sn_{0.025}O_3$/$BaTi_{0.85}Sn_{0.15}O_3$ FUNCTIONALLY GRADED MATERIALS: MASTER SINTERING CURVES AND ELECTRICAL PROPERTIES**

S. Marković, D. Uskoković

Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Belgrade, Serbia

18^{15}-18^{30} **TO THE THORY OF DIRECTIONAL SOLIDIFICATION OF A BINARY ALLOY WITH A MUSHY LAYER. THE EFFECT OF NONLINEAR LIQUIDUS SLOPE**

A.P. Malygin, D.V. Alexandrov

Ural State University, Ekaterinburg, Russia

18^{30}-18^{45} **CHARACTERIZATION OF $LiMF_4$:RE^{3+} MULTIFUNCTIONAL MATERIALS BY HIGH-RESOLUTION OPTICAL SPECTROSCOPY**

D.S. Pytalev, S.A. Klimin, M.N. Popova

Institute of Spectroscopy RAS, Troitsk, Moscow region, Russia

18^{45}-19^{00} **ANOMALOUS HALL EFFECT IN THE SPIN-GLASSLIKE (Ge,Mn)Te-(Sn,Mn)Te**

L. Kilanski[1], R. Szymczak, W. Dobrowolski[1], A.B. Antunes[2], V.E. Slynko[3], E.I. Slynko[3]

[1]Institute of Physics, Polish Academy of Sciences, Warsaw, Poland, [2]Laboratoire National des Champs Magnétiques Intenses, Grenoble, France, [3]Institute of Materials Science Problems, Ukrainian Academy of Sciences, Chernovtsy, Ukraine

19^{00}-19^{15} **OPTICAL PROPERTIES OF PLASTICALLY DEFORMED COPPER**

R. Rudolf[1, 2], I. Anžel[1], N. Romčević[3], M. Mirić[3], B. Hadžić[3], M. Romčević[3], J. Trajić[3]

[1]Faculty of Mechanical Engineering, University of Maribor, Maribor, Slovenia, [2]Zlatarna Celje d.d., Celje, Slovenia, [3]Institute of Physics, Belgrade, Serbia

19^{15}-19^{30} **MULTICOMPONENT POLYCARBONATE-BASED POLYURETHANE ELASTOMERS AND FILMS**

J. Pavličević[1], M. Špirkova[2], A. Strachota[2], K. Meszaros Szecsenyi[3], N. Lazić[4], J. Budinski-Simendić[1]

[1]Faculty of Technology, Novi Sad, Serbia, [2]Institute of Macromolecular Chemistry ASCR, Prague, Czech Republic, [3]Faculty of Sciences, Novi Sad, Serbia, [4]Institute of General and Physical Chemistry, Belgrade, Serbia

SYMPOSIUM C: NANOSTRUCTURED MATERIALS

Wednesday, September 2, 2009

Session I: 09^{00}-13^{00}
Chairpersons: M. Zlatanović, S. Bošković and M. Damnjanović

09^{00}-09^{15} **STRUCTURAL AND MAGNETIC CHARACTERIZATION OF HIGH MOMENT SYNTHETIC ANTI-FERROMAGNETIC NANOPARTICLES**
A.L. Koh[1,2], W. Hu[1], R.J. Wilson[1], S.X. Wang[1], R. Sinclair[1]
[1]Materials Science and Engineering Department, Stanford University, Stanford CA, USA, [2]Department of Materials, Imperial College London, London, UK

09^{15}-09^{30} **TAILORING LOW-DIMENSIONAL SEMICONDUCTOR NANOSTRUCTURES FROM Si AND Ge NANOWIRES**
Dj. Hourlier
Institut d'Electronique, de Microélectronique et de Nanotechnologies, UMR-CNRS 8520, Villeneuve d'Ascq, France

09^{30}-09^{45} **SIZE ANALYSIS OF NANOPARTICLES BY SCATTERING EXPERIMENTS: THE RAYLEIGH DISTRIBUTION, A UNIVERSAL APPROACH**
W. Gille
Martin-Luther-University Halle-Wittenberg, Institute of Physics, Halle, Germany

09^{45}-10^{00} **PREPARATION AND THERMOELECTRIC PROPERTIES OF NANO SIZED $Mm_yFe_{4-x}Co_xSb_{12}$**
L. Zhang[1,2], A. Grytsiv[1], M. Kerber[2], P. Rogl[1], E. Bauer[3], M.J. Zehetbauer[2]
[1]Institute of Physical Chemistry, University of Vienna, Wien, Austria, [2]Physics of Nanostructured Materials, University of Vienna, Wien, Austria, [3]Institute of Solid State Physics, Vienna University of Technology, Wien, Austria

10^{00}-10^{15} **DIFFRACTION FROM NANOTUBES AND QUASI ONE-DIMENSIONAL CRYSTALS**
M. Damnjanović, T. Vuković, I. Milošević
NanoLab, Faculty of Physics, University of Belgrade, Belgrade, Serbia

10^{15}-10^{30} **ELECTRON-PHONON INTERACTION IN GRAPHENE**
I. Milošević[1], N. Kepcija[1], E. Dobardžić[1], M. Mohr[2], J. Maultzsch[2], C. Thomsen[2], M. Damnjanović[1]
[1]NanoLab, Faculty of Physics, University of Belgrade, Belgrade, Serbia, [2]Institut fur Festkorperphysik, TU Berlin, Berlin, Germany

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

11^{00}-11^{15} **QUANTUM CASCADE LASER DESIGN FOR CHEMICAL SENSING AND DETECTION IN THE INFRARED SPECTRAL RANGE**
A. Daničić[1], J. Radovanović[2], V. Milanović[2], D. Indjin[3], Z. Ikonić[3]
[1]Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [2]School of Electrical Engineering, University of Belgrade, Belgrade, Serbia, [3]Institute of Microwaves and Photonics, School of Electronic and Electrical Engineering, University of Leeds, Leeds, UK

11^{15}-11^{30} **FORMATION OF CONDENSED DNA NANOPARTICLES INDUCED BY SPERMINE AND HEXADECYLTRIMETHYLAMMONIUM BROMIDE: DYNAMIC LIGHT SCATTERING AND FLUORESCENCE CORRELATION SPECTROSCOPY STUDY**
M. Štěpánek[1], J. Humpolíčková[2], L. Beranová[2], A. Benda[2], M. Hof[2]
[1]Department of Physical and Macromolecular Chemistry, Faculty of Science, Charles University, Prague, Czech Republic, [2]J. Heyrovský Institute of Physical Chemistry, Academy of Sciences of the Czech Republic, Prague, Czech Republic

11^{30}-11^{45} **SYNTHESIS OF NANOSTRUCTURAL AND AMORPHOUS ALLOYS FROM ELEMENTARY POWDERS BY INTENSIVE PLASTIC DEFORMATION UNDER HIGH PRESSURE**
A.V. Dobromyslov, R.V. Churbaev
Institute of Metal Physics, Ural Division of Russian Academy of Sciences, Ekaterinburg, Russia

11^{45}-12^{00} **NANO ALPHA-ALUMINA POWDERS AND DENSE CERAMICS. CHALLENGES AND ACHIEVEMENTS**
G.R. Karagedov, N.Z. Lyakhov
Institute of Solid State Chemistry and Mechanochemistry, Novosibirsk, Russia

12^{00}-12^{15} **ELECTRON TRANSPORT THROUGH SINGLE PHTHALOCYANINE MOLECULES WITH STM**
A.F. Takács[*, 1, 2], S. Schmaus[1,2], F. Witt[1], T. Balashov[1], M. Bowen[3], E. Beurepaire[3], W. Wulfhekel[1, 2]
*[1]Physikalisches Institut, Universitaet Karlsruhe(TH), Karlsruhe, Germany, [2]DFG-Center for Functional Nanostructures, Universitaet Karlsruhe, Karlsruhe, Germany, [3]Institut de Physique et Chimie des Materiaux de Strasbourg UMR 7504 CNRS-ULP, Strasbourg, France, *present address: Physics Faculty, Babes-Bolyai University Cluj Napoca, Cluj Napoca, Romania*

12^{15}-12^{30} **NANOSTRUCTURE AND PHASE FORMATION UNDER SEVERE MECHANICAL TREATMENT OF Fe-BASED SYSTEM**

E.P. Elsukov

Physical-Technical Institute, UrB RAS, Izhevsk, Russia

12^{30}-12^{45} **WEAR CHARACTERISTICS OF ORBITAL FORGED MATERIALS**

R. Bidulský[1], M. Actis Grande[1], J. Bidulská[2], T. Kvačkaj[2], T. Donič[3], M. Martikán[3]

[1]Politecnico Torino-Alessandria Campus, Alessandria, Italy, [2]Technical University of Košice, Košice, Slovakia, [3]Žilina University, Žilina, Slovakia

12^{45}-13^{00} **NICKEL NANOPARTICLES FOR CATALYTIC APPLICATIONS**

Yu.G. Morozov, O.V. Belousova, M.V. Kuznetsov

Institute of Structural Macrokinetics and Materials Science Russian Academy of Sciences, Chernogolovka, Moscow region, Russia

THIRD PLENARY SESSION

Thursday, September 3, 2009

Session III: 09^{00}-13^{30}
Chairmen: R. Sinclair, V. Radmilović and Z.Lj. Petrović

09^{00}-09^{30} **ELECTRON MICROSCOPY OF NANOPARTICLES FOR CANCER DETECTION**
R. Sinclair[1], P.J. Kempen[1], A.L. Koh[1,2]
[1]Materials Science and Engineering Department, Stanford University, Stanford, CA, USA, [2]Department of Materials, Imperial College London, London, UK

09^{30}-10^{00} **SYNTHESIS AND CHARACTERIZATION OF HIGH-QUALITY GRAPHENE**
V. Radmilović, Z. Lee, A. Dato, K-J. Jeon, T. Richardson, M. Frenklach
National Center for Electron Microscopy, Lawrence Berkeley National Laboratory, Berkeley, California, USA

10^{00}-10^{30} **MONOLITHIC CMOS ACTIVE PIXEL SENSORS FOR DIRECT DETECTION IN ELECTRON MICROSCOPY**
P. Denes[1], M. Battaglia[2], D. Contarato[2], D. Doering[1], B. Krieger[1], P. Giubilato[2], D. Gnani[1], V. Radmilović[3]
[1]Engineering Division, Lawrence Berkeley National Laboratory, Berkeley, CA, USA, [2]Physics Division, Lawrence Berkeley National Laboratory, Berkeley, CA, USA, [3]National Center for Electron Microscopy, Lawrence Berkeley National Laboratory, Berkeley, CA, USA

10^{30}-11^{00} **MULTISITE STIMULATION AND SENSING BY CUSTOM LSI CHIP BY CMOS TECHNOLOGY AND MICROELECTRODE ARRAY**
N. Nakano[1], M. Yamaguchi[1], A. Shimada[2], K. Torimitsu[2]
[1]Keio University, Dept. of Electronics and Electrical Engineering, Yokohama, Japan, [2]NTT Basic Research Laboratories, NTT Corporation, Atsugi, Japan

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

11^{30}-12^{00} **MICROSTRUCTURE EFFECT ON EM-INDUCED DEGRADATIONS IN DUAL-INLAID COPPER INTERCONNECTS**
V. Sukharev[1], A. Kteyan[1], E. Zschech[2], W.D. Nix[3]
[1]Mentor Graphics Corp., San Jose, CA, USA, [2]AMD Saxony LLC & Co. KG, Materials Analysis Department, Dresden, Germany, [3]Department of Materials Science and Engineering, Stanford University, Stanford, CA, USA

12^{00}-12^{30} **MAGNETORESISTANCE IN POSITIVE AND NEGATIVE EXCHANGE BIAS Ni/FeF$_2$ BILAYERED ANTIDOTS**

M. Kovylina[1], M. Erekhinsky[2], R. Morales[3], J.E. Villegas[4], I.K. Schuller[2], A. Labarta[1], X. Batlle[1]
[1]Departament de Física Fonamental and Institut de Nanociència i Nanotecnologia (IN2UB), Universitat de Barcelona, Barcelona, Catalonia, Spain, [2]Physics Department, University of California-San Diego, La Jolla, California, USA, [3]Departamento de Física, Universidad de Oviedo-CINN, Oviedo, Spain, [4]Unite Mixte de Physique CNRS/Thales, Universite Paris Sud, Orsay, France

12^{30}-13^{00} **SUPERHARD AND SUPERPLASTIC BRITTLE NANOMATERIALS**

R.A. Andrievskiy
Institute of Problems of Chemical Physics, Russian Academy of Sciences, Chernogolovka, Russia

13^{00}-13^{30} **GLASS-CERAMIC SCAFFOLDS FOR TISSUES ENGINEERING**

A. Ravaglioli
Ceramics Science and Technology, Faenza, Italy

SYMPOSIUM D: COMPOSITES

Friday, September 4, 2009

Session I: 09^{00}-10^{30}
Chairmen: M. Stevanović, J.P. Šetrajčić and S. Mentus

09^{00}-09^{15} **DETERMINATION OF POLYOLEFINE BASED COMPOSITES NANO STRUCTURE PARAMETERS BY VERY COLD NEUTRONS SCATTERING**
S.P. Kuznetsov[1], I.L. Dubnikova[2], V.S. Litvin[3], I.V. Meshkov[1], A.V. Shelagin[4], A.I. Udovenko[1]
[1]Lebedev Physical Institute, Russian Academy of Sciences, Moscow, Russia, [2]Semenov Institute of Chemical Physics, Russian Academy of Sciences, Moscow, Russia, [3]Institute of Nuclear Researches, Russian Academy of Sciences, Moscow, Russia, [4]Moscow Institute of Physics and Technology, Moscow Region, Russia

09^{15}-09^{30} **IMPACT MODIFIED EPOXY AND THERMOPLASTIC NANOCOMPOSITES; REINFORCEMENT/COMPATIBILIZATION CONCEPT**
I. Kelnar, J. Rotrekl
Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Prague, Czech Republic

09^{30}-09^{45} **STRUCTURAL CHARACTERISATION OF ALUMINIUM – NICKEL COMPOSITES**
L. Klakurková[1], L. Čelko[1], M. Petrenec[2], P. Roupcová[1, 2], J. Švejcar[1]
[1]Institute of Materials Science and Engineering, Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic, [2]Institute of Physics of Materials, Academy of Sciences of the Czech Republic, Brno, Czech Republic

09^{45}-10^{00} **CREATION OF MESOSTRUCTURAL MATERIAL WITH NANOCRYSTALLINE INCLUSIONS OF TITANIUM DIBORIDE BY QUASIDYNAMIC METHOD**
M.P. Bondar`, M.A. Korchagin, Ya.L. Lukyanov, E.S. Obodovski
Lavrentyev Institute of Hydrodynamics, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

10^{00}-10^{15} **MULTIMODE NDE APPROACH FOR ASSESSMENT OF COMPOSITE STRUCTURES IN AEROSPACE APPLICATIONS**
K. Dragan[1], W. Swiderski[2]
[1]Air Force Institute of Technology, Warsaw, Poland, [2]Military Institute of Armament Technology, Zielonka, Poland

10^{15}-10^{30} **INFLUENCE OF ECAP-BACK PRESSURE ON THE POROSITY DISTRIBUTION**
J. Bidulská[1], T. Kvačkaj[1], R. Kočiško[1], R. Bidulský[2], M. Actis Grande[2], T. Donič[3], M. Martikán[3]
[1]Technical University of Košice, Košice, Slovakia, [2]Politecnico Torino-Alessandria Campus, Alessandria, Italy, [3]University of Žilina, Žilina, Slovakia

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

SYMPOSIUM E: BIOMATERIALS

Session I: 11^{00}-12^{30}
Chairmen: Dj. Koruga, N. Ignjatović and Z.S. Petrović

11^{00}-11^{15} **IMITATING THE GROWTH OF TOOTH ENAMEL**
V. Uskoković[1], W. Li[2], S. Habelitz[1]
[1]Department of Preventive and Restorative Dental Sciences, Division of Biomaterials and Bioengineering, University of California, San Francisco, CA, USA, [2]Department of Oral and Craniofacial Sciences, University of California, San Francisco, CA, USA

11^{15}-11^{30} **NOVEL THERMOPLASTIC POLYURETHANE ELASTOMERS BASED ON METHYL-12-HYDROXY STEARATE**
Z.S. Petrović, O. Yemul
Kansas Polymer Research Centre, Pittsburgh State University, Pittsburgh, KS, USA

11^{30}-11^{45} ***IN VITRO* AND *IN VIVO* PERFORMANCE OF NANOSIZED HYDROXYAPATITE PARTICLES COATED WITH POLY-DL-LACTIDE-CO-GLYCOLIDE AS SYSTEMS FOR DRUG DELIVERY OF TIGECYCLINE**
N. Ignjatović[1], P. Ninkov[2], R. Sabetrasekh[2], P. Lyngstadaas[2], D. Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Faculty of Dentistry, Department of Biomaterials, University of Oslo, Norway

11^{45}-12^{00} **POLY(D,L-LACTIDE-CO-GLYCOLIDE)/HYDROXYAPATITE/CLINDAMYCIN CORE-SHELL NANOSPHERES PROCESSED IN THE FIELD OF ULTRASOUND**
M. Vukomanović[1], T. Maksin[2], S. Škapin[3], N. Ignjatović[1], D. Uskoković[1]
[1]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Belgrade, Serbia, [2]Institute of Nuclear Sciences "Vinča", Belgrade, Serbia, [3]"Jožef Stefan" Institute, Ljubljana, Slovenia

12^{00}-12^{15} **QUANTUM FOUNDATIONS OF RESONANT RECOGNITION MODEL**
G. Keković[1], D. Raković[2], B. Tošić[3], D. Davidović[4,5], I. Ćosić[5]
[1]Biological Institute, Belgrade, Serbia, [2]Faculty of Electrical Engeenering, Belgrade, Serbia, [3]Vojvodina Academy of Sciences and Arts, Novi Sad, Serbia, [4]Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [5]School of Electrical and Computer Engineering, RMIT, Melbourne, Australia

12^{15}-12^{30} **HYDROGEN BONDS STUDY BY OPTOMAGNETIC FINGERPRINT**
Dj. Koruga
NanoLab, Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia

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

POSTER SESSION I

Tuesday, September 1, 2009, 20^{30}-22^{00}

SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

P.S.A.1. **LOCAL STRUCTURE AND MORPHOLOGY-DEPENDENT PROPERTIES OF NANOOXIDES**

V. Šepelák[1,2], J. Žaková[2], P. Heitjans[3], K.D. Becker[1]
[1]Institute of Physical and Theoretical Chemistry, Braunschweig University of Technology, Braunschweig, Germany, [2]Institute of Geotechnics, Slovak Academy of Sciences, Košice, Slovakia, [3]Institute of Physical Chemistry and Electrochemistry, Leibniz University Hannover, Hannover, Germany

P.S.A.2. **SORPTION OF CESIUM ON COPPER HEXACYANOFERRATE/POLYMER/ SILICA COMPOSITES: KINETICS AND MODELING STUDIES**

S.K. Milonjić[1,2], I. Bispo[1], M. Fedoroff[3], C. Loos-Neskovic[1], C. Vidal-Madjar[4]
[1]Laboratorie Pierre Süe, CEA-CNRS, CEA Saclay, Gif-sur-Yvette Cedex, France, [2]The Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [3]ENSCP-LECA-CNRS-Université Paris 6, Paris, France, [4]Laboratoire de Recherche sur les Polymères (CNRS), Thiais, France

P.S.A.3. **DETACHEMENT EFFICIENCY OF HEMATITE PARTICLES UNDER TURBULENT FLOW CONDITIONS**

Lj. Čerović[1,2], M. Fédoroff[1], G. Lefèvre, S.K. Milonjić[2]
[1]Laboratory of Electrochemistry, Chemistry of Interfaces and Modelling for Energy, ENSCP-CNRS UMR7575, Paris, France, [2]The Vinča Institute of Nuclear Sciences, Belgrade, Serbia

P.S.A.4. **RED LUMINESCENCE AND THERMOLUMINESCENCE PROPERTIES OF Mn, RE:$CaMgSi_2O_6$**

A. Lecointre, A. Bessiere, B. Viana
LCMCP-ENSCP– UMR7574, ENSCP, Paris, France

P.S.A.5. **THEORETICAL ASSESSMENT OF STABILITY OF FLUOROHYDROXYAPATITES WITH DIFFERENT FLUORINE CONTENT**

S. Raičević
Vinča Institute of Nuclear Sciences, Radiation and Environmental Protection Laboratory, Belgrade, Serbia

P.S.A.6. **SYNTHESIS AND STRUCTURE OF Zn(II) AND Hg(II) COMPLEXES WITH 4-ACETYL-3-AMINO-5-METHYL PYRAZOLE**

B. Holló[1] , V.M. Leovac[1], K. Mészáros Szécsényi[1], G. Bogdanović[2], Ž. Jaćimović[3]
[1]Faculty of Sciences, Department of Chemistry, Novi Sad, Serbia, [2]„Vinča“ Institute of Nuclear Sciences, Laboratory of Theoretical Physics and Condensed Matter Physics, Belgrade, Serbia, [3]Faculty of Metallurgy and Technology, Podgorica, Montenegro

P.S.A.7. **STRUCTURE AND CHARACTERIZATION OF COPPER(II) COMPLEX WITH PYRIDOXAL AMINOGUANIDINE**

Lj. Vojinović-Ješić[1], V.M. Leovac[1], V.I. Češljević[1], G.A. Bogdanović[2]
[1]Faculty of Sciences, Department of Chemistry, Novi Sad, Serbia, [2]"Vinča" Institute of Nuclear Sciences, Laboratory of Theoretical Physics and Condensed Matter Physics, Belgrade, Serbia

P.S.A.8. **1,2,3,4-TETRAOLS : SIMPLE AND GENERAL STRATEGY FOR THEIR CHEMICAL SYNTHESIS**

P. Hadžić[1], M. Popsavin[2]
[1]Institute Goša, Belgrade, Serbia, [2]Faculty of Sciences, Department for Chemistry, University of Novi Sad, Serbia

P.S.A.9. **SYNTHESIS AND CHARACTERIZATION OF Ni(II) AND Zn(II) COMPLEXES WITH *N'*,*N'*^{2}-BIS[(1*E*)-1-(2-PYRIDYL)ETHYLIDENE] PROPANEDIHYDRAZIDE. CRYSTAL STRUCTURES OF TWO HIGHLY SOLVATED BIMETALLIC COMPLEXES OF Ni(II)**

D. Radanović[1], U. Rychlewska[2], B. Warżajtis[2], T. Todorović[3], K. Andjelković[3]
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P.S.A.10. SYNTHESIS, X-RAY AND NMR CHARACTERIZATION OF DIPROTONATED OXALIC DIHYDRAZIDE BASED LIGAND *N′*,*N′*^{2}-BIS[(1*E*)-1-(2-PYRIDYL) ETHYLIDENE]-ETHANEDIHYDRAZIDE

K. Andjelković[1], R.O.M. Eshkourfu[2], G. Kaludjerović[3], D. Mitić[4], D. Sladić[1], D. Radanović[3]
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P.S.A.11. A STUDY OF THE INTERACTIONS OF THE BIOLOGICALLY ACTIVE METHOXY DERIVATIVE OF THE MARINE QUINONE AVARONE WITH DNA

M. Vujčić[1], S. Tufegdžić[1], I. Novaković[1], D. Sladić[2]
[1]Institute of Chemistry, Technology and Metallurgy, Department of Chemistry, Belgrade, Serbia, [2]Faculty of Chemistry, University of Belgrade, Belgrade, Serbia

P.S.A.12. MULTIDIMENSIONAL IMAGING AND MANIPULATION OF NANO-OBJECTS

A. Tunyagi, O. Ponta, M. Maier, I. Burda
Babes-Bolyai University, Physics Department, Cluj-Napoca, Romania

P.S.A.13. THEORETICAL AND EXPERIMENTAL INVESTIGATION OF EXPLOSIVE LOADING OF POWDER MATERIALS

A.E. Buzyurkin[1], E.I. Kraus[1], Y.L. Lukyanov[2]
[1]Khristianovich Institute of Theoretical and Applied Mechanics SB RAS, Novosibirsk, Russia, [2]Lavrentyev Institute of Hydrodynamics SB RAS, Novosibirsk, Russia

P.S.A.14. KINETICS OF THE HYDROGEN OXIDATION ON Pt MODIFIED MoOx NANO-SIZED CATALYST IN THE PRESENCE OF CARBON MONOXIDE

N.V. Krstajić[1], N. Elezović[2], Lj.M. Vračar[1], Lj. Gajić-Krstajić[3], V.R. Radmilović[4]
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P.S.A.15. SYNTHESIS AND CHARACTERIZATION OF POLYANILINE MICRO/ NANOSTRUCTURES DOPED WITH 12-TUNGSTOPHOSPHORIC ACID

G. Ćirić-Marjanović, D. Bajuk-Bogdanović, I. Holclajtner-Antunović, S. Mentus
Faculty of Physical Chemistry, Belgrade, Serbia

P.S.A.16. **FABRICATION AND MULTI-PROPERTIES OF $BiFeO_3$ CERAMICS**
A. Lisińska-Czekaj[1], Ł. Madej[2], E. Jartych[3], D. Czekaj[1]
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P.S.A.17. **USING SOLID OXIDIZER BaO_2 AND $NaClO_4$ IN SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS**
S.M. Busurin, M.L. Busurina
Institute of Structural Macrokinetics and Materials Science RAS, Chernogolovka, Moscow region, Russia

P.S.A.18. **SYNTHESIS OF MULTIDOPED CERIA BASED NANOPOWDERS**
M. Puševac[1], S. Bošković[1], S. Zec[1], B. Babić[1], B. Matović[1], Z. Dohčević-Mitrović[2], S. Mentus[3]
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P.S.A.19. **RAMAN STUDY OF VANADIUM-DOPED TITANIA NANOPOWDERS SYNTHESIZED BY SOL-GEL METHOD**
M. Šćepanović[1], M. Grujić-Brojčin[1], S. Aškrabić[1], A. Golubović[1], Z. Dohčević-Mitrović[1], B. Matović[2], Z.V. Popović[1]
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P.S.A.20. **HOW TO CHANGE PROPERTIES OF FUNCTIONAL FILMS BY SOL-GEL TECHNIQUE**
N. Korobova[1], S. Timoshenkov[2], O. Jharkova[3]
[1]Kazakh National University, Almaty, Kazakhstan, [2]Moscow Institute of Electronic Technique, Moscow, Russia, [3]Lab. of Innovation Technologies of Microelectronics, Moscow, Russia

P.S.A.21. **MICROWAVE-HYDROTHERMAL SYNTHESIS OF $YV_{1-x}P_xO_4$:Eu NANOPHOSPHORS**
O.M. Gaitko, A.S. Vanetsev, E.A. Karpukhina, A.E. Baranchikov
Kurnakov Institute of General and Inorganic Chemistry RAS, Moscow, Russia

P.S.A.22. **RARE-EARTH-BASED PHOSPHOR PARTICLES SYNTHESIS THROUGH HYDROTHERMAL AND SPRAY PYROLYSED ROUTES**
L. Mančić[1], K. Marinković[1], B. Marinković[2], M. Dramićanin[3], O. Milošević[1]
[1]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Belgrade, Serbia, [2]Departamento de Ciência dos Materiais e Metalurgia, Pontifícia Universidade Católica do Rio de Janeiro,Rio de Janeiro, Brazil, [3]Institute of Nuclear Sciences Vinča, Belgrade, Serbia

P.S.A.23. **HYDROTHERMAL SYNTHESIS OF $LiFePO_4$ POWDERS AS CATHODE MATERIAL FOR Li-ION BATTERIES**
M. Jović, Z. Stojanović. Lj. Veselinović, D. Uskoković
Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Belgrade, Serbia

P.S.A.24. **IMPACT OF SOLVENT MIXTURE COMPOSITION AND ADDITIVE PRESENCE ON $LiFePO_4$ FORMATION IN WATER – ISO-PROPANOL SOLUTIONS AT ELEVATED TEMPERATURES AND PRESSURES**
Z. Stojanović, M. Jović, D. Uskoković
Institute of Technical Sciences of SASA, Belgrade, Serbia

P.S.A.25. **ELECTROCHEMICAL BEHAVIOUR OF V_2O_5 AND V_2O_5/C IN AQUEOUS SOLUTION OF $LiNO_3$ AND $Mg(NO_3)_2$**
I. Stojković[1], N. Cvjetićanin[1], S. Marković[2], M. Mitrić[3], S. Mentus[1]
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P.S.A.26. **SYNTHESIS AND CHARACTERIZATION OF TRANSITION ALUMINA PHASES**
Z. Obrenović[1], I. Stijepović[2], M. Maletin[2], O. Bera[2], B. Pilić[2], Lj.M. Nikolić[2]
[1]Alumina Factory „Birač", Zvornik, Republic of Srpska, Bosnia and Hercegovina, [2]Department of Materials Engineering, Faculty of Technology, Novi Sad, Serbia

P.S.A.27. **LOW TEMPERATURE MECHANICAL CHARACTERISTICS OF Ti GRADE 2, PRODUCED BY DIFFERENT METHODS OF SEVERE PLASTIC DEFORMATION**
E. Tabachnikova, A. Podolskiy, S. Smirnov, V. Bengus
B. Verkin Institute for Low Temperature Physics & Engineering, NASU, Kharkov, Ukraine

P.S.A.28. **PREPARATION OF HIGH HEAT CONDUCTIVITY CARBON-COPPER-SILICON MATERIALS AND COATINGS OWING TO MECHANICAL ACTIVATION**
F.Kh. Urakaev[1], V.S. Shevchenko[1], R.N. Abdullaev[2], A.S. Agazhanov[2], R.A. Khairulin[2], I.V. Savchenko[2], S.V. Stankus[2], N.F. Uvarov[3], T.A. Ketegenov[4]
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P.S.A.29. **MECHANICAL ACTIVATION OF CLAY**
M. Vasić[1], Z. Radojević[1], Dj. Janaćković[2], A. Rosić[3]
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P.S.A.30. **HYDROGEN RELEASE AND MICROSTRUCTURE OF MgH_2 BASED COMPOSITE POWDERS CONTAINING A RELEVANT AMOUNT OF $LaNi_5$**
N. Abazović[1], A. Aurora[2], V. Contini[2], M.R. Mancini[2], A. Montone[2], M. Vittori Antisari[2]
[1]Laboratory for Radiation Chemistry and Physics, Institute of Nuclear Sciences Vinča, Belgrade, Serbia, [2]ENEA CR Casaccia, Department of Materials and New Technologies, Rome, Italy

P.S.A.31. **FERROFLUIDS SYNTHESIS BY USING ELECTROCHEMICALLY OBTAINED NANOMETRIC MAGNETITE AS A DISPERSE PHASE**
Lj. Vulićević[1], V. Randjelović[1], N. Ivanović[2], A. Maričić[1]
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P.S.A.32. **SYNTHESIS AND ELECTRICAL BEHAVIOR OF $Bi_5Ti_3FeO_{15}$ CERAMICS**
D. Czekaj[1], A. Lisińska-Czekaj[1], E. Jartych[2]
[1]University of Silesia, Department of Materials Science, Sosnowiec, Poland, [2]Technical University of Lublin, Department of Experimental Physics, Lublin, Poland

P.S.A.33. **3D CERAMIC MEMS FABRICATION USING OXIDE POWDER MIXTURES VIA SELECTIVE LASER SINTERING (SLS)**
I.V. Shishkovsky[1], M.V. Kuznetsov[2], Yu.G. Morozov[2]
[1]Lebedev Physics Institute, Samara branch, Russian Academy of Sciences, Samara, Russia, [2]Institute of Structural Macrokinetics and Materials Science, Russian Academy of Sciences, Chernogolovka, Moscow, Russia

P.S.A.34. **INFLUENCE OF Ca CONTENT ON THE STRUCTURE AND PROPERTIES OF (Co,Ca)O THIN FILMS DEPOSITED BY PLD TECHNIQUE**
L. Cieniek, S. Kac
AGH – University of Science and Technology, Krakow, Poland

P.S.A.35. **INFLUENCE OF Mo CONCENTRATION ON STRUCTURE AND PROPERTIES OF Mo-DOPPED Bi_2O_3 THIN FILMS OBTAINED BY PLD TECHNIQUE**
S. Kac
Faculty of Metals Engineering and Industrial Computer Science, AGH – University of Science and Technology, Krakow, Poland

P.S.A.36. **IN SITU STUDY OF THE NUCLEATION KINETIC AND SINGLE LAYERS GROWTH RATE OF EPITAXIAL $SrTiO_3$ FILMS DURING PULSED LASER DEPOSITION**
A.N. Khodan
A.N. Frumkin Institute of Physical Chemistry and Electrochemistry RAS, Moscow, Russia

P.S.A.37. **MODELING AND EXPERIMENTS IN THE INTERACTION OF LASER BEAM WITH CARBON NANOPOROUS MATERIALS**
M. Janićijević[1], B. Kaludjerović[2], M. Srećković[3], A. Kovačević[4], D. Družijanić[3]
[1]"Metalac", Gornji Milanovac, Serbia, [2]Laboratory for Materials, Institute of Nuclear Sciences "Vinča", Belgrade, Serbia, [3]Faculty of Electrical Engineering, Belgrade, Serbia, [4]Institute of Physics, Belgrade, Serbia

P.S.A.38. **SURFACE MODIFICATIONS OF A Ti-6Al-4V ALLOY BY A LASER SHOCK PROCESSING**
M. Rozmus, J. Kusiński, M. Blicharski
AGH University of Science and Technology, Faculty of Metals Engineering and Industrial Computer Science, Kraków, Poland

P.S.A.39. **THE EFFECTS OF LASER LIGHT INTERACTIONS WITH MATERIALS OF CULTURAL HERITAGE**
S. Ristić[1], M. Srećković[2], S. Polić-Radovanović[1], M. Kutin[1]
[1]Institute Goša, Belgrade, Serbia, [2]Faculty of Electrical Engineering, Belgrade, Serbia

P.S.A.40. **PULSE FREQUENCY AND DUTY CYCLE INFLUENCE ON AISI C1043 STEEL GRADE PLASMA NITRIDED IN COLD WALL CHAMBER**
M. Zlatanović[1], I. Popović[1], V. Zlatanović[2]
[1]Faculty of Electrical Engineering, Belgrade, Serbia, [2]Windtim doo, Belgrade, Serbia

P.S.A.41. **TRANSPORT COEFFICIENTS IN MIXTURES BF_3, F_2 AND F**
Ž. Nikitović, V. Stojanović, Z.Lj. Petrović
Institute of Physics, Belgrade, Serbia

P.S.A.42. **CALCULATIONS OF CROSS SECTIONS DATA FOR SCATTERING OF ELECTRONS ON HB$_r$**
Z.Lj. Petrović, M. Radmilović-Radjenović, M. Vranić
Institute of Physics, Belgrade, Serbia

P.S.A.43. **BREAKDOWN PHENOMENA IN WATER VAPOR MICRODISCHARGES**
M. Radmilović-Radjenović, B. Radjenović
Institute of Physics, Belgrade, Serbia

P.S.A.44. **3D SIMULATIONS OF THE ANISOTROPIC WET ETCHING OF SILICON**
B. Radjenović, M. Radmilović-Radjenović
Institute of Physics, Belgrade, Serbia

P.S.A.45. **RICHARDS TYPE DECHANNELING FUNCTIONS FOR LOW ENERGY PROTONS CHANNELED IN Cu CRYSTALS**
M. Erić, S. Petrović, N. Nešković
Laboratory of Physics (010), Vinča Institute of Nuclear Sciences, Belgrade, Serbia

P.S.A.46. **PROTON IMPLANTATION OF GLASSY CARBON**
Z. Jovanović[1], A. Kalijadis[1], M. Laušević[2], Z. Laušević[1]
[1]Institute of Nuclear Sciences „Vinča“, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

P.S.A.47. **STRUCTURAL CHARACTERIZATION OF BORON IRRADIATED AND BORON DOPED GLASSY CARBON**
A. Kalijadis[1], Z. Jovanović[1], S. Zec[2], M. Laušević[3], Z. Laušević[1]
[1]Laboratory of Physics, Vinča Institute of Nuclear Science, Belgrade, Serbia, [2]Laboratory of Material Science, Vinča Institute of Nuclear Science, Belgrade, Serbia, [3]Faculty of Technology and Matallurgy, University of Belgrade, Belgrade, Serbia

P.S.A.48. **FORMATION OF GAS PHASE FLUORINE AND CARBON CONTAINING MOLECULAR SPECIES IN PLASMA APPLIED IN THIN FILM PRODUCTION**
J. Radić-Perić
Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia

P.S.A.49. **PULSED CO_2 LASER IRRADIATION OF CERIA CERAMICS**
B. Matović[1], S. Bošković[1], M. Trtica[1], G. Branković[2], Z. Dohčević-Mitrović[3], M. Radović[3], Z.V. Popović[3]
[1]Institute of Nuclear Sciences Vinča, Belgrade, Serbia, [2]Institute for Multidisciplinary Research, Belgrade, Serbia, [3]Institute of Physics, Belgrade, Serbia

P.S.A.50. **CHARACTERIZATION OF THE TEMPERATURE PROFILE OF FOAMING POLYURETHANE REACTION MIXTURES**

M. Špírková, A. Strachota

Department of Polymer Networks and Mechanical Properties, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Praha, Czech Republic

P.S.A.51. **MODIFICATION OF LIQUID RUBBERS**

J. Kovářová, J. Podešva

Institute of Macromolecular Chemistry, v.v.i., Academy of Sciences of the Czech Republic, Prague, Czech Republic

P.S.A.52. **DEVELOPMENT OF CORRECTED METHOD FOR CLAY DRYING SUSCEPTIBILITY DETERMINATION IN FAST-DRYING PROCESS**

M. Arsenović, Z. Radojević, Ž. Lalić

Institute for Testing of Materials, IMS, Belgrade, Serbia

P.S.A.53. **RELATION BETWEEN PUNCHING FREQUENCY AND LOADINGS ON TOOLS AT HIGH SPEED BLANKING OF ALUMINIUM ALLOYS**

I. Pahole[1], K. Gotlih[1], T. Vuherer[1], Lj. Milović[2]

[1]Faculty of Mechanical Engineering, Maribor, Slovenia, [2]Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.A.54. **EXPERIENCE FROM MODERN STEAMBOILER MATERIALS WELDING APPLICATION**

I. Samardžić[1], B. Despotović[2], T. Vuherer[3]

[1]Mechanical Engineering Faculty in Slavonski Brod, Croatia, [2]«Termoenergetska postrojenja d.o.o.», Slavonski Brod, Croatia, [3]Faculty of Mechanical Engineering, Maribor, Slovenia

P.S.A.55. **VIDEOEXTENSOMETRIC MEASURING OF DEFORMATION PROCESSES IN AUTOMOTIVE STEEL SHEETS AT TWO STRAIN RATE LEVELS**

M. Mihaliková, Ľ. Ambriško, L. Pešek

Department of Materials Science, Faculty of Metallurgy, Technical University of Košice, Slovak Republic

P.S.A.56. **THE MODELLING OF STABLE AND METASTABLE PHASE FORMATION IN MULTI-COMPONENT Al ALLOYS**

B. Zlatičanin, B. Radonjić

Faculty of Metallurgy and Technology, Podgorica, Montenegro

P.S.A.57. **USING A INDENTATION TECHNIQUES FOR STRAIN DEVELOPMENT MONITORING FOR CONSTRUCTION STEEL SHEETS**

P. Zubko, L. Pešek
Department of Materials Science, Faculty of Metallurgy, Technical University of Košice, Slovak Republic

P.S.A.58. **THE PITCHES USED IN THE FABRICATION OF THE NEEDLE-SHAPED COKE**

M. Ichim[1], F. Barca[2], P. Vasilescu[2]
[1]The Institute of Bioengineering, Biotechnology and Environmental Protection, – S.C. BIOING S.A. Bucharest, Romania, [2]Politehnica University of Bucharest, Chemical Engineering Department, Bucharest, Romania

P.S.A.59. **OBTAINING AND CHARACTERIZATION OF Lu_2O_3 NANOPARTICLES AND TRANSLUCENT CERAMICS ON THEIR BASIS**

N.A. Dulina, N.A. Matveevskaya, R.P. Yavetskiy, Z.P. Sergienko, E.A. Vovk, A.V. Tolmachev
"STC "Institute for Single Crystals" of NAS of Ukraine, Kharkov, Ukraine

P.S.A.60. **A NEW METHOD APPLIED IN THE CASE OF SOME CONSTRUCTION ELEMENTS: COMPUTERISED "MATERIAL – SHAPE" SELECTION**

Sh. Caslli, E. Lamani, D. Elezi
Polytechnic Universty of Tirana, Mechanical Engineering Faculty, Department of Production and Management, Tirana, Albania

P.S.A.61. **PRODUCING OF 5-NONYLSALICYLALDOXIME AND ITS PURIFICATION**

Z. Pouramini, A. Moradi
Department of Chemical Engineering, College of Engineering, Shahid Bahonar Univesrty of Kerman, Kerman, Iran

P.S.A.62. **FABRICATION OF SUPERSATURATED NANOSTRUCTURE AL 7075 ALLOY BY MECHANICAL ALLOYING**

N. Yazdian, M. Tavoosi, F. Karimzadeh
Department of Materials Engineering, Isfahan University of Technology, Isfahan, Iran

P.S.A.63. **MECHANISM AND THERMODYNAMIC ANALYSIS OF NANOCRYSTALLINE NiTi FORMATION BY MECHANICAL ALLOYING**

T. Mousavi, M.H. Abbasi, F. Karimzadeh
Department of Materials Engineering, Isfahan University of Technology, Iran

POSTER SESSION II

Wednesday, September 2, 2009, 20^{30}-22^{00}

SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

P.S.B.1. **PHOTOCATALYTIC HYDROGEN PRODUCTION BY SEMICONDUCTOR HETEROJUNCTION MATERIALS**
Zh. Zou
Ecomaterials and Renewable Energy Research Center (ERERC), Nanjing University, Nanjing, China

P.S.B.2. **OPTICAL CHARACTERIZATION OF Nd – SUBSTITUTED ZIRCONOLITE OF COMPOSITION $Ca_{(1-x)}Nd_xZrTi_{(2-x)}Al_xO_7$ ($0 < x \leq 0.6$)**
K.N. Boldyrev[1], D. Caurant[2], P. Loiseau[2], S.A. Klimin[1]
[1]Institute of Spectroscopy, Russian Academy of Sciences, Troitsk, Moscow region, Russia, [2]LCMCP-UMR CNRS 7574, ENSCP, Paris, France

P.S.B.3. **MECHANICAL PROPERTIES OF P/M MATERIALS OF RAPIDLY SOLIDIFIED Al-Co-Mg ALLOYS AT ELEVATED TEMPERATURES**
M. Sugamata, Y. Ohki
College of Industrial Technology, Nihon University, Narashino, Chiba, Japan

P.S.B.4. **DIELECTRIC PERMEABILITY OF NANOCYLINDER**
S. Jaćimovski[1], V. Sajfert[2], D. Raković[3], B. Tošić[4]
[1]Crime-Police Academy, Belgrade, Serbia, [2]Technical Faculty „M. Pupin”, University of Novi Sad, Zrenjanin, Serbia, [3]Faculty of Electrical Engeenering, Belgrade, Serbia, [4]Vojvodina Academy of Sciences and Arts, Novi Sad, Serbia

P.S.B.5. **ELECTRONIC STATES IN A DOUBLE LATERALLY COUPLED CONCENTRIC NANORINGS IN A MAGNETIC FIELD**
V. Arsoski, M. Tadić
Faculty of Electrical Egineering, University of Belgrade, Belgrade, Serbia

P.S.B.6. **OPTICAL AND MAGNETIC PROPERTIES OF PbTe(Co)**
N. Romčević[1], J. Trajić[1], M. Romčević[1], D. Stojanović[1], B. Hadžić[1], T.A. Kuynetsova[2], D.R. Khokhlov[2], W.D. Dobrowolski[3]
[1]Institute of Physics, Belgrade, Serbia, [2]Moscow State University, Moscow, Russia, [3]Institute of Physics PAS, Warszaw, Poland

P.S.B.7. **CRYSTALLINITY CHANGES OF ISOTACTIC POLYPROPYLENE FILMS MONITORED BY PHOTOACOUSTIC METHOD**
S. Galović[1], Z. Stojanović[1], D. Todorović[2], N. Abazović[1], M. Mitrić[1], M. Popović[1], D. Čevizović[1]
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[2]Institute for Multidisciplinary Research, Belgrade, Serbia

P.S.B.8. **CALCULATION OF MEAN LIFETIME OF SELF TRAPPED STATES IN 1D MACROMOLECULAR CRYSTALS**
D. Čevizović, S. Galović, Z. Ivić, A. Baltes
Vinča Institute of Nuclear Sciences, Belgrade, Serbia

P.S.B.9. **RELATIONS OF POLYMER -FILLER INTERACTION PARAMETERS WITH PROCESSING AND REINFORCEMENT OF SBR/BR BLENDS**
M.B. Plavšić, I. Pajić-Lijaković, M.M. Plavšić
Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.B.10. **NONEXISTENCE OF THE “CLASSICAL TRAJECTORIES” IN THE STERN-GERLACH EXPERIMENT**
M. Arsenijević, M. Dugić
Department of Physics, Faculty of Science, Kragujevac, Serbia

P.S.B.11. **ELECTRON STRUCTURE, PHYSICAL PROPERTIES AND X-RAY SPECTRA OF RM_5Si_3 AND RM_9Si_4 COMPOUNDS (R = Y, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu; M = Ni, Co)**
I.D. Shcherba[1*], Ja. Chmura[1], D. Uskoković[2], A.O. Stosyk[3], Yu.K. Gorelenko[3], B.M. Jatsyk[4]
[1]Institute of Techniques, University of Pedagogy, Krakow, Poland, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Lviv National University by Ivan Franko, Lviv, Ukraine, [3]University of Forestry and Wood Technology, Lviv, Ukraine

P.S.B.12. **PERFORMANCES OF InP FOR MEDICAL X-RAY IMAGING**
M. Djekić[1], H. Šamić[2]
[1]Faculty of Science and Mathematics, Sarajevo, B&H, [2]Faculty of Electrical Engineering, Sarajevo, B&H

P.S.B.13. **ELECTRICAL AND MAGNETIC BEHAVIOR OF TRANSITION METAL OXIDES $(La,Pr)_{2/3}A_{1/3}TMO_3$, A = Ca, Sr AND TM = Mn, Co**
I.G. Deac, A. Vladescu, I. Balasz, A. Tunyagi, R. Tetean
Babes-Bolyai University Cluj-Napoca, Faculty of Physics, Cluj-Napoca, Romania

P.S.B.14. **ADVANCEMENT OF METHODS, TECHNIQUES AND PROCESSES FOR EXTRACTION, SEPARATION AND CHARACTERIZATION OF FULLERENES**
T. Jovanović, Dj. Koruga
Department of Biomedical Engineering, Molecular Machines Research Center, Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia

P.S.B.15. **MEASUREMENT OF COMPLEX PERMEABILITY USING SHORT COAXIAL LINE METHOD IN HIGH FREQUENCY RANGE**
V. Radonić, N. Blaž, Lj. Živanov
Faculty of Technical Science, University of Novi Sad, Serbia

P.S.B.16. **SPECTROSCOPIC CHARACTERIZATION OF $Gd_{0.64}Y_{0.36}VO_4$:Yb(1,5%) SINGLE CRYSTAL**
S.A. Klimin[1], N.N. Novikova[1], B.N. Mavrin[1], M.N. Popova[1], E. Pestryakov[2]
[1]Institute of Spectroscopy RAS, Troitsk, Moscow region, Russia, [2]Institute of Laser Physics, Siberian Branch of RAS, Novosibirsk, Russia

P.S.B.17. **ZERO-DEGREE FOCUSING OF PROTONS CHANNELED IN A TILTED CRYSTAL**
V. Berec, S. Petrović, D. Borka, N. Nešković
Laboratory of Physics (010), Vinča Institute of Nuclear Sciences, Belgrade, Serbia

P.S.B.18. **THE NEW PARAMAGNETIC PILLARED BENTONITES AS DIGESTIVE TRACT MRI CONTRAST AGENTS**
M. Omerašević[1], P. Banković[2], Z. Mojović[2], M. Daković[1,3], D. Jovanović[2], A. Milutinović – Nikolić[2], M. Mojović[1]
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P.S.B.19. **ANGULAR AND SPATIAL DISTRIBUTIONS OF 1 GeV PROTONS CHANNELED IN A BENT SHORT (11, 9) SINGLE-WALL CARBON NANOTUBE**
S. Šopić, D. Borka, S. Petrović, N. Nešković
Laboratory of Physics (010), Vinča Institute of Nuclear Sciences, Belgrade, Serbia

P.S.B.20. **FROM CORRELATED METAL TO MOTT INSULATOR IN GA(V,TI)$_4$S$_8$: DISORDERED – DRIVEN ANDERSON METAL – INSULATOR TRANSITION**
E. Dorolti[1,2], C. Vaju[2], J. Martial[2], B. Corraze[2], E. Janod[2], L. Cario[2]
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P.S.B.21. **Si_3N_4 ELONGATED NANOSTRURES AND FORMING CRITERIA OF POROUS BODY ON THEIR BASIS**
A. Ragulya, A. Bykov, P. Sylenko
I.M. Frantsevych Institute for Problems in Material Science of NAS of Ukraine, Kyiv, Ukraine

P.S.B.22. **ELECTRONIC PRINCIPLES OF SOME TRENDS IN PROPERTIES OF METALLIC HYDRIDES**
N. Ivanović[1], N. Novaković[1], D. Colognesi[2], I. Radisavljević[1], S. Ostojić[3]
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P.S.B.23. **DIAMOND IN SURFACE ACOUSTIC WAVE SENSORS**
M. Hribšek, S. Ristić, B. Radojković
Institute Goša, Belgrade, Serbia

P.S.B.24. **SPECTROSCOPIC CHARACTERIZATION OF THE NEW MULTIFUNCTIONAL MATERIAL $SmFe_3(BO_3)_4$**
E.P. Chukalina[1], M.N. Popova[1], L.N. Bezmaternykh[2], I.A. Gudim[2]
[1]Institute of Spectroscopy, RAS, Troitsk, Moscow region, Russia, [2]Kirensky Institute of Physics, Siberian Branch of RAS, Krasnoyarsk, Russia

P.S.B.25. **THE INFLUENCE OF THERMAL TREATMENTS ON MAGNETIC PROPERTIES OF MnZn FERRITES PREPARED BY PIM TECHNOLOGY**
B. Zlatkov[1], H. Loibl[1], H. Danninger[2], A. Maričić[3], N. Mitrović[3]
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P.S.B.26. **PHASE DIAGRAM OF $Sm_{1-x}Sr_xMnO_3$ PEROVSKITE MANGANITES**
A. Kurbakov
Petersburg Nuclear Physics Institute, Gatchina, Russia

P.S.B.27. **UNIQUE ELECTRON-DOPED MANGANITES: CRYSTAL AND MAGNETIC STRUCTURES AND MAGNETOTRANSPORT PROPERTIES**
A. Kurbakov[1], C. Martin[2], A. Maignan[2], M. Hervieu[2], S. Hébert[2], G. Andre[3], F. Bouree[3], J. Broto[4], H. Rakoto[4], B. Raquet[4]
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P.S.B.28. **DESIGN OF THE SUPPORTS AND CATALYSTS ON THE BASE OF THE MESOPOROUS ALUMINA ENCAPSULATED IN THE UTRAMACROPORE CERAMOMETAL MATRIX**
S.F. Tikhov[1], N.A. Pakhomov[1], V.V. Usoltsev[1], V.A. Sadykov[1], Yu.N. Bespalko[1], N.A. Yazikov[1], A.D. Simonov[1], A.N. Salanov[1], G.V. Golubkova[2], O.I. Lomovskii[2]
[1]Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia, [2]Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia

P.S.B.29. **INFRARED AND RAMAN SPECTROSCOPY STUDY OF LANTHANUM AND ANTIMONY DOPED BARIUM TITANATE PREPARED FROM ORGANOMETALLIC COMPLEX**
Z.Ž. Lazarević[1], N.Ž. Romčević[1], M.M. Vijatović[2], N. Paunović[1], B.D. Stojanović[2]
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P.S.B.30. **SYNTHESIS, CHARACTERISATION AND SORPTIVE PROPERTIES OF ORGANOBENTONITES**
N. Jović-Jovičić[1], A. Milutinović-Nikolić[1], P. Banković[1], B. Nedić[2], B. Dojčinović[3], D. Lončarević[1], D. Jovanović[1]
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P.S.B.31. **SHORT-CIRCUIT OXYGEN DIFFUSION IN THERMALLY GROWN SILICA LAYER**
B. Gligorijević[1], H. Schmidt[2], N. Radović[3], M. Davidović[1], M. Kutin[1], A. Janićijević[3]
[1]Institute Goša, Research and Development, Belgrade, Serbia, [2]Institute of Metallurgy, Materials Physics Group, TU Clausthal, Germany, [3]Faculty of Technology and Metallurgy, University of Belgrade, Serbia

P.S.B.32. **URANIUM (VI) ADSORPTION ON ACIDS MODIFIED ZEOLITIC TUFF**
S. Matijašević, A. Daković, D. Ileš, J. Stojanović, S. Milićević
Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade, Serbia

P.S.B.33. **RELAXATION IN METALLIC GLASS $Ni_{36,5}Zr_{63,5}$**
S. Sulejmanović[1], T. Mihać[1], S. Bikić[2], N. Bajrović[1]
[1]Faculty of Science and Mathematics, Sarajevo, B&H, [2]Faculty of Metallurgy and Materials Science, Zenica, B&H

P.S.B.34. **STRUCTURAL, THERMAL AND MAGNETIC PROPPERTIES OF ELECTROCHEMICALLY DEPOSITED Co-Ni-Mo POWDERS**

N. Mitrović[1], J. Stevanović[2], O. Pešić[1], B. Jordović[1], V. Spasojević[3]
[1]Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Technical Faculty Čačak, Čačak, Serbia, [2]Institute of Chemistry, Technology and Metallurgy, Belgrade, Serbia, [3]Institute of Nuclear Sciences Vinča, Belgrade, Serbia

P.S.B.35. **ORGANIC-INORGANIC NANOCOMPOSITE COATINGS CONTAINING ORGANICALLY MODIFIED LAYERED SILICATES**

M. Špírková[1], P. Duchek[2], J. Kotek[1], A. Strachota[1]
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P.S.B.36. **REAL-LIFE HETEROGENEOUS WELD JOINT ANALYSIS OF HEAT RESISTANT STEELS USING EXPERIMENTAL AND COMPUTATIONAL APPROACH**

V. Jan[1], Z. Hodis[1], J. Sopoušek[2], R. Foret[1]
[1]Brno University of Technology, Brno, Czech Republic, [2]Masaryk University Brno, Czech Republic

P.S.B.37. **CORROSION AND FATIGUE PROPERTIES OF MAGNESIUM ALLOY AZ31**

P. Doležal[1], J. Zapletal[1], M. Zmrzlý[2], B. Pacal[1], A. Němcová[1]
[1]Institute of Materials Science and Engineering, Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic, [2]Institute of Materials Chemistry, Faculty of Chemistry, Brno University of Technology, Brno, Czech Republic

P.S.B.38. **INITIATION AND BEHAVIOUR OF SMALL CRACK DURING PROPAGATION FROM ARTIFICIAL SMALL DEFECTS IN COARSE GRAIN HEAT AFFECTED ZONE**

T. Vuherer[1], Lj. Milović[2], V. Gliha[1], M. Zrilić[2]
[1]Faculty of Mechanical Engineering, Maribor, Slovenia, [2]Faculty of Technology and Metallurgy, Belgrade, Republic of Serbia

P.S.B.39. **MODELING OF HEAT FLOW AND SOLIDIFICATION DURING SPRAY DEPOSITION PROCESS**

P. Tomić[1], M. Kutin[2], M. Davidović[2]
[1]Alumina Factory Company "Birač", Zvornik, B&H, [2]Institute Goša, Research and Development, Belgrade, Serbia

P.S.B.40. **APPLICATION OF MODERN INVESTIGATION TECHNIQUES WITH THE AIM OF DEFECTS IDENTIFICATION IN 30CrMoV9V ALLOY**
A. Milosavljević[1], R. Pljakić[2], M. Gašić[2], R. Petrović[2], M. Savković[2], S. Drecun-Nešić[1]
[1]Faculty of Mechanical Engineering, University of Belgrade, Serbia, [2]Faculty of Mechanical Engineering Kraljevo, University of Kragujevac, Serbia

P.S.B.41. **POROUS STRUCTURE OF SINTERED NIOBIUM COMPOSITE**
L. Skatkov[1], V. Gomozov[2]
[1]PCB "Argo", Beer Sheva, Israel, [2]NTU "KhPI", Kharkov, Ukraine

P.S.B.42. **CONTEMPORARY APPLICATION OF STEELS FOR CUTTING TOOLS**
Lj. Janjušević, M. Prokolab
Goša Institute, Belgrade, Serbia

P.S.B.43. **THE USE OF ADVANCED MATERIALS AND TOOLS AS A GOOD WAY TO IMPROVE THE PERFORMANCE OF MARINE YACHTS**
B. Xhaferaj, M. Duka, V. Kasemi
Technical Sciences Faculty, University of Vlora "Ismail Qemali" Vlore, Albania

P.S.B.44. **INTERPRETATION ABOUT THE ROLE OF THE HOT WORKING (ELABORATION TERMITES) PROCESS IN THE FATIGUE RESISTANCE FOR THE CONSTRUCTIVE STEEL 40**
V. Kasemi, B. Xhaferaj, M. Duka
Faculty of Technical Sciences, University of Vlora "Ismail Qemali" Vlorë, Albania

P.S.B.45. **DESIGN OF THE ADJUSTABLE FOUR-BAR LINKAGES, ONE POINT OF THE COUPLER PLANE OF WHICH GENERATE TWO APPROXIMATELY STRAIGHT PATHS**
D. Ilia[1], A. Anxhaku[2], M. Shehu[1]
[1]Department of Mechanical and Naval Engineering, University of Vlora, Albania, [2]Mechanical Department, Polytechnic University, Tirana, Albania

P.S.B.46. **THE FRACTURE MECHANICAL BACKGROUND OF EUROCODE 3 IN THE STRUCTURAL STEELS**
M. Shehu[1], P. Huebner[2], M. Cukalla[3], D. Ilia[1]
[1]Department of Mechanical and Naval Engineering, University of Vlora, Albania, [2]Metallkunde Institute, Bergakademie, Freiberg, Germany, [3]Mechanical Department, Polytechnic University, Tirana, Albania

P.S.B.47. **CURRENT STATE AND DEVELOPMENT PERSPECTIVE OF ALBANIAN PORTS**
E. Katira, E. Habibi, E. Kulla, E. Mustafaraj, M. Shehu
College of Science and Engineering, Dept. of Mechanical & Naval Engineering, University of Vlora, Albania

P.S.B.48. **ANALYTICAL AND COMPUTATIONAL STRESS ANALYSIS OF FIBER (MATERIAL ORTHOTROPIC)/MATRIX COMPOSITE MODELS**
O. Koça, J. Kaçani, M. Kullolli
Polytechnic University of Tirana, Mechanical Engineering Faculty, Tirana Albania

P.S.B.49. **EFFECTS OF WATER ON THE SURFACE POTENTIAL DECAY IN CORONA CHARGED POLYIMIDE FILMS**
A. Kahlouche[1], A. Bellel[2], S. Sahli[3]
[1]Faculté des Sciences et Sciences de l'Ingénieur,Université Mohamed Boudiaf, M'sila – Algérie, [2]Laboratoire des Etudes de Matériaux d'Electronique pour Applications Médicales (LEMEAMED), Faculté des Sciences de l'Ingénieur, Université Mentouri de Constantine-Algérie, [3]Laboratoire de Microsystèmes et Instrumentation (LMI), Faculté des Science de l'Ingénieur, Université Mentouri de Constantine-Algérie

P.S.B.50. **ANTISTATIC PROPERTIES OF NANOFILLED COATINGS**
B. Gornicka[1], M. Mazur[2], K. Sieradzka[2], E. Prociow[2]
[1]Electrotechnical Institute Wroclaw Division of Electrotechnology and Materials Science, Wroclaw, Poland, [2]Faculty of Microsystems Electronics and Photonics, Wroclaw University of Technology, Wroclaw, Poland

P.S.B.51. **NEW MOLECULAR CONDUCTORS WITH COBALT BIS(DICARBOLLIDE) ANION AND ITS DERIVATIVES**
O.N. Kazheva, O.A. Dyachenko
Institute of Problems of Chemical Physics of RAS, Chernogolovka, Russia

P.S.B.52. **THE INFLUENCE OF WOOD SPECIES ON CURING OF UREA-FORMALDEHYDE ADHESIVE FOR WOOD PANELS PRODUCTION**
M. Popović[1], J. Budinski Simendić[2], J. Miljković[1], J. Pavličević[2], I. Ristić[2]
[1]Faculty of Forestry, Belgrade, Serbia, [2]Faculty of Technology, Novi Sad, Serbia

P.S.B.53. **ORGANOMETALLIC COMPOUNDS AND CORROSION ON THE FLUE GAS SIDE OF THE WATER BOILER SYSTEM**
M. Prvulović, B. Gligorijević, B. Jegdić, M. Prokolab, D. Jovanović
Institute Goša, Research and Development, Belgrade, Serbia

P.S.B.54. **GAMMA RADIATION ABSORPTION CHARACTERISTICS OF CONCRETE WITH COMPONENTS OF DIFFERENT TYPE MATERIALS**
S.J. Stanković[1], R.D. Ilić[1], K. Janković[2], D. Bojović[2], B. Lončar[3]
[1]Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [2]Institute for Testing Materials-IMS, Belgrade, Serbia, [3]Faculty of Technology and Metallurgy, Belgrade, Serbia

P.S.B.55. **INFLUENCE OF THE TEMPERATURE ON THE PROPERTIES OF THE SINTERED PRODUCT ON THE BASIS OF ELECTROFILTER ASH AS A COMPONENT OF THE RAW MATERIAL MIXTURE**

M. Krgović[1], M. Knežević[2], M. Ivanović[1], I. Bošković[1], M. Vukčević[1], R. Zejak[2], B. Zlatičanin[1], S. Djurković[1]
[1]University of Montenegro, Faculty of Metallurgy and Technology, Podgorica, Montenegro, [2]University of Montenegro, Faculty of Civil Engineering, Podgorica, Montenegro

P.S.B.56. **COMPARISON OF CHEMICAL ANALYSIS OF SAMPLE CLAYS AND THE MICROSTRUCTURE OF SINTERED PRODUCT**

N. Marstijepović[1], Z. Begović[1], M. Mirković[1]
University of Montenegro, Faculty of Metallurgy and Technology, Podgorica; Ministry of Internal Affairs, Podgorica, Montenegro

P.S.B.57. **DEVELOPMENT OF NANO- GRAIN STRUCTURE BY MARTENSITIC REVERSION IN AISI 304L STAINLESS STEEL**

R. Surki, S. Sabooni, A. Najafizadeh
Department of Materials, Isfahan University of Technology, Isfahan, Iran

P.S.B.58. **ORGANICALLY MODIFIED NANOSILICA/RIGID POLYURETHANE NANOCOMPOSITES**

M.M. Alavi Nigjeh, Z. Mazaheri Tehrani
Chemistry Department, Faculty of Science, IKIU, Qazvin, Iran

P.S.B.59. **COMPUTER AIDED ETCHING SIMULATION USING CELLULAR AUTOMATA METHOD**

M. Shayan, S.A. Sadough, B. Arezoo
Mechanical Engineering Department, Amir Kabir University of Technology, Tehran, Iran

POSTER SESSION III

Thursday, September 3, 2009, 20^{30}-22^{00}

SYMPOSIUM C: NANOSTRUCTURED MATERIALS

P.S.C.1. **SAXS AND WAXS STUDY OF POLY(BUTYL METHACRYLATE)/ MONTMORILLONITE NANOCOMPOSITE LATEXES**
J. Pleštil[1], Z. Sedláková[1], J. Baldrian[1], P. Holub[2]
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P.S.C.2. **NANOSTRUCTURED THIN FILMS β-Al-Mg OBTAINED USING PLD TECHNIQUE**
A. Radziszewska
AGH University of Science and Technology, Faculty of Metals Engineering and Industrial Computer Science, Cracow, Poland

P.S.C.3. **INFRARED AND STRUCTURAL STUDY OF ZINC OXIDE FILMS AND NANOWIRES**
N.N. Novikova[1], E.A. Vinogradov[1], V.A. Yakovlev[1], S. Pung[2], K.-L. Choy[2]
[1]Institute for Spectroscopy of RAS, Troitsk, Moscow region, Russia, [2]Department of Mechanical, Materials and Manufacturing Engineering, Faculty of Engineering, University of Nottingham, Nottingham, UK

P.S.C.4. **TEMPERATURE- AND FREQUENCY-DEPENDENCE OF DIELECTRIC PROPERTIES OF EPOXY/α-HEMATITE NANOROD COMPOSITE**
V. Djoković, D. Dudić, M. Marinović-Cincović, J.M. Nedeljković
Vinča Institute of Nuclear Sciences, Belgrade, Serbia

P.S.C.5. **COMPARATIVE STUDY OF THE STRUCTURAL AND MAGNETIC PROPERTIES OF NANOSIZED $La_{0.7}Ca_{0.3}MnO_3$ OBTAINED BY MECHANOCHEMICAL AND GLYCINE NITRATE PROCEDURES**
D. Marković, A. Mraković, M. Perović, M. Tadić, J. Blanuša, V. Kusigerski, B. Antić, M. Mitrić, V. Spasojević
Institute of Nuclear Sciences Vinča, Laboratory for Solid State Physics, Belgrade, Serbia

P.S.C.6. **MAGNETIC PROPERTIES OF Mn DOPED AMORPHOUS SiO_2 NANOPARTICLES**
D. Milivojević[1], B. Babić-Stojić[1], Z. Jagličić[2], V. Jokanović[1]
[1]Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [2]Institute of Mathematics, Physics and Mechanics, Ljubljana, Slovenija

P.S.C.7. **CHANGES IN OPTICAL PROPERTIES OF MOLECULAR NANOSTRUCTURES**
S.M. Vučenović[1], J.P. Šetrajčić[2], B. Markoski[3], D.Lj. Mirjanić[1], S. Pelemiš[4], B. Škipina[5]
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P.S.C.8. **QUASISTATIONARY ELECTRON STATES FOR CdTe/ZnTe/CdTe OPEN SPHERICAL QUANTUM DOTS**
D. Stojanović, R. Kostić
University of Belgrade, Institute of Physics, Center for Solid State Physics and New Materials, Belgrade, Serbia

P.S.C.9. **PHOTOREFRACTIVE AND PHOTOCONDUCTIVE FEATURES OF THE NANOSTRUCTURED MATERIALS**
N.V. Kamanina[1,2], S.V. Serov[1,2], P.Ya. Vasilyev[1], V.I. Studeonov[1]
[1]Vavilov State Optical Institute, St. Petersburg, Russia, [2]State Electrotechnical University, St. Petersburg, Russia

P.S.C.10. **SYNTHESIS AND CHARACTERIZATION OF NANOSTRUCTURED HYBRID MATERIALS**
Z. Sedláková[1], F. Kovanda[2], J. Pleštil[1], J. Baldrian[1], L. Brožová[1]
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P.S.C.11. **SYNTHESIS AND CHARACTERIZATION OF ANATASE NANOPOWDERS DOPED WITH Fe IONS**
N.D. Abazović[1], M. Mitrić[1], D. Šojić[2], V. Despotović[2], B. Abramović[2], M.I. Čomor[1]
[1]Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [2]Department of Chemistry, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia

P.S.C.12. **MORPHOLOGICAL CHARACTERIZATION OF NANOFIBROUS MATERIALS FOR MEDICINAL APPLICATION**
J. Širc[1], J. Michálek[1], M. Přádný[1], R. Hobzová[1], M. Šlouf[1], M. Lhotka[2], M. Munzarová[3]
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P.S.C.13. IMMOBILIZATION OF GOLD NANOPARTICLES ON POLYELECTROLYTES THIN FILMS

M. Urzúa[1], X. Briones[1], A. Leiva[2], C. Saldías[2], F. Espinoza Beltrán[3]
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P.S.C.14. THE ROLE OF INTERFACE MODELING IN CREATION OF HIGH FUNCTIONAL NANOSYSTEMS

A.V. Andreeva
Institute of Microelectronics Technology RAS, Chernogolovka, Russia

P.S.C.15. ATOMIC FORCE MICROSCOPY CHARACTERIZATION OF GOLD NANOCRYSTALS

R. Stiufiuc[1,2], F. Toderas[1], G. Stiufiuc[1], C.M. Lucaciu[2]
[1]"Babes-Bolyai" University, Faculty of Physics, Cluj-Napoca, Romania
[2]University of Medicine and Pharmacy "Iuliu Hatieganu", Dept. of Biophysics, Cluj-Napoca, Romania

P.S.C.16. STEEL SURFACE CHARACTERIZATION WITH DIFFERENT COMPOSITION AND VARYING TOOL GEOMETRY BY SCANNING PROBE MICROSCOPY

D. Kojić, Lj. Petrov, R. Mitrović, L. Matija
Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia

P.S.C.17. MECHANOCHEMICAL SYNTHESIS OF ZnO NANOSTRUCTURED POWDER USING A DIFFERENT ORGANIC SURFACTANTS AND ITS INFLUENCE ON THE PARTICLES SIZE AND MORFOLOGY

A. Stanković, Lj. Veselinović, D. Uskoković
Institute of Technical Science of the Serbian Academy of Sciences and Arts, Belgrade, Serbia

P.S.C.18. CORELATION OF STRUCTURAL RELAXATION, THERMAL EXPANSION AND ELECTRICAL RESISTIVITY OF $Fe_{89.8}Ni_{1.5}Si5_{5.2}B_3C_{0.5}$ AMORPHOUS ALLOY

A. Maričić[1], M. Spasojević[1], D. Minić[2], N. Mitrović[1]
[1]Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Technical Faculty Čačak, Čačak, Serbia, [2]Faculty for Physical Chemistry, University of Belgrade, Belgrade, Serbia

P.S.C.19. **MECHANICAL ACTIVATION INFLUENCE ON ELECTRICAL AND MAGNETIC PROPERTIES OF THE SYSTEM POWDER $Fe_{81}B_{13}Si_4C_2$**

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P.S.C.20. **PRESSURE AND TEMPERATURE INFLUENCE ON ELECTRICAL AND MAGNETIC PROPERTIES OF COLD SINTERED POWDER $Fe_{20}Ni_{80}$**

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P.S.C.21. **THE EFFECT OF MICROSTRUCTURAL CHANGES DURING ANNEALING ON ELECTRICAL AND MAGNETIC PROPERTIES OF THE $Fe_{1.42}B_{1.30}Si_{0.14}C_{0.17}$ AMORPHOUS ALLOY RIBBON**

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P.S.C.22. **FABRICATION AND CHARACTERIZATION OF NANOSTRUCTURED Cu-3%wt Mo COMPOUND BY MECHANICAL ALLOYING**

S. Sabooni, T. Mousavi, F. Karimzadeh
Department of Materials Engineering, Isfahan university of Technology, Isfahan, Iran

P.S.C.23. **POLYURETHANE/ CHITOSAN BIONANOCOMPOSITES**

M.M. Alavi Nigjeh, Z. Mazaheri Tehrani
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P.S.C.24. **PUF FOAM/ NANO SILICA COMPOSITES**

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SYMPOSIUM D: COMPOSITES

P.S.D.1. **POLYMERIC COMPOSITES OF METALLACARBORANES AND METALLACARBORANE CONJUGATES**

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P.S.D.2. **ANOMALOUS STABILITY OF "COLOURED" FORM OF SPIROXAZINE PHOTOCHROMS TRAPPED IN POLYCARBONATE MATRIX AFTER SUPERCRITICAL FLUID IMPREGNATION**

P.S. Timashev[1], N.N. Glagolev[2], A.V. Kotova[2], A.B. Solovyeva[2], B.I. Zapadinskii[2], V.N. Bagratashvili[1]

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P.S.D.3. **MICROHARDNESS AND MORPHOLOGY OF POLYPROPYLENE BASED ELECTROCONDUCTIVE NANOCOMPOSITES**

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P.S.D.4. **APPLICATION OF IRRADIATION ON PROPERTIES OF COMPOSITES BASED ON POLYAMIDE**

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P.S.D.5. **FUNCTIONAL CHARACTERISTICS OF THE POLYMER COMPOSITION CONTAINING NANOAGGREGATES OF SOLUBILIZED BY PLURONICS EUROPIUM DIKETONATES AND SPIROOXAZINES**

N.A. Aksenova[1], N.N. Glagolev[1], V.T. Shashkova[1], N.L. Zaichenko[1], L.S. Kol`tsova[1], A.I. Shiyonok[1], I.R. Mardaleishvili[1], P.S. Timashev[2], B.I. Zapadinskyy[1], A.B. Solovieva[1]

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P.S.D.6. **ELECTRICALLY AND THERMALLY CONDUCTIVE COMPOSITES ON THE BASE OF EVA COPOLYMERE FILLED WITH WOLLASTONITE FIBRES COATED BY SILVER**

I. Krupa[1], V. Cecen[2], R. Tlili[3], A. Boudenne[3], L. Ibos[3], I. Novák[1], J. Prokeš[4]
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P.S.D.7. **OPTICAL PROPERTIES OF «POLYIMID - $YBa_2Cu_3O_{6+x}$» COMPOSITES**

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Kazakh National University, Almaty, Kazakhstan

P.S.D.8. **Gd_2O_3:Eu^{3+}/PMMA COMPOSITE: THERMAL AND LUMINESCENCE PROPERTIES**

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Vinča Institute of Nuclear Sciences, Belgrade, Serbia

P.S.D.9. **THE INFLUENCE OF NETWORK PARAMETERS ON THE PROPERTIES OF THERMORESPONSIVE Ag/PNIPA HYDROGEL NANOCOMPOSITE SYNTHESIZED BY GAMMA IRRADIATION**

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P.S.D.10. **RESEARCH ON POLYMER – BONDED MAGNETIC MATERIALS WITH VARIOUS Nd-Fe-B FILLER CONTENT**

A.S. Grujić[1], N.L. Lazić[2], N.M. Talijan[1], V. Spasojević[3], J.T. Stajić-Trošić[1], V.R. Ćosović[1], R. Aleksić[4]
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P.S.D.11. **POLYMER NANOCOMPOSITES FOR OPTICAL APPLICATIONS**

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P.S.D.12. **THERMO-MECHANICAL PROPERTIES OF POLY(VINYL BUTYRAL)/ TITANIUM DIOXIDE NANOCOMPOSITES**
A.M. Torki[1], D.B. Stojanović[1], J.T. Stajić-Trosić[2], P.S. Uskoković[1], V.J. Radojević[1], V.R. Radmilović[3], R.R. Aleksić[1]
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P.S.D.13. **NANOCOMPOSITES BASED ON SILANE TREATED NANOSILICA AND WASTE AND VIRGIN HIGH-DENSITY POLYETHYLENE MATRIX**
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P.S.D.14. **BARRIER PROPERTIES OF COATED AND LAMINATED POLYOLEFIN FILMS FOR FOOD PACKAGE MANUFACTURING**
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P.S.D.15. **ENERGY ABSORPTION CAPACITY OF GLASS-POLIESTER COMPOSITE TUBES**
M. Stamenović[1], S. Putić[2], M. Zrilić[2], Lj. Milović[2], D. Vitković[2]
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P.S.D.16. **GAMMA-RADIATION RESISTANCE OF CARBON BLACK REINFORCED NBR/CSM RUBBER BLENDS**
G. Marković[1], B. Radovanović[2], M. Marinović-Cincović[3], J. Budinski-Simendić[4]
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P.S.D.17. **MIX DESIGN AND PROPERTIES OF ULTRA-HIGH STRENGTH CONCRETE**
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Institute IMS, Belgrade, Serbia

SYMPOSIUM E: BIOMATERIALS

P.S.E.1. **ORGANIZATION OF PROVISIONAL FIBRONECTIN MATRIX WITHIN MULTILAYERED LbL NANOSTRUCTURED BIOMATERIALS**
N. Krasteva [1], K. Hristova[1], K. Kirchhof[2], G. Altankov[3], Th. Groth[2]
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P.S.E.2. **FUNCTIONALIZATION OF CALCIUM PHOSPHATE BIOCERAMICS FROM NATURAL RESOURCES**
E. Pecheva[1], L. Pramatarova[1], E. Iacob[2], L. Vanzetti[2], R. Dimitrova[3], T. Spassov[4], T. Hikov[1], D. Fingarova[1]
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P.S.E.3. **STRUCTURAL AND MICROSTRUCTURAL ANALYSIS OF HUMAN ALVEOLAR BONE USING X-RAY POWDER DIFFRACTION AND RAMAN SPECTROSCOPY**
Lj. Veselinović[1], Lj. Karanović[2], S. Marković[1], N. Ignjatović[1], D. Uskoković[1]
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P.S.E.4. **SYNTHESIS, CHARACTERIZATION AND THE SOLUBILITY OF β-TCP POWDERS WITH Mg AND Zn BASED DOPANTS**
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P.S.E.5 **PRECIPITATION SYNTHESIS AND TWO-STEP SINTERING OF HYDROXYAPATITE NANOPOWDERS**
M. Lukić, S. Marković, N. Ignjatović, D. Uskoković
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P.S.E.6 **TREATMENT OF OSTEOPOROSIS ALVEOLAR BONE WITH COBALT SUBSTITUTED HYDROXYAPATITE NANOPARTICLES**

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P.S.E.7. **ROLE OF PHASE IMAGING IN SURFACE ROUGHNESS ANALYSIS OF BIOPOLYMERS**

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P.S.E.8. **THE RELEASE OF SILVER IONS FROM Ag/P(HEMA/BIS/IA) HYDROGEL COMPLEXES**

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P.S.E.9. **SURFACE MODIFICATION OF METHACRYLATE HYDROGELS FOR COVALENT BINDING OF BIOACTIVE MOTIFS**

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Institute of Macromolecular Chemistry, Academy of Sciences of Czech Republic, Prague, Czech Republic

P.S.E.10. **CONTACT LENSES CHARACTERIZATION BY AFM/MFM AND OPTOMAGNETIC FINGERPRINT**

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P.S.E.11. **SINTHESIS, CHARACTERIZATION AND ANTITUMORAL ACTIVITY OF THE PLATINUM(II) COMPLEX WITH *O,O′*-DIETHYL-ETHYLENEDIAMINE-*N,N′*-DI-(*S,S*)-2(4-METHYL)-PENTANOATE LIGAND**

J.M. Vujić[1], M. Milovanović[2], V. Volarević[2], N. Arsenijević[2], M. Cvijović[1], S.R. Trifunović[3]
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P.S.E.12. **A PRELIMINARY STUDY ON THE ANTIFUNGAL ACTIVITY OF THE ETHANOL EXTRACT OF *HYPERICUM PERFORATUM L.***

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P.S.E.13. **COMPARATIVE INVESTIGATION OF NORMAL AND PATHLOGICAL CERVICAL CELLS BY OPTICODIGITAL MICROSCOPY AND AFM**

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P.S.E.14. **IMPORTANCE OF BIO-CATALYTIC PROCESSES FOR CELL IMMOBILIZATION IN ALGINATE BEADS**

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P.S.E.15. **IMPLEMENTATION OF MATERIALS TESTING METHODS IN DENTAL WITHENING STUDIES**

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P.S.E.16. **SEM ANALYSIS ON RETRIVED DENTAL IMPLANTS**

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P.S.E.17. **ESEM ANALYSIS OF FRACTURED ZIRCONIA CORE DENTAL-CROWNS**

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[1]"Carol Davila" Medicine and Pharmacy University of Bucharest, Romania, [2]University Politehnica from Bucharest, Bucharest, Romania

P.S.E.18. **DISSOLUTION PROPERTIES OF K_2O-CaO-MgO-P_2O_5 BIOACTIVE GLASSES**

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P.S.E.19. **VITAMIN C DEGRADATION DURING THE DRYING PROCESS OF THE WILD-ROSE EXTRACT**

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P.S.E.20. **MATERIALS ASPECTS OF FIBER-OPTIC BUNDLES AND EFFECTS OF DAMAGES CAUSED BY LASER IRRADIATION ON THEIR PROPERTIES**

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P.S.E.21. **CONTEMPORARY MATERIALS IN ORTHODONTICS**

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P.S.E.22. **BIOMIMETICALLY OBTAINED SELF-ASSEMBLED CALCIUM HYDROXYAPATITE THIN FILMS**

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Abstracts

Oral Presentation

PL.S.I.1.

BIOMATERIALS FOR TISSUE ENGINEERING

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The overall objective of all tissue engineering is to fully restore the lost tissue function. Engineered tissues of sufficiently high fidelity are also providing physiologically relevant yet controllable models for fundamental research - for example, to study stem cells in three-dimensional contexts of development or disease, or to screen drugs using micro-array platforms with engineered human tissues. In general, the clinical and scientific utility of tissue engineering depends on our ability to predictably direct the cells to express the right phenotype in the right place and at the right time. We are observing that the same factors that regulate tissue development *in vivo* (molecular, structural, physical) can be used to direct cell fate and tissue assembly in vitro. Therefore, tissue engineering is largely an effort of "imitating nature" as it tends to recapitulate the native environment during tissue development and remodeling in response to injury or disease. The approach we pursue is that of utilizing the cells (the actual "tissue engineers"), biomaterial scaffolds (structural templates for tissue formation) and bioreactors (providing environmental control and signaling cascades to guide tissue formation). We have shown that the use of properly designed biomaterials can direct cell differentiation into specific phenotypes and promote cell assembly into functional tissue structures. This talk will review recent developments in biomaterials for cultivation of human stem cells for two major areas of application: engineering of cardiovascular tissues (a contractile cardiac "patch" for the treatment of myocardial infarction, blood vessels) and engineering of skeletal tissues (cartilage, bone, and anatomically shaped grafts for joint repair). In both cases, the designs of biomaterials for cell culture *in vitro* and cell delivery into the site of injury are inspired by the properties of the native tissues, and the biomaterial scaffold is designed to recapitulate the molecular, structural and mechanical properties of interest. In addition, the biocompatibility and degradation of the biomaterial are of substantial interest. For cardiac tissue engineering these requirements translate into the development of elastomer scaffolds with oriented, interconnected pores for cardiomyocytes and an array of channels for blood flow. For engineering of bone tissue, mechanically robust porous matrix made out of protein-mineral composite would be a biomaterial of choice. We discuss state of the art and some recent developments in the area of biomaterials for tissue engineering and regenerative medicine.

PL.S.I.2.

FUNCTIONALIZATION CHANGES TARGETING SITE AND THE STABILITY OF CARBON NANOTUBES INSIDE LUNG EPITHELIAL CELLS

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Functionalised carbon nanotubes (NTs) are attracting increasing attention as novel delivery systems for drugs in cancer therapy. Development of NTs in medical applications will require an understanding of the effect of surface functionalisation on the amount of uptake and their internal distribution within cells. Further it is essential to establish whether they can be selectively targeted to cells and their cytotoxic effects if they are improperly targeted. The surface characteristics of NTs changes their interaction with the cells, however little is known about the direct effect of surface groups on the amount of cellular uptake, targeting site within the cell and the long term fate of the NTs within the cell, i.e. can they be cleared, degraded by the cell or trafficked between cellular compartments. Internalisation of NTs by cells has previously been reported by tagging the NTs with a flourochrome label to track their uptake into cells by confocal microscopy. However, surface modification of NTs with a flurochrome label will modify the interaction between the NTs and the cell. In addition these techniques suffer from having insufficient resolution to image the position of individual NTs within the cell. Here we use a combination of phase contrast microscopy and energy filtered transmission electron microscopy combined with electron tomography to visualize differences in the interaction of shortened covalently and non-covalently functionalized NTs with lung epithelial cells. Short NH_3^+ functionalized MWNTs (40 nm in diameter, 100 nm length) frequently aggregated primarily within endosomes and also the cytoplasm of the cell. In comparison, polymer wrapped MWNTs (5 nm in diameter) entered cells less frequently where they inserted into the plasma membrane and localized solely within the cytoplasm. Both classes of funtionalised MWNTs appeared to loose their crystallinity and degrade inside the cell. Differences in targeting site within the cell were correlated to differences in cytotoxicity. Whereas the NH_3^+ functionalized MWNTs were non-cytotoxic, the polymer wrapped MWNTs displayed significant levels of cytotoxicity.

Functionalised carbon nanotubes (CNTs) are being tested as contrast agents for medical imaging and for the delivery of therapeutically active molecules to target cells. However before they become used commercially it will be essential to establish their subcellular distribution and whether they are cytotoxic.

Here we characterize uptake of unlabelled, acid-treated, water soluble SWNTs by human monocyte derived macrophage cells using a combination of Raman spectroscopy and analytical electron microscopy and compare our findings to previous work on unpurified SWNTs. The acid-treated SWNTs were less aggregated within cells than unpurifed SWNTs. Bundles, and also individual acid treated SWNTs, were found frequently inside lysosomes and also the cytoplasm where they caused no significant changes in cell viability or structure even after 4 days of exposure.

PL.S.I.3.

NEW METHODS IN MATERIALS RESEARCH USING FOCUSED ION BEAMS

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Focused ion beam technology offers many novel routes for nanoscale fabrication and characterization. In this presentation I summarize examples of new routes to nanoscale patterning, fabrication and property modification developed in our group, drawing upon examples of ultra-fast patterning in PMMA, templating of nanostructure growth in the Ge/Si system, and local doping of individual semiconductor nanostructures. I also describe application of focused ion beams to nanoscale characterization methods, including nanoscale mapping of semiconductor dopants and three-dimensional reconstruction of assembly of nanostructure arrays. Prospects for new FIB capabilities for enhanced nano-fabrication and characterization methods will also be assessed. *Work in collaboration with M. Gerasimova, J. Graham, L. He, A. Kubis (U. Virginia), D. Dunn, F.M. Ross (IBM), S. Liu (Intel), A. Portavoce (CNRS), F. Stevie (NCSU), J. Johansson (Lund U).*

PL.S.I.4.

ON PHYSICS AND NANOENGINEERING OF HIGH-Tc AND RELATED OXIDE FILMS

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In order to nano-engineer new electronic functionalities in complex matter (in an analogy with successful semiconductor planar technologies) it is important to be able to master the nanophase separation and control the electronic dispersion, local dielectric function and interfaces. Specifically in cuprates, since 1997 we systematically perform *Direct* ARPES (=DARPES) on *in-situ* grown, non-cleaved, ultra-thin (<25nm) cuprate films. Specifically, we probe low energy electronic structure and properties of high-T_c films under different degree of epitaxial (*compressive vs tensile*) strain [1-4]. In overdoped in-plane compressed $La_{2-x}Sr_xCuO_4$ (LSCO) thin films we double T_c from 20K to 40K, yet the Fermi surface (FS) remains essentially 2-dimensional (2D) [1]. In contrast, *tensile* strained films show 3-dimensional (3D) dispersion, while T_c is drastically reduced. It seems that the in-plane compressive strain tends to push the apical oxygen far away from the CuO_2 plane, enhances the 2D character of the dispersion and increases T_C, while the tensile strain seems to act exactly in the opposite direction and the resulting dispersion is 3D [2]. We have the FS topology for both cases. As the actual lattice of cuprates is 'Napoleon-cake'-like i.e. rigid CuO_2 planes alternate with softer 'reservoir' (that strains distort differently) our results tend to rule out 2D rigid lattice mean field models [2]. We have recently determined the FS topology from the observed wavevector quantization by DARPES in cuprate films thinner than 18 units cells (<24nm); such a method can be extended to other ultra-thin electronic materials of interest to nano-technology [3,4].

1. D. Cloetta et al., Phys. Rev. B **74**, 014519 (2006) and references therein
2. D. Pavuna et al. in LEHTSC Proceedings (editor: H. Oyanagi), IoP (2008) and references therein
3. C. Cancellieri et al., Phys. Rev. B **76**, 174520 (2007); C. Cancellieri, EPFL D.Sc. Thesis (2008)
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PL.S.I.5.

TUNABLE CERAMICS BASED ON THE $Na_{0.5}Bi_{0.5}TiO_3$ SYSTEM

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$Na_{0.5}Bi_{0.5}TiO_3$ is a complex perovskite that has recently attracted increased attention as a base compound for lead-free piezoelectrics. Its structural and electrical characteristics resemble the typical features of relaxors. The composition of $Na_{0.5}Bi_{0.5}TiO_3$ has often been tailored in order to improve its room-temperature performance. For the preparation of piezoelectric materials, for example, mainly $K_{0.5}Bi_{0.5}TiO_3$ and $BaTiO_3$ have been used. Moreover, we have recently demonstrated that the introduction of $NaTaO_3$ incipient ferroelectrics leads to enhanced voltage-tunable characteristics of the materials prepared.

It is the aim of this presentation to discus structural and electrical characteristics of various $Na_{0.5}Bi_{0.5}TiO_3$ based ceramic system. For example, $SrTiO_3$ is a well-known incipient ferroelectric and therefore enables a shift of the $Na_{0.5}Bi_{0.5}TiO_3$ phase transitions towards lower temperatures. In this way we were able to control the samples` polar order and the intensity of the dielectric relaxations at room temperature. In the presentation the influence of the composition on the single phase ceramic formation will be discussed and the tunable properties described.

O.S.A.I.1.

THE PREPARATION OF SUPERPARAMAGNETIC $BaFe_{12}O_{19}$ PARTICLES BY COPRECIPITATION ROUTE

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Submicron grain sized Ba-hexaferrite is one of the most commonly used material in magnetic-recording applications, one of the promising materials in magnetic nanocomposites for the absorption of microwave radiation and for the high frequency devices working above 40 GHz.

For the preparation of submicron sized particles, mostly the chemical methods were applied, unless the classic ceramic method is used and the calcined powder is subjected to a high energy milling. Up to now, when using chemical methods, a two step procedure was indispensably necessary. After the formation of intimately mixture of starting oxide the calcination at elevated temperatures was applied. Depending on the preparation technique, i.e., the co-precipitation, sol-gel, micro-emulsion, citrate-precursor, sonochemical activation and the mechanochemical activation, the temperature of calcination was gradually decreased, down to 400°C in order to prepare well crystalline submicron sized ferrite particles. All these methods demand the thermal treatment as the final step of the preparation of submicron particles, which were more or less agglomerated. There were also reported some chemical routes as for example: combustion synthesis, glass crystallization and hydrothermal synthesis where the $BaFe_{12}O_{19}$ particles were synthesized in situ.

In this contribution the hydrothermal synthesis of nanosized $BaFe_{12}O_{19}$ particles at low temperatures below 140°C and even below 100°C were studied. At these conditions the crystallization process is sluggish and the activity of $BaFe_{12}O_{19}$ side planes is less active, what prevents the coarsening. Besides, the influence of the precursor concentration on the morphology of the final product was studied and a model is proposed which explains the deviation of the synthesized particles morphology, from that, anticipated by the classical La Meer-Dinger principle.

O.S.A.I.2.

THE SYNTHESIS OF IRON OXIDE-DEXTRAN NANOCOMPOSITES FOR THE APPLICATION IN HYPERTHERMIA

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In the last years the magnetic nanoparticles and their derivatives ferrofluids have found grate interest in the biomedical application. Ferrofluids are stable colloidal dispersion of nano-sized particles of ferro- or ferrimagnetic particles in carrier liquids. Most commonly the magnetite and maghemite are used as magnetic nanoparticles. Ferrofluids have some unique properties, as for instance, being liquid and magnetic and can be for this reason used in biomedical applications for the magnetic cell separation, as contrast agents in magnetic resonance imaging and for magnetic fluid hyperthermia.

Magnetic nanoparetcle encapsulated in dextran were prepared and their magnetic characteristics given. The iron oxide nanoparticles were obtained by the coprecipitation of Fe(III) and Fe(II) salts with ammonium hydroxide and stabilized with carboxymethyl-dextran. The products were purified by dialysis and ultra filtration. The magnetic properties of stabilized particles were characterized using TEM and VSM. The magnetic particles synthesized were of uniform size and coated with dextran. The magnetic liquid was tested for the specific absorption rate (SARS). The specific absorption rate of magnetic liquids under the influence of a high frequency magnetic field – SARS was measured at room temperature. The results were discussed in dependence of the particle morphology, magnetization and the dominant type of magnetic losses, which cause the absorption of magnetic energy by the magnetic particles.

O.S.A.I.3.

INFLUENCE OF LASER MELTING ON MICROSTRUCTURE AND PROPERTIES OF AMORPHOUS COATINGS DEPOSITED BY HIGH VELOCITY OXYFUEL DEPOSITION METHOD

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The goal of this research was to increase the surface wear resistance of elements made of 9%Cr high strength steel. High velocity oxy-fuel (HVOF) thermal spray was used to deposit a $Fe_{57}Cr_8Mo_{12}W_3C_9B_{11}$ alloy coating onto high strength 9%Cr steel substrate. Then the coatings were remelted by means of the Nd-YAG laser, with certain portion of matrix in term to receive surface layer free of porosity and well metalurgically bounded with the matrix. Microstructures of the as deposited coating and laser remelted surface layer were investigated by X-ray diffraction (XRD), scanning election microscopy (SEM), transmission election microscopy (TEM) and differential scanning calorimeter (DSC).

The surface layers obtained after Nd:YAG laser melting of as-sprayed coatings, with overlapping of melted areas, were relatively smooth, morphologically homogenous, but with presence of porosity and cracks. Only layers obtained after laser melting of thin coatings with the highest values of laser power (96 and 112 W) were free of cracks. They showed crystalline structure and lower hardness than other layers obtained by laser melting of thicker coatings (380 m thick), which were amorphous or only partially crystalline.

When coatings were laser melted without overlapping of subsequent melted areas the central part of the laser-melted zone possessed an amorphous structure free of cracks and porosity. Fine cracks and pores were only present in areas near the boundary with un-melted coating. The substructure of these grains consists of very fine dendritic eutectics.

The highest values of microhardness (1800 $HV_{0,65}$) were obtained after laser melting of thick coatings with moderate laser power (96 W). Such layers showed good metallurgical bonding with the substrate. Research revealed that laser melting of as-sprayed coatings improves the wear resistance. The level of the wear resistance for all laser-melted specimens was much higher than that of as-sprayed samples.

Investigation showed that using proper laser treatment conditions of coating remelting, it is possible to get an amorphous surface layer, with high hardness and wear resistance, however with some cracks. Indeed, relatively low cost of the material used for examined coatings, compared to most other bulk metallic glasses and their unique properties they can widely applied in industry.

O.S.A.I.4.

DEFECTS RESPONSIBLE FOR AFTERGLOW IN LUTETIUM SESQUIOXIDES DOPED WITH Eu^{3+}

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Lutetium sesquioxides doped with Eu^{3+} are candidates for scintillating ceramics materials. Their cubic structure ensures that no anisotropy in the optical index causes scattering at grains joints in the ceramics. Besides, Eu^{3+} in theses matrices gives intense red emission within the millisecond range. Hence such scintillating ceramics can find application in X-ray Computed Tomography imaging. However Lu_2O_3:Eu^{3+} tends to show afterglow which is detrimental for the application.

The afterglow is linked to defects in the material that trap charges created during X-ray excitation. We focused our attention in studying the afterglow of lutetium sesquioxide ceramics. The afterglow is found to depend on the synthesis conditions of the powders as well as the sintering conditions of the ceramic.

In an attempt to reduce this afterglow several ways were proposed : designing a mixed gadolinium lutetium oxide / favoring one site occupation by Eu^{3+} / co-doping the matrix with ions such as Ca^{2+}, Zr^{4+}, Pr^{3+} , Ce^{3+} or Tb^{3+}

The effect of these ways was studied by thermoluminescence experiments over a large range of temperature (20K – 600K). We aimed at identifying the defects responsible for afterglow in these ceramics and select the best options to reduce it at a minimum level.

O.S.A.I.5.

INTERACTION BETWEEN SURFACE ACTIVE SOLUTES AND SURFACES OF METAL OXIDES IN POLAR ORGANIC SOLVENTS

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The electroacoustic method makes it possible to determine the zeta potential in concentrated dispersions of solid particles. In this respect the electroacoustic method is very different from electrophoresis, which requires a low solid-to liquid ratio. The surface-active substances are present in non-aqueous solvents and in solid particles as impurities, and the impurities from different sources play different roles in the surface charging at different solid to liquid ratios. At low solid-to-liquid ratios, the values of zeta potentials of certain powder in various "pure" solvents are scattered, since the nature and concentrations of impurities varies from one solvent to another. At high solid-to-liquid ratios, the surface-active substances present in non-aqueous solvents as impurities play a minor role because their amount per unit of the surface area is low, and the surface-active impurities associated with the powder play a major role, because their amount in the system is high. Thus, the values of zeta potentials of certain powder in various "pure" solvents are rather consistent, when the solid-to liquid ratio is sufficiently high. The surface charge can be adjusted by addition of controlled amounts per unit of surface area of surface active substances.

O.S.A.I.6.

NON-CONVENTIONAL SYNTHESIS OF MANNICH POLYOLS

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Mannich polyols are usually synthesized by classical Mannich reaction from phenol, aqueous solutions of formaldehyde and diethanolamine. The reaction results in a Mannich base and a large quantity of water which is removed by vacuum distillation. The final polyols are obtained by alkoxylation of the Mannich base with propylene oxide or mixtures of propylene oxide - ethylene oxide. We studied a non-conventional way to obtain Mannich polyols. In the first step diethanolamine is reacted with paraformadehyde with formation of oxazolidine, a very reactive heterocyclic compound. The anhydrous oxazolidine reacts with phenol forming Mannich base, which is then alkoxylated with propylene oxide. The products are Mannich polyols having lower viscosity and enhanced color than the commercial Mannich polyols. They have very high reactivity and are suitable for "spray" and pour in place rigid polyurethane foams.

O.S.A.I.7.

MICROWAVE METHODS OF OBTAINING OF GRAPHITE INTERCALATION COMPOUNDS AND NANOMATERIALS ON THEIR BASE

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Intercalative compounds on the basis of stratified graphite and fluorocarbonic matrices are very perspective for the production of new nanostructured functional materials. First of all they can be used for the production of nanodimensional carbon materials. We have used microwave heating to obtain new nanostructured materials carrying out the reactions between different organic and inorganic compounds both in stratified graphite and fluorocarbonic matrix. Specific character of this procedure is due to the hard layers of carbon matrix superposing geometric limitations on the behavior zone of chemical reactions in interlaminar spaces of the matrix. It results in generating conditions for the formation of low-sized and anisotropic particles of metals or metal compounds. Thereby laminated intercalate operates as a two-dimensional nanoreactor. Applying microwave heating allows us to improve the intercalating efficiency of target compounds in to layered matrix and develop the new methods of nanostructured functional materials production on the basis of carbon and fluorocarbonic matrices.

O.S.A.I.8.

THE APPLICATION OF CONTROLLED MICROWAVE HEATING IN ORGANIC SYNTHESIS AND EXTRACTION

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Heating by microwave energy has recently been used to produce pharmaceutically promising substances. Our research has been focused on the application of green extraction techniques in the isolation of biologically active products from plant materials. We have successfully applied microwave-assisted extraction (MAE) to the isolation of diterpenoid alkaloids from Aconitum roots and quinolizidine alkaloids from Sofora roots using the CEM Multi-Mode Microwave Reactor "MARS Xpress™ System". The extractions were carried out for 10 - 20 minutes with good yields, with water being a solvent. The advantages of microwave-assisted extraction are: high efficiency, short time and low environmental pollution. Microwave heating is very convenient for using in organic synthesis. MW-heating is instantaneous, very specific and there is no contact required between the energy source and the reaction vessel. We applied controlled microwave heating for acylation of the anti-inflammatory drug (piroxicam) and obtaining N-acyl derivatives of aminoacids. The reactions were carried out promptly with good yields using the Single-Mode Microwave Reactor "Discover™ System" (CEM Corporation).

O.S.A.I.9.

SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS OF COMPLEX OXIDE MATERIALS FOR GAS-SENSING APPLICATION

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Ferrites materials like manganese and barium ferrites are widely used in electronic inductors, radio magnets, magnetic recording tapes and other electromagnetic devices. Modern methods of ferrites production have significant disadvantages due to their big energy loss and wide variability of products properties. In our work we used self-propagating high-temperature synthesis (SHS) with an applied electric field. This method may be very perspective for synthesis of functional materials like ferrites because of its small energy loss, simplicity of fulfilment and possibility for combustion parameters control. Application of external electric field during synthesis of ferrites led to the changing of magnetic properties of synthesized ferrites and combustion parameters like temperature and burning velocity. It is related to the changes of kinetic characteristics of the process at the stage of microstructure formation under the application of electric field.

O.S.A.I.10.

PHASE FORMATION AND MICROSTRUCTURE OF Mn(/Ba)-Fe-O-SYSTEM DURING COMBUSTION SYNTHESIS

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Definition of phase formation mechanism during synthesis of complex oxides is an actual problem for material science. It'll allow to obtaining new products with definite composition and stable properties. Besides that it'll make possible to control the process by electromagnetic interference for example. In the work the main synthesis stages of $MnFe_2O_4$ and $BaFe_{12}O_{19}$ during SHS process of multicomponent oxide systems were determined and phase formation scheme was compiled. The intermediate phases and mechanism of its formation were described. It was established that phase relation of combustion system BaO_2 + 2Fe products changed under external electric field influence. The main phase became $BaFeO_{3-y}$ while during SHS without electric field the main phase was iron oxide. At that time the microstructure of products changed also. It was shown the process proceeded with the liquid phase formation of BaO_2 containing BaO particles. As analysis of combustion wave zone shown layer of growing product may increased under applied electric field. The present results explained effects of electric filed influence on ferrites synthesis observed earlier.

O.S.A.I.11.

DESIGN OF NANOSTRUCTUCTURED OXIDE MATERIALS FOR TERAHERTZ OPTICS APPLICATIONS

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The choice of materials for terahertz optics is rather limited, even some polymer materials are used now, such as polyethylene, polytetrafluoroethylene, polypropylene and others. The most common disadvantage of polymers is a high absorption – that is caused by singularities of chemical constitution and by the effects of intra- and intermolecular hydrogen bondings on the physical properties of these materials. Presence of the unshared electronic pairs in a substance, as well as the molecular water, presence of free and loosely coupled charge carriers – all these increase the efficiency of an interaction with electromagnetic radiation and should increment the losses. The aim of this work is development of the solid-state nanomaterials possessing a small absorption combined with sufficient refraction index in the THz range. The main criteria, used for materials selection, are simple enough: inorganic compounds with a strong chemical bond, a stoichiometric composition is desirable, a minimum concentration of delocalized charge carriers is essential and sufficient polarizability over the THz range. It is obvious, that inorganic materials match these criteria in the greatest degree and, first of all, the stable oxides like Al_2O_3, SiO_2. The advantage of the monolithic nanostructured porous alumina (NOA), the synthesis of which we developed earlier, was used. The optical properties in relationships with the structural, phase and chemical composition of the NOA samples and evolution of these properties after the heat treatment was analyzed. The native structure of NAO consist of three-dimensional network of the amorphous nanofibrils with diameter 5-10 nm, with the composition $Al_2O_3 \cdot nH_2O$, n = 1-4. NOA possesse a small density (0,02-0,04 g/cm^3), high porosity (99 %vol.) and large specific surface (300 – 800 m^2/g). An annealing at 900-1700°C allows to vary the samples density from 0,02 up to 3 g/cm^3, the porosity from 99,3 till 25 % and the specific surface of samples from 800 till 1 m^2/g. An annealing leads to isotropic decreasing of the samples linear sizes, but does not destroy the solidity and the porous structure. This property is rather useful as it allows to control simply and precisely the refractivity of a medium material by changing the density. The absorption in the NOA materials is related to the content of the chemically bounded water and/or the hydroxyl groups. The quantitative interrelation between an absorption coefficient and the content of structural water in samples has been established in our study. Refraction index increases with the density of the samples, and $(n - 1)/\rho$ is an invariant for various media. High and open porosity of NOA allows creating new nanocomposite materials using procedure of chemical impregnation with the other oxides: TiO_2, ZrO_2, CeO_2, PbO. The new nanocomposite oxide systems were developed with the properties designed for the applications on optics, for making the medium materials with non-linear properties, for the heterogeneous macro-ordered materials and metamaterials.

O.S.A.I.12.

EFFECT OF MECHANICAL ACTIVATION ON PHYSICAL-CHEMICAL PROPERTIES OF DRUGS

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The results on influence of mechanical activation on the properties of some poorly soluble pharmaceuticals, indomethacin, piroxicam, meloxicam, and betulin, are presented. Under mechanical treatment, the amorphization of the drugs and, in some cases, the changes in their molecular structure were observed. The mechanocomposites of the drugs with various excipients, including soluble polymers and non-soluble carriers, were obtained by co-grinding using SPEX 8000 vibrational (USA) and AGO-2 planetary centrifugal (Russia) mills. The samples obtained revealed higher release rate and apparent solubility of the drugs with respect to the initial ones. Nevertheless, e.g. for composites of piroxicam with alumina and iron oxide, decreasing the release rate and solubility of the drug was observed suggesting the formation of poorly soluble strong drug - carrier associates.

O.S.A.I.13.

CHEMICAL PROCESS FOR FABRICATION OF MICROMECHANICAL INFRARED DETECTORS

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Micromechanical infrared detectors are a new class of uncooled microelectronic devices. The new type of uncooled focal plane array infrared sensors is based on the original design where a temperature change produces deflection of a membrane connected through a bimaterial cantilever with a plate. An optical readout is used for measuring the membrane deflection. The bimaterial element is composed of two layers that differ greatly in their thermal expansion coefficient: silicon nitride and aluminium. The amorphous silicon was used as a sacrificial layer. The photosensitivity of these devices depends on the layers manufacturing condition. One of the main problems is the removal of the sacrificial layer without changing the mechanical properties of the device layers. The aim of our research was the investigation of device layer properties depending on synthesis conditions. Procedures of amorphous silicon removal by XeF_2 etching for creation of focal plane array of bimaterial cantilever converters were investigated too. The amorphous silicon nitride films were deposited from gas mixture (5% SiH_4 +Ar) and ammonia by plasma-enhanced chemical vapor deposition at the frequency of 13.56 MHz. The amorphous silicon films (a-Si:H) were deposited from gas mixture (5% SiH_4 +Ar) by plasma-enhanced chemical vapor deposition. We used capacitive discharge reactor at the frequency of 40 MHz, substrate temperature 250^{o}C, pressure 0.5 Torr, and power 70 W. The growth rate was around 0.5 nm/sec. Raman spectroscopy was used for structural analysis as a fast and convenient method. The measurements are carried out with Triplemate SPEX spectrometer. The chemical bonding structure of silicon nitride and amorphous silicon films was studied by Fourier IR spectroscopy. The condition growth of silicon nitride films was selected in that way to decrease mechanical stress. It was shown that silicon layers suitable for the technology were amorphous and contained 7-10% of hydrogen. These layers (0.3- 2mkm) were removed by gaseous etching with xenon fluoride. This reagent utilization is an ideal solution for manufacturing of micromechanical membranes due to the high etching selectivity to materials formed device layers. This method provides numerous unique advantages in comparison with wet and plasma etching procedures. The key moment of our technology was the choice of etching parameters for free standing flatness membrane formation. It was shown that the etching rate depends on chemical composition of amorphous silicon. Etching procedure parameters were chosen in order to minimize the exothermal effect of reaction. As a result of our investigation the technology for manufacturing of plane-parallel gap membranes all over large area was developed.

O.S.A.I.14.

SYNTHESIS OF METALLIC AND OXIDE NANO-POWDER BY ULTRASONIC SPRAY PYROLYSIS

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Nanotechnology can be defined as engineering of functional materials at molecular scale. Ultrasonic spray pyrolysis (USP) is an innovative powerful tool for synthesis of particles made from various materials with controlled and uniform size. USP enables very efficient to control powder morphology and allows the application of relatively cheap precursors. Non-agglomerated nanosized particles of metals (Fe, Cu, Co, Ni, Ag, Au, CoFe, NiFe) as well as oxides (ZnO, WO_3, RuO_2/TiO_2) were synthesized by using appropriate solutions and hydrogen or nitrogen atmosphere at RWTH Aachen University in last five years. Well controlled particle sizes have been obtained by adjusting the concentrations of precursor solutions and the conditions of the aerosol thermal decomposition/thermolysis. The temperature range was defined via thermochemical analysis using FactSage® Software. A Scanning Mobility Particle Sizer (SMPS) was applied for on-line measurement of the size distribution in the range from 5 nm to 1000 nm. Dry nanoparticles are deposited using an electrostatic precipitator. The collection efficiencies of nanoparticles will be discussed together with the resulted morphologies for different chemical systems with strong relation to their applications aimed for in medicine, batteries and catalysis.

O.S.A.II.1.

EFFECT OF MECHANICAL ACTIVATION ON THE SHS OF POROUS TiNi

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Titanium nickelide TiNi exhibiting the shape memory effect is one of important materials for surgery applications. One of promising methods for cost-effective preparation of homogeneous materials with uniform porosity and high extent of shape recovery is the SHS (self-propagating high temperature synthesis) from mechanically activated powder mixtures. In this work, we investigated the effect of mechanoactivation (MA) on the structure of green powder mixture, synthesis conditions and on the structure/properties of resultant TiNi-based porous materials. MA was carried out in an inert atmosphere (Ar). MA was found yield green particulates with a laminated structure formed by alternating layers of Ti and Ni, whose thickness markedly decreased with increasing duration of MA, thereby increasing the homogeneity of green mixture. Varying the MA duration, it is possible to SHS-produce materials with desired structure/properties. This work was supported by the Russian Foundation for Basic Research (project no. 08-03-00215a).

O.S.A.II.2.

MECHANOCHEMICAL SYNTHESIS OF CO-CRYSTALS OF MELOXICAM WITH CARBOXYLIC ACIDS

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The synthesis of supra-molecular complexes of two or more components, co-crystals, is very attractive due to the development of new materials with improved properties. Meloxicam is a non-steroidal anti-inflammatory drug. In the present work, the possibility to obtain co-crystals of meloxicam with carboxylic acids by mechanochemical method is studied. The co-crystals were obtained by co-grinding of components in an agate mortar and in a SPEX 8000 vibration ball mill with addition of a few drops of solvent. The formation of co-crystals was confirmed by X-ray diffraction and FTIR data. It has been shown that the addition of polar, low-polar, or water-miscible solvent facilitated interaction of reagents during co-grinding. The influence of traces of water absorbed on the surface of components and preliminary mechanical activation on solid-state reaction was investigated.

O.S.A.II.3.

MECHANOCHEMISTRY OF FLAKY–BASED NANOCOMPOSITES

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The regularities of mechanical activation of flaky compounds (Grahite ©, Hexagonal BN (h-BN) and MoO_3) and two components compositions A/X (A=Al, Ti, Mg, Si; X=C, h-BN, MoO_3) were compared. The main attention was paid to the formation under mechanical treatment of nano dimension particles and nanocomposites as well as to their reactivity. The influence of mechanical properties of substance (plastic metals and brittle Si) on the structure of nanocomposites was found. Reactivity of mechanochemically prepared nano particles and nanocomposites with gases (H_2,O_2,N_2) and liquids (H_2O) as well as mechanochemical reaction A+X was investigated. Mechanical activation leads to the significant increasing of the chemical transformation rate. The contribution of different physical reason on acceleration of chemical transformation is discussed.

O.S.A.II.4.

PROSPECTS OF APPLICATION NEUTRAL AND ACTIVE REAGENTS FOR DEVELOPMENT MECHANOCHEMICAL METHODS OF ENRICHMENT AND PROCESSING MINERAL AND MAN-MADE RAW MATERIALS

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The methods for mechanical activation (**MA**) and self-propagating high-temperature synthesis (**SHS**) - MASHS - is considered for processing different minerals with production of highly dispersed materials. We will focus on the important aspect of mechanochemical processing by grinding in a ball mill, namely, nanoscale wear of the treated minerals and of the milling tools. A new technology called abrasive–reactive wear (**ARW**) is applied in the processing of mineral and man-made raw materials. The effect of quartz MA and ARW during the induction period and temperature of SHS process of obtaining sintered materials is studied. The ARW method is approved by producing the nanocomposite metal-oxide-sulphide powders from carbon, sulphur, galenite and tenorite. The results of the treatment of titanium-containing raw material using the complex procedure including MA, coal and sulphur action are reported. Regularities significant both from theoretical view point and practical application are revealed. The transformation of valleriite into covellite CuS and nickel sulphide NiS_2 using sulphurous anhydride dissolved in water at the temperature 90-95°C as a reagent was examined. An additional ore pretreatment by short-term and high-energy actions in a disintegrator leads to increasing the reaction rate in hydrometallurgical process caused by the increase the degree of liberation of valleriite and serpentine aggregates. Research results of an opportunity of solid-phase sulphidization of the oxidized minerals of copper through carrying out interaction with elementary sulfur in mechanochemical reactor are submitted. Theoretical assumption of possibility to form metal sulfides through MA of oxidized minerals with sulfur presence was confirmed experimentally by X-ray analysis and electrokinetic's potential measurement after mechanochemical processing. Basing on the derived results it was developed general approach to the problems, solving ore and technogenic raw material reprocessing and enriching; it is worked through applying MA and traditional hydrometallurgical processes. Depending on mineral content and the goals set, the tentative stage of MA of geological materials are to be carried out with mixing neutral and active reagents, where neutral reagents are applied as overground active agents and dissolvents, and active reagents would possess properties, changing chemical ore composition and contribute to create definite pH of solutions on the stage of hydrometallurgical refining of ore products.

O.S.A.II.5.

MECHANOCHEMICAL SYNTHESIS OF Ti-CONTAINING HYDROGEN STORAGE NANOCOMPOSITES

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Titanium is well known as a component of light-weight hydrogen storage materials. The fast hydrogenation and dehydrogenation kinetics at low temperatures together with high hydrogen sorption capacity are the most important technological requirements to these materials. Ball milling treatment is widely used for improving the hydrogen sorption kinetics through breaking down particles and creating the larger surface area. Different additives are also applied to ease the milling process and stimulate the H_2 uptake. The particular feature of this work is to use additives (graphite, boron, h-BN) not only as lubricant and anti-sticking, but as matrix-forming materials to create nanocomposites with special hydrogen storage properties: highly-reactive Ti particles of several nm in size being distributed in matrix were protected from atmosphere impact; modification of Ti lattice by interstitial atoms decreased the temperature of metal - hydrogen interaction due to change in thermodynamic parameters of hydrogen uptake and release. Ti/C, Ti/B and Ti/h-BN nanocomposites in flow mechanochemical reactor (He flow). XRD, SEM, TEM and HREM techniques were used to study phase composition and morphology of as-milled powders. The chemical state and local electronic structure of Ti atoms were studied by XES. TPR technique was applied for testing H_2 uptake by as-prepared powders. Hexagonal BN was found to be the most efficient additive improving H_2 absorption by Ti after mechanical activation. Due to drastic decrease in Ti powder size to ~ 4 nm in size distributed in h-BN matrix, TiH_2 was received at 596 K and decomposed at ~ 750 K by further heating in H_2/Ar flow. In the case of Ti/B, TiH_2 was received at 686 K. Prolong Ti/B ball milling accompanied by TiB_2 surface structures formation. Due to this, two-fold decrease in hydrogen sorption capacity was observed. Significant improvement in hydrogen uptake in the presence of graphite is caused by appearance of new (low-temperature) occupation sites available for hydrogen. The reason is chemical and geometrical modification of tetrahedral positions available for hydrogen in Ti lattice due to introduction of C atoms in corresponding octahedral positions. The nanocomposite morphology (close interrelation between Ti nanofragments and nanolayers and sponge-like carbon matrix) is found to responsible for this processes. However, such morphology stimulated formation of surface TiC structures, which suppress further hydriding-dehydriding cycles.

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O.S.A.II.6.

SYNTHESIS OF MONODISPERSE LUMINESCENT OXIDE POWDERS UTILIZING MICROWAVE IRRADIATION

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In present work we discuss a synthetic method which allows one to obtain monodisperse Y_2O_3:R^1, $Y_{2-x}R^2_xO_3$:R^1 (R^1 – Nd, Eu, Er, Tb, Yb; R^2 – Pr, Gd, Sm) luminescent powders with spherical particles by microwave-assisted hydrolysis of corresponding metals nitrates in aqueous solution in presence of carbamide. Microwave treatment of solutions was carried out in inverse Panasonic SD556M microwave oven (applied power – 100 W, duration – 0.5–3 hours). It was shown that suggested experimental technique allows obtaining of monodisperse powders of corresponding oxides with spherical particles of 50-300 nm, depending on the conditions of reaction process. This work was supported by Russian Foundation of Basic Research (grant No.09-03-01067) and grant of President of Russian Federation (MK-1591.2008.3).

O.S.A.II.7.

MECHANICAL ACTIVATION ASSISTED SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS OF NANOCOMPOSITE MATERIALS IN METAL-OXIDE SYSTEMS

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Results of investigation of mechanical activation assisted self-propagating high-temperature synthesis of nanocomposite materials in Me_xO_y-Al, Me_xO_y-Me-Al and Me'_xO_y-Me"-Al systems are presented. On the first step (mechanochemical activation (MA)), metal/oxide nanocomposites were produced. On the second step SHS proceeded in the precursors formed. In spite of the different level of interaction between components of reactive mixtures during MA, as well as different kinetics and vicissitude of chemical interaction during the following SHS, nanocomposite materials with complete inheritance of the precursor's structural morphology can be produced.

This work was performed within integration programs of Siberian Branch of Russian Academy of Science (No 138) and Belarusian Academy of Science (T09CO-014).

O.S.A.II.8.

PHYSICOCHEMICAL TRANSFORMATION OF ALUMINIUM AND QUARTZ POWDERS MIXTURE UNDER LOADING BY SPHERICAL CONVERGING SHOCK WAVES

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The investigation of shock-induced physicochemical reactions between different metals and metal-oxides during propagation of shock waves belongs to the number of the most important problems. In most cases, the rate of such reactions is extremely low under atmosphere pressure and at room temperature. However, it strongly increases under high pressures and at high temperatures. Compaction of the powder materials by means of spherical converging shock waves actions relates to the most progressive technologies making possible to obtain the monolithic materials with new functional properties. In this work loading by spherical converging shock waves was applied to a mixture of aluminium and quartz powder taking in a ratio 1:1. The task of the study was to obtain the monolithic compact with strong bond between particles, to investigate its phase and structural states, and to correlate the data on the phase composition with the parameters of dynamic loading. The powder mixture was pressed preliminarily by static pressure up to density poo = 2.67 g/cm^3. The compact in the shape of sphere 48.85 mm in diameter was put into special shell of a stainless steel. The external radius of the shell was 32 mm. The loading was performed by a converging detonation wave produced by a spherical RDX-based composition explosive layer 8 mm thick. Pressure on the external surface of the shell was 48 GPa. Calculation of the pressure realized in the converging shock wave and in the diverging shock wave was made for the layers located at different distance from loading surface of spherical sample. The layer-by-layer analysis of the structure and phase composition of the recovered sample was performed using the X-ray diffraction, the optical and scanning electron microscopy. The sample retained intact after shock wave loading is monolithic. A number of concentric layers are observed in a meridian section of the sample. The presence of several different zones in the sample reflects the specific features of physicochemical reactions occurring in the mixture of aluminium and quartz powders in different pressure ranges. It was established that pressures below 45 GPa cause only compacting of the material and deformation of aluminium and quartz. The attainment of this pressure initiates the solid-state reaction of SiO_2 decomposition, which leads to precipitation of pure silicon and the evolution of oxygen. The beginning of the silicon precipitation and the chemical reaction of Al_2O_3 formation are separated over the pressure scale. The critical pressure, which is necessary for the Al_2O_3 formation, is about 50 GPa.

This work was supported by the Russian Foundation for Fundamental Research, project no. 08-05-00165.

O.S.A.II.9.

HOMOGENEOUS AND MICROHETEROGENEOUS PEROVSKITE-LIKE SYSTEMS: FORMATION, MICROSTRUCTURE AND REACTIVITY IN OXIDATION REACTIONS

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This work presents results of research aimed at elucidating general trends in formation of the phase composition and microstructure of alkaline-earth doped lanthanum ferrites $La_{1-x}Me_xFeO_{3\pm\delta}$ (Me=Ca, Sr. Ba; x=0÷1) prepared via the mechanochemical route. Combination of diffraction (X-ray diffraction including high temperature investigation, transmission electron microscopy) and spectroscopic methods (Infra-red spectroscopy, Mössbauer spectroscopy) with temperature-programmed techniques (thermal analysis, reduction by H_2) allowed to clarify the effect of the content of a dopant, its nature and preparation conditions on the charge state and coordination of Fe cations determining in turn mobility and reactivity of the surface and lattice oxygen. For mechanochemical route of complex ferrites synthesis, specificity of this technique as well as general trends in formation of homogeneous and microheterogeneous/nanocomposites solid solutions and respective stability ranges were clarified. This allowed obtaining complex perovskite-like ferrites with controlled properties required for application in a specific catalytic process.

O.S.A.II.10.

INFLUENCE OF DOPANT AND ITS PRECURSOR NATURE ON FORMATION OF DOPED APATITE-TYPE LANTHANUM SILICATES VIA MECHANICAL MILLING

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Apatite type lanthanum silicates (ATLS) attract an interest as a new class of solid electrolytes having a high oxide-ion conductivity at intermediate temperatures [1]. These materials are tolerant to a broad range of dopants that provides a possibility of conductivity control. Recently the synthesis of undoped apatite-type silicates by mechanically milling constituent oxides at room temperature has been reported [2]. Our late results have shown that Al-doped ATLS can be also prepared at room temperature via the mechanochemical synthesis (MCS), using high power planetary ball mills that allows the milling time to be significantly decreased [3]. In this paper, the effect of the dopant type and its parent compound nature on the mechanism of Al and Fe-doped ATLS MCS is studied. As dopant precursors, Fe- and Al-oxides and hydroxides, $Fe(HCOO)_3$, SiO_2 impregnated with nitrates have been taken. The apatite formation in the course of milling is studied by XRD, TEM, ^{29}Si and ^{27}Al MAS NMR, IR and UV-Vis spectroscopy. The mechanism of the doped ATLS formation during MCS and an extent of a partial substitution of Si in the apatite with Al or Fe are revealed to be determined by the dopant and its precursor nature. The incorporation of both Al and Fe into the apatite structure through the milling is hampered when α-Al_2O_3 and α-Fe_2O_3 are used as reagents. The formation of doped ATLS occurs via the cluster-topotactic (CT) or dissociative mechanism depending on a dopant parent compound. Thus, using $Fe(HCOO)_3$, $Al(NO_3)_3/SiO_2$ leads to the formation of doped apatite via the dissociative mechanism. The formation of doped ATLS occurs via the cluster-topotactic mechanism in the case of Al and Fe hydroxides/oxides, $Fe(NO_3)_3/SiO_2$ as the dopant precursors, being favoured by structural compatibility of La_2O_3, $La(OH)_3$ and apatite. Using $Al(OH)_3$ results in the formation of Al-doped ATLS via CT mechanism, primarily formed Al-silicate therewith promotes the synthesis. However, when FeO(OH) is taken, only a part of Fe enters into the apatite structure due to the easy formation of $LaFeO_3$. The successful MC synthesis of Fe-doped ATLS originates from $Fe(NO_3)_3/SiO_2$ precursor, when the CT mechanism is realized with the intermediate formation of a Fe-silicate.

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O.S.A.II.11.

SYNTHESES OF SELF-STABILIZING POLYBUTADIENE-BASED POLYURETHANES

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Through the hydroacylation mechanism (the radical addition of aldehydic group to the C=C bond), self-stabilizing polybutadiene-based polyurethanes (PUR) were synthesized. For this purpose, we have prepared a novel hindered-amine light stabilizer (HALS), namely, 2-(1,2,2,6,6-pentamethylpiperidin-4-yloxy)acetaldehyde and added it to the pending vinyl groups of the polybutadiene segments of PUR (synthesized beforehand from hydroxy-terminated polybutadiene and toluene 2,4-diisocyanate) using *N*,*N*-dimethylaniline-accelerated decomposition of dibenzoyl peroxide. Unlike standard low-molar-mass HALS admixed physically to PUR, HALS moieties, joined to the PUR chain by covalent bonds, cannot be evaporated nor washed out from the material. This represents a substantial advantage.

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O.S.A.II.12.

HYPERBRANCHED POLYMERS

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Hyperbranched polymers attract more and more attention as cheaper substitutes of dendrimers of structure and properties sufficient for many, mostly medical or biochemical applications. Many synthetic routes have been proposed to prepare hyperbranched polymers, most of them being one-step polymerization processes, generally much simpler than those leading to dendrimers. The main disadvantage of the hyperbranched polymers prepared in a one-stage process is the extremely broad molecular weight distribution and the degree of branching attained by polymer species substantially smaller than one, the value typical for perfect dendrimers (linear polymers, on the other hand, have the degree of branching approaching zero).

In our work we concentrate on methods of narrowing the molecular weight distribution of hyperbranched polymers prepared in step polymerization of AB_2 monomers, where A and B stand for functional groups capable of reacting with each other. Other systems are off-stoichiometric combinations of monomers A_2 and B_3. The analyses are made by using a kinetic model of polymerization based on the Smoluchowski coagulation equation as well as on Monte-Carlo calculations. The modification of polymerization processes that leads to reduced width of the molecular weight distribution involves application of a small amount of B_3 monomer sharing the same reactive groups with AB_2 one, as well as introducing the latter to the polymerization bath in portions. Experimental verification of the calculations will also be presented for the system involving polymers of 4,4-bis(4-hydroxyphenyl)pentanoic acid.

We will also show that by applying the procedure of gradual introduction to the polymerization bath of both monomers A_2 and B_3, or just one at the time, a non-gelling system can be forced to gel and the generally poor degree of branching of polymer molecules can substantially be improved.

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O.S.A.II.13.

APPLICATIONS OF MOTT'S THEORY TO THE EXPERIMENTAL INVESTIGATION OF ELECTRICAL CONDUCTIVITY OF POLYANILINE CONTROLABLY DOPED WITH SULPHURIC ACID

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Polyaniline (PANI) has been prepared by the oxidation of aniline (ANI) with ammonium peroxydisulfate (APS) in solutions of strong 1M sulphuric acid at 0ºC, with different molar ratios APS/ANI. The emeraldine structure of the PANI has been confirmed by UV-vis spectra. Temperature-dependent DC conductivity of the PANI was studied within the range of 10 do 295K. The temperature interval of 100K to 294K, showed the dependence of resistance ($\alpha=1/2$) which corresponds to the quasi-1D VRH Mott's theory of conductivity. After repeated controllable doping, changes in the resistance dependency of samples are occurred, and the exponents of the PANI conductivity approximately $\alpha\sim2/5$, have been determined experimentally. Those results are in agreement with Fogler-Teber-Shklovskii theory and represent its first experimental confirmation for the PANI doped with sulphuric acid.

O.S.A.II.14.

THE EFFECT OF Gd OR Ho IMPURITIES ON THE PHYSICAL PROPERTIES OF HALF-METALLIC FERROMAGNET Co_2MnSi

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Heusler alloys containing Co and Mn are amongst the most heavily studied half metallic ferromagnets for future applications in spintronics. Ideal performance device would be obtained by incorporating a ferromagnet in which the conduction electrons are 100% spin polarized. One of these candidates was proposed to be Co_2MnSi Heusler alloy. From tunneling magnetoresistance data with one Co_2MnSi electrode, a spin-polarization of 61% was obtained at the barrier interface. The rare earth impurities as R=Gd or Ho increase the spin polarization rate. In this paper we report our experimental and theoretical studies on the effect of rare earths impurities on the physical properties of Heusler half metallic ferromagnet Co_2MnSi.

The analysis of the band structures of the doped alloy shows that the half-metallic properties are completely conserved, while the strong-spin orbit coupling would destroy the magnetic excitations. This effect is not determined by the spin-orbit interaction, but through the coupling between the R(4f) spin with the Mn(3d) itinerant electron spins. We evaluate the strength of such a coupling by calculating, in an ab-initio fashion, the total energy of $Co_{16}RMn_7Si_8$ compound for a parallel and antiparallel f-d coupling. The obtained magnetic moments of Co or Mn sites are in good agreement with the experimental ones.

Magnetic tunnel junctions containing the full Heusler half-metallic ferromagnet Co_2MnSi shows a completely different finite temperature dependence of magnetization and polarization. We attribute this behavior to the existence of nonquasiparticle states above the Fermi energy. The origin of these states is connected to many-body interactions in which magnons play an important role. In order to minimize depolarization at finite temperatures a detrimental effect on magnonic excitations is required. A qualitative change of the magnonic branch can be obtained due to the presence of R impurities. The calculated RE(4f)-Mn(3d) couplings indicate that rare-earths impurities are favorable candidates to minimize the finite temperature effects induced by the presence of magnonic excitations.

PL.S.II.1.

DYNAMICS OF LIQUID CRYSTALLINE PHYSICAL GELS

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This presentation will describe our investigation of liquid crystalline physical gels (LCPGs) - a unique group of materials that can be made into an intriguing variety of tailor-made morphologies. An array of self-assembled supramolecular structures can be realized by applying thermal, electric and/or magnetic stimuli to select mixtures of liquid crystalline materials and hydrogen bonding molecules (gelators) that can aggregate to form physical gels. The ability to control the alignment, and hence molecular architecture, in these LCPGs forms the basis for their use and offers the promise of novel applications in a number of fields that include optical filters, displays with faster switching times, sensing devices and information storage. The work will provide the first complete set of dynamics data that could be used to realize macroscopic properties of LCPGs by molecular concepts. No similar study has been reported in the open literature. In addition, the significance of our research has broader implications. For example, from the study of the effect of molecular architecture on the dynamics of LCPGs, new insights are certain to emerge relevant to the dynamics in other systems, such as covalently cross-linked networks, crystallizing systems, copolymers, polymer blends and biological materials.

PL.S.II.2.

PROCESSING AND PROPERTIES OF ADVANCED COMPOSITE MATERIALS WITH NACOMPOSITE POLYMER MATRICES

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The ability of modifying and modelling materials at nanoscale level is leading modern society to developments which were unthinkable just a decade ago. For this reason, researchers all over the world have focused their studies on nanotechnology and nanomaterials: dispersion of low quantities of nanoparticles in a polymeric matrix can lead to a drastic enhancement of their performance. In the research reported here, we propose to optimize the nanocomposite process, and then to produce a fiber reinforced composite, using the nanocomposite as a matrix.

The first part of this work deals with the study of the nanocomposite. In the case of the processing of thermosetting-based nanocomposites, most of the approaches involve different steps, which include mechanical stirring, high energy sonication and solution-evaporation processing. Most of these techniques, although valid, are limited by their scale up to produce larger amounts of nanocomposite material. In this work two different techniques were used: calendering and mechanical stirring.

Once the study on the nanocomposite was completed, then the nanocomposite matrix was used to prepare fiber reinforced composites using liquid molding. In particular, vacuum assisted resin transfer molding (VARTM) was used to manufacture epoxy and polyester-based composite laminates. The employment of this technique has required the use of low viscosity and long-time-curing resin, in order to allow enough time for the whole impregnation of the fibers. Experimental results obtained on these systems show a significant increase on mechanical properties both in the nanoreinforced matrix and in the respective carbon fiber composites. Furthermore the electrical properties of CNF reinforced nanocomposite were also studied, in order to explore the possibility of developing active panels, able to modify their electrical conductivity with the state of stress.

PL.S.II.3.

MATERIALS WITH TIME CONTROL LUMINESCENCE IN MEDICAL IMAGING

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In medical imaging, careful control of the doping and point defects should be realized to optimize the optical properties. Doping ions and defects could for instance offer a non radiative route which gives rise to a decrease of the luminescence intensity or lead to traps. When these traps are thermally released, they populate the excited state of an emitting centre, leading to afterglow. If in some silicate scintillator such as LPS ($Lu_2Si_2O_7$) there is no such deleterious afterglow, in the case of the LYSO (Lu_2SiO_5) in crystal and Ln_2O_3 in ceramics, afterglow should be avoided and suppressed. These materials are used for X-Rays scans and positron emission tomography (PET). Different examples of codoping materials will be presented to control the afterglow.

Sometimes, there is a great interest for materials with a long afterglow luminescence, also called persistent luminescence for various applications (emergency signing, luminous painting, and lightning sources). We are using this concept for the development of new medical imaging also called Optical Imaging. In such system, nanoparticules of persistent luminescent materials (Mn,Eu,Dy codoped silicates) could present emission lasting for hours and this allows to follow in vivo and in real-time the biodistribution of these fluorescent nanoprobes. In that case, effort is done to improve the optical response and increase the afterglow.

PL.S.II.4.

COMBUSTION SYNTHESIS OF COMPLEX OXIDE MATERIALS: PRESENT STATE AND PERSPECTIVES OF DEVELOPMENT

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New experimental approaches, modern state and perspectives of development in self-propagating high-temperature synthesis (SHS) of complex oxide materials as independent direction in materials and combustion sciences were discussed. Solid oxidizers decomposition as well as combustion products formation under conditions of external electric and magnetic fields was studied. For the first time number of fine powder compositions, perspective as potential gas sensing materials, were produced by SHS. Gas sensing properties investigations have been carried out in the different atmospheric and temperature conditions. Practical applications of SHS-produced complex oxides for explosion, toxic and combustible gases detection have been confirmed. Pure and substituted HTSC were synthesized under zero and constant electric field up to 500 kV/m. The thermal programming desorption (TPD) with associated mass-spectrometry (MS) was used to measure an oxygen and water release from the SHS-made HTSC powders. Measurements were made both before and after treatment in gaseous hydrogen or fluorine over the range of 293-793 K. T_C, particle sizes, oxygen content etc. as functions of synthesis and post-SHS treatment conditions were discussed. Complex investigation of electromotive force (EMF) of combustion was developed for the number of complex oxide systems containing elements of I-VIII groups of Periodic Table. New independent directions in combustion science such as ionic chemistry of heterogeneous combustion and dynamic ionography of heterogeneous combustion processes were developed. The new steps has been also made in the preparative chemistry of complex oxides industrially and laboratory applicable. Number of multifunctional compounds such as indates, gallates, molybdates, tungstanates etc. of alkaline and alkaline-earth metals were synthesized for the first time by SHS using only solid oxidizers.

PL.S.II.5.

QUANTITATIVE DESCRIPTION OF THE INTERFACE BETWEEN γ AND γ´PARTICLES IN NI-AL ALLOYS BY HREM

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Ni Base superalloys are important materials for high temperature structural applications. They owe their excellent mechanical properties to the presence of particles of γ' phase (NiAl with an $L1_2$ structure) in a γ matrix (Ni–Al solid solution with an fcc structure). Besides Al, other elements are used to impart either a higher strengthening or improved corrosion properties at high temperature. However the system Ni-Al retains all the basic characteristics necessary for simulation of the evolution of the particle dispersion with time under the effect of temperature. Diffusion driven coarsening of the particle distribution can lead to a reduction of mechanical strength. This process is promoted by a reduction of the total energy of the system which includes the interfacial and the elastic energies as its main contributors in the solid state. Simulation of the evolution must include these two parameters and the nature of the γ-γ' interface becomes important. Additionally, Ni-base superalloys can exhibit rafting after creep deformation, the γ' precipitates, cuboidal before deformation, change to a flat shape. In such a case, the force on γ/γ' interfaces due to plastic deformation becomes important and so is the nature of the interface itself. There are different interface models ranging from a sharp to a diffuse interface (e.g., using either physical or artificial order parameters). High resolution electron microscopy is an excellent tool to determine the characteristics of the interface both structurally and compositionally in the Ni-Al system as well as in technologically relevant Ni base superalloys. Results are given in this paper with respect to strain fields, sharpness and chemical composition of the interface and its influence on the coarsening regime. This is achieved by direct imaging in high resolution modes both in transmission and in scanning transmission. Exit wave reconstruction is extensively applied to recover phase and amplitude images that are used to map strains and the nature of the interface. Chemical analysis by dispersive and energy loss spectroscopies show the dispersion of alloying elements around the interface in the case of two Ni base superalloys.

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PL.S.II.6.

FAILURE MECHANISMS IN HYBRID NANOCRYSTALLINE CELLULAR MATERIALS

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Nanocrystalline electrodeposition can be used to reinforce conventional cellular metals, creating new types of nanostructured metal/metal cellular composites. This approach takes advantage of the large strength increase that can be obtained by grain size reduction to the nm-scale and the fact that the electrodeposited material is optimally positioned away from the neutral bending axis of the composite cellular struts or ligaments. The failure strength in these materials is controlled by a complex set of mechanisms. For the case when the peak load of the cellular architecture is reached before nanocrystalline sleeve fracture, a composite cellular material approach can be taken in which the strength increase is determined by the predicted behaviour of a conformal hollow tube nanocrystalline cellular material. The magnitude of the structural reinforcement attainable for a given mass of electrodeposited material is therefore largely determined by whether the composite cellular material undergoes stretching-dominated or bending-dominated architectural collapse.

PL.S.II.7.

ALLOY STRUCTURES AT THE NANOSCALE BY ATOM-PROBE TOMOGRAPHY

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The ability to experimentally probe the chemical structure of materials at the atomic scale is the key to ultimately control material properties. Atom-probe tomography is a unique technique that allows the chemical investigation of small volume of materials with near atomic resolution, allowing the quantitative study of atomic scale phenomena. I will present examples illustrating how atom-probe tomography can be used to characterize the structure of selected alloys and contribute to our understanding of the atomistic and nanoscale processes that underpin the kinetics evolution and equilibrium of solute distributions in metallic systems.

O.S.B.1.

CLATHRATE TYPE I THERMOELECTRICS: $\mathbf{Ba_8M_x\square_y\{Ge,Si\}_{46-x-y}}$ M=Mn,Fe,Co,Pd,Pt,Cu,Ag,Au,Zn

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The paper focuses on a systematic study of clathrate formation, clathrate structures, bonding and structure-property relations in clathrate type I materials $Ba_8M_x\square_yGe_{46-x-y}$. In most of these solid solutions ($0<x<8$; $y<3$) clathrates with increasing x and simultaneous decrease of y tend towards a metal-insulator transition. In this context the validity and shortcomings of the Zintl concept for clathrates will be outlined. Via careful tuning of composition high Seebeck effects of positive and negative sign can be achieved. The correlations obtained, although not complete for many systems, may provide useful in defining compositional regions of interest for further search for novel clathrate materials with interesting thermoelectric properties. Intelligent nanostructuring will be essential in increasing ZT.

O.S.B.2.

NANOSTRUCTURED MATERIALS FOR OPTOELECTRONIC APPLICATIONS

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New way to improve the surface properties of the inorganic and organic materials via nanotubes treatment process has been shown. It has been testified that the surface mechanical hardness of the MgF_2, LiF, etc. materials can be increased up to 3-10 times under the conditions of the spectral range keeping. Some simple model to explain the results has been discussed. As an additional, some features of transparent conducting ITO contacts modified with surface electromagnetic waves have been found. The data presented in the current paper testified that these nano-objects-optimized materials could be used as new elements and new laser window for the UV and IR spectral range.

O.S.B.3.

A SYNTHESIS TOOLBOX FOR WELL-DEFINED CATALYST COATINGS: NANOPARTICLES OF NOBLE METALS SUPPORTED ON MESOPOROUS OXIDE FILMS

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The properties of solid catalysts are often size dependent on a nanometer scale, which is e.g. evident for metal nanoparticles such as gold where only small particles are catalytically active. Since heterogeneous catalytic reactions typically include several stages - mass transfer, pore diffusion, adsorption and reaction - catalysts properties are also determined by the supports structure. Optimal performance thus requires understanding and control of the support morphology and the number and structure of active sites. The present work explores methods for the synthesis of wall-coated catalyst layers comprising templated mesoporous metal oxides and noble-metal nanoparticles. Parameters such as pore size, film thickness and particle size were systematically varied to study the corresponding impact on activity and selectivity of the materials in the catalytic hydrogenation of butadiene.

O.S.B.4.

POWDER METALLURGY MANUFACTURING OF CARBON-FREE PRECIPITATION HARDENED HIGH SPEED STEELS

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Carbon-free steels of the type Fe-Co-(Mo,W) have been known for long to attain very high hardness levels through precipitation hardening. However, the classical ingot metallurgy route tended to result in brittle materials. Here it is shown that the powder metallurgy route through mixing of elemental powders, pressing and sintering results in materials with excellent combination of hardness and transverse rupture strength if the processing parameters are adjusted accordingly, in particular sintering and heat treatment being critical stages that should result in chemically homogeneous and fine-grained microstructure. If properly processed, these steel grades offer excellent red hardness since the hardening intermetallic phases are much less sensitive to overaging than the secondary carbides in standard high speed steels.

O.S.B.5.

THERMAL EXPANSION AND MECHANICAL PROPERTIES OF SKUTTERUDITES

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Novel skutterudites (micro- and nanostructured) were prepared with didymium as filler in the structure of ternary skutterudites $DD_y(Fe_{1-x}Co_x)_4Sb_{12}$ and $DD_y(Fe_{1-x}Ni_x)_4Sb_{12}$ in order to improve the thermoelectric properties. Thermoelectric behaviour has been characterized by measurements of the electrical resistivity, thermopower and thermal conductivity in the temperature range from 4.2 to 800 K and ZT was calculated reaching ZT > 1. The density, Vickers microhardness, the elastic and shear modulus were also measured. All these results showed that these new skutterudites are good candidates for thermoelectric devices. For selected samples thermal expansion at low and high temperatures was measured and evaluated. These data were compared and discussed in view of a comprehensive collection of expansion data taken from literature on phosphide, arsenide and antimonide skutterudites.

O.S.B.6.

NOVEL BORIDES IN THE SYSTEMS M-T-B. PHASE EQUILIBRIA AND CRYSTAL STRUCTURES

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Search for novel materials with strong electron correlations turned our attention to T-Ir-B combinations. In several of these systems representatives exist of the $Cr_{23}C_6$-type (τ-phases). Phase relations in the Ir-Fe-B system were investigated revealing a large homogeneity region of the τ-phase in equilibrium with a ternary Fe_3C-type $Fe_{3-x}Ir_xB$ compound (x=1.06). Equilibria at 970°C are furthermore characterized by an extended Fe/Ir substitutional solid solution originating from binary Fe_2B. Crystal structures of $Fe_{3-x}Ir_xB$, τ-IrFeB (a=1.11020 nm) and related τ-IrCoB (a=1.09359 nm) have been evaluated from X-ray single crystal data. The M-T-B systems (M=transition metal, lanthanide and actinoid metal) will be discussed in the terms of formation, stability range and structural arrangements for the metal rich region.

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O.S.B.7.

PHASE RELATIONS AND ADVANCED CERAMIC IN THE SYSTEMS FORMED BY CERIUM AND RARE-EARTH OXIDES

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Phase diagrams in CeO_2, ZrO_2 and Ln_2O_3-bearing systems are of fundamental importance in many applications. Materials based on ceria, zirconia and rare earth oxides are perspective for application in medicine, energy production and machine building because of unique combination of their properties. The phase diagrams of the systems are considered the physicochemical background for creation of such materials as solid electrolytes in fuel cells, oxygen sensors, catalyst carriers, refractory for furnaces, thermal barrier coatings alloys and so on. Solid solutions based on ceria represent the most perspective electrolytes operating at moderate temperatures because their ionic conductivity and high sensitivity to oxygen partial pressure is much higher than in yttria-stabilized zirconia solid solutions. Thermal barrier coatings with double ceramic layer CeO_2 and 8YSZ, or 8YSZ with pyrochlore-type phase $Ln_2Zr_2O_7$ demonstrate high melting temperature, lack of phase transformations at room and operating temperatures, low thermal conductivity, chemical inertness, low mismatch between thermal expansions of ceramic coating and metallic substrate, sufficient adhesion of coating to metal substrate and extra-low rate of ceramics sintering. Doping of ceria with low-valence ions, such as Ln^{3+} and Y^{3+}, to CeO_2-ZrO_2 is effective to suppress an undesirable ion segregation in the phases based on ceria and zirconia in so called ceramic carriers of catalysts, which must be reliable in the course of long-term exploitation.

Phase equilibria in the ternary systems ZrO_2-CeO_2-Ln_2O_3 as well as phase relations in the boundary binary system CeO_2-Ln_2O_3 were studied at 1500, 1100 °C in air in the whole concentration range. X-ray diffraction and electron microprobe X-ray diffraction and petrography were used to determine phase contents. The microstructures of the sintered ceramic samples were examined by using the scanning electron microscopy (SEM).

In the subsolidus area of the phase diagrams ZrO_2-CeO_2-Ln_2O_3 solid solutions based on tetragonal (T) ZrO_2, cubic with fluorite-type structure (F) CeO_2, hexagonal (A) La_2O_3, cubic form of rare-earth oxides (C-type) and monoclinic (B) forms Sm_2O_3 and Gd_2O_3 as well as intermediate phase with pyrochlore-type structure $Ln_2Zr_2O_7$ were determined.

The isothermal sections at 1500, 1100°C for the ternary systems ZrO_2-CeO_2-La_2O_3, ZrO_2-CeO_2-Sm_2O_3 and ZrO_2-CeO_2-Gd_2O_3 were developed.

O.S.B.8.

HETEROSTRUCTURES ON A BASE OF ADVANCED SUPERIONIC CONDUCTORS - NEW FUNCTIONAL MATERIALS FOR NANOIONIC SUPERCAPACITORS

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Nanoionics of advanced superionic conductors" (AdSICs) – the new scientific and technological discipline was first introduced in our previous work [Despotuli A.L., Andreeva A.V., Rambabu B. Nanoionics of advanced superionic conductors // Ionics, 11, 306 (2005)]. AdSICs are crystals with a record high level of ionic conductivity $\sigma_i \approx 0.3$ Ohm^{-1} cm^{-1} (300 K) and a low value of activation energy E~0.1 eV, such as α-AgI, $RbAg_4I_5$, etc. The crystal structure of AdSICs with "channels" for moving ions, is close to optimal for fast ion transport (FIT), however it is disturbed on arbitrary heteroboundaries. This leads to suppression of FIT in the AdSIC-nanosystems (sharp decrease of σ_i and increase of E). Fundamental challenge of nanoionics of AdSICs is conservation of FIT at functional AdSIC/electronic conductor (EC) heterojunctions. The interface design methods at nanoscale allow finding the conditions and materials for synthesis of structure-ordered (coherent) AdSIC/EC interfaces. A coherent heterojunction provides conditions for FIT at the interface and capacitors with these heterojunctions have been called nanoionic supercapacitors (NSC). Theoretical estimates and experimental data on NSC-prototypes with capacity density $\delta_\mathrm{C} \approx 100$ μF/cm^2 and high operation frequency are presented. The NSC and AdSIC are expected to be of great technological and commercial advantage and may be used in many important challenges. The decrease of energy consumption per 1 bit processing (ε) and power supply voltage (V_{dd}) of integrated circuits (ICs) are long term tendencies in micro- and nanoelectronics. In this framework, deep-sub-voltage nanoelectronics (DSVN), i.e. ICs of ~10^{11}-10^{12} cm^{-2} component densities operating near the theoretical limit of ε, is sure to find application in the next 10 years. In nanoelectronics, the demand on high-capacity capacitors of micron sizes sharply increases with a decrease of technological norms, ε and V_{dd}. Creation of high-capacity capacitors of micron size to meet the challenge of DSVN and related technologies is considered.

O.S.B.9.

COMPARISON OF OXIDE AND NITRIDE THIN FILMS – ELECTROCHEMICAL IMPEDANCE MEASUREMENTS AND MATERIALS PROPERTIES

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Oxide and nitride films are being examined for anti-corrosion applications. In this study, aluminum oxide, cerium oxide, and silicon nitride thin films are fabricated via two different techniques. The thickness range of such films is between 100 nm and 3 micrometers. Electrochemical Impedance Spectroscopy (EIS) measurements are utilized to evaluate various films on carbon steel substrates, including Open Circuit Potential (OCP), polarization and impedance measurements. Based on the EIS results obtained, a silicon nitride film has the highest impedance modulus and the lowest corrosion current among the films tested. The materials properties are measured via X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Energy-dispersive Spectroscopy (EDS), and X-ray Photoelectron Spectroscopy (XPS).

O.S.B.10.

CHANGES IN ODS SUPERALLOY MATERIALS INDUCED BY HIGH TEMPERATURE EXPOSITION IN DIFFERENT ENVIRONMENTS

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Mechanically alloyed ODS materials MA 6000 and MA 956 have been annealed at 1100ºC for 24 and 240 hours in air, vacuum of 10^{-3} Pa and hydrogen. Mechanical properties after annealing were then tested at normal temperature. Mass changes due to oxidation and evaporation were also measured. Fracture surfaces, microstructure of the materials and changes in chemical composition were examined. The results of mechanical tests yielded generally only small changes of mechanical properties after all expositions. MA 6000 specimens showed mass loss during the exposure. This is explained by evaporation, formation of voids and formation of oxides. Mainly chromium oxides have been identified on MA6000, these did not adhere well to the surface of the samples, hence the mass loss. On MA956 aluminium oxides formed a uniform, well adherent layers, hence the mass gain during oxidation. In case of hydrogen exposition, MA956 developed aluminium oxide layer with titanium particles embedded in it.

O.S.B.11.

$BaTi_{0.975}Sn_{0.025}O_3/BaTi_{0.85}Sn_{0.15}O_3$ FUNCTIONALLY GRADED MATERIALS: MASTER SINTERING CURVES AND ELECTRICAL PROPERTIES

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The most important aim in the design and processing of functionally graded materials (FGMs) is to obtain high-quality microstructure, and to produce devices free from any form of deformation. During sintering of BTS2.5/BTS15 FGMs, barium tin-titanate powders with different tin content ($BaTi_{0.975}Sn_{0.025}O_3$ and $BaTi_{0.85}Sn_{0.15}O_3$, denoted as BTS2.5 and BTS15, respectively) show different shrinkage rates and different extents of shrinkage, as well as different final density. This phenomenon can lead to excessive shape distortion, warping, delamination, crack development and microstructural damage in the FGMs. Therefore, to achieve high-quality FGM it is desirable to predict the sintering process for each layer in FGM and to design sintering strategies. The master sintering curve (MSC) model is suitable approach to make quantitative predictions of the densification behavior, and to design sintering procedure to prepare high-quality ceramics. Here, BTS2.5/BTS15 FGMs are prepared by the powder-stacking method and uniaxially-pressing process, followed by sintering. The MSCs were constructed, for BTS2.5 and BTS15 graded layers in FGMs, using shrinkage data obtained by a heating microscope during non-isothermal sintering up to 1420 °C with heating rates of, 2, 5, 10 and 20 °/min. The effective activation energies, determined using the concept of MSC, were 359.5 and 340.5 kJ/mol for graded layers BTS2.5 and BTS15, respectively. A small difference of the effective activation energies of chosen powders allowed preparation of high-quality FGMs, without delamination, distortion or other forms of defects.

Electrical characteristics of such BTS2.5/BTS15 FGMs prepared by non-isothermal sintering were determined by an *ac* impedance spectroscopy (*IS*). The *IS* results were used to distinguish the grain-interior and grain boundary resistivity of the ceramics, furthermore, to calculate activation energies for ionic conductivity. The activation energy as deduced from grain-interior conductivity is defined by chemical composition and does not depend on microstructure, while activation energy from grain boundary conductivity is influenced by microstructural development (density and average grain size), and vary for differently non-isothermally treated BTS2.5/BTS15 FGMs. No point dissipation is observed by *IS*, confirming that no insulator interfaces (cracks and/or delamination) between graded layers exist. We found that a smart choice of the heating rate during sintering is important for the fabrication of FGMs with desired electrical properties.

O.S.B.12.

TO THE THORY OF DIRECTIONAL SOLIDIFICATION OF A BINARY ALLOY WITH A MUSHY LAYER. THE EFFECT OF NONLINEAR LIQUIDUS SLOPE

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Many properties of solid materials are determined by the solid-liquid phase transitions. As a result of interaction between thermal and diffusion transport in the processes under consideration, the phase transition proceeds in the zone of mixed solid–liquid state named mushy layer. We consider the quasiequilibrium solidification model of the unidirectional process from a cooled wall. Analytical limitations are derived for possible crystallization regimes with a mushy layer depending on solidification parameters. The case of nonlinear liquidus equation is taken into account.

O.S.B.13.

CHARACTERIZATION OF $LiMF_4:RE^{3+}$ MULTIFUNCTIONAL MATERIALS BY HIGH-RESOLUTION OPTICAL SPECTROSCOPY

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$LiMF_4$ (M=Y or Lu) scheelite type single crystals doped with rare-earth (RE) ions are well-known optical materials for laser applications and theoretical research. Nowadays, they attract attention again, in connection with quantum information processing and storage. For these applications, it is important to know precisely the positions of the RE crystal-field (CF) levels, including the hyperfine sublevels, and to have information on the electron-phonon and ion-ion interactions. The method of high-resolution optical Fourier spectroscopy ensures the best absolute precision of the wave number scale and a detailed knowledge of the line shapes in a very broad spectral range.

In this paper, we present the results on $LiMF_4$ single crystals doped with Pr^{3+}, Tm^{3+} or Ho^{3+}, obtained using the high-resolution Fourier spectroscopy. Samples of high optical quality oriented along or perpendicularly to the crystallographic axis *c* were studied. High-resolution (up to 0.005 cm^{-1}) polarized absorption spectra were registered in the wide temperature (4.3-300 K) and spectral (2000-25000 cm^{-1}) ranges.

Isotopic and hyperfine splittings of several lines were observed in the spectra of $LiMF_4:Tm^{3+}$ and $LiLuF_4:Pr^{3+}$. The isotopic effects are caused by the isotopic disorder in the lithium sublattice but observed hyperfine structure is due to the magnetic hyperfine interaction.
It was shown that a coupling between the RE ions gives rise to new lines in optical spectra. The nature of the coupling and types of the RE-RE dimers are discussed. We observed an interesting manifestation of the resonant electron-phonon interaction in $LiYF4:Tm^{3+}$. The resonant broadening of the ground state occurs due to the precise coincidence of the energy gap between the two CF levels and the energy position of the peak in the density of phonon states of the crystal. Finally, as a result of our investigation, the scheme of CF levels of Pr^{3+} in the $LiLuF_4$ host was obtained.

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O.S.B.14.

ANOMALOUS HALL EFFECT IN THE SPIN-GLASSLIKE (Ge,Mn)Te-(Sn,Mn)Te

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The family of (IV,Mn)VI semiconductors offers the unique opportunity of controlling their magnetic and electrical properties by means of changes of chemical composition. An example of such a material is $Ge_{1-x-y}Sn_xMn_yTe$ mixed crystal. In this material, we observed, for the first time in GeTe based group of semimagnetic semiconductors, the spin-glasslike phase at temperatures as high as 50 K [1]. In the present paper, we report the results of investigation of the Hall effect, magnetoresistance, and magnetization in $Ge_{1-x-y}Sn_xMn_yTe$. The chemical composition of the studied samples changed in the ranges from 0.012 to 0.115 and from 0.09 to 0.142 for molar fractions x and y, respectively. The measurements were performed in magnetic fields up to 13 T and at temperatures between 1.3-200 K. At temperatures below 100 K, we observed the Anomalous Hall Effect (AHE) and negative magnetoresistance. Simultaneous analysis of the results of measurements of the Hall effect and magnetization enabled us to perform qualitative description of the AHE results. The dependence of the AHE coefficient R_s on temperature for samples with varying chemical composition were determined. It may be noted that in both, the magnetization data and the Hall effect data, a hysteretic behavior was observed. We interpreted the negative magnetoresistance, observed below 100 K, as a manifestation of the weak localization effects. The obtained temperature dependencies of the spin coherence length L show significant changes for crystals with different chemical composition.

[1] L. Kilanski, M. Arciszewska, V. Domukhovski, W. Dobrowolski, V.E. Slynko, and I.E. Slynko, J. Appl. Phys. **105**, 103901 (2009)

O.S.B.15.

OPTICAL PROPERTIES OF PLASTICALLY DEFORMED COPPER

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Pure copper (99,99) prepared in the sample of square cross-sections (10x10 mm^2) and of length about 50 mm was extremely plastically deformed with the repeated application of Equal Channel Angular Pressing (ECAP). ECAP, which is known as one of discontinuous processes of severe plastic deformation was applied as an effective technique for producing bulk nano-scaled structures. It is well known that severe plastic deformation of metallic materials often leads to microstructure with ultrafine grains and cross-sections which remain about equal before and after deformation.

Optical properties were investigated using spectroscopic ellipsometry and Raman measurements. The analysis of the spectra was made by fitting procedure based on dielectric function which includes existence of CuO surface layer.

O.S.B.16.

MULTICOMPONENT POLYCARBONATE-BASED POLYURETHANE ELASTOMERS AND FILMS

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This contribution is aimed on polycarbonate-based polyurethanes prepared by one step procedure. Two polycarbonate diols (both of Mw ca 1000), differing in constitution of polycarbonate chain, hexamethylene-diisocyanate and 1,4-butane diol (chain extender) were used as reaction components. Dibutyltin dilaurate was applied as a catalyst. Some samples were reinforced by 1 wt. % of layered silicates (organically modified bentonite and montmorilonite). DMA, DSC, MDSC and SDT methods were used for characterization of materials end-use properties. Chemical structure of samples was determined using FTIR method and morphology was studied by SEM analysis.

O.S.C.1.

STRUCTURAL AND MAGNETIC CHARACTERIZATION OF HIGH MOMENT SYNTHETIC ANTI-FERROMAGNETIC NANOPARTICLES

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Synthetic anti-ferromagnetic nanoparticles (SAFs) are a novel type of magnetic material whereby ferromagnetic components are used to produce monodisperse nanoparticles with low magnetic remanence and high moment over a range of sizes. SAFs are fabricated using nanoimprint lithography, direct deposition of multilayer films and retrieval in liquid phase via an 'etching' release process. Such physical fabrication techniques enable accurate control of particle shape, size and composition. Each SAF is composed of two $Co_{90}Fe_{10}$ layers separated by a non-magnetic ruthenium spacer layer. Tantalum is used as a protective capping layer to passivate and stabilize the nanoparticles when they are suspended in water. We varied the processing conditions systematically to fabricate SAF nanoparticles of different configurations and performed extensive characterization using transmission electron microscopy and alternating gradient magnetometry to study their corresponding structural and magnetic behavior. In order for these nanoparticles to realize their full potential for the required applications, large volumes of particles will need to be fabricated. We demonstrate that it is possible to produce monodisperse SAFs using four-inch-diameter stamps that are made by nanosphere lithography driven by self-assembly of latex spheres. By changing the oxygen plasma etching time and the developing time for undercutting, the diameter of the imprinted holes can be varied, leading to SAFs with different diameters. The present paper describes the findings from our experiments.

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O.S.C.2.

TAILORING LOW-DIMENSIONAL SEMICONDUCTOR NANOSTRUCTURES FROM Si AND Ge NANOWIRES

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One-dimensional nanostructures such as nanotubes and nanowires have received increasing attention in recent years because of their possible application as future building blocks for new kinds of nanoscale devices. Carbon nanotubes have been the focus of much of the work; however, it has proven difficult to control conductivity in these structures, restricting their application. As a result, there is renewed interest in the synthesis and properties of semiconducting nanowires, such as Si, Ge, GaAs or ZnO.

Si and Ge are particularly attractive due to their compatibility with silicon semiconductor technology. The first-steps towards the fabrication of any devices are the controls of the synthesis and properties of nanowires. Many successful synthetic strategies have been developed to obtain bulk quantities of nanowires, using both gas phase and condensed phase techniques.

The growth of nanowires in these techniques is commonly described either by the vapor-liquid-solid (VLS), solid-liquid-solid (SLS) process or Vapor-Solid-solid (VSS).

I will first discuss these mechanisms from a thermodynamic point of view and will point out the conditions in which nanowires can be obtained. Then I will present recent progress in realization of alignment and orientation for a massive parallel assembly of silicon nanowires, and also 3D-nanostructure trees in which the trunk of SiNW serves as the substrate for the nucleation and growth of directionally controlled branches in Ge. This later configuration has been used to explore directly the vibrational behavior of single Ge nanowires without any external manipulation such as handling, connecting or clamping that could modify the measurements of nanowire properties. All these tailored nanostructures may find novel applications in areas ranging from nanosensors, nanoresonators or infrared detectors.

O.S.C.3.

SIZE ANALYSIS OF NANOPARTICLES BY SCATTERING EXPERIMENTS: THE RAYLEIGH DISTRIBUTION, A UNIVERSAL APPROACH

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Size analysis of nanometric particles (or pores) in so-called quasi-diluted two-phase systems can be performed by scattering experiments. For this, a certain order range must be fixed beforehand. Superficially considered, the Rayleigh distribution (RD) of (nearly) spherical particles with random diameter is a very special assumption for particle sizing. On the other hand, the behaviour of the chord length distribution (CLD) of the particles can be detected without any shape assumption. A comparison of CLD and RD in fundamental cases leads to the result: For globular shapes, the differences between RD and CLD are surprisingly small. This can be traced back to the carefully-investigated situation; performing an intersection of spheres with RD in diameter by a random plane, the distribution law of the resulting circle diameters is the same RD.

O.S.C.4.

PREPARATION AND THERMOELECTRIC PROPERTIES OF NANO SIZED $Mm_yFe_{4-x}Co_xSb_{12}$

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Thermoelectric behaviour was studied for $Mm_yFe_{4-x}Co_xSb_{12}$ (x=0, x=1; Mm=mischmetal) from 300 K to 800 K and was compared with data for $Ce_yFe_{4-x}Co_xSb_{12}$. At high temperatures there is no decrease of thermal conductivity by changing from a single filler (Ce) to a multi-element filler (Mm). The power factor for $Mm_yFe_{4-x}Co_xSb_{12}$ is about two times higher than for $Ce_yFe_{4-x}Co_xSb_{12}$ essentially caused by the low electrical resistivity of mischmetal filled skutterudites. Accordingly the figure of merit for $MmFe_3CoSb_{12}$ exceeds 1 at temperatures above 600 K. The influence of multiple parameters concerning impurity phases and grain size on the thermoelectric performance of $Mm_yFe_{4-x}Co_xSb_{12}$ was investigated by least squares fit. The decrease of the crystallite size from micro scale (>20 μm) to nano-scale (100-300 nm) in all cases improves the figure of merit by about 20 %.

O.S.C.5.

DIFFRACTION FROM NANOTUBES AND QUASI ONE-DIMENSIONAL CRYSTALS

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Intensity distribution for diffraction from arbitrary quasi-one dimensional crystal is calculated with help of symmetry classification of such systems onto fifteen conformation classes. Characteristic features of patterns are discussed. In particular, carbon nanotubes are single orbit systems generated by the fifth family line groups. It is shown how the identification of single-wall tubes can be performed in two steps: at first we reconstruct the line group from the pattern, and afterwards the chirality indices are found easily due to the biunique correspondence of the single-wall carbon nanotubes and their symmetry groups. A comment on the diffraction from double- and multi-wall nanotubes is made.

O.S.C.6.

ELECTRON-PHONON INTERACTION IN GRAPHENE

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Symmetry based analysis of the electron-phonon interaction in graphene is performed. Some nontrivial physical properties of graphene are shown to be direct consequence of symmetry, independent on the applied dynamical model. Namely, it is found that there are vibronically uncoupled non symmetric modes which thus might be responsible for the stability of the honeycomb lattice. Symmetry also predicts vanishing of the electron-phonon interaction for quite a number of the normal displacements. Consequently, lattice dynamics along these degrees of freedom is governed by the ion repulsion which leads to the anharmonic terms, being linear in absolute elongation. In particular, this effect is attributed to the K and Γ points of the Brillouin zone, giving insight into origin of the Kohn anomaly. The results are further numerically confirmed within full and tight-binding density functional calculations and force constants model.

O.S.C.7.

QUANTUM CASCADE LASER DESIGN FOR CHEMICAL SENSING AND DETECTION IN THE INFRARED SPECTRAL RANGE

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We present a method for systematic optimization of quantum cascade laser active region, based on the use of genetic algorithm. The method aims at obtaining a gain-maximized structure, designed to emit radiation at specified wavelengths suitable for detection of pollutant gasses in the ambient air by means of direct absorption. After the initial optimization stage, we introduce a strong external magnetic field to tune the laser output properties and to extend the applicability of the given structure to detection of additional compounds, absorbing at wavelengths close to the original one. The magnetic field is applied perpendicularly to the epitaxial layers, thus causing two-dimensional continuous energy subbands to split into series of discrete Landau levels. This affects all the relevant relaxation processes in the structure and consequently the lifetime of carriers in the upper laser level. Since the arrangement of Landau levels depends strongly on the magnitude of the magnetic field, this enables one to control the population inversion in the active region, and hence the optical gain. Furthermore, strong effects of band nonparabolicity result in subtle changes of the lasing wavelength at magnetic fields which maximize the gain, thus providing a path for fine-tuning of the output radiation properties and changing the target compound for detection. Numerical results are presented for GaAs/$Al_xGa_{1-x}As$ based quantum cascade laser structures designed to emit at specified wavelengths in the mid-infrared part of the spectrum.

O.S.C.8.

FORMATION OF CONDENSED DNA NANOPARTICLES INDUCED BY SPERMINE AND HEXADECYLTRIMETHYLAMMONIUM BROMIDE: DYNAMIC LIGHT SCATTERING AND FLUORESCENCE CORRELATION SPECTROSCOPY STUDY

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Both dynamic light scattering (DLS) and fluorescence correlation spectroscopy (FCS) are techniques which can be used for measurements of diffusion coefficients of colloids in solution. The advantage of DLS in comparison with FCS consists in the exponential form of individual contributions to autocorrelation functions, which facilitates the treatment of polydisperse systems and/or separation of translational diffusion motions of the particles from their internal motions by means of the inverse Laplace transformation. In this communication, we compare the results of a study of circular 10 kbp DNA condensation induced by spermine and hexadecyltrimethylammonium bromide. We show that both methods provide qualitatively similar dependences of DNA hydrodynamic radii on condenser-to-basepair ([c]/[bp]) ratio, despite the fact that at high [c]/[bp], the dominating fluctuation visible by DLS is the diffusive motion of large aggregates of condensed DNA instead of the diffusion of single condensed DNA molecules.

O.S.C.9.

SYNTHESIS OF NANOSTRUCTURAL AND AMORPHOUS ALLOYS FROM ELEMENTARY POWDERS BY INTENSIVE PLASTIC DEFORMATION UNDER HIGH PRESSURE

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Synthesis of alloys from elementary powders with the use of intense plastic deformation under high pressure is one of the most perspective techniques to produce new materials. However, in spite of the practical importance of this method, there are only a few works related to the study of the structure of alloys produced under different synthesis conditions. In this work, results of systematic structural study of a large group of alloys fabricated from elementary powders are presented. The Zr−Ti, Zr−Cr, Zr−Nb, Zr−Mo, Zr−Fe, Zr−Co, Zr−Ni, Zr−Cu, Zr−Zn, Zr−Al, Ti−V, Ti−Cr, Ti−Ni, Ti−Cu, and Al−Fe alloys were synthesized by mechanical alloying of powders at room temperature using torsion under pressure 2−5 GPa. The structure of samples was studied by X-ray diffraction analysis and optical and transmission electron microscopy. The results of investigation show that the peculiarities of formation structure are affected by both the type of interacting metals and their volume fractions in the mixture. After deformation under high pressure, the minimal grain size in pure zirconium or titanium is 30−40 nm. The synthesized alloys of the Zr−Ti system have the same grain size. In binary alloys of titanium and zirconium with *d* metals, the formation of nanocrystalline or amorhoups state depends on the volume fractions of components in the initial mixture. With increasing amount of alloying element, the grain size significantly decreases, and in the alloys close to equiatomic compositions, an amorphous state is observed. The amorphous state was obtained in the Ti−Ni, Ti−Cu, Ti−Co, Zr−Ni, Zr−Co, Zr−Zn and Zr−Cu alloys. Mechanical alloying under high pressure results in the increase of the solid solubility of alloying metal in titanium or zirconium. In the Ti−Ni and Ti−Cu systems, the solubility of nickel in titanium grows up to 13 at.%, and of copper up to 10 at.%. In the course of mechanical alloying, high-pressure phases and intermetallic compounds are found to form.

O.S.C.10.

NANO ALPHA-ALUMINA POWDERS AND DENSE CERAMICS. CHALLENGES AND ACHIEVEMENTS

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The main difficulty in the formation of nano alpha-alumina powders is stipulated by considerable rearrangement of crystal lattice in transition from intermediate alumina phases to its stable modification. High value of activation energy of the process requires a temperature of about 1200°C and consequently leads to coarse grained powder whichever method of preparation being used. With this in mind, to prepare nanopowder one have to either find out a way to reduce the activation energy or to subject coarse powder to intensive milling. Both approaches have been used and the resulting nanopowders of 20nm by the former and 50nm by the latter approach obtained. The properties of the powders responsible for their behavior in ceramic processing have been investigated. Nearly full dense materials have been obtained by pressureless sintering at no more than 1300°C.

O.S.C.11.

ELECTRON TRANSPORT THROUGH SINGLE PHTHALOCYANINE MOLECULES WITH STM

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A new approach in miniaturization of electronic devices is the study of molecular electronics, i.e., the fabrication of circuits at the molecular scale. Electron transport through single molecules is at the heart of this approach and has as such become a question of general interest in view of its possible applications. The most important characteristics of a molecular junction are the electron transfer rates between the metal electrodes contacting the molecule and the molecule itself, as well as the transmission of electrons through the molecular orbitals. By using a low temperature scanning tunnelling microscopy (LT-STM), electron transport across single H_2- or Co-phthalocyanine molecules was studied. The molecules were deposited onto clean Cu(111) surface and Co nano-structures on Cu(111) and were contacted through a controlled approach of the tip. Soft phonons from the molecular side groups promote a discrete jump to contact followed by bond formation. Molecular conductance strongly depends on the substrate but not on the central atom of the molecules. This is explained by charge transfer and hybridization of the molecular orbitals with the substrate states as seen by scanning tunnelling spectroscopy.

O.S.C.12.

NANOSTRUCTURE AND PHASE FORMATION UNDER SEVERE MECHANICAL TREATMENT OF Fe-BASED SYSTEM

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So far, the mechanism of phase formation under mechanical alloying and grinding is a subject of extensive studies. The results on nanostructure formation, mechanical alloying of Fe-based binary systems with interstitial (B, C) and substitutional (Al, Si, Ge, Sn) elements, deformation-induced dissolution of interstitial (Fe_2B, Fe_3C) and substitutional (FeSn) phases in α-Fe are presented in this report. The following scheme of nanostructural formation is considered: increasing of dislocation density → polygonization → dislocation pile-up → dynamic recrystallization (grain size $L \approx 100$ nm) → deformation twinning and polymorphous transformation ($L \leq 10$ nm).A term of interface in nanostructure is defined as the area including boundary and close-to-boundary distorted zones. The width of interface has been estimated to be equal of about 1 nm.It has been established that solid-state reactions under severe mechanical treatment begin on condition that α-Fe reaches nanostructural state. The next stage includes penetration of the second component (B, C, Al, Si, Fe, Sn) atoms along grain boundaries of α-Fe and its segregating at boundaries. This segregation is the source to form the first phase in interfaces. Depending on the type of the second component, different phases can be formed: intermetallic compounds, supersaturated solid solutions and amorphous phases.

O.S.C.13.

WEAR CHARACTERISTICS OF ORBITAL FORGED MATERIALS

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The paper focused on the wear mechanism of orbital forged Cu-OFHP (oxygen free high purity) material. The wear behaviour of the Cu-OFHP material is investigated through pin-on-disk tests. Two different processing conditions have been used, ECAP process and then orbital forging. The wear investigations in this orbital formed material are unique; additionaly wear properties shows interesting wear characteristics. Particular attention has been also paid to the friction coefficient and to the role of wear rate.

O.S.C.14.

NICKEL NANOPARTICLES FOR CATALYTIC APPLICATIONS

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Spherical and oxidized Ni particles with different fractional sizes (15-200 nm) were prepared via the crucible-free aerosol method by vapor condensation of the pure metal in an argon (helium) gas flow accompanied by an oxidization process. They were characterized by SEM, EDX, XRD, BET and VSM. The optimum regimes (Ni wire feed rate, gas flow rate) for production of the particles with given sizes, specific surface and saturation magnetization were established. To govern an oxidation ratio of the particles the oxidizing was conducted in situ in dc electric fields (up to 1 MV/m). To create a catalytic coating flowed oxidized particles were immediately deposited on appropriate substrate by using a dc magnetic field. The hydrocarbons oxidation and vapor conversion of hydrocarbon fuels due to the oxide-metal reduction on the powdered samples and coatings were studied.

PL.S.III.1.

ELECTRON MICROSCOPY OF NANOPARTICLES FOR CANCER DETECTION

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One method for detecting cancer cells at early stages is to employ surface enhanced Raman spectroscopy (SERS). Noble metals are known to enhance remarkably the signal from the Raman dye. Suitably coated Ag and Au nanoparticles can then be attached to cancer cells with an active antigen (e.g. nanoparticles functionalized with CD54 antibodies attaching to U937 leukemia cells) and their presence measured by the intensity of the Raman signal. However, since Raman spectroscopy has relatively mild resolution, electron microscopy is essential to actually determine the locations and proportions of such nanoparticles to the cells. This paper describes the direct observation of Ag-based composite organic-inorganic nanoparticles (COINs) and Au-based Oxonica nanoparticles (silica coated gold) and correlates the observations with the Raman intensities. While a greater volume of nanoparticles is associated with higher Raman intensity, there is no observable simple correlation between them. Efforts to establish the particle surface Raman states and the imaging of the biological entities by electron energy loss methods will also be presented.

Funding for this work has been provided by the Stanford Center for Cancer Nanotechnology Excellence Focused on Therapy Response (CCNE-TR) grant (NIH U54).

PL.S.III.2.

SYNTHESIS AND CHARACTERIZATION OF HIGH-QUALITY GRAPHENE

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Graphene is one of the most prominent research topics today in the areas of chemistry, condense-matter physics and materials science. It represents a new class of materials, sp^2-bonded two-dimensional carbon honeycomb lattice, only one atom thick with unique combination of electronic, mechanical, and thermal properties. This presentation will demonstrate how free-standing graphene layers were synthesized from ethanol by a novel substrate-free method in an atmospheric-pressure microwave plasma reactor. The quality of the synthesized graphene was determined using Fourier transform infrared spectroscopy (FT-IR), Raman spectroscopy, x-ray photoelectron spectroscopy, elemental analysis, and an aberration-corrected transmission electron microscopy, which is capable of clearly resolving individual carbon atoms and measuring of individual C-C bond lengths at an accelerating voltage of 80 kV.

PL.S.III.3.

MONOLITHIC CMOS ACTIVE PIXEL SENSORS FOR DIRECT DETECTION IN ELECTRON MICROSCOPY

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In this presentation we will discuss novel detectors for electron microscopy currently being developed at Lawrence Berkeley National Laboratory (LBNL). CMOS Active Pixel Sensors (APS) – commonly used as cell phone cameras – have been of interest as charged particle detectors for about a decade. (An APS is a CMOS integrated circuit, with an imaging region divided into pixels, and a signal processing region. The pixels are “active” as they contain transistors used for buffering the charge collected and then steering it.) APS offer several attractive possibilities for electron microscopy:

- Single electron sensitivity
- Excellent point spread function
- High-speed readout

Within the TEAM Project (http://ncem.lbl.gov/TEAM-project/index.html) we have developed 1k x 1k and 2k x 2k detectors with high sensitivity and 400 frame/second readout. The physics and technology of direct electron detection will be presented, along with current performance and future plans.

PL.S.III.4.

MULTISITE STIMULATION AND SENSING BY CUSTOM LSI CHIP BY CMOS TECHNOLOGY AND MICROELECTRODE ARRAY

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Neuron sensing and stimulation techniques using a microelectrode array (MEA) are key importance for the development of a brain-machine interface. We have developed neural sensing and stimulation systems with a microelectrode array (MEA). The system has functions for recording and stimulating a neural signal on the same electrode. The MEA substrate is fabricated using photolithography. On glass substrates, a thin indium-tin-oxide (ITO) layer is deposited to form the electrode-array patterns by etching. The surface of 8 x 8 square grid (64 sites) were electrochemically polymerized from a blend of poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate) (PEDOT-PSS) and ethylenedioxythiophene (EDOT) onto ITO microelectrodes to reduce interface impedance to around several 10 kΩ at 1kHz that is lower enough for sensing and stimulation.

Our current system consist huge equipments therefore unsuitable for future mobile applications. CMOS technology has the big potential for high-density integration and digital or analog processing with low power consumption. We have developed 16 channel preamplifiers with stimulation signal formation circuits on a 2.4 x 2.4 mm^2 chip by 0.18 μm triple-well process. The preamplifier circuits can amplify a small neural signal with chopper operation to prevent the relatively large flicker noise. The stimulation circuits can apply the voltage ±700 mV to any channel and timing using serial digital data. The bi-phase stimulation waveform can be formed on the LSI chip. That function was confirmed by the connection to the conventional system. The miniaturization of the system by the custom LSI will have the great advantage for the future brain machine interface applications.

PL.S.III.5.

MICROSTRUCTURE EFFECT ON EM-INDUCED DEGRADATIONS IN DUAL-INLAID COPPER INTERCONNECTS

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A novel physical model and a simulation algorithm are used to predict EM induced stress evolution in dual-inlaid copper interconnects. Simulation is employed to investigate the dual effect of the microstructure, which consists of (a) the effect of GBs as the sources/sinks for vacancies and plated atoms and as the channel for vacancy migration, and (b) the effect of texture-related variations of the modulus of elasticity on the stress evolution in copper lines caused by EM. The major difference between our approach and the previously described ones is the accounting of additional stress generated by the plated atoms. As it is shown this stress plays an important role in the vacancy equilibration. The results of the numerical simulation have been proven experimentally by EM degradation studies on fully embedded dual-inlaid copper interconnect test structures and by subsequent microstructure analysis, mainly based on electron backscatter diffraction (EBSD) data. The virtual EM-induced void formation, movement and growth in a copper interconnect were continuously monitored in an *in-situ* scanning electron microscopy (SEM) experiment. The copper microstructure, particularly the orientation of grains and grain boundaries, was determined with EBSD. Microstructure has a significant influence on grain boundary diffusivity and on stress evolution. For interconnects with interfaces that resist atomic transport and where grain boundaries are the important pathways for atom migration, degradation and failure processes are completely different for microstructures with randomly oriented grain boundaries compared with "bamboo-like" microstructures. The correspondence between simulation results and experimental data indicates the applicability of the developed model for optimization of the physical and electrical design rules. Simulation-based optimization of the interconnect architecture, segment geometry, material properties and some of the process parameters can produce on-chip interconnect systems with a high immunity to EM-induced failures.

PL.S.III.6.

MAGNETORESISTANCE IN POSITIVE AND NEGATIVE EXCHANGE BIAS Ni/FeF$_2$ BILAYERED ANTIDOTS

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The comprehensive explanation of the exchange bias phenomenon (EB) in nanostructured materials still remains a challenge, despite the number of experimental and theoretical investigations. In this talk, we will review some of the main experimental observations related to the occurrence of EB in those systems, focusing the attention on the phenomenology associated to the so-called negative and positive EB. The main open questions posed by the experimental observations will be discussed and contrasted to existing theories and models for EB. We will also discuss our recent results in nanoelements, including a model based on the micromagnetic simulations that are in agreement with experimental observations.

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PL.S.III.7.

SUPERHARD AND SUPERPLASTIC BRITTLE NANOMATERIALS

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It is well known that nanomaterials-based metals and alloys are characterized by the high values of strength (hardness) and poor ductility. On the one hand, this is connected with a big part of interfaces as stoppers for dislocation moving and, on the other hand, the grain size decrease tends to limited dislocation activity and other deformation mechanisms (such as grain boundary sliding and grain boundary cracking) fall into first place. As applied to nanometals and nanoalloys, these problems are widely discussed in many books, reviews and papers. In contrary, the information on strength and deformation of brittle nanomaterials-based intermetallics, carbides, borides, nitrides, and oxides is not so comprehensive and seems to be very limited. This report presents a brief overview in this field. The high hardness values (at the diamond level) have been independently observed by USA/Sweden, Russian, German and Austrian researchers in both multilayer nitride films and monolayer boride films about 15-20 years ago. There are some interesting features on the deformation of these superhard films. The SEM fracture surface studies of TiN nanostructured films/bulks were found to be the intergranular type of crack propagation. This type of fracture can be explained by estimation of the length of Griffith embryonic equilibrium crack which is about 10 µm in length. Then such long crack does not take places in nanostructure with a grain size of 100 nm and lower. The deformation of these superhard films under indentation was found to be of homogeneous type (TiN films with a clear-defined columnar structure) and inhomogeneous that (TiB_2 films with a stone-like structure). The last type of deformation is characterized by the shear bands formation like in the case of the amorphous subjects. Interesting feature of the TiN film deformation is that the residual plastic deformation of brittle TiN columns after load indentation has been revealed. Direct observation of plastic deformation of SiC single crystalline nanowires was recently observed by Chinese scientists in SEM and TEM (in situ). The superplastic deformation of nanosized Si_3N_4 and oxide ceramics has been observed in compression over a wide range of strain rate and temperature (USA, Japan, Russia, etc.) So now there are many examples of ductility and superplasticity of brittle nanomaterials. However, many poor studied questions such as the nature of nanograin boundaries, the suppression of dynamic recrystallization and formation of nanograin boundary cracks and so on need more theoretical and experimental study.

PL.S.III.8.

GLASS-CERAMIC SCAFFOLDS FOR TISSUES ENGINEERING

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After "a historical ecursus" about the prostheses of the first and second generation, that brought to men suitable devices to solve in part or totally the problems linked to the degradation of some organs due to the congenital trauma, acquired and/or aging, the studies that are in progress (of the third generation) will be reported. The aim is to give rise to new devices (prostheses, scaffolds, etc.) able to host cells and genes for tissues engineering and as carriers for the controlled release of active principles.

It concerns of new ceramic-glass composition that give to the bioactive glasses, conceived by L.L.HENCH, remarkable applicative benefits, thanks to their mechanical properties, biocompatibility, at a controlled readsorbability, already applied with success in the odontoiatric, otorinolaringoiatric and as cements in bulk and as coating. The possibility to obtain porous devices (scaffolds) at bidimensional architecture thanks to their enough easy workability, proposes them as candidates to contain, with success, cells of different specialization thanks to a suitable sintering involving all the ions requested by cells and genes to rebuild damaged tissues without troubling the basic electro--magnetic fields of the cell membranes in their physiological turnover also favouring their re-establishment when necessary.

We are now in progress, through an international wide project, to redefine the scaffolds on the basis of cells trends suggesting numerous silico-calcium phosphates systems prepared either through fusion of raw materials or trying to obtain performance more and more suitable through sol-gel and wet-chemistry methods, thanks to a wide international collaboration.

At present the RKKP system represents the most efficaceous as glass --ceramic scaffold to host cells able to give rise to ripe and natural bone tissues when replace the damaged ones even if osteoporotic , thanks to the addition of elements as Ta2O5 and Al2O3 suitably distributed in the silico--calcium phosphate matrix.

We are in progress to ascertain if this kind of doped system (RKKP) could be efficaceous also to contain groups of genes asking about the mechanisms that trigger when they are in contact with the glass--ceramic scaffold RKKP from the point of view of their activity (their kind of work) an interactivity with the other genes (transduction, apoptosis, etc.) particularly making reference to the genomic control of the cycle of the osteoblasts.

O.S.D.1.

DETERMINATION OF POLYOLEFINE BASED COMPOSITES NANO STRUCTURE PARAMETERS BY VERY COLD NEUTRONS SCATTERING.

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A method for materials research based oneself on the unique properties of the very cold neutrons (VCN) (the VCN wave lengths are in nanometer range) have been developed in Lebedev Physical Institute [1]. The VCN scattering was successfully used in developing the polymerization intercalation technology of creation of the polymer nanocomposite based on polyethylene and laminated natural mineral montmorillonite [2], in developing the technology of creation of the polyethylene nonbornen co-polymer with better then polyethylene optical properties [3]. In this work VCN scattering was used to study the super molecular structure (SMS) of polyolefine based composites. The multywalled carbon nanotubes (MWCNT), calcium carbonate and montmorillonite submicron particles were used as the fillers. The first type filler was used to obtain the multi functional material with high modulus of elasticity and high electro- and thermo-conductivity. These properties depend on the parameters of the MWCNT and its distribution in composite. The second type filler was used to increase the stroking solidity of polypropylene without the loss of material cruelty. The coefficient of elasticity and the yield point dependencies on the filler concentration were obtained for. The montmorillonite/polyethilene sample was studied to compare its SMS with the same of the sample obtained by polymerization intercalation technology. All samples were obtained by melting polymer/filler mixture under the pressure. Special modification additions were used to change the polymer/filler interaction on the filler surface. The fractal type structure model was used to describe the VCN scattering on the fillers agglomerates. The volume part of isolated filler particles in composite was obtained by VCN scattering, as well as its average dimensions. The thickness of MWCNT wall was also determined by X-ray diffraction method. The coefficient of elasticity and the yield point dependencies on the filler concentration were obtained for $CaCO_3$/polypropilen composite.

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O.S.D.2.

IMPACT MODIFIED EPOXY AND THERMOPLASTIC NANOCOMPOSITES; REINFORCEMENT/COMPATIBILIZATION CONCEPT

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In nanocomposites with multiphase polymer matrix, the effect of organophilized nanoplatelets of clay is more complex than in conventional nanocomposites. As a result, mechanical reinforcement and increase of many other material parameters, like barrier properties and inflammability, are accompanied with simultaneous affecting of structure. Clay influences dynamic phase behaviour of polymer blend, the compatibilizing effect is significantly influenced by clay localization and degree of its dispersion. Moreover, clay may also influence morphology of dispersed inclusions by formation of complex structures. We present a study of both thermoplastic (PA 6, PET) and epoxy-based nanocomposites containing polymeric impact modifiers with clay-refined dimensions of inclusions and core-shell structure. The mechanisms leading to the formation of structures consisting of polymeric core and outer shell formed by stacks of clay platelets, especially the role of polymer/clay affinity, mixing protocol and combination of clays with different modification are discussed. Due to enhanced toughening efficiency of these complex particles and simultaneous influencing of polymer constituents parameters by dispersed clay, well balanced mechanical behaviour can be achieved. Most marked simultaneous enhancement of strength, stiffness and toughness was found in nanocomposite with PA 6/elastomer matrix. In the case of analogous epoxy nanocomposites, complex effect of clay on structure and mechanical behaviour of systems containing both liquid rubbers and hyperbranched polyesters is presented.

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O.S.D.3.

STRUCTURAL CHARACTERISATION OF ALUMINIUM – NICKEL COMPOSITES

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The aluminium matrix composites were prepared by HVOF spraying of nickel and nickel with 20 wt.% chromium powders onto the aluminium sheet's surface followed by annealing at the temperature 600°C and 630°C. Immediately after the annealing was the composites rapidly cooled by fan down to the room temperature. At the interface between the original coating sprayed and aluminium matrix the layers containing the Al_3Ni_2 and Al_3Ni intermediate phase compositions were created. These layers have tendency and some of them spalled out from the matrix surface during the cooling. Moreover nickel without the assistance of chromium diffuse into the aluminium matrix and produce stenghtening by stable Al_3Ni and metastable Al_9Ni_2 particles. It seems that the origin of the less known metastable Al_9Ni_2 phase also depends on fast cooling rate. The microstructures were obtained by scanning electron microscope and transmission electron microscope. Layers and Al+(Al_3Ni+Al_9Ni_2) band thickness measurements were realized by means of image analyses. Chemical compositions were estimated by energy dispersive microanalysis. Qualitative and quantitative X-Ray diffraction was used for determination of phases.

O.S.D.4.

CREATION OF MESOSTRUCTURAL MATERIAL WITH NANOCRYSTALLINE INCLUSIONS OF TITANIUM DIBORIDE BY QUASIDYNAMIC METHOD

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High-strength mesostructural composite (MC) was received by quasidynamic method. Copper or internal-oxidized copper (IOC) was used as a basis material for MC, and nanocomposite consisted of mixture contained 60 % copper and 40 % nanosize particles of titanium diboride (TiB_2) was used as a material of inclusions. The method of production of the material, characterized by high plastic deformations, has determined self-organizing of a microstructure together with conservation of the sizes of strengthening TiB_2 particles in the inclusions structure. Mechanical properties MC essentially exceeded properties of a matrix of composites: microhardness has increased by 1.6 times for MC with a basis from IOC and more than by 4 times with a basis from copper. Strength of MC by 2 times higher than IOC strength and deformation before destruction of the MC greater, than by 4 times. High plasticity MC is determined by absence of physical bond between components of a basis material and inclusions - between copper and particles TiB_2. Due to mobility of nanosize particles at loading the relaxation of stresses in a matrix - skeleton is essentially accelerated and resistance to destruction increases.

O.S.D.5.

MULTIMODE NDE APPROACH FOR ASSESSMENT OF COMPOSITE STRUCTURES IN AEROSPACE APPLICATIONS

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This work presents modern approach for damage detection in composite structures of aerospace applications. In such structures like Glass Reinforced Plastics GFRP as well as Carbon Reinforced Plastics CFRP different failure modes can occur during the service life of such elements. Failure modes are connected with the cycling fatigue loads, impact damage as well as environmental conditions. Moreover during the manufacturing process different damages occur and affect material strength. Failure modes and types of damage are following:

- Delaminations
- Disbonds
- Foreign object inclusions
- Porosity.

For the purpose of damage detection different NDE (Non Destructive Evaluation) techniques will be presented such as: ultrasonic, low frequency acoustics, IR thermography, shearography. The use of multimode techniques enables the characterization of different failure modes. It means that a single technique is not able to provide full possibility of detection of all failure modes.

Results describe detectability and Possibility of Detection (PoD) for flaws of different sizes, shapes and types. The specimens were prepared with some defects and inspection was performed with the use of selected techniques. That work proves the necessity of using Non Destructive Testing methods for the quality control and maintenance procedures of composite elements.

O.S.D.6.

INFLUENCE OF ECAP-BACK PRESSURE ON THE POROSITY DISTRIBUTION

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The main aim of presented paper is show how back pressure equal channel angular pressing (ECAP-BP) influenced the porosity distribution in powder metallurgy (PM) aluminium alloys. When back pressure is applied, the accumulation of damage in deformed samples decreases due to the fact that the shear strain takes place under predominantly compressive stresses state. Consequently, ECAP-BP influenced the porosity distribution in terms of the severe shear deformation involving. According to the obtained results, interesting applications for this new progressive method in physical and metallurgical research fields are shown.

O.S.E.1.

IMITATING THE GROWTH OF TOOTH ENAMEL

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Tooth enamel forms in the body over the period of 2 – 4 years by substituting the enamel matrix, a protein gel mostly composed of a single protein, amelogenin. Self-assembly of amelogenin and the products of its selective proteolytic digestion are presumed to direct the growth of elongated apatite fibers and their organization into bundles that eventually comprise the enamel, the hardest tissue in the mammalian body. The aim of this work has been replicating the biological formation of enamel in a programmable titration system wherein the growth of apatite substrates is initiated in the presence of the assemblies of amelogenin and its cleavage products following the reaction with matrix-metalloprotease-20, one of the two main proteases involved in the hydrolysis of amelogenin *in vivo*. The 7-day constant titration rate experiments designed so as to include a high initial concentration of phosphate ions and saturation equal to zero have resulted in a significant site-specific growth of the substrate apatite crystals. Despite their mainly hydrophobic nature, amelogenin nanospheres, the size and surface charge properties of which were analyzed using dynamic light scattering, were shown to act as a nucleation-promoting agent during the crystallization of apatite. The rate of proteolysis coupled to the crystal growth was also observed as directly proportional to the crystal growth rate, confirming a crucial effect of the proteolysis on the proper formation of enamel. The project is supported by the NIH/NIDCR grants R01-DE017529 and R01-DE015821.

O.S.E.2.

NOVEL THERMOPLASTIC POLYURETHANE ELASTOMERS BASED ON METHYL-12-HYDROXY STEARATE

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Novel vegetable oil-based elastomers were prepared from hydrogenated ricinoleic acid methyl esters. Polyester polyol with molecular weight 2500 was synthesized by transesterification of methyl-12-hydroxy stearate and 1,6-hexanediol. Segmented polyurethanes with 50 and 70% soft segment concentration (SSC) were prepared via the prepolymer method by reacting polyester polyol with diphenylmethane diisocyanate (MDI) and 1,4-butanediol as chain extender. Thermal and mechanical properties of polymers indicated good micro-phase separation. Both soft and hard segment displayed certain degree of crystallization. While tensile strengths were in the expected range elongations were low, presumably due to lower molecular weights.

O.S.E.3.

IN VITRO AND *IN VIVO* PERFORMANCE OF NANOSIZED HYDROXYAPATITE PARTICLES COATED WITH POLY-DL-LACTIDE-CO-GLYCOLIDE AS SYSTEMS FOR DRUG DELIVERY OF TIGECYCLINE

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Calcium-phosphate/poly(dl-lactide-co-glycolide) (CP/PLGA) composite biomaterial in granular form showed a high potential in the reconstruction of bone tissue. Compared to pure polymers, the combination of CP with biodegradable polymers used in bone drug delivery systems shows certain advantages. Composite biomaterials in nano particulate (NPs) form may have significant advantages over those in micro- or submicro-particulate form.

The purpose of the study presented in this paper has been to examine the possibility of the synthesis of a new nanoparticulate system for controlled and systemic drug delivery with double effect. In the first step, a drug is released from bioresorbable polymer; in the second stage, after resorption of the polymer, non-bioresorbable calcium phosphate remains the chief part of the particle and takes the role of a filler, filling a bone defect. The obtained tigecycline-loaded calcium-phosphate(CP)/poly(dl-lactide-co-glycolide)(PLGA) nano particles contain calcium phosphate coated with bioresorbable polymer and 0.6, 2 and 5wt% tigecycline.

The composite was analyzed by FT-IR, XRD, HPLC and AFM methods. The average particle size of the nanocomposite increases with the augmentation of the part of antibiotics, and it ranges from 65 to 95 nm. Release profiles of tigecycline were obtained by UV-VIS spectroscopy in physiological solution at 37^{o}C. Experimental results were analyzed using Peppas and Weibull mathematical models. Based on kinetic parameters, tigecycline release was defined as non-Fickian transport. The *in vitro* cytotoxicity of the nanocomposite was examined on standard cell lines of MC3T3-E1, in vitro. The obtained low values of LDH activity (under 37%) indicate low cytotoxicity level. Inhibition of bacteria in aerobic and anaerobic conditions *in vitro* was analyzed after 1, 2 and 3 weeks. The behaviour of the composite under real-life conditions was analyzed through implantation of the nanocomposite into living organisms, *in vivo*. The system with the lowest tigecycline content proved to be an adequate system for local and controlled release.

O.S.E.4.

POLY(D,L-LACTIDE-CO-GLYCOLIDE)/HYDROXYAPATITE/CLINDAMYCIN CORE-SHELL NANOSPHERES PROCESSED IN THE FIELD OF ULTRASOUND

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In some types of bacterial caused infections of bone tissues, like osteoarthritis and osteomielitis, long-lasting medication with antibiotics is required. Due to low vascularization of this type of tissue, traditional medication has low efficiency causing numerous side effects. Insufficiently long therapeutic dosage of medicament in the place of infection and other unwanted effects caused by long-lasting application of antibiotics can be resolved by controlled release of these medicaments from biodegradable and bioactive implants locally suited in the place of infection.

In this work ultrasonic method was developed for encapsulation/immobilization of clindamycin within poly(d,l-lactide-co-glycolide)/hydroxyapatite (PLGA/HAp) composite material. During the evaluation of this encapsulation/immobilization process both organic/water/water and organic/organic/water double emulsion methods modified with ultrasonic processing was applied. An influence of different solvents and nonsolvents on morphological properties of PLGA/HAp particles with clindamycin was determined. Results revealed that encapsulation/immobilization process was strongly related to solubility of clindamycin within applied solvents/nonsolvents. The most regular morphology formed from smooth, sphere-like particles with nanometre-range sizes was obtained in organic/water/water ultrasonic processing method using acetonitrile as polymeric solvent and water as polymeric nonsolvent. Influence of different contents of antibiotic within PLGA/HAp composite on morphological properties of PLGA/HAp/clindamycin obtained using acetonitrile/water solvent/nonsolvent was analyzed, too. It was revealed that both parts of PLGA/HAp composite, polymeric and ceramic contain one part of clindamycin during this encapsulation/immobilization process. According to this fact, structural model for distribution of antibiotic within PLGA/HAp composite was proposed.

O.S.E.5.

QUANTUM FOUNDATIONS OF RESONANT RECOGNITION MODEL

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Biomolecular recognition is open scientific problem, which has been investigated in many theoretical and experimental aspects. In that sense, there are encouraging results within Resonant Recognition Model (RRM), which is based on theory of information spectrum of macromolecules. The RRM concept is based on the finding that there is a significant correlation between spectra of the numerical presentation of amino acid and their biological activity. It has been found through an extensive research that proteins with the same biological function have a common frequency in their numerical spectra. This frequency was found then to be a characteristic feature for protein biological function or interaction The Resonant Recognition Model (RRM) proposes that the selectivity of protein interactions is based on resonant energy transfer between interacting biomolecules and that this energy, electromagnetic in its nature, is in the frequency range of 10^{13} to 10^{15} Hz, which incorporates infra-red (IR), visible and a small portion of the ultra-violet (UV) radiation. In this paper, the quantum mechanical basis of the RRM model will be investigated using the solution in the simplified framework of Hückel-like theory of molecular orbits.

O.S.E.6.

HYDROGEN BONDS STUDY BY OPTOMAGNETIC FINGERPRINT

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Hydrogen bonds has dual property, classical (electrostatic interaction based on Colombo law) and quantum (wave function based on Schrödinger equation). Since Planck constant is one of the main criteria for decision which process is quantum, or how much is close to quantum, we use electrical and magnetic forces of valence electrons, as point of departure, to develop method for optomagnetic fingerprint of matter. During the study of different type of water (as one of the richest matter with hydrogen bonds) and ices, we observed in optomagnetic spectra phenomena which characterize matter from both covalent and non-covalent bonding (ion-ion, ion-dipole and dipole-dipole interaction). In paper we present results of hydrogen bond investigation of different type of water, biomolecules, alloys, alkali halides, metal hydrate, etc. by optomagnetic fingerprint and classical spectroscopy. We discuses properties, rules and importance of hydrogen bonds for biomolecules and nanomaterials. Bearing in mind that Linus Pauling, in his book *Nature of the Chemical Bond* (Cornel University Press, 1939), for the first time presented the systematic concept of the hydrogen bond to the molecular world and its machinery, this paper is written in honor to him and 70th anniversary of one of the most important scientific paradigm.

Poster Presentation

P.S.A.1.

LOCAL STRUCTURE AND MORPHOLOGY-DEPENDENT PROPERTIES OF NANOOXIDES

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It is well recognized that properties of nanocrystalline materials are determined to a large extent by the local structure of their internal interfaces (grain boundaries) and external surfaces (near-surface layers). In this contribution, selected examples are presented of Mössbauer, XPS and NMR spectroscopic studies of the local structure of interfaces/surfaces in nanostructured oxides. Several interesting structural features of nanooxides are involved in the work, e.g., the nonuniform core–shell structure of nanoparticles, the nonequilibrium cation distribution, the canted spin arrangement, the modified nearest-neighbor cation configuration, and the deformed polyhedron geometry. Quantitative information is provided on the particle size- and shape-dependent ionic and spin configurations of nanooxides. The magnetic properties of cubic and spherical oxide nanoparticles of similar sizes are studied experimentally and theoretically. It is evidenced, for example, that the blocking temperature (T_B) of the oxide nanoparticles depends on their shape, with the spherical ones exhibiting larger T_B. The experimental effective anisotropy and the Monte Carlo simulations indicate that the different random surface anisotropy of the two morphologies is the main origin of these effects. Both, the magnetization enhancement and the magnetic degradation of nanooxides are discussed in terms of a modified core–shell model, in which a competition between the effects of spin canting and site exchange of cations in the interface/surface shell of nanoparticles plays a decisive role.

P.S.A.2.

SORPTION OF CESIUM ON COPPER HEXACYANOFERRATE/POLYMER/SILICA COMPOSITES: KINETICS AND MODELING STUDIES

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The sorption of cesium ions, from aqueous solutions, on composite sorbents was investigated under static (by the batch method) and dynamic (on column) conditions. The composite sorbents consisted of copper hexacyanoferrate retained by an anion-exchange polymeric layer bound to porous silica beds. The influence of cesium concentration and solution flow rates on cesium sorption was studied. The kinetic data were fitted with various models and the best fit was obtained by generalized kinetic equation. Column experiments were carried out under constant influent cesium concentration and bed depth, at different flow rates. The breakthrough capacity as well as the bed exhaustion decreased with increasing the flow rate. The dynamics of the sorption process was modeled by bed depth service time (BDST), mass transfer, and Thomas and Yoon-Nelson models.

P.S.A.3.

DETACHEMENT EFFICIENCY OF HEMATITE PARTICLES UNDER TURBULENT FLOW CONDITIONS

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An accumulation of undesired solid particulate matter suspended in a fluid on industrial equipment surfaces, defined as fouling, causes severe reduction of their efficiency. In many cases, this involves corrosion products such as iron oxides, some of them in the form of hematite. Fouling is the net result of two competitive processes acting simultaneously, the deposition and the re-entrainment stage. The objective of this study is to contribute to a better understanding of the process of reentrainment. An experimental set-up, able to monitor in situ physicochemical and hydrodynamic parameters on a laboratory scale previously designed and built has been used. The circuit tubing was made of polypropylene, and a suspension of hematite particles was injected. A first series of experiments has been perfomed to follow the kinetics of the deposition processes, as a function of pH. The deposition process was the slowest for the highest pH value, which was modelled by the increase of the rate of reentrainment. A second series of experiments has been carried out at a low pH, using different initial concentrations of the suspension. The detachement process of the hematite particles was followed in the turbulent flow, as function of pH. This protocol has allowed to analyse the kinetics of the reentrainment step.

P.S.A.4.

RED LUMINESCENCE AND THERMOLUMINESCENCE PROPERTIES OF Mn, RE:$CaMgSi_2O_6$

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We have developed inorganic luminescent nanoparticles which are suitable for *in vivo* imaging and can avoid most of inherent problems encountered in classical optical systems. The key parameter of this technology is based on a generation of persistent luminescence nanoparticles emitting in the red, which can be optically excited before *in vivo* injection. The persistent luminescence lasts for several hours and permits the removal of the background noise originating from *in situ* excitation.

The selected composition is Mn,RE:$CaMgSi_2O_6$. In the compounds, Mn^{2+} ion is the luminescent center whereas RE (Eu^{2+} and Dy^{3+} cations) act as the UV sensitizer and the trap center respectively. In order to improve the persistent luminescence and the understanding of the related mechanism, we have synthesized, by a sol-gel method, the Mn,RE:$CaMgSi_2O_6$ materials with different dopants (single doped (Mn^{2+}, Eu^{2+}or Dy^{3+}) and codoped materials (Mn^{2+}, Eu^{2+} and RE^{3+})). The persistent luminescence of these materials has been evaluated and thermoluminescence (from 50 K to 600 K) has been correlated to these results. To go in deeper details of the mechanism two excitation sources (UV and X-rays) have been used leading in both cases to persistent luminescence. It is therefore possible to assign the various roles of the dopants.

P.S.A.5.

THEORETICAL ASSESSMENT OF STABILITY OF FLUOROHYDROXYAPATITES WITH DIFFERENT FLUORINE CONTENT

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Fluoride is one of the elements contained in biological apatites, which strongly modifies their crystallinity and solubility. Fluoride causes both crystal growth and preferential re-acquisition of calcium. Thus, the presence of fluoride in drinking water represents the key agent in battling caries, working primarily via topical mechanisms: inhibition of demineralization and enhancement of remineralization.

On the other hand, some results strongly indicate that the stability of apatite decreases with the uptake of fluoride producing dental fluorosis and contributes to brittle bones. Reported results of laboratory and field experiments also demonstrate opposite effects of fluoride uptake on stability of inorganic microfiltration membranes with hydroxyapatite (HA) which are applied to the treatment of wastewater and defluoridation of drinking water.

In order to clarify this controversy about the effect of fluoride uptake on HA stability, we have analyzed the stability of fluorohydroxyapatites (FHA) $Ca_{10}(PO_4)_6(OH)_{2-2x}F_{2x}$ with different fluorine content. In this analysis, we used the value of the ion-ion interaction potential as a measure of stability of FHA crystals. Results of this analysis revealed that stability of FHA is not a linear function of the fluorine content. We demonstrated that the uptake of fluoride up to $x \leq 0.4$ decreases the stability of FHA and that above this concentration stability of FHA is substantially improved. Some practical consequences of this finding for the treatment of drinking water and wastewater have been discussed.

P.S.A.6.

SYNTHESIS AND STRUCTURE OF Zn(II) AND Hg(II) COMPLEXES WITH 4-ACETYL-3-AMINO-5-METHYL PYRAZOLE

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Thanking to their essential theoretical and practical importance, pyrazole derivatives and their metal complexes have been since long a subject of interest of resarchers of different profiles. The present work is concerned with the synthesis and structure of zinc(II) and mercury(II) complexes with 4-acetyl-3-amino-5-methylpyazole (*aamp*). Monocrystals of the neutral tetrahedral bis(*aamp*)-diisothiocyanato-zinc(II) complex were obtained by the reaction of warm diluted ethanolic solutions of *aamp* and a mixture of zinc(II) nitrate and ammonium thiocyanate. Besides, another tetrahedral complex, tetracyanatomercurate(II), containing two monoanion derivatives of pyrazole as the counter ions, *Haamp*$^+$, was obtained from an ethanolic solution of the ligand and a mildly acidic aqueous solution of mercury(II) thiocyanate and ammonium thiocynate. In the zinc complex, *aamp* is coordinated in the usual way, i.e. through the pyridine nitrogen atom, whereas the mercury complex involves strong hydrogen bonds. The complexes were characterized by elemental and x-ray structural analyses, IR spectrometry, conductometric measurements and thermal analysis methods.

P.S.A.7.

STRUCTURE AND CHARACTERIZATION OF COPPER(II) COMPLEX WITH PYRIDOXAL AMINOGUANIDINE

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Aminoguanidine is a well-known inhibitor of the formation of advanced glycation end products and is considered to be promising for the treatment of diabetic complications. Schiff base of pyridoxal and aminoguanidine (PLAG) appeared to be more effective than aminoguanidine, a well-known antidiabetic-complication compound, in preventing nephropathy in diabetic mice, and brief data have been presented indicating the antioxidant activity of the aduct. In view of the importance of PLAG and copper(II) as a biometal it was of interest to determine the structure of their complex. This work presents the structure of the copper(II) complex formed by the reaction of warm equimolar methanolic solutions of copper(II)-nitrate and PLAG. In the complex, PLAG is coordinated through the oxygen atom of the deprotonated phenol hydroxyl, hydrazinic and azomethinic nitrogens, forming together with the coordianted methanol a square-planar environment around copper(II) ion. The pyridoxal moiety occurs in the form of a zwitter-ion. The complex was characterized by the data of elemental and x-ray structural analyses, as well as by IR spectrometric and conductometric measurements.

P.S.A.8.

1,2,3,4-TETRAOLS : SIMPLE AND GENERAL STRATEGY FOR THEIR CHEMICAL SYNTHESIS

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General synthetic approach to alkyl-1,2,3,4-tetraols, arylalkyl-1,2,3,4-tetraols and similar tetrahydroxy alcohols is described. The synthesis starts from xylose thru easily accessible 3,5-anhydro-1,2-*O*-alkylidene-D-xylofuranose. The 3,5-ahydro ring opening with different Grignard reagents gave 5-deoxy-5-C-alkyl-xylofuranose. Hydrolysis of protective group, followed by already described methods of aldehyde group reduction leads directly to title compounds. Obtained polyols with different length of alkyl rest could serve as surface active compounds for protein solubilization and as emulsifying agents.

P.S.A.9.

SYNTHESIS AND CHARACTERIZATION OF Ni(II) AND Zn(II) COMPLEXES WITH *N',N'²*-BIS[(1*E*)-1-(2-PYRIDYL)ETHYLIDENE]PROPANEDIHYDRAZIDE. CRYSTAL STRUCTURES OF TWO HIGHLY SOLVATED BIMETALLIC COMPLEXES OF Ni(II)

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The bimetallic $[Ni_2(H_2L2)_2](ClO_4)_4$ (**1**), $[Ni_2(HL2)(H_2L2)](ClO_4)_3$ (**2**) and $[Zn_2(H_2L2)_2](ClO_4)_4$ (**3**) complexes (H_2L2 = *N',N'²*-bis[(1*E*)-1-(2-pyridyl)ethylidene]propanedihydrazide) were synthesized and characterized. The structure of complexes (**1**) and (**2**) was established by X-ray analysis. Preliminary X-ray data and NMR spectroscopy were used for the characterization of complex (**3**). The complexes (**1**) and (**2**) were obtained from the same synthetic reaction and two crystal types of these complexes have been isolated during the fractional crystallization process as green (**1**) and brown (**2**) crystals. The less stable green crystals of layered structure converted slowly to brown crystals of channel structure while being kept in the solution. The apparent changes in crystal colour signalled a process of the ligand deprotonation. In complex (**1**) each Ni(II) ion is coordinated with two NNO donor atom sets from two H_2L2 ligands forming an octahedral geometry. Similarly, in complex (**2**) the octahedral geometry of each Ni(II) ion is attained by coordination of two NNO donor atom sets, one from the neutral and the other from the monoanionic form of the ligand.

P.S.A.10.

SYNTHESIS, X-RAY AND NMR CHARACTERIZATION OF DIPROTONATED OXALIC DIHYDRAZIDE BASED LIGAND *N′*,*N′*²-BIS[(1*E*)-1-(2-PYRIDYL) ETHYLIDENE]-ETHANEDIHYDRAZIDE

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In direct synthetic reaction of $Zn(ClO_4)_2·6H_2O$ and ligand *N′*,*N′*^{2}-bis[(1*E*)-1-(2-pyridyl)ethylidene]ethanedihydrazide (H_2L1) $H_4L1(ClO_4)_2·2H_2O$ (1) was obtained instead of the expected Zn(II) complex with ligand H_2L1. The structure of $H_4L1(ClO_4)_2·2H_2O$ was characterized by NMR spectroscopy and X-ray crystallography. In the crystal structure of compound (**1**) cationic units H_4L1^{2+} reside in layers parallel to 010, while the perchlorate anions and solvent molecules are placed in-between successive 010 layers. The serendipity also followed our attempt to obtain the Zn(II) complex with H_2L1 by condensation of oxalic dihydrazide and 2-acetylpyridine in the presence of Zn(II). The product of this reaction was azine 2-{1-[(1-(2-pyridinio)ethylidene)hydrazono]ethyl}pyridinium diperchlorate (**2**) already characterized by X-ray crystallography. The *transoid* conformation is asserted for (**1**) and (**2**). Both compounds may be efficient in propagating the magnetic interaction when they bind two metal centers.

P.S.A.11.

A STUDY OF THE INTERACTIONS OF THE BIOLOGICALLY ACTIVE METHOXY DERIVATIVE OF THE MARINE QUINONE AVARONE WITH DNA

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Avarol is a sesquiterpene isolated from the marine sponge *Dysidea avara*, and avarone is its corresponding quinone. Compounds from marine origin and their derivatives have attracted much interest in recent years due to their interesting pharmacological properties including anti-inflammatory, antipsoriasis, antitumor and antiviral actions. Their activities are, at least in part, associated with interactions with DNA. As a continuation of our investigation of mechanisms of antitumor activity of the marine quinone/hydroquinone couple avarone/avarol, spectroscopy study and gel agarose electrophoresis results of the interaction of avarone and 3'-methoxyavarone are reported here. UV-Vis absorption spectra of the complexes of linear high-molecular calf thymus DNA—quinone showed changes in spectra of DNA molecule, which are more pronounced in case of the methoxy derivative. Study of interactions of the compounds (in increasing concentrations) with supercoiled low-molecular plasmid DNA revealed the capability of the quinones to form circular and open and nicked circular forms of pBR 322 and pUC 18 plasmids. The effects are stronger again in case of the methoxy derivative, which is very active to melanoma Fem-X cells, more active than avarone itself, indicating a significance of DNA binding to the cytotoxic activity of this type of compounds.

P.S.A.12.

MULTIDIMENSIONAL IMAGING AND MANIPULATION OF NANO-OBJECTS

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In near upcoming we have much to learn about the nano-scale world, including how properties such as mechanical properties, electrical transport, and dynamics are affected by the atomic scale structure of the nano-objects and their interfaces. *Nanomanipulation* provides exciting insight into these problems by allowing us to probe individual nano-objects with great facility, and to combine property characterization with structural information. Advanced user interfaces will continue to play a critical role in making experiments more transparent to the user, and enabling the scientist to be virtually in the nano-scale world. The nanomanipulator is obtained by integration of a scanning probe microscope with its controller, a SPIDAR (SPace Interface Devices for Artificial Reality) force-feedback device with its controller and a PC computer with high graphics facilities. These local cluster formed by minimum three computers communicate across an IP-based network. The goal of our SPIDAR development will allow the scientist to be immersed virtual in the nano-scale world. Our intention is to combine Scanning Probe Microscope (SPM) with a virtual reality interface to provide the intuitive display of instrument data and natural control of the SPM instrument functions. The significance of the virtual-reality interface to the SPM is that it gives the scientist simulated presence on the sample surface. The benefits of this are: improved perception of 3D structures, more effective exploration of the sample, the ability to observe dynamic processes in near real time, and the ability to interactively modify the surface. A 3D image processing will use a mix of images in a head-mounted display. Implementation of *x-ray-vision* unit to SPM nanomanipulation software, which is well known in few avionics applications, will introduce the *augmented reality* concept. This concept is expected to have wide applications in nanomanipulation to ensure, during complex situations, what is effectively *x-ray vision* to the user by combining computer graphics rendering with hidden elements. Actually, this concept can be very elegant in its simplicity and very useful for nanomanipulation unit.

P.S.A.13.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF EXPLOSIVE LOADING OF POWDER MATERIALS

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Methods of an explosive loading of magnetic character materials in ampoules of maintenance are applied to reception new, including composite, materials with unique mechanical properties. Besides, these methods can be used for examination of the phase transitions occuring in materials at high pressures and temperatures, shock waves arising behind front, and also for synthesis of metastable phases.

The loading of magnetic character materials in ampoules of maintenance can be carried out both plane, and oblique shock waves. The scheme of an explosive loading a oblique shock wave is characterized by great values of shift strain, in comparison with a plane shock loading that leads to improvement of bonding between compacted particles. Besides this scheme allows to gain compacts not only in the form of plates, but also pipes, cores, cones, etc. Also it is possible to gain compacts the greater sizes. The scheme of a loading plane shock waves allows to vary values of pressure and temperatures behind front in wider limits and to reach much higher values of these parameters. At the same time, the scheme is more material-intensive and has restrictions on the size of weighted samples.

Experiments on explosive were spent for a copper powder under the cylindrical scheme without the central core. The powder consisted of particles, under the shape of close to spherical. Structures of cross sections and fractographs of compacts were explored by means of optical and scanning electronic microscopes. The noncontact electromagnetic method measures shock adiabats of an explored powder. It is shown, that explosive компакты, gained in a mode of the irregular reflection under the rotationally symmetric scheme without the central core, can have the homogeneous structure. Homogeneous on structure компакт can be gained, if velocity of a detonation of charge BB at explosive compaction does not exceed a magnetic character material, where - velocity of a plane shock wave at which behind front the material heats up to temperature of fusion.

P.S.A.14.

KINETICS OF THE HYDROGEN OXIDATION ON Pt MODIFIED MoOx NANO-SIZED CATALYST IN THE PRESENCE OF CARBON MONOXIDE

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Due to the importance of the HOR in fuel-cells technology, various Pt-based catalysts have been examined from the viewpoint of immunity of the electrocatalysis of the HOR from CO-poisoning of the anode catalysts. An appreciable improvement of the CO tolerance has been found at Pt with adatoms such as Ru, Sn [1,2], Pt-M (M=Ru, Rh, Os, W Sn) [3-5] based alloys, and Pt with oxides (RuO_xH_y) [6].

In the present work, the electrocatalytic of home made highly dispersed nano-sized MoOx-Pt/C catalysts prepared by the polyole method combined by MoO_x post-deposition was investigated in the presence of CO, in 0.5 moldm^{-3} $HClO_4$ solution. The partial pressure of CO in CO/H_2 gas mixture was 100 ppm.

Carbon monoxide was adsorbed on the RDE for various time interval with keeping the potential at 0.05 V (RHE). The coverage of CO was determined by applying the first potential sweep (from 0.04 to 1.20 V), in N_2 saturated solution at potential scan rate of 0.1 Vs^{-1} and compared it with the sweep on the clean electrode, by measuring the decrease in the hydrogen desorption charge, ΔQ_H.

MoO_x(20%)Pt/C catalyst exhibits an excellent CO tolerance, as it was found that the reduction in kinetic current, I_k, is negligible even at $\Theta_{CO} = 0.46$. It was found for this catalyst too, that the CO adsorption rate was much slower than that of Pt and the Pt sites for HOR were not so rigidly blocked by adsorbed CO partially due to its enhanced mobility, resulting from their modified electronic structure of surface Pt sites. Voltammetric studies suggest that an excellent CO tolerance of this catalyst could be also result of the oxidation of adsorbed CO to CO_2 by oxophilic MoO_x species at low overpotentials by a redox-mediated mechanism.

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P.S.A.15.

SYNTHESIS AND CHARACTERIZATION OF POLYANILINE MICRO/ NANOSTRUCTURES DOPED WITH 12-TUNGSTOPHOSPHORIC ACID

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Polyaniline (PANI) micro/submicro/nanostructures doped with 12-tungstophosphoric acid (WPA) were synthesized by the oxidation of aniline with ammonium peroxydisulfate as an oxidant in aqueous solution, in the presence of WPA. The influence of starting WPA/aniline mass ratio on the electrical conductivity, molecular and supramolecular structure, and thermal stability of synthesized PANI-WPA material was studied. The electrical conductivity of PANI-WPA increases with the content of WPA up to a maximum value of 5.3×10^{-3} S cm^{-1} for WPA/aniline = 1.0. The nanorods coexist with submicro/microspheres in conducting products obtained at longer polymerization times, while solely submicro/microspheres are characteristic for nonconducting products isolated at shorter polymerization times, as revealed by scanning electron microscopy. The average diameter of nanorods is in the range (50–130) nm and decreases with the increase of the WPA/aniline ratio. FTIR spectroscopy and TGA analysis confirmed that PANI was doped by WPA. Molecular structure of PANI-WPA was also studied by Raman spectroscopy.

P.S.A.16.

FABRICATION AND MULTI-PROPERTIES OF $BiFeO_3$ CERAMICS

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One of the very promising approaches to create novel and high performance materials is to combine in one material different physical properties to achieve rich functionality. Therefore, multiferroics - materials which are simultaneously (ferro)magnetic and ferroelectric, and often also ferroelastic or ferrotoroidic - attract now considerable attention, both because of the interesting physics involved and as they promise important practical applications in spintronics, information storage devices such as multi-state non-volatile memories, sensors, phase shifters, amplitude modulators and optical wave devices. Recently, multiferroism has been observed in several perovskite-type materials like $BiFeO_3$, $YMnO_3$, $BiMnO_3$ etc. The present study describes our attempts to synthesize the high-performance ceramic material - bismuth ferrite ($BiFeO_3$) and characterize its multiferroic properties. The thermogravimetry, differential thermal analysis and X-ray diffractometry was utilized to characterize the process of $BiFeO_3$ synthesis from the simple oxide powders Bi_2O_3, and Fe_2O_3. The mixed oxide method followed by the hot pressing sintering was utilized to fabricate the ceramic samples. Results on the ac response of the ceramic samples by impedance spectroscopy up to 600 ^{0}C are given and dielectric properties of $BiFeO_3$ are discussed. Mossbauer spectroscopy and magnetic balance were also used to characterize the $BiFeO_3$ ceramic samples.

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P.S.A.17.

USING SOLID OXIDIZER BaO_2 AND $NaClO_4$ IN SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS

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Using of solid oxidizers during self-propagating high-temperature synthesis (SHS) of oxide materials is a good way to resolve two problems at once: to realize combustion and to obtain the required composition of the product. Solid oxidizer BaO_2 is used for the production of such barium-containing materials as $BaFe_{12}O_{19}$, ($YBa_2Cu_3O_7$), $BaTiO_3$. Traditionally in SHS metal powder is used as a fuel, gas oxygen as an oxidizer and special flowing reactor with oxygen cylinders and hoses is required. If the oxygen supply is sufficient inside the reaction mixture there is no need in using gas oxygen. Such sufficiency may be achieved by the introduction of BaO_2 into the reaction mixture. During heating BaO_2 decomposes according the scheme: $2BaO_2 \rightarrow 2BaO + O_2$. Free oxygen is consumed in oxidizing metal fuel and promoted so the combustion reaction. As a result of interaction of BaO with intermediate products in the combustion wave and required compounds (ferrites, superconductors, etc.) are formed. As decomposition temperature of barium peroxide is rather high (1143 K) in some cases the introduction of an additional solid oxidizer may be required. For this aim sodium perchlorate $NaClO_4$ is well used. Changing relation of solid oxidizer in green mixture we may change velocity and amount of proceeding oxygen. It may be extra parameter for controlling the combustion wave, phase and structural composition of the combustion product.

P.S.A.18.

SYNTHESIS OF MULTIDOPED CERIA BASED NANOPOWDERS

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Mulitidoped ceria nanopowders with different particle sizes were produced by two different methods. The following compositions were prepared: $Ce_{0.8}Nd_{0.01}Sm_{0.04}Gd_{0.04}Dy_{0.04}Y_{0.07}O_{2-\delta}$ and $Ce_{0.8}Sm_{0.005}Gd_{0.005}Dy_{0.095}Y_{0.095}O_{2-\delta}$, as well as pure ceria for comparison. Parameters of the MGNP synthesis process were investigated by variation of glycine to nitrate ratio from 1.00 to 1.67, which affected powders properties like specific surface area, crystallinity, as well as crystallite size. In addition, the room temperature self propagating synthesis was applied to synthesize the same compositions.

Characterization of the obtained powders revealed that all the samples were single phase ceria solid solutions, while the particle size of the powders prepared by the two mentioned mehtods, differed by an order of magnitude. It is interesting to note that with powders obtained at room temperature inspite of very small particle size (2-4 nm) crystallinity was very high, which was proved by XRD, TEM as well as by Raman spectroscopy.

P.S.A.19.

RAMAN STUDY OF VANADIUM-DOPED TITANIA NANOPOWDERS SYNTHESIZED BY SOL-GEL METHOD

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Pure titania (TiO_2) nanopowders and TiO_2 doped with 10 mol % of vanadium ions (V^{3+}) are synthesized by sol-gel technology. The dependence of structural characteristics of nanopowders on synthesis conditions is investigated by X-ray diffraction and Raman spectroscopy. Very intensive modes observed in Raman spectra of all nanopowders are assigned to anatase phase of TiO_2. Additional Raman modes of extremely low intensity which can be related to the presence of small amount of brookite amorphous phase are observed in pure TiO_2 nanopowders. In V-doped nanopowders anatase was the only TiO_2 phase detected. The variations in duration and rate of calcination almost do not influence the Raman spectra of pure TiO_2, but has great impact on Raman modes of anatase, as well as the additional Raman modes related to the presence of vanadium oxides in V-doped samples. In order to estimate the dependence of nanocrystallite size on synthesis conditions and correlate it with the XRD results, the shift and asymmetrical broadening of the most intensive anatase Raman mode ($E_{g(1)}$) are analyzed by phonon confinement model.

P.S.A.20.

HOW TO CHANGE PROPERTIES OF FUNCTIONAL FILMS BY SOL-GEL TECHNIQUE

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The development of new improved type of functional films on the conception of multiphase structure has been carried out in this paper. Metal alkoxide solutions were used for application of thin films by electrophoretic deposition technique. We succeeded in preparation of amorphous, crystalline and composite films. Specific features of the preparation technique were considered. Microstructure of the films was examined as well as their physical properties. TEM analyses reveals that films deposited from aging sols and heat-treated at temperatures 300 - 400°C contain small whiskers and nanocrystallites. The alteration in crystallization behavior of Al_2O_3 whiskers was discussed in terms of aging starting sols before electrophoretic deposition for dielectric films. Superconducting (YBCO and BSCCO) and piezoelectric ($BaTiO_3$) ultra-fine uniform film preparation has been discussed.

P.S.A.21.

MICROWAVE-HYDROTHERMAL SYNTHESIS OF $YV_{1-x}P_xO_4$:Eu NANOPHOSPHORS

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It is well known that microwave treatment under hydrothermal conditions allows to speed up processes of materials synthesis and crystallization due to acceleration of diffusion in alternate electromagnetic field. In present work we developed new facile method for synthesis of $YV_{1-x}P_xO_4$:Eu nanosized phosphors using microwave-hydrothermal treatment. It was shown that proposed technique allows to obtain weakly aggregated almost monodisperse powders of $YV_{1-x}P_xO_4$:Eu with particle sizes varying from 15 to 50 nm, depending on the synthesis conditions. Synthesized nanopowders exhibit strong luminescence at 615 nm which corresponds to Eu^{3+} $^5D_0 \rightarrow ^7F_2$ transition. This work was supported by Russian Foundation of Basic Research (grant No.09-03-01067) and grant of President of Russian Federation (MK-1591.2008.3).

P.S.A.22.

RARE-EARTH-BASED PHOSPHOR PARTICLES SYNTHESIS THROUGH HYDROTHERMAL AND SPRAY PYROLYSED ROUTES

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The synthesis of nanomaterials with controlled morphology is a subject of special interest in current trend of miniaturisation. It is already shown that "soft solution chemical processing" is superior to other synthesis techniques for the preparation of such materials. When one-dimensional nanomaterials are considered, the hydrothermal method is shown to be one of the simplest techniques for their obtaining. On the other side, processing of highly spherical three-dimensional nanostructured particles is feature of the powders obtained via spray pyrolysis process. Currently there is a great interest in synthesis of nano-phosphors, mainly due to a number of potential advantages which they posses over traditional luminescent materials. Here, we present the results related to the $(Y_{0.75}Gd_{0.25})_2O_3$:Eu^{3+} (5at%) system synthesized by both hydrothermal and spray pyrolysis processes. Conversion of the starting nitrates mixture into desired oxide composition is performed with a help of ammonium hydrogen carbonate solution during hydrothermal treatment of precipitated mixture at 200°C/3h, while pure nitrate precursors in dispersed phase (aerosol) are thermally decomposed at 900°C within a tubular flow reactor in a spray pyrolysis process. The obtained powders are additionally thermally treated either at 600/1000°C - 3h (for those hydrothermally processed) or 1100°C – 12h (for the spray pyrolyzed ones). Comparison of the morphological, structural and functional characteristics of the powders is done based on the results of X-ray powder diffractometry, particle size analysis, scanning electron microscopy, X-ray energy dispersive spectroscopy, transmission electron microscopy and photoluminescence measurements.

P.S.A.23.

HYDROTHERMAL SYNTHESIS OF $LiFePO_4$ POWDERS AS CATHODE MATERIAL FOR Li-ION BATTERIES

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Phospho-olivine $LiFePO_4$ have been intensively studied as lithium insertion cathode materials for next generation of Li-ion secondary batteries. $LiFePO_4$ has an interesting theoretical specific capacity of about 170 $mAhg^{-1}$, a good cycle stability and technically attractive flat voltage versus current profile of 3.45 V versus Li^+/Li. A further advantage of this material, thanks to its stability, is the improved safety at high temperatures. In this work, $LiFePO_4$ was prepared by hydrothermal reaction starting from water solutions of LiOH, $FeSO_4$ and H_3PO_4. After hydrothermal reaction the obtained powder was heat treated in reduction atmosphere to avoid oxidation of Fe^{2+} to Fe^{3+}. Powder was additionally treated by high energy ball-milling. The structural and morphological properties of $LiFePO_4$ powder was characterized by X- ray diffraction and scanning electron microscopy. $LiFePO_4/Li$ battery was characterized electrochemically by constant current charge-discharge cycling.

P.S.A.24.

IMPACT OF SOLVENT MIXTURE COMPOSITION AND ADDITIVE PRESENCE ON $LiFePO_4$ FORMATION IN WATER – ISO-PROPANOL SOLUTIONS AT ELEVATED TEMPERATURES AND PRESSURES

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High capacity storage of electric energy is technology of strategic importance for modern society. As lithium-ion batteries with their high capacity and generated power can improve electrical storage for electric vehicles and portable devices; they became a one of the major topics of research today. One of most perspective cathode material for lithium-ion batteries is $LiFePO_4$. Superior characteristics of this material are high Li storage capacity, stability, non-toxicity and low price, major disadvantage is low electronic conductivity. In this work we have investigated possibility to obtain pure $LiFePO_4$ nano-crystalline powders using water – iso-propanol mixture as reaction medium at temperatures in range of 180 to 220 ^{o}C and corresponding equilibrium pressures in stainless steel autoclave. Time was varied from 1 up to 24 h. In supplement, impact of different organic additives on morphology and size of particles is examined. Phase composition is determined by XRPD, morphology of particles by SEM and particle size distribution from light scattering measurements (LPSA). Electrochemical characterization of synthesized material is performed by constant current charge/discharge cycling.

P.S.A.25.

ELECTROCHEMICAL BEHAVIOUR OF V_2O_5 AND V_2O_5/C IN AQUEOUS SOLUTION OF $LiNO_3$ AND $Mg(NO_3)_2$

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V_2O_5 may be used as anode material for rechargeable lithium-ion batteries in both aprotic and aqueous electrolyte solutions. This oxide is soluble in hydrogen peroxide (H_2O_2), and may be recovered from the solution in various physical forms. In this work, commercial V_2O_5 powder was dissolved in 10% solution of H_2O_2, and, in one-half of the solution, 10 wt. % (relative to dry V_2O_5) of carbon black was added. The solvent was evaporated and the resulting powders were dried at 200°C. The structure and appearance of the powders were examined by X-ray powder diffraction (XRPD), TGA/DTA, SEM and particle size analyzer. Electrochemical behaviour was tested in aqueous saturated solution of $LiNO_3$ and $Mg(NO_3)_2$, by cyclic voltammetry at different scan rates. On the basis of peak potential differences, intercalation/deintercalation reactions of both Li^+ and Mg^{2+} ions were found to be much faster for composite sample, V_2O_5/C, compared to simple V_2O_5. The discharge capacity of V_2O_5/C amounted to 139 $mAhg^{-1}$ in $LiNO_3$ solution, and 155 $mAhg^{-1}$ in $Mg(NO_3)_2$ solution, while V_2O_5 displayed discharge capacity of 63 $mAhg^{-1}$ only, in each of these two solutions.

P.S.A.26.

SYNTHESIS AND CHARACTERIZATION OF TRANSITION ALUMINA PHASES

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Porous alumina based powders have attracted a great interest of researchers due to their wide range of applications in different areas such as catalysis, electronic and optoelectronic devices, etc. In addition, it is also used as the starting material for the preparation of alumina based ceramics. This variety of applications is possible because of the fact that alumina has transition oxide polymorph forms beside aluminum hydroxide, AH, and oxohydroxide, AOH. The transition alumina, especially γ and η aluminas, are extremely important materials with high porous structure, average crystallite on nanoscale and large surface area which enable their adsorption properties. The main goal of our researches was to elucidate effect of composition of AH and AOH starting powders, their phase composition, average particle size, their surface area as well as effect of their further heat treatment (time, temperature) on characteristics of finally obtained alumina powders. The main issue was to define conditions of preparing alumina active transition phases, mainly γ and η alumina, with high surface area and with crystallite size on nanoscale. As starting AH i AOH powders, we used powders produced in factory "Birac" in Zvornik, Republic of Srpska, B&H. These powders were composed of different fractions of phases, such as boehmite, pseudoboehmite, bayerite or gibbsite. Samples were characterized by using: FT-IR spectroscopy, BET, DTA/TG, dilatometric measurements, XRD, SEM. The obtained results have shown that phase composition of finally prepared alumina powders depends on properties of starting powders (their phase composition, surface area, average grain size) and conditions of their further heat treatment. Alumina powder based on bayerite after thermal activation at 500°C was transformed to η-alumina powder with high surface area of about 374 m^2/g and with average crystallite size below 6 nm.

P.S.A.27.

LOW TEMPERATURE MECHANICAL CHARACTERISTICS OF Ti GRADE 2, PRODUCED BY DIFFERENT METHODS OF SEVERE PLASTIC DEFORMATION

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Physical and mechanical properties of the nanostructured materials can be improved by use of combined methods of the severe plastic deformation (SPD). In this work, with the help of various SPD methods (equal-channel angular pressing (ECAP), quasi-hydro extrusion (QHE), cryorolling (CR), and their combination) the eight different structural state of polycrystalline Ti Grade 2 were produced: 1) the initial coarse-grained Ti Grade 2, produced by hot forging; 2) the nanostructured state, produced by ECAP of initial Ti Grade 2 (8 passes of ECAP at 720 K); the states 3-7 produced by QHE of the state 1 at 300 or 77 K to 32-55 % of deformation; 8) – the state 2, subjected to CR at 77 K to 50 %. Values of microhardness H_V were measured at 300 K, yield stress $\sigma_{0.2}$ and deformation to failure ε_f were registered at temperatures 4.2 - 300 K under uniaxial compression of specimens with strain rate $4 \cdot 10^{-4}$ c^{-1}. Average grain sizes were established by transmission electron microscopy and changed from 20 μm to 0.1 μm for the different investigated structural states. The largest increase of H_V and $\sigma_{0.2}$ values is registered for combined action of ECAP and QHE (the latest was made at 77 K to 53 % of deformation; the state 7). For example, at temperature 4.2 K under compression the $\sigma_{0.2}$ values increase by 86 % in comparison with the $\sigma_{0.2}$ of initial Ti Grade 2 and by 13 % against the $\sigma_{0.2}$ of ECAP Ti Grade 2. It worth to note that plasticity of the nanostructured Ti Grade 2 in this high-strength state remains at level of 10-15 % in all temperature interval. Also, peculiarities of different nanostructured states, which influence on low temperature mechanical characteristics of Ti Grade 2, are discussed.

P.S.A.28.

PREPARATION OF HIGH HEAT CONDUCTIVITY CARBON-COPPER-SILICON MATERIALS AND COATINGS OWING TO MECHANICAL ACTIVATION

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Valuable information on the mechanism of mechanical activation (**MA**) is obtained from the accurate characterization of wearing processes that take place within mechanochemical reactors (**MR**). We focus on two related aspects of MA in MR:
(**i**) nanoscale wear of the treated substances and of the milling tools;
(**ii**) deposition of a powder coating on the surface of the milling tools.

A new technology called abrasive-reactive wear (**ARW)** has been developed that utilizes wear debris as an integral component of the reaction system rather than treating it as a harmful impurity. From the point of view of enhancing the possibilities of the ARW method, the use of diamond is of special interest owing to its unique physicochemical and abrasive properties and ability to interact with transitional metals and alloys, i.e., a combination of properties of both abrasives and reagents. It should also be noted that mechanochemical synthesis could in the future provide a more efficient utilization of both natural and synthetic diamonds as the result of introducing the low-grade raw material into the technological process. This technology is applied to the preparation of carbon-copper-silicon nanocomposites and coatings. A specific example of a property of technological relevance that characterizes materials prepared by techniques studied in the present report is the heat conductivity. Linked to this, the problem of heat removal is very important for the semiconductor industry. For this reason, the improvement of thermal properties of materials used for manufacturing microelectronics components becomes crucial. The USA “ADS” company offered nanocomposite materials on a Cu and diamond basis that have a higher heat conductivity in comparison with traditionally used materials on a Cu or Al basis. Moreover, particles of diamond in copper-diamond composites show a high degree of stability to graphitization under sintering at temperatures up to 1150-1250K and thus this composite material can be used for the creation of contacts and high-current electric contacts in the low-voltage equipment. ARW is used to process mixtures of diamond-graphite-silicon powders in MR with the copper milling tools and generates nanocomposite powdered products. The equipment for synthesis of diamonds is modified to obtain sintered pellets for electrical and heat conductivities measurements. ARW can also be adapted to the preparation of coatings. For example, if copper plate is attached to the wall of the milling container, the impacts by the copper milling tools activate the surface of the plate, deliver particles from the powder charge and pound them onto or into the surface. The structure and properties of the coating depend on the MA conditions. Some experimental aspects of the preparation of coatings (deposition of MA elements on copper) are discussed.

P.S.A.29.

MECHANICAL ACTIVATION OF CLAY

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Comparative review of experimentally determined results of clay properties prepared according to classical procedures of processing and mechanical activation is presented. Mechanical activation of the same raw material was carried out in a lab. mill ˝Pulverisette 6˝ (Fritsch, Germany) over the time periods of 30, 60, 90 and 120 minutes. Testing of technological features relevant for process of forming, drying and firing of heavy clay products indicates the increase of plasticity and mechanical characteristics of products, lowering of firing temperatures, and changing of drying sensitivity in the case of mechanically activated clay. The drying process of the samples made from activated and inactivated clay was examined in detail. Two mathematical models, based on multi factorial experimental design technique, were set up. The first decribes the moisture value and the second one the velocity value of the product when it reaches the critical point during drying, as a function of temperature, relative humidity and the velocity of the drying medium.

P.S.A.30.

HYDROGEN RELEASE AND MICROSTRUCTURE OF MgH_2 BASED COMPOSITE POWDERS CONTAINING A RELEVANT AMOUNT OF $LaNi_5$

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Metal hydrides are considered interesting and promising materials for the development of hydrogen storage technology based on solid state. Mg hydride in particular is very attractive due to its high gravimetric and volumetric capacity, the reversibility of the H_2 absorption and desorption process and its relatively low cost and abundance. The unfavorable aspect of this material mainly consists in the high ΔH of formation of Mg-H bond that give rise to too high sorption temperatures for any technological application. For this reason, in the last years several studies have been accomplished on MgH_2 composites in order to improve the hydrogen sorption kinetics of MgH_2 by the addition metal or metal oxides as catalyst and by inducing structural defect by mechanical processing of the powders as ball milling. In this contest, we have investigated dehydrogenation behavior of reactive ball milled MgH_2 with addition of $LaNi_5$ that is known forming less-stable hydrides, in order to synthesize a material able to release hydrogen at temperatures lower than the pure ball milled MgH_2, by involving a collective behavior of the phases. We have explored different processing conditions varying milling time and relative weight percentage of the two phases. Structural evolution of the composites has been investigated by X-Ray Diffraction and Scanning Electron Microscopy, which evidenced the formation of new non-reactive amorphous phases for long ball milled samples. Hydrogen desorption has been studied by Differential thermal analysis and Thermogravimetric Analysis (TGA) simultaneously performed and Differential Scanning Calorimetry. Optimum desorption conditions have been obtained with MgH_2 – 30 wt%$LaNi_5$ composite that expressed significant improvement on hydrogen both in term of fast kinetics and relatively low temperature respect to pure ball milled MgH_2. In fact the decomposition reaction, for the optimum additive content and for the proper processing conditions, onsets at about 450 K and releases most of the hydrogen content in about 60 s at 573 K. The decomposition mechanism has been studied by isothermal measurements that show that the whole process can be described by at least two mechanisms limiting the reaction rate. In the initial step of the decomposition the reaction seems to be kinetically limited by the nucleation of transformed phase, while, at advanced level of desorption, the bulk diffusion appears to limit the process. On the basis of the experimental results we propose a mechanism of phase transformation where a percolating network of the two phases is formed, at least in some steps of the decomposition reaction.

P.S.A.31.

FERROFLUIDS SYNTHESIS BY USING ELECTROCHEMICALLY OBTAINED NANOMETRIC MAGNETITE AS A DISPERSE PHASE

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Future applications of Fe_3O_4 to high-performance magnetic nanodevices and biomedical materials in the form of ferrofluids will necessitate the synthesis of monodisperse Fe_3O_4 nanoparticles with diameters ≤20nm and narrow size distribution. Even aqueous synthetic routes for magnetite nanoparticles preparation have been improved during the last decade, all of them have some important inconveniences. Here, magnetite nanoparticles were synthesized electrochemically, under various conditions of current densities and temperature of electrolytes. On this way prepared nano-powders were examined as a potential disperse phases in the both, water-based and oil-based ferrofluids. Some physical properties of the synthesized ferrofluids were examined as a consequence of crystal-chemical properties of magnetite nano-powders used.

P.S.A.32.

SYNTHESIS AND ELECTRICAL BEHAVIOR OF $Bi_5Ti_3FeO_{15}$ CERAMICS

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Bismuth layer structured ferroelectrics (BLSFs or Aurivillius phase) are of great technological interest due to their ferroelectric properties and various applications. If modified appropriately, BLSFs may exhibit novel physical properties which enrich their functionality. Aim of the present research was to fabricate and study electric and magnetic properties of the Aurivillius phases in the $Bi_4Ti_3O_{12}$ - $BiFeO_3$ (BTO-BFO) system. Materials of BTO-BFO system, combining ferroelectric, semiconducting and ferromagnetic properties, are potentially attractive for producing advanced materials for information processing and information storage applications. The general formula of BTO-BFO compounds is $Bi_{m+1}Fe_{m-3}Ti_3O_{3m+3}$. These compounds have layered perovskite-like structures, first described by Aurivillius, in which fluorite-like bismuth-oxygen layers of composition $\{(Bi_2O_2)^{2+}\}_\infty$ alternate with (001) perovskite-like slabs of composition $\{(Bi_{m+1}Fe_{m-3}Ti_3O_{3m+1})^{2-}\}_\infty$. The values of *m* indicate the number of perovskite-like layers per labs and may take integer or fractional values. Fractional *m* value corresponds to mixed-layer structures, which contain perovskite slabs of different thicknesses. The mixed oxide method was employed for the ceramics fabrication. $Bi_{m+1}Fe_{m-3}Ti_3O_{3m+3}$ ceramics with $m=4$ were prepared from simple oxide powders Bi_2O_3, TiO_2 and Fe_2O_3. Stoichiometric mixture of the powders was thermally analysed with Netzsch STA-409 system so parameters of the thermal treatment were determined. After calcination process the pellets were formed and pressed into disks with the diameter of 10mm and 1mm thickness. Free sintering was used for final densification of ceramic samples. The crystalline structure of the sintered samples was examined by X-ray diffractometer. $\Delta 2\Theta=0.01^0$ per 8 s (the Philips PW 3710 X-ray diffractometer, Θ - 2Θ method) at room temperature. Impedance spectroscopy was utilized to characterize the ac response within the temperature range up to 600 ^{0}C. Mossbauer spectroscopy at room temperature was used and hyperfine parameters were calculated from the spectra.

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P.S.A.33.

3D CERAMIC MEMS FABRICATION USING OXIDE POWDER MIXTURES VIA SELECTIVE LASER SINTERING (SLS)

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3D mesoporous parts with wide range of electro-physical characteristics were produced via Direct Metal Laser Sintering process using number of exothermal oxide powder mixtures. Following compositions was also traditionally used as green mixtures in Self-Propagating High-Temperature Synthesis (SHS): ceramoplastic (PZT + PVDF or SiO_2 additives) with ferroelectric properties; biocompatible $Al(Al_2O_3)$ + Zr (ZrO_2) ceramics; ferromagnetic Ba + M, Li + M and Sr + M (M = Fe, Cr) systems for $Li_{0.5}Fe_{2.52x}Cr_xO_4$, $BaFe_{12-2x}Cr_xO_{19}$ and $SrFe_{12}O_{19}$ ferrites; high temperature superconducting ceramics such as $YBa_2Cu_3O_7$ etc. These materials may be potentially applied in smart micro devices (Micro Electro Mechanical Systems, or MEMS devices) such as ultrasonic sensors, filters, piezoelectric detectors, drug delivery systems, pumps etc. Physico-chemical properties of 3D parts may be described by changing of the "phase–structure" connectivity, which has been confirmed by SEM-EDX and X-ray results, volume fraction of the main phases or pores in the composite and number of special distributions. Optimal regimes of 3D parts laser beam synthesis and electro physical features of their properties were determined in depending from the laser influence parameters.

P.S.A.34.

INFLUENCE OF Ca CONTENT ON THE STRUCTURE AND PROPERTIES OF (Co,Ca)O THIN FILMS DEPOSITED BY PLD TECHNIQUE

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In this paper the results of investigations of pure and Ca-doped CoO thin films deposited by PLD technique are presented. The study carried out for variable Ca content allowed to establish optimal conditions for good quality oxide films preparation. The microstructure, chemical/phase composition and morphology of obtained thin films were examined by means of diverse techniques (SEM, TEM, EDS, XRD). For estimation of deposited Ca-doped CoO films quality the thickness measurements, nanohardness and scratch tests (adhesion) were performed. Obtained results confirm that using PLD technique it is possible to carry stoichiometric composition of (Co,Ca)O from target to single crystal substrate and allow to conclude that the calcium dopant concentration (chemical composition) influence on the morphology and properties of deposited (Co,Ca)O films.

P.S.A.35.

INFLUENCE OF Mo CONCENTRATION ON STRUCTURE AND PROPERTIES OF Mo-DOPPED Bi_2O_3 THIN FILMS OBTAINED BY PLD TECHNIQUE

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The paper presents the results of investigations of Mo-doped Bi_2O_3 thin films obtained by PLD technique, using Nd:YAG laser. Bismuth oxide is the material having wide application in the electronic and optical industry. The objective of our investigation is stabilization of high temperature δ phase to lower temperature, which permits take advantage of interesting properties of this material (good ion conductivity, changing conductivity with temperature) widely. The Mo concentration and process parameters influence on the structure and properties were studied. The laser energy, the substrate temperature and the oxygen pressure in the vacuum chamber during deposition by PLD process influence strongly the chemical composition and morphology of obtained films. The SEM, TEM, EDS and XRD investigations are presented in present paper. The adhesion to the substrate (scratch tests), nanohardness and electrical conductivity of obtained thin films were studied. The results of investigations carried out indicate that it is possible to carry stoichiometric composition of pure and Mo doped Bi_2O_3 alloy from target to substrate and it is possible to use produced by PLD process thin films to e.g. gas sensors, catalyst production.

P.S.A.36.

IN SITU STUDY OF THE NUCLEATION KINETIC AND SINGLE LAYERS GROWTH RATE OF EPITAXIAL $SrTiO_3$ FILMS DURING PULSED LASER DEPOSITION

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This study is an attempt to find accordance between theoretical estimations and real parameters of $SrTiO_3$ (STO) film measured by AFM, XRD and *in situ* RHEED. The effects of oxygen pressure on the ablation products flux have been studied first and quantitative relations between density of a laser flux, gas pressure and growth rate were established for 570 – 780°C. These results were in quantitative agreement with kinetic model based on conservation equations for adiabatic expansion of laser plasma in gas. Further analysis of homoepitaxial growth process was based on kinetic approach and two theoretical models of film nucleation have been used to establish relationships between deposition conditions and film properties: surface composition, structure, roughness, number of growing monolayers, and film thickness. New principles of RHEED data treatment were proposed and surface relaxation kinetics was measured for single-pulses and for films deposited under constant pulse rate up to 5 Hz. The time constants of the relaxation of the deposited particles were measured. Using LEED and in situ RHEED, it has been shown, that growth at temperatures above 650°C is characterized by presence of surface phase. It mean, that experimental estimations of a kinetic processes at the surface are attributing first of all to the surface phase properties, whereas a growing film structure is formed deeper, under film-surface layer interface and determined by the conditions of phase stability. This structure transition occurs at the depth, which exceeds the number of not completely filled monolayers. In this connection, the evolution of the theory of Smooth Multilayer Growth (SML) seems promising enough. The obtained results were applied for making at the surface of $SrTiO_3$ single crystals 7 nm layer with high conductivity and high mobility of electrons.

P.S.A.37.

MODELING AND EXPERIMENTS IN THE INTERACTION OF LASER BEAM WITH CARBON NANOPOROUS MATERIALS

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In this work, the interaction of materials with both well-known commercial lasers and rarely used lasers like alexandrite, Er^{3+}:YAG and others, are analyzed according to the dynamical regimes. Modeling through various numerical approaches and analytical approximations has been performed. The results of sample irradiation, obtained by some of microscopic techniques (optical, SEM ...), are analyzed by image processing methods. The modeling includes the processes existing up to melting point by finite differences method. Particularly, specific critical energies have been analyzed, which lead to melting, evaporation, sublimation and so-called optimal energy. In contemporary interpretations of interaction modeling, there are developed approaches for CW and pulse (longer pulses) lasers. The interaction with ultra-short pulses demands new approaches which seem to be still in development.

P.S.A.38.

SURFACE MODIFICATIONS OF A Ti-6Al-4V ALLOY BY A LASER SHOCK PROCESSING

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The aim of this work was to examine the effect of the laser shock processing (LSP) on the morphology, microstructure and surface layer properties of a titanium Ti-6Al-4V alloy. Laser shock processing was accomplished by a high-power Q-switched Nd:YAG laser, operating in a 1,064 µm wavelength range. The laser power density was 140 MW/cm^2 and a puls duration 18 ns. The microstructure of the treated material were analysed by optical, scanning and transmission electron microscopy. The roughness of the surface was measured by TOPO-L50 equipment. The compressive residual stresses were measured by X-ray diffractometry. It has been found that the laser shock peening (LSP) is an effective surface treatment to harden the surface layer of the materials.

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P.S.A.39.

THE EFFECTS OF LASER LIGHT INTERACTIONS WITH MATERIALS OF CULTURAL HERITAGE

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The effects of laser light and material interaction during the process of testing, processing and conservations of cultural heritage objects are very important concerning of the material characteristics preservation. Ruby and Nd^3YAG lasers are very often used as light sources in a variety of optical recording and testing methods of cultural heritage items (eg interferometry). Special emphasis is give on the undesirable effects that may occur in the tests due to local laser beam focusing and to energy density increasing, as well as on the application of the laser processing, corrosion cleaning and material sintering.

P.S.A.40.

PULSE FREQUENCY AND DUTY CYCLE INFLUENCE ON AISI C1043 STEEL GRADE PLASMA NITRIDED IN COLD WALL CHAMBER

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Pulse plasma nitriding of AISI C 1043 steel grade samples was performed in a cold wall chamber at various pulse frequencies, duty cycle and temperature at constant treatment time. The thickness of diffusion zone was considered as the process efficiency dependent on nitriding process parameters. At the constant temperature and treatment time the compound and diffusion zone thickness may be controlled by duty cycle and frequency of applied pulse voltage. The charged particles and active species time variation was monitored by recording the electrical response of the current sensor and photomultiplier signal induced by optical emission of the active species particles. The compound and diffusion zone thickness were measured by Vicker's microhardness and by the calotest method. It was found that the current and photomultiplier signals correspond to the first order system response so that charged particles and active species generation and quenching may be described by the characteristic process times. The process efficiency is dependent on duty cycle and voltage pulse frequency due their influence on the ion bombardment flux and active species time variation. The sample temperature and duty cycle are not independent variables and the diffusion zone thickness is influenced by compound zone thickness as well. The diffusion zone grows at different rates before and after compound zone formation.

P.S.A.41.

TRANSPORT COEFFICIENTS IN MIXTURES BF_3, F_2 AND F

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In this paper we used the available data for electron impact scattering cross sections for electrons in BF_3 to calculate the transport coefficients for electrons. Monte Carlo simulation was used to perform calculations calculating transport coefficients as well as rate coefficients in dc electric fields, crossed electric and magnetic dc fields and rf fields.

Cross section sets were compiled and tested against the swarm data and transport coefficients were calculated and measured for dc and rf fields. We have also tested how transport coefficients are affected by the presence of radicals such as F or the molecule F_2.

Calculations were performed by using our Monte Carlo technique for electron (and also ion and fast neutral) transport involving either time integration method or null collision method. Both approaches have been verified on basic swarm benchmarks.

Our Monte Carlo simulation is initiated by 500000 electrons with the initial Maxwellian electron energy distribution function with mean energy of 1eV. Gas number density was $3.54*10^{22}$ m^{-3} and phase between electric and magnetic field was $\pi/2$.

The presently derived set of data provides a basis for a complete plasma model implantation by using BF_3 containing plasmas. Such data are the foundation for development of computer aided design of plasma devices and should include: electron scattering cross sections, dc electron transport data for *E* and *ExB* fields, ion-molecule reactions and excited state collision data.

P.S.A.42.

CALCULATIONS OF CROSS SECTIONS DATA FOR SCATTERING OF ELECTRONS ON HB_r

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Collisions of electrons with atoms and molecules determine the behavior of plasmas. The ionization of a molecule induced by electron impact represents a basic electron-molecule collision process important in many practical applications such as low-temperature processing plasmas, fusion-edge plasmas, gas discharges, radiation chemistry, mass spectrometry and chemical analysis. Therefore, studies of electron scattering collisions have attracted considerable attention over the years. Hydrogen bromide HB_r is used in calculating transport coefficients as well as rate coefficients in dc electric fields, crossed electric and magnetic dc fields and rf fields. This work dealing with HB_r is focused on computing the total (integrated) electron scattering cross-sections as well as the BEB (Binary-Encounter-Bethe) ionization cross section by using R-matrix method. This data will enable more accurate calculation of the transport coefficients.

P.S.A.43.

BREAKDOWN PHENOMENA IN WATER VAPOR MICRODISCHARGES

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Micro discharges can be considered as a new class of plasmas that allow formation of non-equilibrium plasmas at atmospheric pressures. The fact that microdischarges operate under conditions where boundary effects dominate indicates the importance of establishing scaling laws in microgaps. In this paper, the departure of the breakdown voltage from the Pachen's law at extremely small electrode separations is theoretically studied. In the standard breakdown criteria the secondary emission coefficient that incorporates the enhancement has been included. The obtained expression has been applied for determination of the breakdown voltage in water vapors in microgaps. The results of this research can be applied in the construction of compact pulse power generators for bioelectric applications.

P.S.A.44.

3D SIMULATIONS OF THE ANISOTROPIC WET ETCHING OF SILICON

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In this paper we have simulated the profile evolution during anisotropic wet etching of silicon by using the level set method. Angular dependence of the etching rate was based on the the silicon symmetry properties, by means of the interpolation technique using experimentally obtained values of the principal [100], [110], [111] directions in KOH solutions. Some examples illustrating developed methodology are presented. The calculations are performed by employing an extension of the sparse field method for solving three dimensional (3D) level set equations in the case of non-convex Hamiltonians.

P.S.A.45.

RICHARDS TYPE DECHANNELING FUNCTIONS FOR LOW ENERGY PROTONS CHANNELED IN Cu CRYSTALS

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We present here the energy dependences of the dechanneling functions for low energy protons in the <100>, <110>, and <111> Cu crystal channels. The proton initial energy varies in the range between 10 and 200 keV. The dechanneling functions were generated using the MARLOWE computer code, which enabled us to follow the proton trajectories in the channels. Then, the generated dechanneling functions were modeled by the Richards type sigmoidal dechanneling functions. We show that the parameters of the modeled dechanneling functions, x_c, k and d, strongly depend on the proton initial energy. Parameter x_c is connected to the proton dechanneling range, and parameters k and d to the dechanneling rate.

P.S.A.46.

PROTON IMPLANTATION OF GLASSY CARBON

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We present the results referring to the proton irradiation process and its implication on glassy carbon (GC) surface and structural properties. The irradiation was performed at room temperature using 15 keV H^+ ions up to the doses of $3\cdot10^{18}$ ion cm^{-2}. Wetting angle and cyclic voltammetry (CV) measurements have been used for characterization of surface changes caused by proton irradiation, while morphological and structural changes were characterized by: scanning electron microscopy (SEM), atomic force microscopy (AFM) and Raman spectroscopy measurements. Irradiated GC has better hydrogen reduction properties, therefore being better cathode material. The analysis of Raman spectra reveals disordering of GC, as a consequence of irradiation. As a result of proton irradiation, wetting of GC surface is drastically increased. Surface roughness varies with irradiation dose in the range 10^{17} – 10^{18} ion cm^{-2}, peaking at the dose of $5\cdot10^{17}$ ion cm^{-2}. By correlating surface roughness and wetting angle linear upgrowth was established.

P.S.A.47.

STRUCTURAL CHARACTERIZATION OF BORON IRRADIATED AND BORON DOPED GLASSY CARBON

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The aim of this work was to examine structural changes induced by boron incorporation into glassy carbon. Boron incorporation was achieved by tree different ways: by chemical doping by mixing phenol-formaldehyde resin with boric acid, B^{3+} ion irradiation of phenol-formaldehyde polymer plate before carbonization and B^{3+} ion irradiation of glassy carbon plate. B^{3+} ion irradiation was performed at energy of 50 keV and dose of $5x10^{16}$ ion/cm^2. Samples were characterized by atomic force microscopy (AFM), Raman spectroscopy and X-ray diffraction. AFM micrographs showed that B^{3+} irradiation of GC leads to stripping of GC surface. Results obtained by Raman spectroscopy and X-ray diffraction show that chemically incorporated boron in polymer acts as defect in structure and affects glassy carbon structure more than incorporated boron by irradiation. Irradiation of GC plate almost destroyed GC structure and converted it to an amorphous structure.

P.S.A.48.

FORMATION OF GAS PHASE FLUORINE AND CARBON CONTAINING MOLECULAR SPECIES IN PLASMA APPLIED IN THIN FILM PRODUCTION

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Plasma plays an important role in the production and modification of thin films. Formation of thin films from a feed gas through a set of gas-phase and surface chemical reactions is called chemical vapour deposition (CVD). If the thin film formation process is stimulated by plasma the CVD process is called plasma enhanced chemical vapour deposition (PECVD). PEVCD method has been successfully applied in production of fluorocarbon thin films, a very promising material for microelectronic industry.

The properties of deposited thin films depend on steady state conditions achieved in gas phase via gas phase reactions including also the chemical reactions with the constituents of formatted solid state (film). In this paper we consider the formation of different carbon, fluorine am also hydrogen containig species (CF, CF_2 , CF_3, C, C_2, C_3, CH, CHF etc.,) which could be substantial species in the deposition process of fluorocarbon thin films. This process is investigated theoretically by computing the equilibrium composition of the gas mixture containing fluorocarbon compound (like CF_4, C_2F_6, CH_2F_2) with argon and with argon and hydrogen. The calculation is performed for temperature range between 500 and 6000 K, for different C/F/H ratios and for the total pressure in the system of 1 bar and 0.1 bar. In order to take into the consideration the nonequilibrium conditions in the real plasma used, the method of the calculation is modified in that way to take into account the possible discrepancy between the electron temperature and the temperature corresponding to the heavy particles (atoms, molecules radicals). The obtained concentrations of molecules and radicals important for the formation of fluorocarbon thin films, were compared to those experimentally determined.

P.S.A.49.

PULSED CO_2 LASER IRRADIATION OF CERIA CERAMICS

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Nanometric pure ceria powder as well as Fe doped ceria powders were synthesized by self-propagating room temperatures process. The both pressed and sintered samples were exposed by pulsed CO_2 – laser radiation. The energy absorbed from the laser beam was partially converted to thermal energy and the effects on the morphological changes were considered by means of XRD, Raman, Scanning Electron Microscopy and Energy Dispersive Spectroscopy techniques. The morphological features and processes that accompany the interaction can be summarized as follows: (1) appearance of plasma in front of the target during sample irradiation, (2) drilling and exfoliation of the sample in the central zone of the irradiated area, and (3) appearance of grainy structure in the surrounding peripheral zone.

P.S.A.50.

CHARACTERIZATION OF THE TEMPERATURE PROFILE OF FOAMING POLYURETHANE REACTION MIXTURES

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Temperature profiles in foaming polyurethane reaction mixtures were investigated. Commercial mixtures based on toluene diisocyanate and commercial polyether triols were catalyzed by several catalytic mixtures: by a standard commercial system, and by modified ones, in which the triamine component was replaced by alternative catalysts. The time dependences of temperature in the reaction mixture and the times of foam growth, as well as the quality of the obtained foams were compared for the different catalytic systems used on the same polyurethane system.

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P.S.A.51.

MODIFICATION OF LIQUID RUBBERS

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Radical additions of phenolic or hindered-amine light stabilizer (HALS) derivatives to the pending C=C bonds of hydroxy-terminated low-molar-mass polybutadienes (the so-called liquid rubbers, HTPB) have resulted in the formation of polymer-bound stabilizers bearing a variable content of phenolic or HALS moieties in the side chains. New hybrid polymer-bound stabilizers, bearing sterically hindered piperidine (HALS) and sterically hindered phenolic antioxidant moieties covalently bound to the *same polymer chain* of HTPB show a synergic protective effect and are further aimed at the stabilization of commercial polymers, in which they can perform also as impact modifiers. Their stabilizing efficiency was evaluated by means of thermoanalytical methods, DSC and TGA in air.

Financial support of the Grant Agency of the Czech Republic (project 203/07/0987) is gratefully acknowledged.

P.S.A.52.

DEVELOPMENT OF CORRECTED METHOD FOR CLAY DRYING SUSCEPTIBILITY DETERMINATION IN FAST-DRYING PROCESS

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Manner of ceramic raw material (especially heavy clay) during drying process is one of widely discussed subjects. Method by Frenchmen A. Bigot and V. Bodin is mostly in usage. They constructed an instrument which records linear shrinkage as a function of mass loss, which is graphically represented as Bigot`s curve. For a long time this was the only way to group clays on the basis of drying susceptibility, according to the obtained critical point.

New findings in clay drying processes, especially "fast drying" process which is being developed in order to decrease energy consumption, indicate that clay drying criteria must be updated. Drying behavior of different types of clays which underwent different regimes is presented in this paper, aiming to develop a corrected method for clay drying sensitivity determination using Bigot`s criteria in fast-drying process. Unexpected conclusions are drawn, incompatible with traditional criteria.

P.S.A.53.

RELATION BETWEEN PUNCHING FREQUENCY AND LOADINGS ON TOOLS AT HIGH SPEED BLANKING OF ALUMINIUM ALLOYS

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Blanking is a relatively good investigating process for punching frequencies in the range between 20 to 100 strikes per minute. For low frequencies the relation between the punching frequency and loadings on the tools are very well described. For higher punching frequencies about 600 and more strikes per minute the dynamic response in the tool are dramatically changed. So the dynamic loads on the tool, at high punching frequencies, cannot be calculated with the use of mathematical relations which are valid for low punching frequencies, consequently new research was required.

In this paper the measuring of forces on tools for blanking of aluminium alloys at high frequencies is described. The dependency of the punching frequency on the blanking force was observed with respect to mechanical properties of the material and the thickness of the aluminium sheets. With the measured data new mathematical relations about the blanking process are developed. The new relations give better insight into the complete dynamic system: the press, the punching tool, and the work-piece.

The result of the research has given interesting discoveries: the increase of the punching frequency results in the decreases of the punching force. Lower punching forces leads to lower forces on the punching tool what is important for the tool design.

P.S.A.54.

EXPERIENCE FROM MODERN STEAMBOILER MATERIALS WELDING APPLICATION

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Due to global higher needs trend for energy consumption, demands for durability and reliability of steamboiler components are much more emphasized. That leads to modern steamboiler materials application in extraordinary heavy service conditions (creep, fatigue, thermo mechanical load in service, corrosion in aggressive medium, ...). Nowadays, in modern steamboiler components and plants production which operate in heavy service conditions, new modern materials P91, P92 and Ni based alloys are used. Due to fact that those materials are relatively new and there is not enough experience from service and also from special laboratory investigations, this paper gives some practical data from several years' practical application in workshop and special laboratory investigations.

P.S.A.55.

VIDEOEXTENSOMETRIC MEASURING OF DEFORMATION PROCESSES IN AUTOMOTIVE STEEL SHEETS AT TWO STRAIN RATE LEVELS

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Videoextesometry is a new experimental technique for non contact strain measurement, which enables to measure the longitudinal and transversal strain components on a planar surface of the loaded object. Experimental equipment uses a CCD camera (640 x 480 pixels) for monitoring the process on the surface area of 20 x 10 mm. The special software calculates the displacements of contrast dots prepared on the specimen surface. The paper presents results obtained experimentally on two steel grades for automotive steel sheet during tensile testing at slow and high strain rates in the quasistatic loading range. Non contact strain measuring is used to monitor the strain development and strain localisation.

P.S.A.56.

THE MODELLING OF STABLE AND METASTABLE PHASE FORMATION IN MULTI-COMPONENT Al ALLOYS

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In recent years the use of thermodinamic modelling via the CALPHAD method has been extensively applied to industrial alloys of many types. Purpose of the present paper is to provide a review and examples of the practical application of the CALPHAD method to commercial industrial Al - alloys. A further purpose of the paper is to present new results for the modelling of metastable hardening phases, such as GP zones, θ', S', and show how CALPHAD modelling can be extended to calculate relevant diagrams for their formation. Many Al - alloys are hardened by metastable phases such as GP zones, θ', S' etc. and it is therefore important that the thermodynamic calculations are able to include such phases, both for understanding and predicting metastable equilibria, but also as necessary input into kinetic equations to calculate the conditions for formation of these phases. Results of the kinetic modelling show excellent consistency with observed behaviour in practice.

P.S.A.57.

USING A INDENTATION TECHNIQUES FOR STRAIN DEVELOPMENT MONITORING FOR CONSTRUCTION STEEL SHEETS

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The paper deals with examination of relation between the hardness and the size of plastic zone during the tensile loading. For measurements of hardness was UCI hardness method used. Deformation was evaluated by non-contact extensometry – videoextensometry. The result present existence of the exponential relation between hardness and plastic deformation: $HV = HV_p + k\varepsilon^a$. For experiments were used two types of steel sheets. Hot rolled sheets with thickness of 10 mm and thin automotive sheets with the thickness of 1 mm.

P.S.A.58.

THE PITCHES USED IN THE FABRICATION OF THE NEEDLE-SHAPED COKE

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This paper indicates the necessity and utilization of the pitch coke in Romania. It suggests the limitations of the pitches obtaining conditions utilized in this purpose and also the possibilities of separating the fractions used to obtain a top quality pitch coke. Romania it is a country that has an advanced coke-chemical industry. We are the only country in Southeastern Europe that produces carbonic products. The Romanian line of carbonic products develops based on the importation of needle-shaped coke and binders, pitches used as binders and encasement materials. Romanian coke tar working represents a special economic efficiency in the process of obtaining pitch and coke pitch. The experimental researches in the field of pitch utilization for the coke production, used in the coal industries conducted to the following conclusions. Elaborating pitches must remove inorganic mass, insolubles in quinoline and aliphatic components. Researches had shown that quinoline solubility, filtration and vacuum distillation used in removing quinoline and aromatic components can lead the pitch to the desired quality. Calcinations of the obtained pitch, it's coking with a low temperature gradient can result a coke pitch with the quality values requested by the obtaining process of the needle-shaped coke.

P.S.A.59.

OBTAINING AND CHARACTERIZATION OF Lu_2O_3 NANOPARTICLES AND TRANSLUCENT CERAMICS ON THEIR BASIS

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Nowadays Lu_2O_3 optical ceramics is considered as a promising material for laser or scintillation application. The purpose of this work was to obtain and study lutetium oxide nanopowders and compacts on their basis. We have obtained the monodisperse spherical nanoparticles of Lu_2O_3 with diameter of 60-120 nm and specific surface area of 14-22 m^2/g. The influence of precursor drying method on Lu_2O_3 nanoparticles agglomeration has been established. It has been shown that precursor drying in air at room temperature or by azeotropic distillation allows one to prevent Lu_2O_3 powders agglomeration. Lu_2O_3 monodisperse nanoparticles have been consolidated to form homogeneous dense compacts with density of 47-55 % by colloidal pressure filtration or uniaxial pressing methods. The preliminary optical properties of vacuum sintered Lu_2O_3 ceramics have been determined.

P.S.A.60.

A NEW METHOD APPLIED IN THE CASE OF SOME CONSTRUCTION ELEMENTS: COMPUTERISED "MATERIAL – SHAPE" SELECTION

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The aim of this paper is the presentation of a computer-aided approach for materials-shape selection, applied in the case of the secondary beams in constructions. Taking into account the complexity of the problem, which consists firstly in the "multiplication" of the materials diversity with that of forms and technologies of their fabrication, it is argued the inefficacy of the traditional engineering design practice and the necessity to use new procedures, called rationale, enabling the systematic elaboration of a huge information without any "a priory" exclusion of possible alternatives. During the application of the proposed procedure in the case of secondary beams, by the means of CES software, it is performed the screening of the structural sections database and the ranking of the most appropriate candidates (a short list) for two main kinds of priorities, emphasizing the mass decrease and the cost reduction. The formalization of such priorities is realized using the index performance method (Ashby method), expressing them by the properties relations who correspond to four different indices. This analysis shows that among the most competitive candidates of the short list, besides the steel sections (quite exclusively used in our construction industry) must be considered also those of the aluminum, composites and wood. The analysis is further completed applying a multicriterial search, which allows a more objective evaluation of the total performance of different candidates. It seems that composite sections possess values insufficiently known till now by our designers. The bringing out of such innovative alternatives is one of the superiority of the proposed approach to the traditional ones.

P.S.A.61.

PRODUCING OF 5-NONYLSALICYLALDOXIME AND ITS PURIFICATION

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5-nonylsalicylaldoxime is a strong copper extractor that is mainly used for the process of copper solvent extraction. In this work it was synthesized by the reaction of formaldehyde and nonylphenol magnesium methoxide, in an anhydrous medium. In order to achieve a selectively orthoformylated product, at first the hydroxyl group of nonylphenol was modified by magnesium methoxide. The nonylphenol magnesium salt was then formylated by paraformaldehyde. The oximation reaction was finally applied to the prepared nonylsalicylaldehyde. Impurities of the resulted 5-nonylsalicylaldoxime were removed by several steps liquid extracting via water and acid washing. The solvent was finally removed by evaporating under reduced pressure. Some instrumental analyzing such as H-NMR and GC/MS spectra were taken on the product in order to interpret the reaction quantitatively and qualitatively. The formyl and oxime functional groups were characterized by H-NMR spectra. The GC/MS spectra also verify the production of salicyladoxime molecule.

P.S.A.62.

FABRICATION OF SUPERSATURATED NANOSTRUCTURE AL 7075 ALLOY BY MECHANICAL ALLOYING

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In this study formation of supersaturated AL 7075 alloy was investigated. For this purpose a mixture of initial elements (Al,Zn,Mg,Cu) based on chemical composition were subjected to high-energy milling for various times. The ball to powder mass ratio was considered 10:1. The structural changes of powder particles during MA were studied by X-ray diffraction (XRD), scanning electron microscopy (SEM), and microhardness measurement. The aluminum crystalline size estimated with broadening of XRD peaks by Williamson-Hall formula. The results showed after 40h of milling an Al-Zn-Mg-Cu supersaturated solid solution with a grain size of 24 nm was obtained. It was observed that the position of Al peak slightly shifted to higher angles by increasing milling time. The microhardness measurement demonstrated maximum hardness has been accessed was approximately 240 HV.

P.S.A.63.

MECHANISM AND THERMODYNAMIC ANALYSIS OF NANOCRYSTALLINE NiTi FORMATION BY MECHANICAL ALLOYING

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Nanocrystalline NiTi intermetallic was produced from a mixture of Ni and Ti powders by mechanical alloying (MA). The product was characterized using X-ray diffraction and scanning electron microscopy. A thermodynamic analysis of the process was carried out using Miedema model. The results indicated that a composite lamellar structure of Ni and Ti is formed with the dissolution of Ti in Ni at the early stages of MA. The resulting supersaturated solid solution becomes non-stoichiometric and finally disordered B2-NiTi intermetallic phase with grain size of 25 nm. Thermodynamic analysis approved the mechanism of NiTi formation and showed that there is a thermodynamic driving force in Ni-Ti binary to form solid solution which has the minimal Gibbs free energy compared to amorphous phase and the product of MA is the most stable phase in Ni-Ti binary system.

P.S.B.1.

PHOTOCATALYTIC HYDROGEN PRODUCTION BY SEMICONDUCTOR HETEROJUNCTION MATERIALS

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The photocatalytic decomposition of water with a semiconductor under visible light attracts increasing interest because the attempt is aimed not only at producing hydrogen from water utilizing solar energy, but also at finding methods of making use of the photosynthetic process as green plants for direct production.

In this talk, we will introduce advance and development of photocatalysis and hydrogen energy research in our group for the relative research project. A photoelectrochemical cell with semiconductor heterojunction electrodes, $SrTiO_3/\alpha\text{-}Fe_2O_3$ and $\alpha\text{-}Fe_2O_3/WO_3$ were prepared and their structures and properties were characterized, respectively. It was observed that the photocurrent and the incident photon to current conversion efficiencies (IPCE or external quantum efficiencies) of these heterojunction were higher than that of the singles, particularly under visible light irradiation. These semiconductor heterojunction electrodes have potential to be a photoanode for hydrogen production under sunlight illumination.

We found some new series of oxide semiconductor photocatalysts: AgAlO2, BiFeO3. These photocatalysts have different crystal structure, leading to different electronic structures.Their photocatalytic degradation of organic contaminants was investigated systematically, by selecting acetaldehyde as a model gaseous contaminant, chloroform as a model solvent contaminant and methylene blue (MB) as a model dye contaminant, respectively.

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P.S.B.2.

OPTICAL CHARACTERIZATION OF Nd – SUBSTITUTED ZIRCONOLITE OF COMPOSITION $Ca_{(1-x)}Nd_xZrTi_{(2-x)}Al_xO_7$ ($0 < x \leq 0.6$)

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Zirconolite (nominally $CaZrTi_2O_7$) is a naturally occurring phase envisaged as nuclear wasteform for actinide (Pu, Np, Am, Cm) immobilization because of its ability to easily accommodate these elements in its structure and because of its excellent chemical durability and long-term behaviour under α self-irradiation in spite of its amorphization tendency. Nevertheless, for security problems arising from manipulating highly radioactive actinides, most of the research is done with non-radioactive elements (actinide surrogates) with close physicochemical properties such as lanthanides. This is why in this study trivalent actinides were simulated by the neodymium ion. It is the f-element like actinides and its ionic radius is close to those of the Am^{3+}, Cm^{3+}, and Pu^{3+} ions. Moreover, the Nd^{3+} ion is an optically and a magnetically active ion which makes it a nice probe of its environment.

$Ca_{(1-x)}Nd_xZrTi_{(2-x)}Al_xO_7$ polycrystalline materials were prepared by solid state reaction for $0.1 \leq x \leq 0.6$: 0.6 corresponds to the Nd solid solution limit in zirconolite (2M-polytype). In addition, single crystals of $Ca_{0.93}Nd_{0.07}ZrTi_{1.93}Al_{0.07}O_7$ composition were prepared by the flux method. All these materials were investigated at low temperature (4 K – 77 K) by Electron Spin Resonance (ESR), optical absorption and optical fluorescence under selective excitation. Although Nd^{3+} ions occupy only one crystallographic site (i.e. the calcium site for the charge compensation scheme envisaged here), as was demonstrated by X-rays Rietveld structural refinements, all the spectroscopic techniques reveal on the one hand an inhomogeneous broadening of the transitions, and on the other hand the existence of different neodymium environments. Depending on the spectroscopic technique (ESR or optical spectroscopy) and the transition which is investigated, from 2 to 4 environments could be identified for the Nd^{3+} ions in the samples. These different kinds of environment can be understood from the structure of zirconolite, when considering the second coordination shell of Nd. It comprises a split site that can be occupied either by Ti^{4+} or by Al^{3+} ions, which influences a surrounding and hence the crystal field of neodymium. To assess these assumptions, statistical calculations will be made and compared with the results derived from the simulation of the optical absorption spectra.

P.S.B.3.

MECHNICAL PROPERTIES OF P/M MATERIALS OF RAPIDLY SOLIDIFIED AL-CO-MG ALLOYS AT ELEVATED TEMPERATURES

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With an aim of obtaining aluminum P/M materials strengthened by at room temperature dispersion of transition metal compounds and solid solution of Mg, Al-2mass%Co and Al-5mass%Co alloys with varied Mg additions of 0, 1 and 5 mass% were prepared by rapid solidification techniques. Rapidly solidified flakes were produced by argon gas atomization and subsequent splat quenching on a water-cooled copper roll. The flakes were consolidated to the P/M materials by hot extrusion after vacuum degassing. Cast ingots of these alloys were also hot-extruded under the same conditions to the I/M reference materials. Uniform dispersion of fine intermetallic compounds (Co_2Al_9) was observed in all the as-extruded P/M materials. Added Mg was present as the solute in the I/M and P/M materials alloy even after annealing. The P/M materials containing Mg exhibited higher hardness and strength than those without Mg at room temperature. Tensile strength increased with increasing amount of Mg in the I/M materials at elevated temperatures. However, strength of the P/M materials decreased with addition of Mg at 573K and 673K. According to the steady state creep rate and creep rapture time, the creep resistance of the P/M materials containing Mg was clearly inferior to that of Mg-free alloys. Thus the positive effects of Mg additions on mechanical properties of the P/M materials of Al-Co-Mg alloys disappeared at higher testing temperature.

P.S.B.4.

DIELECTRIC PERMEABILITY OF NANOCYLINDER

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In nanocylinder, cut-off from molecular crystal, dielectric permeability tenzor is investigated. Excitons in nanocylinder arise due to the exciting of the electron subsystem of molecule. The two-level sheme of electron excitations is assumed, which means that Pauli operators create and annihilate excitons. In evaluation of dielectric permeability Dzhyaloshinskii-Pitaevskii approach is used, connected with retarded and advanced exciton Green function. It turned out that refraction and absorption indices depend on configuration coordinates, having maximal values at boundary crossections of cylinders and minimal value at central crossection. By convinient choice of dipole-dipole matrix elements high exciton concetrations could be achieved.

P.S.B.5.

ELECTRONIC STATES IN A DOUBLE LATERALLY COUPLED CONCENTRIC NANORINGS IN A MAGNETIC FIELD

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Two concentric GaAs/(Al,Ga)As nanorings in a normal magnetic field are theoretically studied. The single-band effective mass approximation is adopted for both the electron and hole states. The oscillator strength for the interband transitions is also computed. The electronic structure in two bands exhibits the Aharonov-Bohm oscillations. The pattern of these oscillations is found to strongly depend on the radia of two rings, which affects the dependence of the oscillator strength on the magnetic field. Furthermore, possibility of the *excitonic* Aharonov-Bohm effect in the analyzed system is briefly discussed.

P.S.B.6.

OPTICAL AND MAGNETIC PROPERTIES OF PbTe(Co)

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Semimagnetic semiconductors have attracted a great deal of interest not only for their potential use in spintronics, but also because of the fundamental question of how a magnetic metal can be derived from a paramagnetic insulator. The most common method involves substitution of Ni into the crystal structure of IV-VI semiconductors.

In this paper we used X-ray, far-infrared reflectivity and magnetic susceptibility measurements to investigate the optical and magnetic properties of PbTe(Co). Also, we used two models to describe magnetic and phonon structure. Agreement between experimental results and models prediction is very good.

P.S.B.7.

CRYSTALLINITY CHANGES OF ISOTACTIC POLYPROPYLENE FILMS MONITORED BY PHOTOACOUSTIC METHOD

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A modified photoacoustic technique has been developed for determining the thermal properties of polymer samples. Thermal properties of some polypropylene films have been measured on room temperature for a set of samples, by changing the preparation conditions by the rate of cooling. From the results of thermal diffusivity and specific heat it has been obsereved that the thermal diffusivity is sensitive to the degree of cristallinity of polypropylene samples. This behaviour can be attributed to microstructural changes in polymer chains, which is shown by the variations in the amorphous/crystalline ratio, obtained from the x-ray diffraction data. The microstructural variations followed by cristallinity changes have been confirmed from infra-red and AFM analysis.

P.S.B.8.

CALCULATION OF MEAN LIFETIME OF SELF TRAPPED STATES IN 1D MACROMOLECULAR CRYSTALS

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In this paper we calculate mean lifetime of NH stretch self trapped states (ST) in 1D macromolecular crystals (MC). As a theoretical background we use famous Holstein MC model. Particular attention was paid to the influence of the interaction of the ST states with single optical phonon mode on the sideband absorption spectrum of the 1D macromolecular crystals. We must emphasize to previous papers in which polaron mean lifetime is accounted semi-empirically. In that sense our results are more correct and have deeper physical signification. It is shown that values of the ST mean lifetime are strongly dependent of temperature and other system parameters. Furthermore, obtained values of the mean lifetimes are significantly differs than semi-empirically values in some areas of both, temperature and system parameters. In that sense this model enables better explanation of the temperature dependence and system parameter dependence of the sideband absorption spectra of 1D MC. Using obtained results we briefly discuss ability to experimental verification of presence of ST states in 1D macromolecular crystals.

P.S.B.9.

RELATIONS OF POLYMER -FILLER INTERACTION PARAMETERS WITH PROCESSING AND REINFORCEMENT OF SBR/BR BLENDS

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Production of environmental –friendly elastomer materials attracts much attention last ten years, because of decrease of both, the fuel consumption in traffic and the global heating. The dominant role in such materials has nano- structured silica as a filler. Keeping in mind that production of finely dispersed carbon black rubber fillers was the first nano- structuring technology, although based for long time completely on empirical principles, relations of those two main reinforcing fillers is still of high interest, in many aspects. Obviously, the similar macro- effects obtained in reinforcement by each of the fillers, can be subscribed to some very general nano- structure features that both kind of particles have in common, because the chemical constitution and atomic interactions are completely different. Because of that, many authors have tried to apply accumulated experience with carbon black nano – structuring for design of silica reinforced elastomer materials. But, other aspects of fine –particles polymer reinforcement design, advise us that some essential differences in physical constitution also exist. Especially it can be seen from differences in flow behavior during processing of the material.

In thus contribution we consider rheological properties of both, final material and elastomer compound during processing, experimentally and theoretically, to elucidate interactions of nano- structured silica fillers in styrene- butadiene (SBR) / butadiene (BR) blend much more in detail. From results obtained, we develop mathematical relations between structure parameters and dynamical behavior of such poly- phase elastomer materials, possible for practical applications in industry.

P.S.B.10.

NONEXISTENCE OF THE "CLASSICAL TRAJECTORIES" IN THE STERN-GERLACH EXPERIMENT

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The Stern-Gerlach experiment is a paradigm of the quantum measurement of spin. Its physical interpretation is in intimate relation with the physical basis of the current research in the atomic (molecular) nanofabrication procedures. Nevertheless, the deeper foundations of the experiment are not known yet. Here, we give the arguments for the physical nonexistence of the so-called "classical trajectories" of the atoms (molecules) in front of the screen. Some nanotech-related consequences are distinguished.

P.S.B.11.

ELECTRON STRUCTURE, PHYSICAL PROPERTIES AND X-RAY SPECTRA OF RM_5Si_3 AND RM_9Si_4 COMPOUNDS (R = Y, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu; M = Ni, Co)

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The rare earth – transition metal – silicon intermetallic compounds are interesting as materials for the nuclear fuel reactors constructing. The relatively high heat resistance and high neutron absorption cross-section make the very perspective their application as neutron capture materials. The investigation on possible application of these compounds for the radio engineering, electronics, computing technology, etc, are in progress. The electric conduction, thermo ionic and magnetic properties are investigating as well.

The crystal structure of new representatives of the $CeNi_{8.5}Si_{4.5}$ structure type (substructure of $NaZn_{13}$ type) and RM_5Si_3 (UCo_5Si_3 and YNi_5Si_3 structure types) was determinate. X-ray phase and structure analyses were used to specify the composition of the samples. The elemental composition of the compounds was confirmed using the scanning electron microscopy. Magnetic and electrical properties of these compounds were measured. High values of the Curie points were observed in RM_9Si_4 compounds in spite of the low magnetic moments per atom (~0.4 μ_B).

High-energy spectroscopy has been used to study the electron structure of the investigated new ternary intermetallic compounds. 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 RM_5Si_3 compounds have been calculated. Between the experimental and calculated X-ray emission spectra RM_5Si_3 good agreement has been obtained.

P.S.B.12.

PERFORMANCES OF InP FOR MEDICAL X-RAY IMAGING

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In this paper we consider InP for solid state X-ray imaging detectors in the photon energy range of medical applications. Taking into account its physical properties, we calculate spatial resolution and contrast of the pixellated InP detector and examine the effect of the fluorescence on image quality. Finally, we compare InP with materials that are currently used for medical imaging.

P.S.B.13.

ELECTRICAL AND MAGNETIC BEHAVIOR OF TRANSITION METAL OXIDES $(La,Pr)_{2/3}A_{1/3}TMO_3$, A = Ca, Sr AND TM = Mn, Co

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The manganese and cobalt perovskites display remarkable magnetic and transport properties of interest for technical applications. Magnetic oxide semiconductors are among the candidates for a high Curie temperature ferromagnetic semiconductor that are expected to be used in spintronics at room temperature. We present a detailed magnetic study of the polycrystalline transition metal oxides $(La,Pr)_{2/3}A_{1/3}TMO_3$, A = Ca, Sr and TM = Mn, Co, at low temperatures including electrical resistance, magnetization and ac susceptibility measurements. The results of this analysis suggest that such compounds have ferromagnetic semiconductor-type behavior. The samples were prepared by a solid state reaction method with various heat treatments. The x-ray analysis indicated pseudo-cubic perovskite structures with space group Pnma. The magnetic measurements showed hysteresis loops and typical $M(T)$ ferromagnetic curves. The ferromagnetic behavior was also confirmed by the real component of the ac susceptibility, $\chi'(T)$, temperature dependence. There was not sensible dependence of the magnetization behavior on the sintering temperatures of the samples. The resistivity measurements suggested semiconductor behavior for the studied system in the temperature range from 5 to 300 K, as a function of doping content and for certain sintering temperatures. In magnetic fields, up to 7 T, the system showed negative magnetoresitance. It appears that we can tune the transition temperatures (as measured, in the range from ~ 100 to 250 K) and the resistivity magnitudes by doping content and by sintering temperature. The electrical behavior of the studied samples has the main features of conduction in a phase separated system: it shows negative magnetoresistance and it is controlled by grain-boundary effects.

P.S.B.14.

ADVANCEMENT OF METHODS, TECHNIQUES AND PROCESSES FOR EXTRACTION, SEPARATION AND CHARACTERIZATION OF FULLERENES

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In the first phase of the work, the basic C_{60} and C_{70} as well as the higher fullerenes, mainly C_{76} and C_{84}, were Soxhlet extracted with *n*-heptane, *p*-xylene and *o,m,p*-xylene from the samples of carbon soot, produced in electrical arc, yielding 0.7 %, 5.9 % and 11.8 % of the extract, respectively. The remaining, *p*-xylene insoluble soot was extracted with pyridine, increasing the entire extract yield for an additional 5.9 % to 11.8 %, due to original advanced method. The procedures for increases of fullerenes yields, as well as for additional, selective extraction of the higher fullerenes were found. Chromatographic separations of the obtained extracts were performed by continual, one phase elution, under atmospheric pressure, with original, defined gradients of solvents, from pure hexane or 5 % toluene in hexane to pure toluene, on active Al_2O_3 columns, by new improved methods. The basic and the higher fullerenes of high purities were isolated in increased yields, using smaller volumes of solvents, smaller masses of stationary phase, as well as cheaper laboratory equipment. Identifications of fullerenes in chromatographically purified fractions and the obtained extracts were performed by determined IR and UV/VIS techniques that have not been presented previously for the higher fullerenes.

P.S.B.15.

MEASUREMENT OF COMPLEX PERMEABILITY USING SHORT COAXIAL LINE METHOD IN HIGH FREQUENCY RANGE

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In this paper, the possibility of complex permeability measurement of different ferrite materials is shown using short coaxial sample holders in frequency range between 300 kHz and 1 GHz. The design of coaxial high frequency sample holder is presented, the principle of measurement and calibration are explained in details. The measuring of complex permeability is managed based on accomplished formulas, and results that are obtained are discussed. For computer control processing of measurement, the user-friendly program has been developed. In order to verify proposed method, the measurement results of F14 and F19 NiZn ferrite samples are compared with catalog *Fair-rate* sample characteristics.

P.S.B.16.

SPECTROSCOPIC CHARACTERIZATION OF $Gd_{0.64}Y_{0.36}VO_4$:Yb(1,5%) SINGLE CRYSTAL

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Strong electron-phonon interaction for Yb^{3+} ion in oxide single crystals is a reason why they are promising as laser media for tunable and femtosecond lasers. Vanadates RVO_4 (R=Y, Gd) are well-known host media materials. Mixed vanadates $(R'_xR''_{1-x})VO_4$ doped with rare earth are expected to have even broader spectral lines due to the local deformations connected with difference in ionic radii of R'^{3+} and R''^{3+} ions. In this paper we characterize the $Gd_{0.64}Y_{0.36}VO_4$:Yb(1,5%) single crystal in comparison with the YVO_4:Yb(1,5%) one using the infrared (IR) transmission and reflection as well as Raman spectroscopies.

Single crystals doped with ytterbium were grown by Chokhralsky method. Polarized temperature-dependent IR transmission spectra in the range of ytterbium absorption were measured using a BRUKER IFS125HR Fourier spectrometer. Raman spectroscopy was done on a home-made triple monochromator equipped with nitrogen-cooled CCD-camera. For the reflection measurements we used a BRUKER IFS66.

We present the energy level scheme of Yb^{3+} ion and assign the irreducible representations to the crystal-field levels. The existence of non-equivalent Yb^{3+} centers in a mixed crystal is discussed. Raman and IR reflection spectra have revealed that the phonon modes observed are in good agreement with the group-theoretical analysis. The correlation between the phonon spectrum and the electron-phonon bands is discussed.

P.S.B.17.

ZERO-DEGREE FOCUSING OF PROTONS CHANNELED IN A TILTED CRYSTAL

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The effect of focusing around the origin of the scattering angle plane of protons channeled in a tilted <100> Si thin crystal is investigated theoretically. It is called the effect of zero-degree focusing of channeled protons. The calculations were performed for the proton energy of 2 MeV and the reduced crystal thickness of 0.5, corresponding to the end of the first rainbow cycle. We followed the evolution of the angular distribution of channeled ions with the tilt angle. The angular distributions were generated by the computer simulation method using the numerical solutions of the proton equations of motion. We also generated the rainbow patterns corresponding to the angular distributions, and used them to explain the strength of the effect of zero-degree focusing and its weakening for the larger tilt angles. The obtained results are important for understanding the possibilities for subatomic microscopy with proton beams in crystal channels.

P.S.B.18.

THE NEW PARAMAGNETIC PILLARED BENTONITES AS DIGESTIVE TRACT MRI CONTRAST AGENTS

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The increased use of imaging technologies in diagnostic studies, such as MRI, has contributed to the development of the wide range of new materials which could be successfully used as image improving agents. However, there is a lack of such substances in the area of gastrointestinal tract MRI. Recent studies show that, many of the traditionally popular relaxation altering agents, such as iron, generally show poor results and disadvantages in this area provoking black bowel, side effects of diarrhea and, from an important analytical standpoint, the presence of artifacts arising from clumping. Local concentration of paramagnetic species may lead to ferromagnetic effects, drastically altering image quality. Paramagnetic species, represented by gadolinium also seem to be potentially suitable agents for these studies. Nevertheless, this metal itself cannot be used in humans because of its toxic properties. Diethylenetriamine pentaacetic acid (DTPA) complexes of trivalent gadolinium have less (but still present) toxicity than the uncomplexed salt. However, contrast opacification has been reported and less than 60% of the gastrointestinal tract magnetic resonance scans showed improved delineation of abdominal pathologies. Furthermore, nearly 40% of the patients reported diarrhea and meteorism. Therefore, there is clearly a need for orally effective, well tolerated agents that can be used in humans for digestive imaging studies. This MRI contrast should be useful for visualizing the anatomy of the digestive tract and particularly to differentiate between normal and pathological states, such as tumors. The solution has been proposed as zeolites or smectite clays (hectorite and montmorillonite) enclosing of paramagnetic metal ions obtained by ion-exchange methods. However, such materials have problems of leakage of paramagnetic ions causing the appearance of the named side-effects. In our recent studies we proposed the usage of the pillaring method for paramagnetic metal encapsulation in bentonite. By this way, paramagnetic cations like Fe^{+3}, Mn^{+2} and Gd^{+3} were introduced between clay layers as metallic polioxo cations. After calcination, these polyoxo cations grow to be pillars (oxides of these metals) which are incorporated into the clay matrix which prevents ion-leaching and side-effects previously described. In this study we show that Co and Dy paramagnetic-pillared bentonites could also be successfully used as MRI digestive tract non-leaching contrast agents, altering the longitudinal and transverse relaxation times of fluids in contact with the clay minerals.

P.S.B.19.

ANGULAR AND SPATIAL DISTRIBUTIONS OF 1 GeV PROTONS CHANNELED IN A BENT SHORT (11, 9) SINGLE-WALL CARBON NANOTUBE

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In this work we investigate theoretically the angular and spatial distributions of protons channeled in a bent short (11, 9) single-wall carbon nanotube. The proton energy is 1 GeV and the nanotube length is 10 μm. The bending angle is varied between 0 and 0.2 mrad. The angular and spatial distributions of channeled protons and the corresponding rainbow patterns were generated numerically. The interaction between a proton and a carbon atom was described by the Doyle-Turner interaction potential. We present the angular and spatial distributions together with the corresponding rainbow patterns in the scattering angle and transverse position planes, and show that the distributions can be fully explained by the corresponding patterns. In addition, we discuss the possibility of applying the obtained results for production of nano-sized ion beams with carbon nanotubes.

P.S.B.20.

FROM CORRELATED METAL TO MOTT INSULATOR IN GA(V,TI)$_4$S$_8$: DISORDERED – DRIVEN ANDERSON METAL – INSULATOR TRANSITION

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Ternary chalcogenides belong to an interesting class of transition metal system of formula AM_4X_8 (with A = Ga, Ge; M = V, Nb, Ta, Mo; X = S, Se) which exhibit a cubic structure of the $GaMo_4Se_8$-type that is often described as a cation-deficient spinel. Fascinating physical phenomena like a pressure induced transition to a superconducting state ($GaNb_4S_8$) or nonvolatile electric-pulse-induced insulator to-metal transition and possible superconductivity ($GaTa_4Se_8$) were observed. Recently we have synthesized and characterized the first Ti member of the AM_4X_8 family of tetrahedral transition metal cluster compounds with deficient spinel type structure. In the present work we investigated the structure, electronic and magnetic properties of the solid solution $GaV_{4-x}Ti_xS_8$, ($0 \leq x \leq 4$) which shows a metal insulator transition around x = 0,75. While $GaTi_4S_8$ is a correlated metal, GaV_4S_8 is a Mott insulator. As so-called Mott insulator is a compound where the electron are localized because the on site Coulombic repulsion energy (called Hubbard energy U) is too high compared with the kinetic energy. X-ray diffraction on the sintered powder show the presence of Ga vacancies and a strong declustering of the transition metal atoms and an increasement of the intracluster distances $d_{M\text{-}M}$ by increasing the Ti content. Electrical measurements shows that above x = 3.5 the temperature dependence of the resistivity present a positive temperature coefficient consistent with a metallic like behaviour. For x = 3 and 2.75, the resistivity follows a power law dependence on the temperature which is characteristic for a disordered – driven Anderson metal – insulator transition, in the critical regime. Bellow x = 2.5 the observed $\ln \rho \approx T^{-1/2}$ suggest the existence of a soft coulombian gap related to the existence of inter-site electronic repulsion V. Finally, a Mott insulator state is recovered for V = 4 (x = 0).

P.S.B.21.

Si_3N_4 ELONGATED NANOSTRURES AND FORMING CRITERIA OF POROUS BODY ON THEIR BASIS

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Diminishing of grains sizes of the sintered ceramic material to the nanolevel allows substantially increase hardness of polycrystalline material. Increase of fracture toughness and strength of such nanostructured ceramics on the basis of refractory nitrides possibly due to application of the extended structural elements. Among these are nanorods, nanowires and nanotubes. Today such materials are supplied by different firms, for example, silicon nitride with the particles sizes of 100 x 800 nm. In IPMS of NASU the processes of synthesis of silicon nitride nanotubes and different elongated nanostructures are investigated. As a result of which the terms of synthesis of nanoparticles are determine. The present work is devoted to characterization of the titled materials and research of possibilities of forming of dense body, containing the elongated particles, placed in a matrix of TiN equiaxial particles. The parameters of process, providing the developed shear deformations which allow obtaining a dense green body for subsequent sintering are disclosed.

P.S.B.22.

ELECTRONIC PRINCIPLES OF SOME TRENDS IN PROPERTIES OF METALLIC HYDRIDES

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Due to their presently extensive, important and versatile potential applications, metal hydrides (MH) are among the most investigated solid-state systems. Theoretical, numerical and experimental studies have provided considerable knowledge about their structure and properties. However, despite this number of results, the basic electronic principles of various interactions present in MH have not been yet completely resolved. Even in the simplest MH, i.e. alkali hydrides (Alk-H), some trends in their properties, and especially their deviations are not well understood. Similar doubts exist in the alkaline-earth hydrides (AlkE-H) series, and for transition metal hydrides (TM-H). These deviations are even more pronounced for complex systems, like TM-doped AlkE-H, and alanates. The present work is an attempt of explaining some trends in the properties of AlkH, AlkE-H, and TM-H, starting from fundamental electronic principles. Such an approach provides a valuable insight in characteristics of metal-H and H-H interactions in these hydrides, and their changes with the external parameters, like temperature, pressure, defects or impurity introduction. The knowledge of the basic interactions and processes taking place in simple MH is essential for the design and optimization of complex MH-systems interesting for practical applications in the hydrogen storage field.

P.S.B.23.

DIAMOND IN SURFACE ACOUSTIC WAVE SENSORS

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The application of diamond in SAW sensors is considered. The new method of the complete analyses of gas chemical sensors on diamond is presented. It is based on the electromechanical equivalent circuit of the SAW sensor. The method is very efficient and can be used for the optimal design of gas sensors. Since the diamond can be easily merged into solid state and biological systems, the development of smart biological sensors is possible. The advantages over silicon based sensors are also shown.

P.S.B.24.

SPECTROSCOPIC CHARACTERIZATION OF THE NEW MULTIFUNCTIONAL MATERIAL $SmFe_3(BO_3)_4$

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Rare-earth iron borates with general formula $RFe_3(BO_3)_4$ crystallize in the huntite type non centrosymmetric trigonal structure. The main feature of the structure of these compounds is helicoidal chains of the MO_6 octahedra running along the *c*-axis. The crystals of iron borates are an interesting object for magnetism. On the other hand, some of the rare-earth iron borates were found to possess multiferroic features, this opens new fields in their applications. Development of growth technologies allows to carry out thorough investigation of the properties of the $RFe_3(BO_3)_4$ single crystals. Recently, $SmFe_3(BO_3)_4$ single crystals have been grown using the bismuth trimolibdate $Bi_2Mo_3O_{12}$ based flux. For the first time, we have performed the broad-band optical absorption study of the *f-f* transitions of the Sm^{3+} ion in $SmFe_3(BO_3)_4$. Transparent dark-green crystals had a good optical quality. For optical measurements, we used thin platelets cut either perpendicular or parallel to the *c*-axis of the crystal. High-resolution (up to 0.1 cm^{-1}) polarized temperature-dependent spectra were registered in the region 1500-22000 cm^{-1} using a Bruker IFS 125HR Fourier spectrometer. The sample was in a closed-cycle cryostat Cryomech ST430 at a fixed (±0.05 K) temperature between 3.5 and 300 K. From the analysis of spectral data we have determined the energies of the Sm^{3+} crystal-field (CF) levels (which are Kramers doublets) for the $^6H_{15/2,\ 13/2,\ 11/2,\ 9/2,\ 7/2,\ 5/2}$, $^6F_{11/2,\ 9/2,\ 7/2,\ 5/2,\ 3/2,\ 1/2}$, and $^4F_{5/2,\ 3/2}$ multiplets. The knowledge of the CF levels of the ground multiplet is essential for the understanding of the magnetic and calorimetric properties of $SmFe_3(BO_3)_4$. The splitting of spectral lines below 32±1K was observed. This splitting manifests the establishment of magnetic order in the sample. We conclude from the spectral data that $SmFe_3(BO_3)_4$ preserves the trigonal R32 crystal structure down to at least 3.5 K.

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P.S.B.25.

THE INFLUENCE OF THERMAL TREATMENTS ON MAGNETIC PROPERTIES OF MnZn FERRITES PREPARED BY PIM TECHNOLOGY

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In this study, Mn-Zn ferrite magnets produced by powder injection molding (PIM) have been investigated. The feedstock for powder injection molding was prepared by mixing ferrite powder with a low viscosity binder. Green samples were subjected to solvent debinding and subsequent thermal debinding followed by sintering. Sintering conditions were 1340 ^{O}C during 3.5 hours in different atmosphere (air and argon). Magnetic measurements were performed by Faraday balance and by B-H hysteresisgraph.

The differential scanning calorimetry (DSC) method was used for investigating the thermal stability. It was shown that the examined alloy crystallizes in three stages. The first crystallization stage occurs about 400-450 ^{O}C, the second at 750-800 ^{O}C and third at 1200-1250 ^{O}C. Temperature dependence of the magnetic susceptibility of green sample was investigated by the modified Faraday method in the temperature region from room temperature up to 600 ^{O}C. It has been established that the Curie temperature is over 200 ^{O}C and increase after successive thermomagnetic treatments in external magnetic field. The magnetic susceptibility increases by 100% after the first heating up to 300 ^{O}C, 120% after the second heating up to 350 ^{O}C and finally 800 % after the third heating up to 450 ^{O}C (numbers are comparation to the starting value). Sample sintered in air atmosphere was attained the highest density about 4.78 g/cm^3 and therefore has the highest saturation magnetisation (~ 450 mT), remanence (~ 213 mT), initial magnetic permeability (~ 1970) as well as the lowest coercivity (~ 47 A/m) at frequency of 1 kHz.

P.S.B.26.

PHASE DIAGRAM OF $Sm_{1-x}Sr_xMnO_3$ PEROVSKITE MANGANITES

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Structural and magnetic phase diagram of colossal magnetoresistive $Sm_{1-x}Sr_xMnO_3$ ($0.16 \leq x \leq 0.67$) perovskite manganites, constructed on the basis of their regular investigations by a high-resolution neutron powder diffraction is submitted. It is shown, that a real picture of the physical phenomena in Sm-Sr manganites is considerably more various and is interesting than it followed from temperature magnetic and transport macromeasurements. The tendency of researched system to formation of the ordered phase-separate states as on crystallographic, so, in the even greater degree, and at a magnetic level is demonstrated.

P.S.B.27.

UNIQUE ELECTRON-DOPED MANGANITES: CRYSTAL AND MAGNETIC STRUCTURES AND MAGNETOTRANSPORT PROPERTIES

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The structural and physical properties of the electron-doped $Sm_{0.1}Ca_{0.9-x}Sr_xMnO_3$ perovskite manganites have been studied by combining x-ray and neutron diffractions with measurements of magnetization (in static or pulsed magnetic fields), magnetic susceptibility, resistivity and thermoelectric power. The stabilization of different (crystallographic and magnetic) states by Sr doping gives the opportunity to control the robustness of the antiferromagnetism versus A-site size parameters, such as $<r_A>$ and σ^2. It is demonstrated that in Mn^{+4}-rich manganites the colossal magnetoresistive properties can be optimized by chemical pressure. The magnetic and structural phase diagram has been established. There is a clear correlation showing the strong relationships between structures and properties in this $Mn^{+3.9}$ series.

P.S.B.28.

DESIGN OF THE SUPPORTS AND CATALYSTS ON THE BASE OF THE MESOPOROUS ALUMINA ENCAPSULATED IN THE UTRAMACROPORE CERAMOMETAL MATRIX

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The main stages of the preparation of the porous composite supports and catalysts prepared from the aluminum containing powders blended with aluminum hydroxide precursors through the hydrothermal treatment in a special die providing the good excess of water inside followed by calcinations were studied. The powdered alloyed precursors were prepared using mechanochemical activation of the powdered metals and aluminum. The relations between the textural and mechanical properties and some parameters of the synthesis have been studied. The catalysts for the dehydrogenation of light paraffins and for the process of fuels combustion have been made using impregnation. The main factors determining the activity, selectivity of the catalysts and their textural properties as well as enhanced crushing strength have been discussed.

P.S.B.29.

INFRARED AND RAMAN SPECTROSCOPY STUDY OF LANTHANUM AND ANTIMONY DOPED BARIUM TITANATE PREPARED FROM ORGANOMETALLIC COMPLEX

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Pure and doped with lanthanum, La and antimony, Sb barium titanate powders were prepared by polymeric precursors method through Pechini process which was carried out as a three-stage process from organometallic compex. Obtained powders were pressed into pallets and sintering was performed at 800°C and 1300°C for 2-8 h with heating rate of 10°C min^{-1}. The formation of phase and crystal structure of pure and La and Sb doped barium titanate was approved by XRD analysis and Raman and IR spectroscopy. The influence of La and Sb doping on powders particle size and morphology and microstructure of barium titanate ceramics by scanning electron microscopy was investigated. Therefore it was analyzed relation between grain size, structure and properties of obtained ceramics. Electrical measurement for pure and doped with 0.3 mol% and 0.5 mol% La and Sb barium titanate ceramics was carried out. Influence of La and Sb doping on barium titanate properties was discussed.

P.S.B.30.

SYNTHESIS, CHARACTERISATION AND SORPTIVE PROPERTIES OF ORGANOBENTONITES

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In this paper partial substitution of cations in the interlayer region of bentonite with different amounts of two aliphatic and one aromatic quaternary ammonium cation was performed in order to synthesize sorbent able to simultaneously sorb both heavy metal cations and molecules of selected organic pollutant. Domestic clay from Bogovina was prepared according to a common procedure comprising the following steps: grinding, sieving, Na exchange, cation exchange and drying in order to obtain organobentonite. The change in the chemical and phase composition, as well as textural properties of the starting clay and synthesized organobentonites was monitored using X-ray diffraction, UV-Vis diffuse reflectance spectrometry, infrared spectroscopy and physisorption of nitrogen. The incorporation of surfactant molecules into smectite structure lead to subsequent transformation of hydrophilic to organophilic surface. Experimental results showed that sorption of organic pollutant increased with increasing surfactant to bentonite ratios, while the rate of removal of heavy metals by sorption decreased with increasing organophylicity.

P.S.B.31.

SHORT-CIRCUIT OXYGEN DIFFUSION IN THERMALLY GROWN SILICA LAYER

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Amorphous polymer-derived Si-C-N ceramics can be doped with different elements (Al etc.) through various pre-ceramic polymer routes. Thus, controling of the high temperature oxidation resistance can be achieved on atomic level. An important factor for silica layer growth is oxygen diffusion in protective thermally grown layers. In order to get insight of the oxygen diffusion mechanism, analysis should include both, bulk and short-circuit diffusion. XRD measurements of oxidized Si-C-N and SiC revealed the possibility that oxide layers were fully crystallized and are composed of nano-sized cristoballite grains. Secondary ion mass spectrometry depth profile analysis after $^{18}O_2/^{16}O_2$ isotope exchange experiments on oxidized SiC indicated that short-circuit diffusion is probably grain boundary diffusion of molecular oxygen.

P.S.B.32.

URANIUM (VI) ADSORPTION ON ACIDS MODIFIED ZEOLITIC TUFF

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Acid modified natural zeolites are the prosperious materials for uranium (VI) removal from water solution. The modified zeolite samples were obtained by treatment of zeolite - clinoptilolite with acids: hydrochloric, oxalyc and citric. Adsorption was investigated at different amounts of solid phase in suspension, different concentrations of uranim (VI) in solution, as well as at different pH values. Starting and modified zeolites were characterized by chemical analysis, XRPD analysis, thermal (DT/TG) analysis, IR spectroscopy, SEM and by determination of cation exchange capacity, while starting and nonadsorbed amounts of uranium (VI) ion were determined by fluorometric method. Modification of zeolitic tuff with acids significantly increased adsorption of uranium (VI). Uranium (VI) adsorption data for zeolite modified with hydrochloric acid was fitted to the Langmuir model.

P.S.B.33.

RELAXATION IN METALLIC GLASS $Ni_{36,5}Zr_{63,5}$

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The metallic glass ribbons of $Ni_{36,5}Zr_{63,5}$ were prepared by melt spinning. The samples have a large frozen-in structural disorder and in comparison to their crystalline state, a very high electrical resistivity. They are metastable and they relax structurally towards more stable state whenever atoms attain noticeable mobility. As the most structurally sensitive property the electrical resistivity of these samples was used to follow the relaxation process from room temperature to 673K. To complete the investigation of structural relaxation the electrical resistance of as-quenched, annealed and about twenty years aged $Ni_{36,5}Zr_{63,5}$ samples was measured in the temperature range from 77K to 275K. The obtained results were presented graphically.

P.S.B.34.

STRUCTURAL, THERMAL AND MAGNETIC PROPPERTIES OF ELECTROCHEMICALLY DEPOSITED Co-Ni-Mo POWDERS

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The Co-Ni-Mo alloy powders were electrochemically deposited from alkaline ammoniac electrolyte at constant current densities (400 mA/cm^2 and 800 mA/cm^2). Between each other, Ni and Co are anomalously deposited, and both metals induce Mo deposition, which on its own cannot be deposited from aqueous solutions.

Appropriate selection of chemical composition of the electrolyte (varying of Co, Ni and Mo ions ratios) and current density was used to make influence on the particle sizes of deposited powders. The thermal stability was examined by differential scanning calorimetry (DSC). Scanning electron microscopy (SEM), as well as hysteresis B-H loops obtained by SQUID magnetometer, was used for characterization of structure and magnetic properties, respectively.

DSC traces exhibit single endothermal process about 720 ^{O}C associated to crystallization process. SEM micrographs show decrease of the particle size with the increase of the Mo concentration in the electrolyte. The powders deposited from the electrolyte containing (1:1) Ni^{2+}/Co^{2+} concentration ratio have primarily flake like particles of angular shapes while the powders deposited from electrolyte containing (4:1) Ni^{2+}/Co^{2+} concentration ratio are in the form of large agglomerated particles having more or less dense cauliflower structure.

Hysteresis B-H loops exhibit round (R) shape with remanence M_r between 5 mT and 10 mT and coercivity H_c in the range from 39 Oe to 99 Oe. Low values of magnetization can be associated to the high level of oxygen with the role of magnetic inclusion. Different values of coercivity are in correlation with the different particle size, ie. there is observed increase of coercivity as the particle size increase from range of 70-140 nm to range of 100-170 nm.

P.S.B.35.

ORGANIC-INORGANIC NANOCOMPOSITE COATINGS CONTAINING ORGANICALLY MODIFIED LAYERED SILICATES

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Organic-inorganic (O-I) nanocomposite coatings (prepared by sol-gel process, i.e., *in situ* inorganic building blocks build-up followed by organic epoxy network formation) feature by high degree of self-assembly of the matrix. Two commercial layered silicates (LS), Bentonite for water systems (Fluka) and natural montmorillonite (Cloisite® Na, Southern Clay Products) were modified by organic compounds containing hydroxyl groups. After this manner, modified LS (dispersed in water) were put into the reaction mixture and subsequently incorporated into organic-inorganic (O-I) matrix. The concentration of modified LS in coatings was around 0.5 wt. %. The influence of the kind of modification and the type of LS on tensile and other end-use properties will be discussed.

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P.S.B.36.

REAL-LIFE HETEROGENEOUS WELD JOINT ANALYSIS OF HEAT RESISTANT STEELS USING EXPERIMENTAL AND COMPUTATIONAL APPROACH

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Two alternative composite welds were manufactured by GTAW technology according to standard technological procedures. The welds connected two base materials with different chromium content using high chromium intermediate layer and low alloyed main weld consumable material. Experimental analysis was carried out on weld samples after PWHT and on samples annealed up to 1000 hours at 650ºC. Microhardness and chemical profiles of interstitial and substitutional elements across all weld interfaces in the samples were measured. Phase diagrams, activity values for diffusing elements for all materials used in the welds were calculated by ThermoCalc using Steel16 database. Phase and chemical profiles for all interfaces in the welds after heat treatment and annealing were also calculated using DICTRA and Steel16 and Dif databases. Non-linear starting chemical profiles were used for the kinetic simulations to model the mixing during realistic welding. The results of the simulations agree well with all experimental results.

P.S.B.37.

CORROSION AND FATIGUE PROPERTIES OF MAGNESIUM ALLOY AZ31

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The contribution deals with corrosion degradation and fatigue properties assessment of AZ31 alloy made by squeeze casting method. Corrosion attack of the specimens was carried out in salt spray environment based on 5% NaCl solution with gradual reaction time. The assessment of fatigue properties of the AZ31 alloy after given corrosion attack was focused on evaluation of the influence of the loading cycle stress amplitude on the fatigue life and on the elastic-plastic feedback of the material to the cyclic loading established by means of analysis of the curves of cyclic strengthening-weakening. Fracture surfaces were also observed in the SEM and analyzed in terms of fractography.

P.S.B.38.

INITIATION AND BEHAVIOUR OF SMALL CRACK DURING PROPAGATION FROM ARTIFICIAL SMALL DEFECTS IN COARSE GRAIN HEAT AFFECTED ZONE

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It is well known that fatigue crack can propagate faster than long cracks, but propagation of small cracks (microstructural or physical small cracks) can retard or even stop because of microstructural barriers. If stress concentration factor at crack tip (ΔK) is high enough or even higher than threshold (ΔK_{th}) then physically small crack can propagate as long cracks. A lot of researches had been done by Murakami, Endo, Ritchie, Suresh and co-author how small initiate and propagate from small defect, but small attention were devoted to local residual stresses. They appear near small defect and they can play important role during crack initiation and crack propagation. Small defects often appear in weld metal and heat affected zone (HAZ) during welding. Coarse grain heat affected zone (CGHAZ) is near weld toe where stress concentration in weld joint additionally appears. Research had been done on simulated CGHAZ using special heat treatment which enables study of influence local residual stresses near small defect. Small defects were prepared artificially by using Vickers indentation. Study found out that local residual stresses influence on the location of crack initiation and to the mechanism of crack propagation.

P.S.B.39.

MODELING OF HEAT FLOW AND SOLIDIFICATION DURING SPRAY DEPOSITION PROCESS

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The solidification behavior of droplets as well as spray-deposit of Al-4.5 wt% Cu alloy is simulated by modeling based on heat flow analysis. The model incorporates droplet dynamics and their thermal states during atomization process. The resultant spray enthalpy is used to analyze heat flow during solidification of the spray deposit. The effect of process variables like atomization pressure, melt superheat and nozzle to substrate distance on the solid fraction and enthalpy of the spray is analyzed. The results of modeling are compared with the experimentally determined thermal profile of the spray deposit. The results indicate that the cooling rate for a wide size range of droplets varies from 103-105 Ks-1 in contrast to a slow cooling rate of 1 to 10 Ks-1 of the spray deposit. Empirical correlation between cooling rate of the spray deposit and the grain size has been established. It is inferred that cooling rate is not the sole determining factor in controlling grain size of the deposit during spray deposition process.

P.S.B.40.

APPLICATION OF MODERN INVESTIGATION TECHNIQUES WITH THE AIM OF DEFECTS IDENTIFICATION IN 30CrMoV9V ALLOY

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Investigation was carried out on steel 30CrMoV9V EN 10250-3; 1999, and during dynamic loaded exploitation the cracks occurred. Manufacturing of constructive parts of stated steel was according to the technical conditions. However, the fracture of work piece directs to the causes of defects formation in material. Investigation was carried out on scanning electron microscope (SEM) and by energo-dispersive spectroscopy (EDS) with the aim to analyse the reliability of material and to identify defects, with the special attention given to the previously determined mechanical properties.

P.S.B.41.

POROUS STRUCTURE OF SINTERED NIOBIUM COMPOSITE

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This report presents the results of investigating of the porous structure of sintered niobium composite. It allows to extend the small-angle X-ray scattering (SAXS) and to increase the reliability of the results obtained, by the “combined” supplementing the SAXS with Hg porosimetry data. The method proposed in this work was used to investigate the surface of compact Nb pellets obtained by high temperature vacuum sintering of niobium powder. This object allows to vividly demonstrate the possibilities of the “combined” method for solving the problems of surface physics. In distinction to the SAXS, which detects the submicropore of any mode, Hg porosimetry method detects only open pores. Experiments have shown that that most of submicropore are open, i.e. usage of Hg porosimetry results is quite reasonable to supplement the SAXS. The ‘combined” application of the SAXS and the Hg porosimetry method to investigate the structural surface inhomogeneities has allowed not only choose the most appropriate approximation of surface inhomogeneities shapes (according to the SAXS data), but also to take into consideration the polimodality of the investigated submicropore system by revealing (on the basis of the Hg porosimetry) correlation between the shape and the radius of the pores.

P.S.B.42.

CONTEMPORARY APPLICATION OF STEELS FOR CUTTING TOOLS

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The most important condition cutting tools have to fulfil nowadays is the longevity of the active part i.e. the blade or cutting edge. During operation, the blade becomes dull and worn out. In contrast to machine elements most often stressed in a different way during operation, only a very shallow layer of cutting tools wears out, due to very high specific pressures and temperatures at work there. In order for this active part of the tool to be resistant to wear and tear it should be resilient, the hardness of the tool material should be very high, its structure should satisfy some very demanding criteria, and honing should give a shape capable of fulfilling subsequent conditions of tool usage.

Heating the tool most often lowers its hardness, but tool steels do not change structure until a certain high temperature is reached. Depending on its chemical composition, steel's hardness is recurrent also in conditions of the tool staying heated up to high temperatures for prolonged periods of time.

P.S.B.43.

THE USE OF ADVANCED MATERIALS AND TOOLS AS A GOOD WAY TO IMPROVE THE PERFORMANCE OF MARINE YACHTS

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The industrial production and the requests for marine Yachts, in the actual situation of a competitive market, impose the procurement of the optimal solutions with the aim the acquirement of the requested level about the precision and quality of the final product.

Against the product nave in generally and Yacht in particularly are considerable limitations in the designing faze. This product have to respect the chargment requests, such as: the request about the acquirement of the maximal speed with the minimal power, the requests about the realization of the requested water-displacement, its consumption, its maintenance, the national and international normative, comforts as well as a satisfying level of safety.

The tendency of all times in the design and construction of the ships type Yachts, were the realization of these vehicles, acquired in a small weight of the empty ship, without affected to their characterizes and performances.

In this article we are going to focus on the issue as how the use of advanced materials can help the Yacht designers for the satisfaction of the requests preferred in their designs.

P.S.B.44.

INTERPRETATION ABOUT THE ROLE OF THE HOT WORKING (ELABORATION TERMITES) PROCESS IN THE FATIGUE RESISTANCE FOR THE CONSTRUCTIVE STEEL 40

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The incensement of the using range of different brands of steel requests good knowledge of the physical-mechanical characteristics as well as the specific distinctions that follow their distrainment process.

The study about the fatigue phenomenon, the mechanism of fatigue crack generation has its specific characteristics in dependence of the chemical composition and microstructure.

Our materials aim the presentation of some experimental results as well as the statistic analyses about the fatigue of steel Ç 40. The steel brand Ç 40 was selected as representative of the steel constructions. It is characterized from the contents of chrome and nickel in large range 0,7-0,8% .

The interpretation of the fatigue mechanism is focused on definition of the microstructure influence (Chemical composition and hot working) in the fatigue resistance of steel constructions.

P.S.B.45.

DESIGN OF THE ADJUSTABLE FOUR-BAR LINKAGES, ONE POINT OF THE COUPLER PLANE OF WHICH GENERATE TWO APPROXIMATELY STRAIGHT PATHS

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The article provides the method of synthesis of the four-bar linkage, one point of the coupler plane of which, generate two approximately straight paths. To make this, the linkage must be adjusted, so hereby we have given the different adjustments of the linkage and for the one of them is given the method of synthesis. In the end we have designed the linkage in SAM and simulated it. Hereby we can see the result of our work.

P.S.B.46.

THE FRACTURE MECHANICAL BACKGROUND OF EUROCODE 3 IN THE STRUCTURAL STEELS

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The concept of EUROCODE III is applicable to high-toughness structural steels (SZ Sonderzähe Baustähle) if the validity of the correlation between the temperature T_{KJ100} where the elastic-plastic fracture toughness is $K_{IJ} = 100$ MPa√m,and the transition temperature of Charpy V-notch pendulum impact test T_{27J}, can be proved for S_{355ML} and S_{460ML} grade steels. Requirements of the heavy steel construction industry, shipbuilding and the offshore industry, who want to use thermo-mechanically rolled high-strength structural steel with thicker plates (>63 mm). The valid standard DIN EN 10113-3 [1] limits the product range to £ 63 mm in view of the reduced toughness and property anisotropy of thicker thermo- mechanically rolled plates.

P.S.B.47.

CURRENT STATE AND DEVELOPMENT PERSPECTIVE OF ALBANIAN PORTS

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On overview of Durres, Vlora, Saranda and Shengjin Ports stimulate students of DIMN (Department of Mechanics and Naval Engineering) in University of Vlora to do a general research over their development perspective in infrastructure and National Strategy Plan. This project introduces concrete results collected in their actual development phases. This is not on enthusiastic situation but we are available to present their actual state and Albanian perspective like a maritime country together with other region countries, developing maritime transport.

P.S.B.48.

ANALYTICAL AND COMPUTATIONAL STRESS ANALYSIS OF FIBER (MATERIAL ORTHOTROPIC)/MATRIX COMPOSITE MODELS

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For a 2D fiber (material orthotropic)/matrix composite disc with given diameter, which is considered to be subjected to a stationary and homogeneous change of temperature with respect to the stresses free state, a detailed stress analysis is given. The work is based on analytical solution for the corresponding 2D-cases of plane elasticity (plane stress, plain strain and generalized plane strain), which are given here in following GALERKIN'^{s} displacement functions. Secondly by the same approach an analytical solution of first order is presented for the 2D-problem. Major stress analysis results of this solution agree well with findings of a detailed finite element stress analysis of this complexes 2D problem of thermo elasticity, which gives further understanding of where and failure of thermally stressed composites may occur.

P.S.B.49.

EFFECTS OF WATER ON THE SURFACE POTENTIAL DECAY IN CORONA CHARGED POLYIMIDE FILMS

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The changes in the electrical properties of polymer materials due to the effects of charging and geometrical parameters on the surface charge decay of polyimide materials have been reported in several studies. Therefore, polyimide film exhibits high water absorption because of its imides bonds, which presents problems in practical applications. In this work, we investigate the influence of water absorption on the surface potential decay characteristics of polyimide films previously charged by corona system. From results, it has been found that for the same charging conditions, the surface potential decay is faster for the soaked samples in water than new samples.

P.S.B.50.

ANTISTATIC PROPERTIES OF NANOFILLED COATINGS

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The results of antistatic, physical and electrical properties investigation of nanofilled coatings have been presented. Antistatic performance of materials is essential not only due to safety and preventing of dust and dirt attraction but also effects on an electrical field distribution in the high voltage insulating systems. The polyester and polyesterimide compounds added with silver and silica nanoparticles were examined by charge decay measurements after corona charging, using JCI 155v5 apparatus produced by JCI Part of Chilworth Technology Ltd. The charge decay times have varied appreciably between the nanofilled coatings while the volume and surface resistivity of the all tested coatings did not demonstrate meaningful differences. Total quantity of charge transferred to the sample by the negative corona discharge was considerably greater then by positive one, probably owing to the greater mobility of electrons. In spite of almost the same quantity of the initial charge, the polyester compound dissipated fairly better than polyesterimide because of its structure and permittivity. Deep traps on the polyesterimide surface cause difficulty in charge moving either into the bulk or along the surface. It was found that the ability of surface to drain charge away is the better for coatings with 1,3% of silver nanoparticles whereas the coatings modified with nanosilica shows the poor antistatic properties; the times of charge decay were four order longer then that of unmodified coatings. Barrier properties of nanosilica are advantageous for e.g. decreasing of water absorption and enhancement of resistance to partial discharges of coating but also may be adverse for charge decay.

P.S.B.51.

NEW MOLECULAR CONDUCTORS WITH COBALT BIS(DICARBOLLIDE) ANION AND ITS DERIVATIVES

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Recently we have started investigation of the structure-property relationship in a series of fulvalene salts of cobalt bis(dicarbollide) anion and its derivatives. Just a few conducting radical cation salts containing metallacarborane anions have been described so far. However, no radical cation salt derived from the cobalt bis(dicarbollide) anion $[3,3'\text{-Co}(1,2\text{-C}_2B_9H_{11})_2]^-$ or its halogen derivatives was reported.

The report presents synthesis and study of the first molecular conductors with cobalt bis(dicarbollide) anion and its halogen derivatives, based on organic π-donors of electrons – bis(ethylenedithio)tetrathiafulvalene (ET) and its derivatives.

Conducting properties investigation revealed that $(TMTSF)_2[3,3'\text{-Co}(1,2\text{-C}_2B_9H_{11})_2]$ salt possesses conductivity S_{293} = 15 $Ohm^{-1}cm^{-1}$, that is the maximum value of conductivity for all studied metallacarborane radical cation salts.

This work was supported by RFBR.

P.S.B.52.

THE INFLUENCE OF WOOD SPECIES ON CURING OF UREA-FORMALDEHYDE ADHESIVE FOR WOOD PANELS PRODUCTION

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Urea-formaldehyde (UF) resin presents, by far, the most utilized adhesive system in the particleboard and fiberboard manufacturing. At the temperatures above 100 ^oC in the presence of catalyst, this resin undergoes cross-linking reaction and bonding of wood in the hot press. In this work the crosslinking of commercial UF adhesive has been studied using differential scanning calorimetry (DSC) method. This method is a suitable tool for simulation of conditions which occurred within the mat during hot pressing. The influence of different industrial wood species on the curing behavior of wood-flour/adhesive mixtures has been evaluated. Peak temperature and enthalpy of curing reaction were registered from dynamic scans. Both values were influenced by the presence of wood flour and related wood species. Addition of wood flour made from different wood species increases peak temperature, in general. The highest peak temperature of curing reaction was reached by addition of poplar flour, having the mean value of 100.2^oC registered under the heating rate of 10^oC/min, while the pure UF adhesive had the lowest peak temperature of 94.9^oC, under the same scanning regime. Enthalpy of reaction, showed more complex influence of wood species. In addition, different heating rates were used in order to calculate activation energy of pure adhesive curing as well as wood-flour/adhesive mixtures.

P.S.B.53.

ORGANOMETALLIC COMPOUNDS AND CORROSION ON THE FLUE GAS SIDE OF THE WATER BOILER SYSTEM

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Combustion of heavy fuel oil (HFO) in water boiler system has resulted in formation of deposite on steel tube surfaces. In order to investigate fume side corrosion of the steel tubes and give analysis on possibility of application of organometallic HFO additives, it was necessary to employ quantitative and qualitative analysis of the HFO, deposite, flue gases and water boiler working conditions. HFO contained highly corrosive agences Na, V and S. Deposite analysis has reaveled increased amount of Fe and sulfate species, while water solution of deposite had a low pH value indicating its acidic nature. The water boiler worked with periodic shutdowns. Steel tubes were damaged, probably, due to low temperature corrosion processes, termed as „dew point" corrosion, during shutdown time, and „cold-end" corrosion, during operation of water boiler.

P.S.B.54.

GAMMA RADIATION ABSORPTION CHARACTERISTICS OF CONCRETE WITH COMPONENTS OF DIFFERENT TYPE MATERIALS

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Nuclear facilities like nuclear power stations, nuclear research reactors, particle accelerators and linear accelerator in medical institution use concrete in building construction. The different type materials of the aggregate as component of concrete were analysed to provide radiation protection. The energy deposited and the linear attenuation coefficients in different concretes have been calculated with the photon transport Monte Carlo software. The numerical simulations results show that using barite as an aggregate in the concrete is one of the solutions for gamma ray shielding. Thereat, it is shown non-destructive method for determining the gamma radiation absorption characteristics of concrete.

P.S.B.55.

INFLUENCE OF THE TEMPERATURE ON THE PROPERTIES OF THE SINTERED PRODUCT ON THE BASIS OF ELECTROFILTER ASH AS A COMPONENT OF THE RAW MATERIAL MIXTURE

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In this paper it was investigated the influence of the temperature on the properties of the sintered product on the basis of electrofilter ash from the hydropower plant "Pljevlja". The other component of the raw material mixture was illite-kaolinite clay. Previously the characterization of the components of the raw material mixture was done (determination of chemical and mineral content, grain size distribution, density and humidity). The samples were formed by plastic shaping in a mould corresponding to a parallelepiped with dimensions 7.7 cm x 3.9 cm x 1.6 cm. The samples were fired at the temperatures of 800°C, 900°C, 1000°C, 1100°C and 1200°C. For the sintered product there were determined linear and volume shrinkage during sintering, as well as total porosity and compression strength. The microstructure of the sintered product was determined by the microscopic analysis. On the basis of the performed investigations there were determined the optimal temperature of sintering of the raw material mixture and the influence of the temperature on volume shrinkage, total porosity and compression strength of the sintered product.

P.S.B.56.

COMPARISON OF CHEMICAL ANALYSIS OF SAMPLE CLAYS AND THE MICROSTRUCTURE OF SINTERED PRODUCT

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This paper studied the chemical analysis of samples and the starting microstructure of sintered products based on illite-kaolinite clays.

The aim of this work was to determine the influence of chemical composition and structure of illite-kaolinite clay on microstructure of sintered products. Work compared microstructures of sintered products and two types of clay with the labels "BP" and "PV" were used.

Baking of the samples was carried out at a temperature of 1200°C. Previously were set chemical composition of clay and set microstructure composition of sintered products, which were previously formed in the parallelepiped form mold. Clay was chemically analyzed by atomic absorbing spectrophotometer Perkin Elmer 4000th. Microstructure of sintered products is determined by SEM microscopy.

The purpose and goal of this work was a contribution to the research and production of sintered products and to defining of their physical-chemical features. At a temperature of 1200°C in both starting samples allow comparison of physical-chemical characteristics. The results of research provide a basis for improving the physical characteristics of the product chemical based feedstock mixtures and confirm the importance of microstructure and composition sintered.

At kaolinite system, thermally treated at 1200°C, when it comes to chemical composition of individual grains, EDS analysis identify the presence silicon, which indicates the existence of SiO_2 forms, known as cristobalite. In this way, the SEM analysis identified and boron as an element that is in nature not in its free state.

Based on the results obtained by SEM analysis, it should be noted that in the sample "PV" the presence of the element boric is identified, while in the sample "BP" it is not. Boron is a chemical element, can be amorphous and crystalline shape and difficult to melt. In nature, it does not exist in free-state but only as boric acid and borates. It is used in nuclear technology for the withdrawal of oxygen as a catalyst (usually in the form of compound).

Microstructure analysis was performed this interesting identification which gives us the right to continue testing the sites "BP" and "PV".

P.S.B.57.

DEVELOPMENT OF NANO- GRAIN STRUCTURE BY MARTENSITIC REVERSION IN AISI 304L STAINLESS STEEL

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Austenitic stainless steels usually exhibit excellent corrosion resistance, toughness and formability; however the strength level (particularly the yield strength) is relatively low. Strengthening is attained by cold-working that induces martensite transformation this transformation may also play important roles in Austenitic stain less steels. During plastic deformation, depending on the steel composition and the cold working variables, some induced martensite can be formed. Effective way to increase yield strength without impairing ductility is grain refining. Since austenitic Stain less steels do not under go phase transformation at typical annealing temperatures, the only way to refine the grain is by thermo-mechanical processes including both deformation and phase transformation.

In this work the alloy used is a Fe-18.2% Cr-8.22% Ni alloy. Since this alloy has metastable austenitic structure at room temperature, it almost transforms to lath-martensite by 55% Cold-rolling (from 10% to 90%, Cold reduction was carried out at cold water, 0˚C). Further cold-rolling 90% deforms transformed martensite itself, and results in the formation of dislocation-cell structure instead of lath-martensitic structure. Samples annealed at different range of temperatures and times. The Samples were analyzed after austenite reversion by SEM, XRD, Ferritscop Optical metallography, Hardness and Tensile Test. at 90% cold rolled, T= 700 ˚C and t= 300 min, the grain size was measured 280 nm with 58% elongation and 1010 Mpa yield Strength (initially grain size was 36 μm, elongation and yield Strength were 52% and 300 Mpa). The results reported here indicate the viability of the development of an ultrafine grain structure as an effective way to Strengthening austenitic stainless steels.

P.S.B.58.

ORGANICALLY MODIFIED NANOSILICA/ RIGID POLYURETHANE NANOCOMPOSITES

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Nanosilica was modified by γ-glycidoxypropyltrimethoxysilane (GPTS) and further modification accomplished by diethanol amine. The modified nanosilica was used in polyurethane rigid foam (PUF) formulations. Formulated PUFs was characterized by FT-IR and thermal analysis (TA) methods. Tensile test, dynamic mechanical (DMA), thermomechanical analysis (TMA) and scanning electron microscopy (SEM) performed for evaluation of mechanical, thermo mechanical and morphological properties, respectively. The modified nanosilica enhanced thermal stability and static mechanical properties and reactive functional groups on nanosilica surface, affected reactant ratios by causing decrements in hard segments which accomplished by storage modulus (E') increments.

P.S.B.59.

COMPUTER AIDED ETCHING SIMULATION USING CELLULAR AUTOMATA METHOD

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Due to the highly anisotropic behavior of silicon bulk etching, there have been many publications on etch simulation and convex corner compensation for specific geometries. This paper presents a new computer simulation model for all shapes in three dimensional micromachining process in nano scale. The algorithm of the model based on the strength of chemical bounds and link status of its lattice neighbors of an atom. We have developed a new concept of simulation micromachining method by combining two calculation methods, a molecular dynamics calculation module to define chemical reaction probability and a random cellular automata module to calculate and predict etch shape. In random cellular automata method, an atomic level simulation method has been proposed. Updating of atoms in a same time and assuming most of an atom in a cell in last cellular automata algorithm caused to reducing accuracy of simulation that in random cellular automata method is developed. The random cellular automata model uses the reaction probability as calculated by molecular dynamics method to determine the probability of etching events. The cellular automaton applies these probabilities to each of the atoms to stochastically decide which atoms to remove during a time step. Repetition of this time step leads to end shape of process. This method provides improved spatial resolution and accuracy compared with the last CA methods that used in MEMS fabrication process.

P.S.C.1.

SAXS AND WAXS STUDY OF POLY(BUTYL METHACRYLATE) / MONTMORILLONITE NANOCOMPOSITE LATEXES

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A series of novel poly(butyl methacrylate)/chemically modified montmorillonites nanocomposite latexes have been prepared by emulsion polymerization. This technique allowed preparing of stable nanocomposite latexes with high (30 – 45 wt.%) solid contents and with loading of inorganic particles up to 5 wt.%. To determine the microstructure of the clay layers, and that of the organoclay poly(butyl methacrylate) nanocomposites, wide- and small-angle X-ray scattering (WAXS, SAXS) techniques were used. The latexes have been characterized using SAXS. This technique provided information both on the size and size distribution of the latex particles and on the structure of the clay layers. A pitfall which might lead to a misinterpretation of SAXS data of clay nanocomposites has been indicated.

P.S.C.2.

NANOSTRUCTURED THIN FILMS β-Al-Mg OBTAINED USING PLD TECHNIQUE

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In this work the nanostructured films Al_3Mg_2 were deposited using pulsed laser deposition (PLD) technique. The β-Al-Mg phase (cF1168) is a very complex intermetallic compound. In this compound occurs a partially occupied and split position leading to 1168 atoms per unit cell. In connection with it, this phase could be applied as thermoelectric and corrosion resistant material, with good adhesion to the substrate and definite hardness.

The current paper showed the structure, phase and chemical composition, topography and hardness of these films. These aluminium based films can be easily deposited from pure metallic target by modification of process parameters (e. g. laser fluence, substrate temperature).

The β-Al-Mg thin films were prepared on Si (400) and AZ91D substrates by using Nd:YAG laser. Structure and chemical composition investigation showed that the films possess generally nanocrystalline structure and that the quantity of aluminium and magnesium a little changed along the film depth. The surface topography, adhesion and hardness of films was varied as results of changing of the laser fluence value and the substrate temperature.

P.S.C.3.

INFRARED AND STRUCTURAL STUDY OF ZINC OXIDE FILMS AND NANOWIRES

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One-dimensional oxide systems, specifically zinc oxide (ZnO) thin films and nanowires (NWs), have attracted much attention last time. ZnO is an n-type direct-gap semiconductor with a large exciton binding energy (60 meV) and wide gap (3.37eV) at room temperature. ZnO is regarded as a promising photonic material for light emitting diode, solar cell and many others. ZnO thin films and nanowires are interesting material systems for investigation of optical properties. Understanding the specifics of phonon spectrum of ZnO nanostructures can help in development of ZnO-based optoelectronic devices.

In this work, we have studied the structural and optical properties of non-oriented and highly c-oriented ZnO films and nanowires synthesized by Atomic Layer Deposition (ALD) technique and Chemical Vapor Deposition (CVD) technique, respectively. The vertically aligned ZnO NWs were grown on the highly c-oriented ZnO film without foreign catalyst, whereas the randomly aligned ZnO NWs were grown on p-type Si (100) catalyzed by Au. The crystal and structural properties of ZnO specimens have been analyzed using a combination of XRD, SEM/EDX, and XPS. The optical quality of ZnO in these specimens has been probed by the infrared measurements. Reflectivity and transmittance measurements in the spectral range 50-7500 cm-1 have been done using IFS 66v/s (BRUKER) infrared Fourier-transform spectrometer. Reflection units were used for the near normal incidence and for the oblique angles (30, 45 and 60 degree) of incidence in polarized light. The spectral resolution was 4 cm^{-1}.

For ZnO film deposited at 280oC at the near normal incidence only one phonon peak ~ 410 cm-1 related to transverse optical (TO) vibrations perpendicular to the optical axis was observed. Hence the film is highly oriented, and its optical axis is normal to the surface. For ZnO film deposited at 170oC no preference orientation could be seen, because in the spectrum both TO phonon (380 and 410 cm-1) peaks are present. For ZnO NWs an asymmetric peak near 580 cm^{-1} appeared in the spectra. It can be assigned to nanowires, because it was not present in the spectra of ZnO films.

This work was supported by Project EXCELL in EC 6FP, Contract Number 515703**.**

P.S.C.4.

TEMPERATURE- AND FREQUENCY-DEPENDENCE OF DIELECTRIC PROPERTIES OF EPOXY/α-HEMATITE NANOROD COMPOSITE

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Temperature- and frequency-dependence of dielectric properties of epoxy/α-hematite nanorod composite have been investigated. First, the nanorods were synthesized by the forced hydrolysis method and further mixed with epoxy to obtain the nanocomposite. TEM analysis revealed that they have an average diameter of about 8 nm, with an average aspect ratio of 25. Because of their high specific surfaces, nanorods affected segmental mobility of epoxy molecules to a large extent. An increase in the glass transition temperature (Tg) and a decrease in the real part of dielectric permittivity in high frequency/low temperature region were observed. It is further noticed that at elevated temperatures (above Tg) and low frequencies the real part of dielectric permittivity of the nanocomposite exceeds that of the pure matrix, i.e. there is a transition towards microcomposite-like dielectric behaviour.

P.S.C.5.

COMPARATIVE STUDY OF THE STRUCTURAL AND MAGNETIC PROPERTIES OF NANOSIZED $La_{0.7}Ca_{0.3}$ MnO_3 OBTAINED BY MECHANOCHEMICAL AND GLYCINE NITRATE PROCEDURES

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Mixed valent nanosized $La_{0.7}Ca_{0.3}MnO_3$ was prepared by two different synthesis routes: mechanochemical milling and glycine nitrate procedure. Microstructural characterization was performed by TEM microscopy and XRD measurements. These measurements showed that applied synthesis routes give samples with different morphologies, particle's sizes and distributions, as well as lattice parameters and microstrains. As a consequence of these specific microstructural features, different magnetic properties, like blocking temperatures, saturation magnetizations and coercive fields are observed. Evolution of microstructural and magnetic characteristics, with sample annealing, was discussed.

P.S.C.6.

MAGNETIC PROPERTIES OF Mn DOPED AMORPHOUS SiO_2 NANOPARTICLES

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Preparation and magnetic properties of amorphous SiO_2:Mn nanoparticles are described. Nanoparticles were prepared by a hydrothermal procedure with nominal manganese concentration x = 1 and 5 at%. The amorphous structure of SiO_2 was confirmed by XRD. Slow scan XRD didn't show any impurity crystalline phases that might arise from manganese oxides. Magnetic (SQUID) measurements show complex magnetic behaviour being combined of paramagnetic contribution and superparamagnetic/ferrimagnetic contribution originating from Mn_3O_4 phase.

P.S.C.7.

CHANGES IN OPTICAL PROPERTIES OF MOLECULAR NANOSTRUCTURES

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This paper represents an overview about exciton systems in molecular nanostructures (ultra thin films and superlattices) and their implications in optical properties, primarily on absorption coefficient, which is given in form of dielectric permittivity. With utilization of Green's function method, we have calculated dispersion law, spectral weight of exciton states and dielectric permittivity for every type of nanostructures. All obtained results are compared with optical properties in bulk crystals. Dielectric permittivity in all types of nanostructures shows very narrow and discrete dependence of external electromagnetic field frequency, which is a consequence of the expressed quantum effects, very thin thickness in these structures (or at least one dimension confinement) and boundary conditions.

P.S.C.8.

QUASISTATIONARY ELECTRON STATES FOR CdTe/ZnTe/CdTe OPEN SPHERICAL QUANTUM DOTS

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The energy spectra of an electron in open spherical quantum dot (QD) within the effective mass approximation (EMA) and rectangular potential model is presented Energy structure of quantum dots is important because of their possible applications in electronic and optoelectronic devices. For proper description and interpretation of tunneling processes knowledge of resonant states of quantum dots is necessary. Energy values depend on parameter like size of system and spatial composition**.** The lifetimes of the quasistationary states are computed within the framework of the scattering S-matrix method. It is shown how core radius and barrier thickness for the CdTe/ZnTe/CdTe example influence electron states and their lifetimes.

P.S.C.9.

PHOTOREFRACTIVE AND PHOTOCONDUCTIVE FEATURES OF THE NANOSTRUCTURED MATERIALS

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Photoconductive and photorefractive characteristics of fullerene- and nanotubes-doped organic thin films based on conjugated organics, such as polyimide, polyaniline, pyridine, etc. have been studied. As an additional, the liquid crystal mesophase with nanoobjects has been investigated. The increase of the charge carrier mobility of nanosensitized organics has been established. The nonlinear refraction and cubic nonlinearity have been investigated at wavelength of 532 nm via four-wave mixing technique using Raman-Nath diffraction regime. The thin holographic grating has been written at the spatial frequencies placed in the range of 90-150 mm^{-1}. The energy density has been chosen in the range of 0.1-0.9 $J\times cm^{-2}$. The correlation between photoconductive and nonlinear optical parameters has been revealed. The nanostructured materials can be proposed for different area of nano- and microelectronic applications.

P.S.C.10.

SYNTHESIS AND CHARACTERIZATION OF NANOSTRUCTURED HYBRID MATERIALS

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Organic-inorganic hybrid materials with well-defined morphology and structure at the nanometric scale containing low amount (1–5 wt %) of chemically binded inorganic hydrotalcite-like nanofiller were prepared by *in-situ* emulsion and solution copolymerizations. Layered double hydroxides (LDHs) with general chemical composition of $[M^{II}_{1-x}M^{III}_x(OH)_2]^{x+}[A^{n-}_{x/n}\cdot yH_2O]^x$ were intercalated with organic anions (acrylate, methacrylate, 2-acrylamido-2-methyl-1-propansulfonate, 4,4'-azobis(4-cyanopentanoate) and 4-vinylbenzoate). The intercalated LDHs have been employed as comonomers for the preparation of poly(butyl methacrylate) - modified LDH hybrid polymers. The prepared materials were characterized by using X-ray scattering (WAXS and SAXS) and dynamic light scattering techniques. Gas transport properties of hybrids were determined.

P.S.C.11.

SYNTHESIS AND CHARACTERIZATION OF ANATASE NANOPOWDERS DOPED WITH Fe IONS

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Titania nanopowders doped with different amounts of Fe^{3+} ions were synthesized by coprecipitation method from organic precursors. Obtained materials were characterized by using structural (XRD), morphological (SEM) and optical (UV/vis and photoluminescence) techniques. XRD patterns of doped materials have shown exclusive presence of anatase phase. UV/Vis reflection measurements revealed that, comparing with pure anatase, doped samples have greatly enhanced absorption in visible part of the spectra, with absorption maximum at about 475 nm. Photocatalytic activity of doped samples was also tested.

P.S.C.12.

MORPHOLOGICAL CHARACTERIZATION OF NANOFIBROUS MATERIALS FOR MEDICINAL APPLICATION

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Biomedical applications such as wound dressings for skin regeneration or corneal transplants require special demands on the three-dimensional porous synthetic scaffolds. Nanofibrous materials prepared by electrospining have considerable potential in this area. Besides the chemical composition, the morphology of nanofibers plays a key role in the cell adhesion, growth and proliferation. The aim of this study was to characterize the morphology of polymeric nanofibers prepared from chitosan, gelatin, PA6/12, PAN, PCL, PLA and PUR by various physical methods. The results obtained by mercury porosimetry, BET nitrogen adsorption/desorption measurements, scanning electron microscopy and soaking of the samples under various conditions were compared and evaluated.

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P.S.C.13.

IMMOBILIZATION OF GOLD NANOPARTICLES ON POLYELECTROLYTES THIN FILMS

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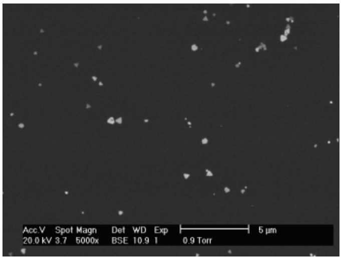
The spontaneous adsorption process of gold nanoparticles on silicon wafers modified with a series of polyelectrolytes was studied. The synthesis of gold nanoparticles was performed by reduction of potassium tethrachloroaureate III (KAuCl4) with biodegradable block copolymer Poly (vinyl pyrrolidone)- Poly (-caprolactone)-Poly (vinyl pyrrolidone) (PVP-PCL-PVP), both in aqueous solution. Polyelectrolytes of different structures were deposited by dipper coating on Si wafers functionalized with aminopropyltrimethoxysilane, APS. The polyelectrolyte deposits were characterized by ellipsometry, and the respective adsorption isotherms were established.



The polyelectrolyte deposits with immobilized gold nanoparticles were characterized by SEM and AFM.

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P.S.C.14.

THE ROLE OF INTERFACE MODELING IN CREATION OF HIGH FUNCTIONAL NANOSYSTEMS

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Nanosystems (NS), including structures, materials, devices, are thermodynamically open and metastable, highly complex and heterogeneous systems. The system complexity, which is characterized by high density of interfaces, occupies a central role in determining the functionality of nanosize devices. The driving force of the evolution of NS during synthesis can be the system tendency to a minimum of entropy production. From this point of view, the formation of coherent low energy interfaces in NS seems predetermined. These interfaces corresponding to an extremum of energy determined by symmetry can be chosen as states-attractors in NS [1]. The original crystallochemical concepts of searching for low energy interfaces in NS of different materials, modeling of interface atomic structures and thermodynamic and synergy considerations are applied for the creation of new high-performance nanomaterials, devices, technologies. There are discussed: (1) Processes of preferential formation of low-energy special twist and tilt boundaries in order to obtain high coercive sintered permanent magnets on the basis of Sm-Co powders [2]. (2) The special boundary design upon formation of Bi, Bi-Sb thin films with a big length of electron mean free path (λ_e) [3]; (3) Processes of structure selforganization of interface reaction zone in CVD-method in order to obtain high conductive with good adhesion thin tungsten films on the silicon substrate - perspective materials for multilayered contact metallization of integrated circuits [4]; (4) Basic crystallochemical methods of searching for symmetry perfect interfaces in NS on the basis of advanced superionic conductors (AdSIC) and application of crystal interface engineering methods for the creation of high functional heterojunctions AdSIC/EC (EC is an electronic conductor) as prototypes of nanoionic supercapacitors (NSC) [5].The NSC and AdSIC are expected to be of great technological and commercial advantage and may be used in many important challenges [6]. The interface modeling and study the self-organization phenomenon in NS distinctly show that interface design methods are urgently needed for the development of new high-performance nanomaterials and devices.

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P.S.C.15.

ATOMIC FORCE MICROSCOPY CHARACTERIZATION OF GOLD NANOCRYSTALS

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Gold nanocrystals are promising candidates for optical, electronic and biological applications. They are of immense interest due to their intriguing surface plasmon resonance (SPR) property originating from the collective oscillation of conduction electrons in response to an optical excitation. Nonspherical gold nanocrystals such as nanorods, nanotriangles, nanoplates, etc., show two plasmon bands : one in the visible region similar to spherical nanoparticles and another one in the higher wavelength region that sometimes extends well into the near-infrared (NIR) region of the spectrum. Metallic nanocrystals exhibiting such SPR band in the NIR region have potential applications in cancer hyperthermia and new cell imaging and as heat absorbing for solar energy production.

Among all the preparation methods biosynthesis of gold nanocrystals by plant extracts is a very promising route which allows the fabrication of nanoparticles with different shapes and dimensions ranging from a few nanometers to micrometers. On the other hand Atomic Force Microscopy is arguably the dominant technique for nanoscale characterization and/or manipulation. However, the ability to achieve quantitative chemical contrast by AFM is not as straightforward as topographic imaging. Using the unique capabilities of Amplitude Modulation Atomic Force Microscopy we have characterized a broad range of gold nanocrystals biosynthesized by reduction of aqueous chloroaurate ions in pelargonium plant extract. Specifically, we have studied the phase shift dependence on the tip–surface separation, interaction regime, cantilever parameters, free amplitude and tip–surface dissipative processes and we have converted these results into energy dissipation values. Furthermore, energy dissipation maps provide a robust method to image material properties because they do not depend directly on the tip–surface interaction regime.

P.S.C.16.

STEEL SURFACE CHARACTERIZATION WITH DIFFERENT COMPOSITION AND VARYING TOOL GEOMETRY BY SCANNING PROBE MICROSCOPY

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In this paper we analyzed a possible application of scanning probe microscopy techniques in characterization of lathe steel processing. We investigated the influence that variation of tip curvature has onto topographic and magnetic properties of two common steel samples (AiSi302 and AiSi316). The tip curvatures used were 0.8 mm, 1 mm, and 1.2 mm while other parameters were fixed. We used all three tip curvatures on each of two samples, and obtained the total of six different settings. It can be seen that, aside from expected change in topography and processed surface granulation size due to change in tool geometry, also different magnetic properties arise as a consequence of variation of knife tip curvature. We conducted a standard surface characterization in order to provide a new possible guideline for quality assessment and or determine future surface structure integrity of processed materials. We present the resulting images showing the topography, magnetic force, conductivity and phase image surface examination of chosen samples.

P.S.C.17.

MECHANOCHEMICAL SYNTHESIS OF ZnO NANOSTRUCTURED POWDER USING A DIFFERENT ORGANIC SURFACTANTS AND ITS INFLUENCE ON THE PARTICLES SIZE AND MORFOLOGY

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Pure zinc oxide (ZnO) nanostructured powder was prepared by mechanochemical method followed by heat-treatment in a planetary ball-mill using agate jars and alumina balls. The frequency of the rotation of jars around the common axis was 180 per minute, activation times were from 30 min to 4 h. Mechanochemical processing involves the mechanical activation of reactant mixture in a liquid phase (wet milling). We studied influence of organic surfactants on reduction of ZnO particles size, their shape and size distribution. As a process controlling agent (PCA), we used different organic compounds such as oxalic acid, oleic acid and isopropanol. After milling procedure, intermediate compounds were calcinated in air to form ZnO powder. Powders characterization was preformed using X-ray diffraction method (XRD) and scanning electron microscopy (SEM).

P.S.C.18.

CORELATION OF STRUCTURAL RELAXATION, THERMAL EXPANSION AND ELECTRICAL RESISTIVITY OF $Fe_{89.8}Ni_{1.5}Si5_{5.2}B_3C_{0.5}$ AMORPHOUS ALLOY

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In this study, non-isothermal and isothermal changes of thermal expansion and electrical resistivity of $Fe_{89.8}Ni_{1.5}Si5_{5.2}B_3C_{0.5}$ amorphous ribbons have been investigated.

After multistep heating treatments was observed increase of temeperature range of thermal expansion linearity. Temperature coefficient of electrical resistivity increase to. During isothermal treatments performed on 440°C, 460°C and 480°C was recorded decrease of electrical resistivity. It was associated to process of structural relaxation of amorphous structure.

Calculation of kinetic parameters of structural relief was preformed by isothermal measurements results. This process was performed in two steps, the first one with activation energies E_{a1}=187 kJ/mol and the second one with E_{a2}=202 kJ/mol.

P.S.C.19.

MECHANICAL ACTIVATION INFLUENCE ON ELECTRICAL AND MAGNETIC PROPERTIES OF THE SYSTEM POWDER $Fe_{81}B_{13}Si_4C_2$

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Mechanical mixture of the powders Fe (81%), B (13%), Si (4%), C (2%) has been activated in Planetary Ball Mill for 120 minutes, 360 minutes and 720 minutes respectively. XRY analysis of the as-cast and activated powders has shown that the powder that was activated for 360 minutes has amorphous phase 30% more than the samples activated for 120 and 720 minutes.

Thermoelectrical analysis of the powder activated for 360 minutes showed that structural relaxation process of the powder occurs within temperature range of 160 - 260°C, which is accompanied by decrease in resistivity of around 60%.

Thermomagnetic measurements have proved that within the same temperature range magnetic permeability increases. Magnetic permeability of the sample activated for 360 minutes and annealed at up to 260°C upon cooling increases by about 30%. The increase in magnetic permeability upon annealing at up to 260°C is caused by structural relaxation process of activated powder. Upon structural relaxation process the walls of magnetic domains show greater mobility, whereas the number of disoriented atoms in-between domain walls is much smaller, which significantly adds to greater magnetic permeability.

P.S.C.20.

PRESSURE AND TEMPERATURE INFLUENCE ON ELECTRICAL AND MAGNETIC PROPERTIES OF COLD SINTERED POWDER $Fe_{20}Ni_{80}$

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The physical properties of transition ferrous metals (3d-transition metals) have been the subject of intensive studies for decades now, partly because of their scientific significance and partly because of their potential practical application. This paper analyzes the processes that accompany changes in electrical and magnetic properties during annealing of the samples obtained through cold sintering of polycrystal powder of mechanical mixture of iron and nickel ($Fe_{20}Ni_{80}$).

Resistivity dependence on temperature has been investigated by four-point method in temperature range from 290 K to 800 K in liquid argon atmosphere. Mass magnetic susceptibility was measured by Faraday method in temperature range from 290 K to 850 K in argon atmosphere.

The changes which were notable during annealing were monitored by means of X-ray analysis of as-cast and annealed cold sintered samples. The changes in peak widths led to a conclusion that deformed crystal structure thus recovers. Hence, it has been shown that recovery process during sample annealing is characterized by changes in resistivity and mass magnetic susceptibility, which is presumed to be the result of energetical stabilisation of electronic structure.

P.S.C.21.

THE EFFECT OF MICROSTRUCTURAL CHANGES DURING ANNEALING ON ELECTRICAL AND MAGNETIC PROPERTIES OF THE $Fe_{1.42}B_{1.30}Si_{0.14}C_{0.17}$ AMORPHOUS ALLOY RIBBON

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Differential scanning calorimetry and X-ray analysis were used to study the structural changes in the $Fe_{1.42}B_{1.30}Si_{0.14}C_{0.17}$ amorphous alloy during annealing. The alloy was stable up to 200ºC. Structural relaxation occurred within the temperature range of 200°C do 400°C, resulting in the short-range ordering. Highly disordered clusters, distributed within the amorphous alloy matrix, developed into α-Fe nanocrystals. The effect of these structural changes on the magnetic and electrical properties of the alloy was established. Upon relaxation, the magnetic permeability of the alloy was found to have increased by about 18% due to an increase in the mobility of the magnetic domain walls and due to better domains orientation. At temperatures higher than 310°C, the magnetic permeability decreased gradually at first and then rapidly with increasing temperatures, reaching zero at the Curie temperature. The Curie temperature increased from 410°C to 590°C as the crystalline phase proportion of the alloy increased. Crystallization occurred within the temperature range of 500°C to 560°C, inducing a sudden drop in electrical resistivity. At 25°C, the magnetic permeability of the crystalline alloy was about 55% lower than that of the fresh amorphous alloy.

P.S.C.22.

FABRICATION AND CHARACTERIZATION OF NANOSTRUCTURED Cu-3%wt Mo COMPOUND BY MECHANICAL ALLOYING

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In this study, nanostructured Cu-3% wt Mo compound was prepared by mechanical alloying of pure Cu and Mo powders. The milling operation was carried out in planetary ball mill using hardened chromium steel vial and balls under argon atmosphere with a constant ball to powder ratio of 10:1. The structural evolution and characterization of powder particles after different milling time were studied by X-Ray Diffraction, SEM observation and Microhardness measurements. The effect of milling time on formation mechanism of supersaturated solid solution was investigated. The results showed the displacement of broadened Cu peaks to lower angles and formation of supersaturated solid solution at longer milling time. Finally the Cu achieved a crystalline size of about 12 nm. The nanocrystalline Cu-3%wt Mo compound exhibited microhardness value of about 300HV due to formation of solid solution and refinement of crystalline size.

P.S.C.23.

POLYURETHANE/ CHITOSAN BIONANOCOMPOSITES

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γ-glycidoxypropyltrimethoxysilane was used as silane based organic modifier for nano silica particles and synthesized nano materials used in preparation of water borne polyurethane/ chitosan nanocomposites. The synthesized nanocomposites were characterized using thermal, spectroscopy methods and nano dispersions were evaluated by SEM technique. In addition, mechanical properties studied in detail and data showed the performance of chitosan moieties in mechanical as well as thermal properties. The interactions between coupling agent, nano silica, chitosan and polyurethane backbone were investigated by spectroscopy methods.

P.S.C.24.

PUF FOAM/ NANO SILICA COMPOSITES

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n-(2-Aminoethyl)-3-aminopropyltrimethoxysilane used as organic modifier in surface modification of nano SiO_2 and modified nanoparticles used in rigid polyurethane foam formulations. Increasing in modified nanosilica content in polyurethane foam formulation, caused performances in thermal, mechanical and dynamical properties of synthesized nanocomposites. Data interpretations showed that the presence of functional groups on the nanosilica surface affected stoichiometry and reduced hard phase formation in bulk polymer. Characterization was done by Fourier transform infrared spectroscopy (FT-IR), thermo gravimetric analysis, dynamic mechanical analysis, thermo mechanical analysis, scanning electron microscopy.

P.S.D.1.

POLYMERIC COMPOSITES OF METALLACARBORANES AND METALLACARBORANE CONJUGATES

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Polyhedral metallacarborane [3-cobalt bis(1,2-dicarbollide)]$^-$, CoD$^-$, interacts with cationic polymer poly(2-vinylpyridine), PVP, and with non-ionic poly(ethylene oxide), PEO. A result of such interactions in solution is precipitation of the composite (complex). The CoD$^-$ interacts with PVP because it shows high affinity to amino functionalities. The CoD$^-$ molecules are bound to the PEO chains via dihydrogen bonds. We studied the composites in bulk by spectroscopic and scattering methods. We also studied a formation of the composite with double hydrophilic PEO-containing polymers in order to disperse it in form of nanoparticles. The nanoparticle size and shape were imaged by AFM. To get more information on the molecular structure, fluorescein-CoD$^-$ conjugates were also studied. The system can find application in targeted drug delivery.

P.S.D.2.

ANOMALOUS STABILITY OF "COLOURED" FORM OF SPIROXAZINE PHOTOCHROMS TRAPPED IN POLYCARBONATE MATRIX AFTER SUPERCRITICAL FLUID IMPREGNATION

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A supercritical fluid is defined as a substance above its critical temperature and critical pressure. The critical point represents the highest temperature and pressure at which the substance can exist as a vapour and liquid in equilibrium. Supercritical fluids are suitable as an ecological substitute for organic solvents in a range of industrial and laboratory processes. Carbon dioxide and water are the most commonly used supercritical fluids. Besides other important properties supercritical CO_2 ($scCO_2$) is known as an effective polymer plasticizer medium (Tc= 31,1 oC; Pc= 7,38 MPa). This $scCO_2$ property usually use in new composite materials synthesis by organic or inorganic low-molecular substance impregnation. This report demonstrates a new approach of optic polymers modification by organic photochroms using $scCO_2$ medium. Various thermoplastic polymers (polyethylene, polypropylene, PMMA, polycarbonate) were impregnated with spiroantrooxazine (-1/,3/,3/-threemethylspyro (indoline-2/,3-3H- antraceno- [2,1-b] oxazin) (SAO) dissolved in supercritical CO_2. SAO molecules have usually stable unexcited form (A) that transfers to unstable "coloured" form (B) under the action of UV light. It was found that the supercritical fluid (SCF) impregnation of polycarbonate (PC) with SAO causes the anomalous stabilization of its coloured form B, unlike other polymers under study. The bleaching time of SAO in PC after its photoexcitation (900 s) is two orders of magnitude higher than that in polypropylene. Moreover, after supercritical fluid impregnation of PC up to 20% of SAO is originally formed in coloured form, which is not bleachable for 250 days (the whole period of observation), i.e. is extremely stable. The temperature and pressure effects on SAO concentration in different polymer matrixes were measured. At least some part of SAO incorporated into the polymeric matrix was formed nanocrystals of ~10-20 nm size. Possible mechanisms of the observed effect of the anomalous stability of coloured SAO form trapped in the polycarbonate matrix after its SCF are discussed in this thesis.

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P.S.D.3.

MICROHARDNESS AND MORPHOLOGY OF POLYPROPYLENE BASED ELECTROCONDUCTIVE NANOCOMPOSITES

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In the present study the Vickers microhardness and the creep rate of two types of polypropylene (PP) based composites have been determined. First type was electrically conductive composites of montmorillonite (MMT) and PP prepared by modification with conducting polymer – polypyrrole (PPy). The second type of nanocomposite contained different content of carbon nanotubes (CNT) in PP matrices. Concerning PP/CNT nanocomposites, it has been established that the microhardness increases with increasing the filler content and then remains constant at certain filler content. The presence of MMT and PPy leads to the increase in microhardness of the PP/MMT/PPy materials. The final microhardness values have been determined by the influence that both kinds of fillers, MMT and PPy increased the microhardness of the composites.

P.S.D.4.

APPLICATION OF IRRADIATION ON PROPERTIES OF COMPOSITES BASED ON POLYAMIDE

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Examining mechanical and thermal properties we were comparing effect of electron beam with γ-beam under irradiation in air of polyamide-6 reinforced by glass fibers.

While the composite exposed to electron beam declared an increasing of gel content formation with growing irradiation doses, no gel content was determined in the samples subjected to γ-irradiation. Electron beam irradiated composites showed improvement of Young modulus and tensile strength within increasing radiation dose. On the other hand γ-irradiation induced some drop or minimal changes of mechanical characteristics of the samples. We suppose that competitive process - oxygen degradation in air took part because of longer exposure time needed to reach the same doses. Reduction of melting temperatures as well as heats of fusion with increasing γ-radiation doses was corresponding to mechanical characteristics measured.

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P.S.D.5.

FUNCTIONAL CHARACTERISTICS OF THE POLYMER COMPOSITION CONTAINING NANOAGGREGATES OF SOLUBILIZED BY PLURONICS EUROPIUM DIKETONATES AND SPIROOXAZINES

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The main problems of photosensitive and light resistant polymer compositions preparation are stabilizing within matrix of photoactive compound (PAC) such as complex europium β-diketonates or spirooxazines, with linear size less than 1 mkm and achieving of uniform distribution of such particles inside the matrix. Most effectively these problems can be solved by solubilizing of injected particles with diphylic substances. Usually they are non-ionic surface active compound (SAS) which are soluble in hydrophobic polymer matrix. In this paper it was shown that the terpolymers ethylene and propylene oxide (pluronics) can be used as suitable SAS solubilizer of PAC. It was provided the comparative investigation of the pluronics effect on function properties of complex β-europium diketonates and spirooxazines injected in different polymer matrix. It was shown that luminescence intensity (I_{615}) of some solubilized complex β-europium diketonates injected into polymethylmetacrylate (PMMA) is increased in 5 times comparing with intensity of nonsolubilized luminophore. We suggest that luminophore solubilization caused PAC aggregate size decreasing and reducing of concentrative dissipation effect. At the same time no changes of I_{615} detected for solubilized complex europium β-diketonates injected curing oligokarbonatmetacrylate (OKM2). It supposed that pluronic with molecule weight 2090 during the process of curing is pressed out from high density system (molecule weight internodale block is 418) and also destruction of luminophor-pluronic assoation is happened. This way main part of pack is located within polymer matrix in nonsolubilized form. However, in case of some solubilized spirooxazines injection into PMMA or curing OKM2 it was observed that in pluronics presence the efficacy of photocoloration is increased in 1.5-2 times (in compare with nonsolubilized phochromes). The conclusion about particle size of PAC solubilized by pluronics made based on AFM analysis of crystallized pluronic F127 agglomerate structure on mica surface from its solution in chloroform. It was made with and without PAC presence in solution. Without photoactive compounds pluronic is crystallized on mica surface as dendrite-like (tree-like) structure. However after evaporation of europium β-diketonates and pluronic chlorophorme solutions associations crystallized on mica surface has structure of independent islands with linear size about 200-500 nm.

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P.S.D.6.

ELECTRICALLY AND THERMALLY CONDUCTIVE COMPOSITES ON THE BASE OF EVA COPOLYMERE FILLED WITH WOLLASTONITE FIBRES COATED BY SILVER

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New types of electrically and thermally conductive polymeric composites were prepared using ethylene-vinylacetate (EVA) matrix filled with silver-coated wollastonite fibers. The thermal, electrical, mechanical and adhesive properties of the composites will be reported in this lecture. The electrical percolation threshold was found about 8 vol.% and the highly electrical conductivity value (1.8×10^5 S.m^{-1}) was reached for 29 vol.% of filler fraction. Except electrical conductivity, it was shown that silver coated fibers significantly improved the thermal conductivity of composites despite the low silver volume content. The mechanical and adhesive properties of these composites will be also discussed and correlated with some models.

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P.S.D.7.

OPTICAL PROPERTIES OF «POLYIMID - $YBa_2Cu_3O_{6+x}$» COMPOSITES

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Explored influence cutting the cooling and further endurance under nitric temperature on IK-spectrum polymer composite material «Polyimide - high-temperature superconductor YBCO». The given material was made on base polyimide, in which was entered in the manner of filler crystalline powder YBCO. IK-spectrums were determined prepared sample so and after their processing by fluid nitrogen. The sample was lowered in fluid nitrogen on 300 s and IK-spectrums left with and in 72 hours. IK -spectrums left on IK-spectrometer IKS - 29. It is installed that in prepared sample reveal itself the bands of the absorption typical both for polyimide of the film, and as for sample HTSC themselves.

The properties most polyimide of the film are not changed, under small concentration HTSC fillers. With increase the concentrations in IK-spectrum more brightly reveal itself the bands of the absorption typical of sample HTSC themselves. In source and sample processed by fluid nitrogen revealed itself typical of HTSC broad band of the absorption in the field of 3300 - 3500 sm^{-1} conditioned crystal hydrations Cu, Y, Ba. After processing by fluid nitrogen polyimide film completely saves its structure. The reduction of the amplitude existed in the field of 4200-1750 sm^{-1} connected with reduction of the concentrations free ion in structure polyimide. The absence of the band of the absorption other insulated hydracids of the groups is explained by high degree of the covering to surfaces of the molecules HTSC polymer matrix.

P.S.D.8.

Gd_2O_3:Eu^{3+}/PMMA COMPOSITE: THERMAL AND LUMINESCENCE PROPERTIES

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In recent years there is an increasing interest in obtaining and investigating composite materials that comprise nanoparticles as fillers and polymers as matrix. Such composites may display combined features of both components, and sometimes even novel properties resulting from their mutual interactions. It is important that both unique size-dependent properties of nanoparticles and favourable properties of polymer material remain preserved in the composite. In this research we investigated the possibility of obtaining composite material using as polymer matrix poly(methyl methacrylate) - PMMA and Gd_2O_3:Eu^{3+} nanopowder as filler. Three samples, containing 1, 3 and 5 mass % of Gd_2O_3:Eu^{3+}, are prepared with a dispersion casting method. Results from FTIR measurements show that nanoparticles are embedded in the polymer matrix without forming any kind of chemical bonds with the host. This is confirmed further by examining their optical properties: the composites exhibited characteristic red emission coming from the $^5D_0 \rightarrow {}^7F_2$ transition of Eu^{3+} ion in Gd_2O_3:Eu^{3+}. The observed lifetime values, around 1.1 ms, are quite high and suggest successful encapsulation of dopant ions in polymer through gadolinium oxide host. We also investigated the influence of Gd_2O_3:Eu^{3+} on the modification of thermo-degradable properties of the polymer matrix. Thermal analyses give evidence of unchanged thermal stability of polymer phase in the composites. All samples display combined, unaltered features of both composite components, inorganic and organic.

P.S.D.9.

THE INFLUENCE OF NETWORK PARAMETERS ON THE PROPERTIES OF THERMORESPONSIVE Ag/PNIPA HYDROGEL NANOCOMPOSITE SYNTHESIZED BY GAMMA IRRADIATION

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The radiolytic synthesis is simple and facile approach to fabricate well dispersed metal nanoparticles in crosslinked polymer network i.e. hydrogel. This work describes synthesis of silver nanoparticles (AgNPs) in thermoresponsive poly(N-isopropylacrylamide) (PNIPA) hydrogels. PNIPA hydrogels, with different initial concentration of monomer, were previously obtained by gamma irradiation induced polymerization and crosslinking. The *in situ* reduction of Ag^+ ions was performed using strongly reducing species, such as hydrated electrons and 2-propanol radicals, formed under the radiolysis of water. UV-Vis absorption spectra of Ag/PNIPA hydrogel indicated the presence of surface plasmon band with maxima around 400 nm, which is characteristic for AgNPs (diameter less than 10 nm). Size of synthesized AgNPs and morphology of crosslinked polymer network were investigated by TEM and SEM, respectively. PNIPA is typical representative of thermoresponsive polymer with lower critical solution temperature (LCST) at about 32^oC in aqueous solution. Correspondingly, the crosslinked PNIPA hydrogel exhibits phase separation and changes volume abruptly in response to the variations of the external changes. LCST of hydrogels, neat PNIPA and Ag/PNIPA nanocomposites, were determined gravimetricaly by swelling procedure in the temperature range from 10 to 50^oC. Swelling and deswelling properties of synthesized samples were investigated in water at room temperature (22^oC) and at 45^oC, respectively. Finally, silver release from Ag/PNIPA hydrogel nanocomposites was investigated by ICP measurement.

P.S.D.10.

RESEARCH ON POLYMER – BONDED MAGNETIC MATERIALS WITH VARIOUS Nd-Fe-B FILLER CONTENT

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One of more important developments in magnetic materials, polymer bonded magnets, have opened a new world of application opportunities. The Nd-Fe-B/polymer type composite materials offer an excellent combination of strong magnetic and dynamical-mechanical properties. The transition temperatures of filler and matrix should be selected carefully considering the future application. Uniform particle distribution and good adhesion between Nd-Fe-B powder particles and polymer are essential for the quality of the composite, while stiffness of polymer matrix is one of the influencing factors as well. The damping properties of Nd-Fe-B/polymer composites were studied by dynamic mechanical analysis (DMA) and compared with pure polymer sample. Thermal stability was analyzed using simultaneous DSC/TGA technique. As expected, the results of magnetic measurements show that the amount of magnetic powder has direct influence on magnetic properties of composite, which is clearly illustrated by obtained hysteresis loops.

P.S.D.11.

POLYMER NANOCOMPOSITES FOR OPTICAL APPLICATIONS

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Processing and characterization of PMMA-Y_2O_3 (Er^{3+}) nanocomposites is presented in this study. Nanocomposites were fabricated by using laboratory mixing molder with different content (1 %, 2% and 5%) of Eu-ion doped Y_2O_3 nanophosphor powder with particle size of 20 nm. These series were classified in two groups: first, without particle treatment before mixing process and the second with modification of matrix-particles interface using spin-coating. Agglomeration is a significant problem in nanocomposite manufacturing, which include nanoparticles distributed within host matrix material. The influence of particle surface treatment and content on their de-agglomeration and distribution uniformity in composites and, consequently, on the optical and dynamic-mechanical properties of nanocomposites were investigated. The structure and the particle size distribution were investigated by X-ray diffraction (XRD) and scanning electron microscopy (SEM); the optical properties of starting particles and obtained nanocomposites were investigated by laser-excited luminescence spectroscopy. Dynamic-mechanical analysis was performed in order to determination of mechanical properties of nanocomposites (storage modulus, loss modulus, glass transition temperature).

P.S.D.12.

THERMO-MECHANICAL PROPERTIES OF POLY(VINYL BUTYRAL)/TITANIUM DIOXIDE NANOCOMPOSITES

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Poly(vinyl butyral) (PVB) and titanium dioxide (TiO_2) nanocomposites were prepared by injection molding nanocomposite materials using LMM (Laboratory mixing molder). The thermo-mechanical properties of the nanocomposites were studied using two different inorganic fillers: colloidal TiO_2 (sol) and powder of TiO_2 nanoparticles. Addition of colloidal TiO_2 to the polymer matrix produced good filler dispersion while the use of TiO_2 powder resulted in aggregated particles in the PVB matrix. The TiO_2 nanoparticles used have an average diameter of 25 nm and their weight fraction varied from 1 up to 7 wt. %. The TiO_2 nanoparticles are characterized by scanning electronic microscopy (SEM) and infrared (IR) spectroscopy. The so obtained nanocomposite is analyzed by thermogravimetry (TGA), differential scanning calorimetry (DSC) and dynamical mechanical analysis (DMA). DMA analysis showed that nanocomposites gave the highest storage modulus values and the lowest tanδ values than those of pristine PVB in booth case. The highest improvement of mechanical properties is achieved for nanocomposite containing 5 wt. % colloidal TiO_2. The thermal characteristics of these nanocomposites were also enhanced by incorporating TiO_2 (powder and sol) into the PVB matrix. Preparation of the nanocomposites is simple, easy to operate, with some prospects for ballistic applications.

P.S.D.13.

NANOCOMPOSITES BASED ON SILANE TREATED NANOSILICA AND WASTE AND VIRGIN HIGH-DENSITY POLYETHYLENE MATRIX

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This study investigates the effect of dicumyl peroxide (DCP) as cross-linking and γ-methacryloxypropyltrimethoxy silane as coupling agent on thermomechanical properties of nanosilica reinforced virgin and waste high-density polyethylene (HDPE) composites. Modification of nanosilica was performed by silanization under supercritical carbon-dioxide. The additions of DCP and silanized nanosilica lead to the improvement of the mechanical properties of composites in comparison to pure virgin and waste HDPE. Silanized nanosilica, as well as the presence of dicumyl peroxide during sample preparation, substantially improved the thermal stability of the waste and virgin matrix.

The addition of 0.2 phr of DCP and 2 phr of silanized nanosilica leads to highest improvement in tensile strength of about 44% and modulus increase of about 34% for HDPE composite. Similar trends are observed for composites with waste HDPE, increase of strength and modulus are found to be 36% and 31%, respectively.

P.S.D.14.

BARRIER PROPERTIES OF COATED AND LAMINATED POLYOLEFIN FILMS FOR FOOD PACKAGE MANUFACTURING

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The research of food packaging barrier properties is very important from a technological point of view. Thus the diverse part of the material science field has many applications to food package on laboratory or industrial-scale. The manufacturing demands for polymer packaging films with defined barrier against gases, moisture and flavors are now very restrictive. The gas transport coefficients vary generally with parameters which can be intrinsic to the polymer, such as the degree of crystallinity, the nature of the polymer, or even the thermal and mechanical histories of samples. The kind of gases used, characterized by its molecule size and nature as well as its conditions of temperature and pressure, are also factors influencing barrier properties. Molecular orientation which usually develops in processing is known to have a major effect on the mechanical properties of both glassy and crystalline polymers. In order to achieve good barrier laminates, one key issue along the whole production chain (from film extrusion to lamination) is given by the material surface properties. Additives generally increase the permeability. Orientation of macromolecular chains reduces gas diffusivity. Polyolefin packaging can have a range of requirements, among them low water loss, sealability, extended shelf life, high flexibility, optical clarity, slow permeability to oxygen and carbon diokcide, lack of leachables, dimensional stability during sterilization, flex resistance and environmental compatibility. The objective of this study was to assess the differences between the barrier properties of coated and un-coated polyolefin films. Eight types of packaging films are prepared by standard industrial procedure by cast film extrusion processing with chill rollers: biaxially oriented polypropylene (BOPP), BOPP coated by acrylic copolymer, metallized BOPP by aluminum, and low-density polyethylene (LDPE). The influence of lamination and metallization on the gas permeability was studied by Lyssy's method. The moisture transparency was determined according to the gravimetric method. It was estimated a substantial differences between the barrier properties of the coated and un-coated films. It was estimated that the lamination process improves the oxygen barrier but not necessarily the moisture barrier, due to the different mechanisms for oxygen and moisture permeability.

P.S.D.15.

ENERGY ABSORPTION CAPACITY OF GLASS-POLIESTER COMPOSITE TUBES

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In general, the behaviour of composite materials and composite tubes are different than metals. Unlike metals, they have characteristics of brittle crack with maximal deformations 1.5-2%. In spite of that they can be used as elements for amortization, such as auto industry. Up to now, as a form of safety, all components in the production of automobiles, which ask for great resistance on breaking, have been of metal. However, today, with intensive development of composite material and their wide selection of possibilities, the producers of cars (but in all other industries) producers turn more and more to non-traditional composite materials, and every material has to satisfy criteria of energy needed for the crack of observed material. Great number of latest research showed that composite materials satisfy all safety standards.

Having all previously said in mind, the subject of this paper is experimentally determination of energy of static crack of glass-polyester composite tubes with the definite structure and the known process of fabrication. The aim is determination of possibility of their usage as elements for the amortization of impact. Two types of samples of different diameter of circular transversal cut of tubes. The samples were tested till crack under static compression loading, by entering loading under small speeds. The forces were determined and shortening while making first damages, as well as maximal values under which there was a complete destruction of samples. From the diagrams received directly from the devices for testing, certain energies were determined. The tests were done on servo-hidraulic testing machine INSTRON 1332 with controller INSTRON FAST TRACK 80800, with the usage of hydraulic jaws and certain electronic equipment for the collection and work on data.

P.S.D.16.

GAMMA-RADIATION RESISTANCE OF CARBON BLACK REINFORCED NBR/CSM RUBBER BLENDS

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In this applicative work curing behavior, mechanical properties and radiation resistance of carbon black filled rubber composites were studied. Acrylonitrile butadiene rubber (NBR) and chlorosulphonated polyethylene rubber (CSM) were used as network precursors. The curing characteristics of NBR/CSM rubber blend (50:50, w/w) were assed using oscillating disc rheometer. The reinforcing effect of carbon black with primary particles 40 nm was estimated as the value of so called rubber-filler interaction parameter (m) for samples with different filler content. The gamma radiation resistance of nanocomposites was determined from the tensile strength and crosslinking level (obtained from swelling data) after prolonged exposure to γ-irradiation (dose rate of 10 kGyh^{-1}and total absorbed dose of 100, 200, 300 and 400 kGy).

P.S.D.17.

MIX DESIGN AND PROPERTIES OF ULTRA-HIGH STRENGTH CONCRETE

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Modern civil engineering is characterized with increasing application of Ultra-high strength concrete (UHSC). Structure and prepare of UHSC are intensively analyzed in the last fifteen years. Possibilities of getting UHSC with domestic materials based on experimental work shown in this paper. It was made three series of samples with different types of cement. Steel fibers were used and the length of 8mm cross-section 0.175mm. The samples were cured at a temperature 20 ± 2 and relative humidity 95%. In addition to testing physical-mechanical properties of this material, the shrinkage and creep were also observed. In this paper we showed the microstructure of concrete in different age. A special attention, we turn on the cross-section samples where cement is not hydrated completely.

P.S.E.1.

ORGANIZATION OF PROVISIONAL FIBRONECTIN MATRIX WITHIN MULTILAYERED LbL NANOSTRUCTURED BIOMATERIALS

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Nanostructured materials are of great interest for tissue engineering in the recent years, because they have been found to improve the interaction with cells and therefore their acceptance as implants. To this regard the layer by layer (LbL) technique provides a simple approach to fabricate multicomponent films of nanometer thickness with tailored architecture. Here, using LbL technique we have assembled biomimetic multilayers of heparin and chitosan, in order to assess the ability of osteoblast-like cell to reorganize provisional fibronectin (FN) matrix. Different pH values during multilayer formation were applied to control their physicochemical properties. Our data demonstrated strong dependence of fibronectin matrix reorganization on pH values. Therefore, LbL technique shows a high potential to control the surface properties of biomaterials.

P.S.E.2.

FUNCTIONALIZATION OF CALCIUM PHOSPHATE BIOCERAMICS FROM NATURAL RESOURCES

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In this study, calcium phosphate bioceramics have been synthesised from natural materials that are available in large quantities in nature. Calcium phosphate based bioceramics were synthesised by using eggshell derived raw materials mixed with phosphoric acid. After the calcium phosphate scaffolds were prepared, three various coatings were applied by using a precipitation method: (i) apatite, (ii) nanodiamond or (iii) apatite-nanodiamond coating. In this work, the preparation and coating processes as well as morphological, structural observations and characterisation are presented.

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P.S.E.3.

STRUCTURAL AND MICROSTRUCTURAL ANALYSIS OF HUMAN ALVEOLAR BONE USING X-RAY POWDER DIFFRACTION AND RAMAN SPECTROSCOPY

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X-ray powder diffraction and chemical analysis show that mammalian bones and teeth are an impure form of hydroxyapatite, (HAp) $Ca_{10}(PO_4)_6(OH)_2$. The major difference of natural bioapatites from hydroxyapatites is in the presence of small amount of F and about 3 wt% CO_3. The chemical composition of biogenic apatites usually range from carbonate-hydroxyapatite, $Ca_{10-x}(PO_4)_{6-y}(CO_3)_y(OH)_z$, to $Ca_{10-x}(PO_4)_{6-y}(CO_3)_yF_z$. These end-members of an isomorphic series of carbonate-apatites have also been referred to as minerals dahllite and francolite, respectively. Details of crystal structures of carbonate-containing apatites are important because CO_3^{2-} ions influence the reactivity and stability in thermal and aqueous conditions. In this work, we analyzed natural hydroxyaptite extracted from alveolar human bone by thermal treatment with hot H_2O_2. The Rietveld structural refinement of the occupation number indicate partial replacement of PO_4^{3-} ions by CO_3^{2-} Microstructure size-strain line broadening analysis shows anisotropic X-ray line broadening due to the small crystallite size (about 10 nm) and lattice strain effects. The Raman spectroscopy confirms the presence of the PO_4^{3-}, CO_3^{2-}, OH^- ions and the law degree of atomic ordering in the apatite structure. SEM and EDS methods were used for morphology and chemical composition analysis.

P.S.E.4.

SYNTHESIS, CHARACTERIZATION AND THE SOLUBILITY OF β-TCP POWDERS WITH Mg AND Zn BASED DOPANTS

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It is well established that trace elements such as magnesium and zinc in calcium phosphate ceramics strongly influence both the biological response of implant materials, and affect the crystallographic, mechanical and chemical properties of manufactured ceramics. Specific aims are to prepare and characterize the crystallographic, morphologic, and chemical properties of a series of Mg/Zn-TCP materials, ant to determine the short and long term initial dissolution rates of the materials prepared, respectively. Separately, these ions have been associated with bone formation, biomineralization and osteoporosis therapy. Beta-TCP and β-Zn,Mg-TCP were prepared by a solid-state reaction, then calcinations at 900ºC for 2hr, and finally sintered at 1100ºC for 2hr. Unit cell parameters a_o and c_o, and molar volume V_o decrease linearly for atomic ratios $Me^{2+}/ Me^{2+} + Ca^{2+}$ varying from 0 to 10 mol.%. The powders were characterized by X-ray diffraction (XRD) and infrared spectroscopy (IR) for the crystalline phase, scanning electron microscopy (SEM) for the particle size and morphology of the structures, and SEM with energy dispersive system (EDAX) attachment for Ca, P and Mg/Zn analyses The dissolution behavior of Mg-substituted samples was tested in distilled water, at pH=6.1. Results demonstrated that Zn^{2+} and Mg^{2+} ions can easily substitute for Ca^{2+} ions in the TCP lattice. Increasing the substitution of Ca^{2+} content from 0 to 10mol.% reduces the dissolution rate of Zn/Mg-TCP samples.

P.S.E.5.

PRECIPITATION SYNTHESIS AND TWO-STEP SINTERING OF HYDROXYAPATITE NANOPOWDERS

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Hydroxyapatite, (HAp), $Ca_5(PO_4)_3(OH)$, due to its excellent biocompatibility and osteoconductivity as well as close similarity to human bone structure, represents a promising material for hard tissue implantation. However, mechanical properties of synthetic HAp are not so good as those of natural bones and that limits load-bearing application. Recently it was found that nanostructured ceramics have much better mechanical properties. The nanostructured ceramics could be obtained by two-step sintering technique. Of course, to have such final product, nanopowder as starting material is necessary.

In this work, method of chemical precipitation was performed to prepare hydroxyapatite (HAp) nanopowders. The synthesis parameters, like concentration of starting solutions, speed of stirring, time of ageing, as well as time of ultrasound treatment of as-precipitated powders, were investigated in terms of particle size and particles size distribution. The obtained powders were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and particle size measurements. In order to suppress accelerated grain growth during final stage sintering and to maintain bioceramics nanostructured, with the most uniform grain size distribution, was treated by two-step sintering technique. The samples were uniaxially pressed into pellets and were first heated to the higher temperature T_1 and attained at this for a short time, just to render pores unstable. After that, the sample was cooled down to the temperature T_2 and kept for prolonged time. At the latter temperature densification should occur without grain growth because of difference in kinetics of desirable grain boundary diffusion and undesirable grain boundary migration. The best temperature range was determined by try and error method and master sintering curve in order to reach the highest possible density.

P.S.E.6.

TREATMENT OF OSTEOPOROSIS ALVEOLAR BONE WITH COBALT SUBSTITUTED HYDROXYAPATITE NANOPARTICLES

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In this study nanocomposite was used for reconstruction of alveolar bone defect of mandible. Specifically, the main interest for the use of magnetic nanoparticles in biomedical applications is that an inhomogeneous external magnetic field exerts a force on them, and thus they can be manipulated or transported to a specific diseased tissue by a magnetic field gradient. In addition, magnetic particles are of interest because they do not retain any magnetism after removal of the magnetic field. Specifically, inorganic biodegradable nanoparticles (including ceramics, like hydroxyapatite) will be functionalized with bioactive compounds that bond to bone of low mass. Extremely good results in the recovery of alveolar bone osteoporosis were achieved already after 6th week of the application of magnetic nanoparticles. After bonding specifically to osteoporotic bone and not healthy bone, magnetic nanoparticle systems will deliver bioactive compounds to locally increase bone mass. Implantation of magnetic nanoparticles will create bone construction and enable quick formation of new bone and become the material of choice for accelerated bone regeneration.

P.S.E.7.

ROLE OF PHASE IMAGING IN SURFACE ROUGHNESS ANALYSIS OF BIOPOLYMERS

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Phase image features are as easy to perceive, distinguish and accept as the eye can see. In surface technology, differences in contour and colour on a phase image can be used either for topography image's validation checking or for the better understanding of surface generation process.

This paper describes the methodology of rough surface analyses and the role that the phase images has in them. Two surfaces of same biomaterial were polished under different conditions. Polished surfaces were prepared and recorded by scanning probe microscopy in the only appropriate mode for delicate materials such as biomaterials - the tapping mode. Simultaneously gathered topography and phase images were analysed in order to observe measuring errors and choose topographic images suitable for standard and fractal roughness analyses.

First, surface roughness of selected topographic images was analysed by standard roughness parameters. Laboratory microscope JEOL SPM5200 has accompanied software WinSPM for image analyses. Standard surface roughness analysis was also conducted using this software. Surfaces' roughnesses were evaluated based on a number of parameters correlated to surface profile or surface area.

In addition, phase image also provided useful information for fractal analysis. Topographic images were attached to ASCII files with data that represent surface height in every pixel of recorded image. Based on phase image analysis results, checked and accepted topography images were loaded in Matlab custom-made procedures for fractal analysis. Fractal analysis based on modified "skyscrapers" method, set up in previous research, provides fractal dimensions for polished surfaces' images. Based on the fact that machined surface with larger fractal dimension is rougher than the one with the lower value, on the one hand, and that there is an optimal value for good functional behaviour, on the other hand, final decision on surface quality can be arrived at. As a result of two surfaces' roughness quantification, two values of fractal dimension are used for surface characterisation, comparison and functional behaviour prediction.

Authors underline the effectiveness of phase image in surface roughness analyses, either conventional or fractal one. At the same time, the authors consider fractal analysis as more suitable for identification, comparison and functional behaviour prediction when compared to the conventional one. Fractal analysis conclusions can constitute valuable feed-back information for manufacturing process, and in this case, could influence the selection for optimal polishing duration.

P.S.E.8.

THE RELEASE OF SILVER IONS FROM Ag/P(HEMA/BIS/IA) HYDROGEL COMPLEXES

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Metal hydrogel complexes are particularly interesting due to their novel and improved properties as compared with virgin hydrogels, as well as due to their potential applications. In this paper, a series of novel pH-responsive Ag/P(HEMA/BIS/IA) (silver/poly(2-hydroxyethyl methacrylate/monofunctional poly(alkylene glycol)s/itaconic acid)) hydrogel complexes with different types of monofunctional poly(alkylene glycol)s (BIS) are regarded as potential antimicrobial agents, since they show high and pH sensitive efficacy to release Ag^+ ions in an aqueous medium. The silver ion release properties were determined by inductively coupled plasma mass spectrometry (ICP-MS) and the effects of the different P(HEMA/BIS/IA) hydrogel compositions on the Ag^+ ion release characteristics are discussed. It was found that the hydrogel composition and pH swelling characteristics were very decisive for the silver ion release properties and hence the antimicrobial efficacy. The antibacterial activity of the hydrogel complexes was evaluated during one week. The results indicate that all investigated hydrogel complexes are highly active against *Staphylococcus aureus* (gram (+) germ) and *Escherichia coli* (gram (-) germ) during the release period. Due to these facts, the pH responsive hydrogel complexes reported here might be potentially smart materials and excellent storehouses of silver.

P.S.E.9.

SURFACE MODIFICATION OF METHACRYLATE HYDROGELS FOR COVALENT BINDING OF BIOACTIVE MOTIFS

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Synthetic hydrogels are often used in biomedical applications because many of them are compatible with living tissue. Moreover, they can meet most criteria for artificial tissue properties. Generally, cell adhesion and proliferation proceeds better in the presence of some biologically active molecules (e.g. proteins, oligopeptides) on the support surface. In this work, monomers 2-hydroxyethyl methacrylate, glycerol monomethacrylate and 2-ethoxyethyl methacrylate were selected for (co)polymerization to control the amount of hydroxy groups and the physical-chemical properties of prepared hydrogels. Various chemical modification reactions of surface hydroxy groups were employed to covalently attach suitable bioactive motifs. The conditions of hydrogel surface treatment and their effect on bioactive compound immobilization were compared and evaluated.

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P.S.E.10.

CONTACT LENSES CHARACTERIZATION BY AFM/MFM AND OPTOMAGNETIC FINGERPRINT

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Polymers conformation states of contact lenses surface are changed during contact lenses production. Since, quality of contact lenses depend of conformation state of surface molecules and its orientation, we investigate contact lenses surface by AFM/MFM and optomagnetic fingerprint techniques. We find out that surface quality and magnetic properties of contact lenses have influence on light transmission. Bearing in mind this result biomedical investigation of surface state and magnetic property of contact lenses on human vision is next step in our research program.

P.S.E.11.

SINTHESIS, CHARACTERIZATION AND ANTITUMORAL ACTIVITY OF THE PLATINUM(II) COMPLEX WITH *O,O′*-DIETHYL-ETHYLENEDIAMINE-*N,N′*-DI-(*S,S*)-2(4-METHYL)-PENTANOATE LIGAND

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Rosenberg′s discovery of the antitumor activity of cis-platin, cis-$[PtCl_2(NH_3)_2]$, represents the starting point in the ever increasing field of bioinorganic platinum chemistry. Since the introduction of cisplatin, a large number of new platinum compounds have been prepared and tested for antitumor activity.

Sinthesis, characterization and antitumoral activity of O,O′-diethyl-ethylenediamine-N,N′-di-(S,S)-2(4-methyl)-pentanoate ligand and its complex with platinum(II) is described here. The platinum (II) complex was characterized by elemental analysis, infrared, ^{1}H and ^{13}C NMR spectroscopy. The ligand and complex were tested for cytotoxic activity on tumor cell line human lymphocyte leukemia cells (HLL). Effects of this compound on cell viability were determined using MTT colorimetric technique.

P.S.E.12.

A PRELIMINARY STUDY ON THE ANTIFUNGAL ACTIVITY OF THE ETHANOL EXTRACT OF *HYPERICUM PERFORATUM L*

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This study was aimed at estimating the effectiveness of the *H. perforatum* extract to inhibit the growth of the *P. canescens* and *F. oxysporum* fungi. The experiment was conducted using the dilution (MIC) and microscopic methods to examine the antifungal activity of the ethanol extract of *H. perforatum* against the selected fungi. The MIC of the ethanol extract of *H. perforatum* for the examined fungi, *P. canescens* and *F. oxysporum*, was 10 mg/mL. The microscopic method used to determine the antifungal activity of the ethanol extract of *H. perforatum* against *P. canescens* and *F. oxysporum* showed that an increase in the extract concentration induced a decrease in the number of spores in both fungi, by 62 % in *P. canescens* (within the extract concentration range of 0-45 mg/mL Hyp, the spore number decreased from 104 to 40 CFU/mL) and by 72% in *F. oxysporum* (within the extract concentration range of 0-45 mg/mL Hyp, the spore number decreased from 100 to 24 CFU/mL), i.e. the higher concentrations of the *H. perforatum* extract exhibited the antifungal effect. The obtained results suggested that the ethanol extract of *H. perforatum* showed antifungal effects (the higher the extract concentration, the higher its antifungal effect).

P.S.E.13.

COMPARATIVE INVESTIGATION OF NORMAL AND PATHLOGICAL CERVICAL CELLS BY OPTICODIGITAL MICROSCOPY AND AFM

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Cervical cancer and endometrial carcinoma are the most common invasive cancers of the female genitial tract and accounts for 12% of all invansive cancer in women, excluding skin cancer. We use standard opticodigital microscopy (magnification up to x 600) and atomic force microscopy (AFM, JSPM-5200) to detect normal, displastic and cancerous cells. They were taken, fixed and coloured using Papp smears during regular colposcopic examination. To analyse images, both classical and nano, we develop initial software, which help us to make decission if smear is normal or contains displastic or cancerous cells. Since AFM method may investigate one-by-one cell in details, this method has adventage to compare with classical one, especially for early detection of suspicious cells. This method is based of complete analises of the whole surface of the smears and it is not dependent on the capability, subjectivity, experience and knowledge of the practition.

P.S.E.14.

IMPORTANCE OF BIO-CATALYTIC PROCESSES FOR CELL IMMOBILIZATION IN ALGINATE BEADS

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Cell immobilization is very attractive and modern engineering method for a variety of application in biotechnology, pharmacy and medicine. Calls can be immobilized in polymer beads of small dimensions, having network structure and been suspended in fluids during different industrial processes. The network structure of polymer matrix, prevent cells to escape from the bead during the process and provide at the same time possibility of fluid diffusion with nutrients and cell metabolism products through the bead, what is important for process performances.

Many cell types can adapt to such life conditions but a number of difficulties usually arise in later stages of the process and its efficiency decrease in spite of engineering optimizations. It can be related to catalytic action of some species produced in the process, but also to changes of the system structure due to cell colony growth and volume expansion. In this contribution we consider and try to relate both, increase of cell concentration in a bead and increase of free radicals produced by oxygen supply and cell performances in the particular stage. It is obvious that with higher number of cells in a system should increase the concentration of peroxide as product of cell metabolism as was pointed already by L. Pauling who also proposed some organic substances as vitamin C, to prevent it, by catalytic action. In our contribution such approach is combined with energy balance consideration of the process in a very general sense. The changes of process parameters are considered experimentally and theoretically in the function of cell dynamics, consuming also significant energy end changing the morphology of a bead system as well.

P.S.E.15.

IMPLEMENTATION OF MATERIALS TESTING METHODS IN DENTAL WITHENING STUDIES

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Discoloration of teeth is an esthetic problem, which requires effective treatment. The objective of the study was to determine the surface morphological changes on enamel following treatment with two "In office bleaching" agents. Ten intact freshly extracted human premolars and third molars (for orthodontic and preventive purpose) were selected for the study. Twenty fragments were prepared with mesio-distal cutting. The samples were randomly assigned to two groups. Group 1 received 38% hydrogen peroxide gel simulating the clinical application, three times for 20min. during the day. Group 2 received 35% carbamide peroxide gel simulating the clinical application (tree times a week for 1h). The control samples were treated with the saline using the same procedures. Samples were then prepared for the SEM evaluation of enamel surface morphology on x 500, x1000 and x 5000 magnification. The samples treated with 38% hydrogen peroxide show rougher enamel surface morphology with grooves and convex ridges, some shallow and deeper pits combined with a smooth band compared to 35% carbamide peroxide treated samples. The surface hardness of samples was measured using the Knoop method and showed that there is evident loss of teeth hardness during the treatment, but the hardness was reestablished after reminelarisation during three weeks in saliva.

P.S.E.16.

SEM ANALYSIS ON RETRIVED DENTAL IMPLANTS

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This study was developed for evaluating the possible causes of losing primary stability of dental implants and to find possible associations between implant design or implant surface treatment and the quality of surrounding bone tissue. There been evaluated five titanium dental implants with different shapes and surface morphology by ESEM. The lost during 3 to 6 month of the primary stability for the dental implants evaluated at the interface was attributed for blood supply deficiency of the surrounding bone in case of the implants inserted in the anterior-lateral and lateral mandible bone, over compression implant surrounding bone with consecutive necrosis without leaving the possibility of normal healing both for the maxilla and the mandible or because of prosthetic load deficiency by applying forces out of the implant axis.

P.S.E.17.

ESEM ANALYSIS OF FRACTURED ZIRCONIA CORE DENTAL-CROWNS

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Not only is zirconia an excellent material for copings and frameworks, but it is also used elsewhere in the body for bone replacement and implantation. Besides all advantages, zirconia has extremely poor fatigue resistance. This study wanted to evaluate the benefits and limits for using zirconia as core material in dental prosthodontics. It has been taken into the study 3 human cases that had been dental restorated with zirconia cores crowns and bridges. The cores and crowns were ESEM evaluated before and after layering feldspatic ceramics. One case was retrieval analyzed after 3 months period when the ceramic zirconia core fractured in use. The indication of using milled zirconia as framework for ceramic layering is not well defined yet. In conclusion, the dental prosthetic restorations using zirconia cores should be designed in such a manner that the framework to withstand only compression forces.

P.S.E.18.

DISSOLUTION PROPERTIES OF K_2O-CaO-MgO-P_2O_5 BIOACTIVE GLASSES

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Conventional phosphate glasses have hygroscopic property and poor chemical durability caused by the glass structure. However, the new specific applications for soluble phosphate glasses as environmental materials were proposed (glass fertilizer, anti-bacterial, far-infrared radiation), dental and bio-medical. Due to that, the knowledge of the chemical processes occurring during the contact of glass with specific solution are the subject of constant interest. In this paper the solubility of glass from the K_2O-CaO-MgO-P_2O_5 system in different solutions was investigated. The glass with 10 mol% of K_2O was melted in platinum crucible at T=1260 ^oC for t=1 h. The obtained glass sample was transparent, without visible residual gas bubbles. The glass transition temperature of T_g=585 ^oC was determined. The dissolution experiments were performed with 1g of the powder glass (0.3-0.63 mm) using deionized water (pH=6,62) and 2 wt% solution of citric acid (pH=3,89) at 37 ^oC for different times. The chemical activity of glass was estimated by measuring of glass mass loss, pH, conductivity and concentrations of P and K in solutions. The results were shown a complex behaviour of these parameters. More intensive dissolution process of glass in citric acid solution than in deionized water was determined. Also, the time dependence of these parameters differences which indicate that the kinetics and mechanisms of dissolution of glass in these solutions are different.

P.S.E.19.

VITAMIN C DEGRADATION DURING THE DRYING PROCESS OF THE WILD-ROSE EXTRACT

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In this paper was studied the experimental work of the degradation function of vitamin C (ascorbic acid) during the convective drying in fixed bed of wild-rose extract of wild rose, under different temperatures. The values of moisture content, vitamin C concentration were experimentally obtained at different time stages for a range of the drying temperature of the air used as drying agent between [30, 110]^{o}C. The experimental data were correlated in empirical equations for vitamin C degradation constant function of drying temperature and for the moisture content in kinetic of drying, as a function of drying temperature. The study precede the spray drying of the wild rose fruit extract of vitamin C and was useful to determine the optimal drying temperature, critical drying period and critical moisture content at which the vitamin C can be reactivated after drying process.

P.S.E.20.

MATERIALS ASPECTS OF FIBER-OPTIC BUNDLES AND EFFECTS OF DAMAGES CAUSED BY LASER IRRADIATION ON THEIR PROPERTIES

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Materials factors are central both to sensing means and practical implementation of most optical fiber sensor systems. However, there is often a danger that these aspects will be neglected in design of experimental systems. Some important materials interaction areas, relevant to optical fiber sensors, are explored in this paper. Technological procedure of fusing of optical fibers into a bundle is very complex and obtained bundles of optical fibers have different optical powers, which depend on their different radiuses. In order to reduce weakening of optical power and to perfect the process of fusing of optical fiber bundles, the subject of this paper was numerical and experimental analysis of the size of the joint area and properties of the joint of optical bundles` ends. The specter of application of optical fiber bundles in various milieus is very broad, so in the experimental part we presented the effects of the laser irradiation and damages occurring then on their properties. Follow-up was done of the microscopic analysis of damages and based on obtained results potential possibility was given for further application of damaged optical fiber bundles.

P.S.E.21.

CONTEMPORARY MATERIALS IN ORTHODONTICS

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Bonding brackets on tooth surface represents a great progress in fixed orthodontic therapy. Patient’s comfort, a conservative approach and simplicity of the procedure of placing brackets are only some of the advantages. Effectiveness in fixing brackets has been to a large degree achieved by the development of modern materials. We will analyse here modern adhesive materials on the basis of composite resins that are used in fixed orthodontic technique. Glass-ionomer cements modified by resins demonstrate bigger strength of the connection for tooth enamel compared to traditional glass-ionomers. The latest researches that address determining the strength of the connection of orthodontic brackets fixed with the said materials will be presented in this paper. After completing the analysis, we will suggest further researches in that direction, necessary for clinical trials.

P.S.E.22.

BIOMIMETICALLY OBTAINED SELF-ASSEMBLED CALCIUM HYDROXYAPATITE THIN FILMS

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Formation of calcium hydroxyapatite (CHA) thin films on the silica coated steel surface was investigated in this study. Slightly modified simulated body fluid (SBF) in combination with Eagle’s Minimum Essential Medium (EMEM) or Fetal Calf Serum (FCS) was used as bioactive liquid environment. Combination of SBF with these bioorganic phases with significant contents of amino active groups from amino acids and electrically charged proteins shows significant influence to the kinetics of the CHA nucleation and its further grain growth. The phases obtained after various time of sample soaking in the medium were analyzed by FTIR-ATR, while AFM investigations pointed out the mechanism of CHA nucleation. Investigations of mass changes of the samples showed the increase of the rate of CHA self nucleation for mixture of SBF and EMEM or FCS in comparison with SBF alone. The rate is also dependent from the time of sample ageing in these mediums.

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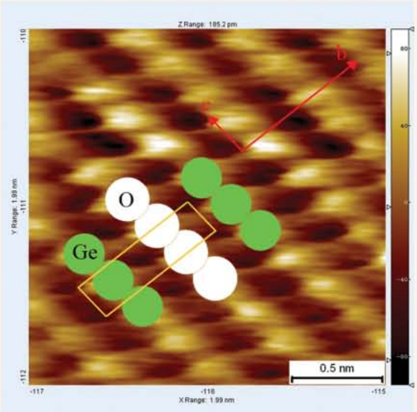

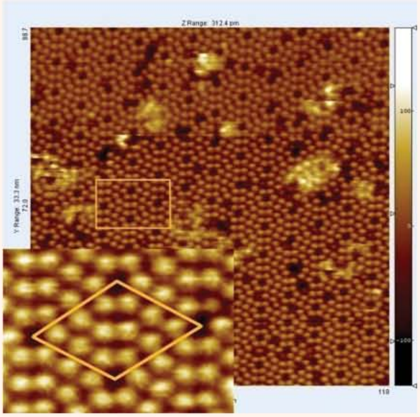

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