## TENTH ANNUAL CONFERENCE

# YUCOMAT 2008

Hotel "Plaža", Herceg Novi, Montenegro, September 8–12, 2008
http://www.yu-mrs.org.yu




# Programme
# and
# The Book of Abstracts

Organised by:
**Materials Research Society – Serbia**
**Materials Research Society – Montenegro (in founding)**
and
**Institute of Technical Sciences of the**
**Serbian Academy of Sciences and Arts, Belgrade**

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**“YUCOMAT 2008”**
Programme and The Book of Abstracts

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## WORD OF WELCOME BY THE PRESIDENT OF MRS-SERBIA

Dear Colleagues,

Welcome to YUCOMAT 2008 Conference and in Herceg Novi!

To start with celebratory note – this spring MRS-Serbia has become a 25th member of the Federation of European Materials Societies (FEMS).

In the last several years YUCOMAT Conferences have showed constant rise and 2008 Conference is a step-up from the previous one. Three plenary sessions with 19 invited lectures by the leading experts in the field, 5 symposia with 4 oral and 3 poster sessions with altogether more than 230 presentations given by the authors from more than 30 countries – just in numbers this conference represents a significant opus. Also included are a workshop on INCOMAT project "Creating international cooperation teams of excellence in the field of emerging biomaterial surface research", round table on how to prepare a successful proposal, a presentation of HEMTEK Company (sponsor of this Conference) and the exhibition of synthesis and characterization equipment.

Just reading abstracts while preparing the Conference programme, assured me that once again the participants will have the opportunity to hear the latest results from the hottest topics in the field. I noticed many presenting authors that are faithful participants and still many more that will attend for the first time. To encourage you to mix with your colleagues from all over the world, as always, we have structured each day to allow for maximum networking: photo session and welcome cocktail on Monday, poster sessions next three days as high-lights of each day social life (and stepping-stone to the night life of Herceg Novi), bus-trip to unforgettable Dubrovnik on Wednesday afternoon, boat-trip around breathtaking Boka Kotorska Bay on Thursday afternoon, and sprinkling of coffee-breaks will surely give you lots of opportunities to meet, reunite, discuss, think and inspire.

We are, again, giving special incentive for young researchers to show us their best work: awards for the best PhD and MSc theses defended between last and this year's conference, and the best oral and poster presentation will be carefully selected and proclaimed at the Closing ceremony.

During the last year, our Presidency and Organizing Committee, with the help from the International Advisory Board and infatigable Sasha, our Conference Secretary, worked hard to put together and realize this meeting. In particular, I would like to thank our Vice-Presidents, Dr. Slobodan Milonjic, Prof. Dejan Rakovic and Prof. Velimir Radmilovic, for their inspiring suggestions, thought-provoking discussions and unstoppable support.

It is my pleasure to announce that this Conference is dedicated to our Vice-President, Prof. Velimir Radmilovic – Mimo. He was born 60 years ago in this city, which is traditional host of our Conferences. On behalf of our Society and, I believe, all participants, I wish him good health, much success and further thriving promotion of our regional activity on the global level.

On behalf of all MRS-Serbia officers, I wish you a splendid conference and a very nice stay in beautiful Herceg Novi.

With best regards,

Dragan Uskokovic
President of MRS-Serbia

## MRS-Serbia

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

## 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 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.

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. Similar to other MR societies in the world, the programme was made and objectives determined. Until 2003 Conferences were held every second year and then they grew into Annual Conference that will be 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).

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# Programme

## CONFERENCE PROGRAMME

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| **SYMPOSIUM B** | Advanced Materials for High-Technology Application |
| **SYMPOSIUM C** | Nanostructured Materials |
| **SYMPOSIUM D** | Composites |
| **SYMPOSIUM E** | Biomaterials |
| **WORKSHOP:** | INCOMAT Project |

## GENERAL INFORMATION

**DATE AND VENUE:** The conference will be held on September 8-12, 2008, at the PLAŽA Hotel, in Herceg Novi, Montenegro. Participants will be accommodated at the Plaža Hotel. The conference will begin on Monday, September 8th, at 09.00 and end on Friday, September 12th, 2008 at 12.30.

**REGISTRATION:** Registration, registration fee payment, conference materials distribution, etc, will take place at the conference desk (Conference Secretariat) open on Sunday, September 7, and Monday, September 8, from 8.00 to 19.00, on Tuesday to Thursday 8.00-10.00, 14.00-16.00 and 18.00-20.00, and on Friday from 8.00 to 12.30. 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, Workshop on INCOMAT project and Round Table on how to write successful project proposal.
Oral presentations of papers to be given in PLENARY SESSIONS are limited. Time available for delivery is 30 min for invited 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 Materials and Manufacturing Processes (by Taylor and Francis, IF2007=0.612), Surface Engineering (by Maney Publishing, IF2007=0.444), and Acta Physica Polonica A (by Institute of Physics, Polish Academy of Sciences, IF2007=0.340), all on SCI list. 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:** Workshop on INCOMAT project and an Exhibition of synthesis and characterization equipment will be held during the Conference. Hemtec, sponsor of this Conference, will present its products on Thursday. 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

*<u>Sunday, September 7, 2008</u>*

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

*<u>Monday, September 8, 2008</u>*

| | |
|---|---|
| $08^{00}$-$09^{00}$ | **Registration** |
| $09^{00}$ | **OPENING CEREMONY**<br>- Introduction and Welcome |
| $10^{00}$-$13^{00}$ | **First Plenary Session** |
| $13^{30}$ | **Photo Session** |
| $15^{00}$-$19^{00}$ | **Symposium A** |
| $19^{30}$-$20^{30}$ | **Cocktail Party** |

*<u>Tuesday, September 9, 2008</u>*

| | |
|---|---|
| $09^{00}$-$13^{00}$ | **Second Plenary Session** |
| $15^{00}$-$19^{00}$ | **Symposium B** |
| $15^{00}$-$19^{00}$ | **Workshop INCOMAT project** (Press-Hall) |
| $20^{30}$-$22^{00}$ | **Poster Session I** (Symposium A) |

*<u>Wednesday, September 10, 2008</u>*

| | |
|---|---|
| $09^{00}$-$13^{30}$ | **Third Plenary Session** |
| $11^{00}$-$13^{00}$ | **Round Table – How to write a successful proposal** (Press-Hall) |
| $14^{00}$-$19^{00}$ | **Excursion to Dubrovnik, Croatia** |
| $20^{30}$-$22^{00}$ | **Poster Session II** (Symposium B) |

*<u>Thursday, September 11, 2008</u>*

| | |
|---|---|
| $09^{00}$-$12^{00}$ | **Symposium C** |
| $12^{00}$-$12^{30}$ | **Presentation of HEMTEK, sponsor of the Conference** |
| $14^{00}$-$19^{00}$ | **Boat-trip around Boka Kotorska Bay** |
| $20^{30}$-$22^{00}$ | **Poster Session III** (Symposiums C, D and E) |

*<u>Friday, September 12, 2008</u>*

| | |
|---|---|
| $09^{00}$-$12^{00}$ | **Symposium E** |
| $12^{00}$-$12^{30}$ | **Awards and Closing of the Conference** |

## FIRST PLENARY SESSION

Monday, September 8, 2008

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Chairpersons: V. Radmilović, U. Dahmen and D. Raković

$10^{00}$-$10^{30}$ **ELECTRON MICROSCOPY OF NANOSCALE MATERIALS AS A DRIVING FORCE FOR THE TEAM PROJECT**
U. Dahmen
*National Center for Electron Microscopy, Lawrence Berkeley National Laboratory, University of California, Berkeley, CA, USA*

$10^{30}$-$11^{00}$ **MONODISPERSED $Al_3$(LiScZr) CORE/SHELL NANOSTRUCTURES EMBEDDED IN Al-RICH MATRIX**
V. Radmilović
*National Center for Electron Microscopy, Lawrence Berkeley National Laboratory, University of California, Berkeley, CA, USA*

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

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$12^{00}$-$12^{30}$ **SCANNING PROXIMITY PROBES FOR NANOSCIENCE**
I.W. Rangelow
*FG Mikro- und Nanoelektronische Systeme, Technische Universität Ilmenau, Fakultät für Elektrotechnik und Informationstechnik, Institut für Mikro- und Nanoelektronik, Ilmenau, Germany*

$12^{30}$-$13^{00}$ **HIGH-RESOLUTION TEM OF LAYERED CRYSTALS AND INCOMMENSURATE MISFIT LAYER COMPOUNDS AND THEIR INTERFACES**
W. Jäger
*Microanalysis of Materials, Institute of Materials Science, Christian-Albrechts-University, Kiel, Germany*

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

## SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

**Session I**: $15^{00}$-$19^{00}$
Chairpersons: A. Auroux, M. Drofenik and A. Montone

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M. Drofenik[1,2], I. Ban[1], D. Makovec[2], D. Lisjak[2]
*[1]Faculty of Chemistry and Chemical Engineering, University of Maribor, Slovenia,*
*[2]Jožef Stefan Institute, Ljubljana, Slovenia*

$15^{15}$-$15^{30}$ **INFLUENCE OF THE PREPARATION METHOD ON THE PROPERTIES OF $V_2O_5$-$TiO_2/SO_4^{2-}$ CATALYSTS**
H. Zhao[1], S. Bennici[1], J. Shen[2], A. Auroux[1]
*[1]IRCELYON, UMR5256 CNRS-Université Lyon 1, Villeurbanne, France,*
*[2]Laboratory of Mesoscopic Chemistry, School of Chemistry and Chemical Engineering, Nanjing University, Nanjing, China*

$15^{30}$-$15^{45}$ **INFLUENCE OF THE NATURE OF CHEMICAL REAGENTS ON SINTERING NANOSIZED PIEZOCERAMICS OF LEAD ZIRCONATE-TITANATE**
A.A. Gusev, E.G. Avvakumov
*Institute of Solid State Chemistry and Mechanochemistry of Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia*

$15^{45}$-$16^{00}$ **APPLICATION OF ULTRASOUND IN THE SYNTHESIS OF CATHODE MATERIALS FOR LITHIUM ION BATTERIES**
D. Jugović[1], N. Cvjetićanin[2], M. Mitrić[3], S. Mentus[2], D. Uskoković[1]
*[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Faculty of Physical Chemistry, University of Belgrade, Serbia, [3]The Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

$16^{00}$-$16^{15}$ **LENGTH CONTROL OF $\alpha$-$MnO_2$ NANORODS AND THEIR THERMOGRAVIMETRIC STUDY**
P. Umek[1], R. Cerc Korošec[2], A. Gloter[3], U. Pirnat[4]
*[1]Jožef Stefan Institute, Ljubljana, Slovenia, [2]Faculty for Chemistry and Chemical Technology, University of Ljubljana, Ljubljana, Slovenia, [3]Laboratoire de Physique des Solides, CNRS UMR8502, Université Paris Sud, Orsay, France, [4]University of Nova Gorica, Rožna dolina, Nova Gorica, Slovenia*

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Yu.G. Morozov, O.V. Belousova, M.V. Kuznetsov
*Institute of Structural Macrokinetics and Materials Science Russian Academy of Sciences, Chernogolovka, Moscow Region, Russia*

$16^{30}$-$16^{45}$ **DEVELOPMENT OF MICROWAVE METHODS OF SYNTHESIS OF COORDINATION COMPOUNDS FOR CVD PROCESSES AND FOR OBTAINING OF NANOMATERIALS**
A.N. Mikheev
*Nikolayev Institute of Inorganic Chemistry SB RAS, Novosibirsk, Russia, Research and Educational Centre, Novosibirsk State University, Novosibirsk, Russia*

$16^{45}$-$17^{00}$ **HOW CAN MECHANOCHEMISTRY BE USED TO PRODUCE PHARMACEUTICAL SUBSTANCES?**
N. Pankrushina[1,2], I. Nikitina[1,2], E. Chernjak[1], C. Myz[2,3], T. Shakhtshneider[2,3], 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: $17^{00}$-$17^{30}$**

$17^{30}$-$17^{45}$ **MECHANOCHEMICAL SYNTHESIS OF NANOCOMPOSITES OF DRUGS WITH INORGANIC OXIDES**
T.P. Shakhtshneider[1,2], S.A. Myz[1,2], M.A. Mikhailenko[1,2], T.N. Drebushchak[1,2], V.A. Drebushchak[2,3], A.P. Fedotov[2], B.B. Bokhonov[1], A.S. Medevedeva[4], V.V. Boldyrev[1,2]
*[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]Institute of Geology and Mineralogy SB RAS, Novosibirsk, Russia, [4]A.E. Favorsky Irkutsk Institute of Chemistry SB RAS, Irkutsk, Russia*

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A.I. Nizovskii[1], M.V. Trenikhin[2], M.R. Sharafutdinov[3], I.P. Prosvirin[1], V.I. Bukhtiyarov[1]
*[1]Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia, [2]Institute of Hydrocarbon Processing Problems SB RAS, Omsk, Russia, [3]Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia*

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A.N. Streletskii, A.Yu. Dolgoborodov, I.V. Kolbanev, M.N. Makhov
*N.N.Semenov Institute of Chemical Physics RAS, Moscow, Russia*

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S.M. Busurin, M.L. Busurina
*Institute of Structural Macrokinetics and Materials Science RAS, Chernogolovka, Moscow region, Russia*

$18^{30}$-$18^{45}$ **THERMO-MECHANICAL PROCESSING BY LASER IN MULTIPHASE STEELS**
H. Palkowski, A. Brück
*Institute of Metallurgy - Metal Forming and Processing - Clausthal University of Technology, Clausthal-Zellerfeld, Germany*

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A. Kosmač
*Euro Inox, Brussels, Belgium*

## SECOND PLENARY SESSION

*Tuesday, September 9, 2008*

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Chairpersons: D. Perović, D. Suvorov and D. Petranović

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E.W. Vekris, D.D. Perovic, G.A. Ozin, S. Aitchison
*Department of Materials Science and Engineering, University of Toronto, Toronto, Canada*

$09^{30}$-$10^{00}$ **CORDIERITE GLASS CERAMICS STUDIED BY X-RAY SCATTERING AND ELECTRON MICROSCOPY**
W. Bras
*Dutch-Belgian beam lines, Netherlands Organization for Scientific Research (NWO), DUBBLE CRG @ ESRF (European Synchrotron Radiation) Facility, Grenoble, France*

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D. Suvorov, M. Spreitzer
*Advanced Materials Department, »Jozef Stefan« Institute, Ljubljana, Slovenia*

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

$11^{00}$-$11^{30}$ **INTERFACIAL SOLID-STATE PROCESS CONTROL FOR MICRO- AND NANOCOMPOSITES**
M. Senna
*Faculty of Science and Technology, Keio University, Yokohama, Japan*

$11^{30}$-$12^{00}$ **PROCESSING OF POLYMER MATRIX NANOCOMPOSITES**
J.M. Kenny, L. Valentini
*European Centre for Nanostructured Polymers, University of Perugia, UdR INSTM, Terni, Italy*

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J. Kusinski[1], S. Kac[1], S. Surblé[2], G. Baldinozzi[2], G. Petot-Ervas[2]
*[1]University of Mining and Metallurgy, Laboratory Surface Engineering, Krakow, Poland, [2]Research group CNRS/SPMS- Ecole Centrale Paris, 92295 Châtenay Malabry / SRMA-CEA Saclay, Gif sur Yvette, France*

$12^{30}$-$13^{00}$ **NANO-STRUCTURED MATERIALS DEVELOPED BY CONTROLLED PHASE TRANSFORMATIONS AND SYNTHESIS PROCESSES**
G. Solórzano
*Department of Materials Science and Metallurgy, PUC-Rio de Janeiro, Brazil*

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## SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATION

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Chairmen: V. Dondur, M. Davidović and S. Bošković

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M. Kuznetsov
*Institute of Structural Macrokinetics and Materials Science RAS (ISMAN), Chernogolovka, Moscow region, Russia*

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E.A. Levashov, Yu.S. Pogozhev, V.V. Kurbatkina, A.E. Kudryashov, E.I. Zamulaeva
*State Technological University "Moscow Institute of Steel and Alloys", Scientific-Educational Center of SHS, Moscow, Russia*

$15^{30}$-$15^{45}$ **METALLIC GLASS-TUNGSTEN COMPOSITES**
S. Nowak, P. Ochin, A. Pasko, Y. Champion
*ICMPE-CNRS Université Paris 12, Thiais, France*

$15^{45}$-$16^{00}$ **STRUCTURAL AND LUMINESCENT PROPERTIES OF $Y_4Al_2O_9$ (YAM*)* NANOCRYSTALS OBTAINED VIA SOL-GEL METHOD**
L. Lipińska[1], A. Rzepka[1], W. Ryba-Romanowski[2], R. Diduszko[1], A. Pajączkowska[1]
*[1]Institute of Electronic Materials Technology, Warsaw, Poland, [2]Institute of Low Temperature and Structural Research, Polish Academy of Science, Wrocław, Poland*

$16^{00}$-$16^{15}$ **THE EFFECT OF CHLORIDE AND WATER ON THE CORROSION OF COPPER IN 1-BUTYL-3-METHYLIMIDAZOLIUM TETRAFLUOROBORATE**
K. Marczewska-Boczkowska, M. Kosmulski
*Department of Electrochemistry, Lublin University of Technology, Lublin, Poland*

$16^{15}$-$16^{30}$ **ELECTROCHEMICAL BEHAVIOR OF $Li_{3-x}M1_xV_{2-y}M2_y(PO_4)_3$ (M1=K, M2=Sc) /C COMPOSITE CATHODE MATERIAL FOR LITHIUM-ION BATTERIES**
Yu.G. Mateyshina[1, 2], N.F. Uvarov[1,2]
*[1]Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia, [2]Novosibirsk State University, Novosibirsk, Russia*

$16^{30}$-$16^{45}$ **ELECTROCHEMICAL PROPERTIES OF COMPOSITE SOLID ELECTROLYTES $LiClO_4$-MgO**
A.S. Ulihin[1, 2], N.F. Uvarov[1,2]
*[1]Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia, [2]Novosibirsk State University, Novosibirsk, Russia*

$16^{45}$-$17^{00}$ **STRUCTURAL, PHYSICAL AND ELECTRICAL PROPERTIES OF IRON DOPED VANADIUM BORATE GLASSES**
V. Singh Kundu[1,2], R.L. Dhiman[3], D.R. Goyal[1], A.S. Maan[1]
*[1]Department of Physics, Maharshi Dayanand University, Rohtak, India*
*[2]Department of Electronic Science, Kurukshetra University, Kurukshetra, India*
*[3]Department of Physics, S.D. College (Lahore), Ambala Cantt., India*

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$17^{30}$-$17^{45}$ **THERMODYNAMIC PROPERTIES OF LIQUID TRANSITION METALS AND ALLOYS FROM INTERATOMIC PAIR INTERACTIONS**
N.E. Dubinin
*Institute of Metallurgy of the Ural Branch of the Russian Academy of Sciences, Ekaterinburg, Russia*

$17^{45}$-$18^{00}$ **FLUORINE INFLUENCE ON ANODIC FILM COMPOSITION AND SURFACE MORFOLOGY OF InAs (III)A**

N. Valisheva[1], T. Levtsova[1], G. Kurishev[2], I. Prosvirin[2], I. Petrenko[1], E. Rodjakina[1]
*[1]Novosibirsk Institute of Semiconductor Physics, Novosibirsk, Russia, [2]Boreskov Institute of Catalysis, Novosibirsk, Russia*

18⁰⁰-18¹⁵ **SELF-SIMILAR SOLIDIFICATION OF BYNARY ALLOYS**
A.P. Malygin, D.V. Alexandrov, A. Malashkevich
*Ural State University, Ekaterinburg, Russia*

18¹⁵-18³⁰ **THE CHARACTERIZATION OF DEFECTS IN MULTI-LAYERED COMPOSITE MATERIALS BY THERMAL TOMOGRAPHY METHODS**
W. Swiderski
*Military Institute of Armament Technology, Zielonka, Poland*

18³⁰-18⁴⁵ **USE OF THE POWDER LIQUID METHOD FOR ALUMINIDE DIFFUSION COATINGS FORMATION ON INCONEL 713lc Ni-BASED SUPERALLOY**
L. Čelko, L. Klakurková, J. Švejcar
*Institute of Materials Science and Engineering, Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic*

18⁴⁵-19⁰⁰ **AN EXPERIMENTAL STUDY OF RESIDUAL STRESSES INDUCED IN COMPOSITE PRESSURE VESSELS (CPV)**
R.A. Al-Madani, M.E. Jarnaze
*Academy of Graduate Study, Tripoli, Libya*

## WORKSHOP: INCOMAT PROJECT "Creating international cooperation teams of excellence in the field of emerging biomaterial surface research"

Press-Hall

**Session I:** 15⁰⁰-19⁰⁰

## THIRD PLENARY SESSION

*Wednesday, September 10, 2008*

**Session III:** $09^{00}$-$13^{30}$
Chairpersons: R. Sinclair, S. Best and S. Milonjić

$09^{00}$-$09^{30}$ **THE MEETING OF MEMS AND NANOTECHNOLOGY**
G.W. Auner[1,6], P. Siy[1], R. Naik[2], S. Ng[3], G. Newaz[4], P. McAllister[5], J. Smolinski[1], M. Brusatori[1]
*Smart Sensors and Integrated Microsystems Program, [1]Electrical and Computer, Biomedical Engineering, [2]Dept. of Physics, [3]Dept. of Chemical Engineering, [4]Dept. of Mechanical Engineering, [5]Dept. of Neurosurgery, [6]Biomedical Engineering, Wayne State University, Detroit, MI, USA*

$09^{30}$-$10^{00}$ **STRUCTURAL AND FUNCTIONAL (SUPERFICIAL) BIOCOMPATIBILITY OF NEW AMORPHOUS / QUASICRYSTALLINE Ti-BASED COMPOSITES**
H. Lefaix[2], P. Vermaut[2], S. Zanna[1], A. Galtayries[1], F. Prima[2], R. Portier[2]
*[1]LPCS, UMR-CNRS 7045, ENSCP, Paris, France, [2]Groupe de Métallurgie Structurale, LPCS, UMR-CNRS 7045*

$10^{00}$-$10^{30}$ **MAGNETIC AND OTHER METALLIC NANOPARTICLES FOR POSSIBLE MEDICAL APPLICATIONS**
R. Sinclair, H. Li, A.L. Koh
*Department of Materials Science and Engineering, Stanford University, Stanford, California, USA*

$10^{30}$-$11^{00}$ **MAGNETIC AND ELECTRONIC PROPERTIES OF IRON OXIDE NANOPARTICLES OF CONTROLLED SIZE AND SHAPE**
P. Guardia, N. Pérez, A. Labarta, X. Batlle
*Departament de Física Fonamental and Institut de Nanociència i Nanotecnologia (IN2UB), Universitat de Barcelona, Barcelona, Catalonia, Spain*

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

$11^{30}$-$12^{00}$ **NANOSTRUCTURED APATITES: THE NEXT GENERATION OF BIOACTIVE MATERIALS?**
S. Best
*Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, UK*

$12^{00}$-$12^{30}$ **SIZE-DEPENDENT AND INTERFACE EFFECTS IN PROPERTIES OF NANOSTRUCTURED MATERIALS**
R.A. Andrievskiy
*Institute for Problems of Chemical Physics, Russian Academy of Sciences, Chernogolovka, Moscow Region, Russia*

$12^{30}$-$13^{00}$ **CAN CARBON NANOTUBES BE COMPETITIVE IN CHIP INTERCONNECT APPLICATIONS**
D. Petranovic
*Design to Silicon Division, Mentor Graphics Corp., San Jose, California, USA*

$13^{00}$-$13^{30}$ **NANOANALYSIS OF MATERIALS BY MEANS OF EELS SPECTRUM IMAGING IN A TRANSMISSION ELECTRON MICROSCOPE**
W. Grogger, F. Hofer, G. Kothleitner, B. Schaffer
*Institute for Electron Microscopy and Fine Structure Research, Graz University of Technology, Graz, Austria*

## ROUND TABLE: HOW TO WRITE A SUCCESSFUL PROPOSAL

Press-Hall

**Session I:** $11^{00}$-$13^{00}$

$11^{00}$-$13^{00}$ **CALLS AND TENDERS DEALING WITH NEW MATERIALS FOR INCO COUNTRIES AND HOW TO WRITE A SUCCESSFUL PROPOSAL: PARTICIPATION RULES AND CALLS FOR FP7 – FOCUSED ON BIOMATERIALS AND INCO COUNTRIES**
H.-J. Schmidt
*Stiftung für Technologie, Innovation und Forschung Thüringen (STIFT), Erfurt, Germany*

## SYMPOSIUM C: NANOSTRUCTURED MATERIALS

*Thursday, September 11, 2008*

**Session I:** $09^{00}$-$12^{00}$
Chairmen: M. Zlatanović, J. Nedeljković and J. Šetrajčić

$09^{00}$-$09^{15}$ **USING DIELECTRIC RELAXATION SPECTROSCOPY (DRS) AND DYNAMIC MECHANICAL SPECTROSCOPY (DMS) TO STUDY MOLECULAR DYNAMICS OF DENDRIMERS IN HYDROPHOBIC/HYDROPHILIC MEDIA**
S. Ristić, J. Mijović
*Othmer-Jacobs Department of Chemical and Biological Engineering, Polytechnic University, Brooklyn, NY, USA*

$09^{15}$-$09^{30}$ **ON THE PENTAHEPTITE NANOTUBES**
M. Damnjanović, Z. Popović, I. Milošević
*NanoLab, Faculty of Physics, University of Belgrade, Belgrade, Serbia*

$09^{30}$-$09^{45}$ **SYNTHESIS AND APPLICATIONS OF NOVEL VANADIUM OXIDE NANOTUBES**
A. Kumar[1], N. Dhawan[2]
*[1]Materials Science and Engineering Department, Stanford University, CA, USA*
*[2]Metallurgical Engineering Department, Punjab Engineering College, Chandigarh, India*

$09^{45}$-$10^{00}$ **ULTRASONIC AEROSOL ROUTE FOR THE SYNTHESIS OF RARE EARTH OXIDE NANOPARTICLES**
O. Milošević[1], L. Mančić[1], K. Marinković[1], L. Gomez[2], I. Martin[2], M.E. Rabanal[2], P.D.Townsend[3]
*[1]Institute of Technical Sciences of Serbian Academy of Sciences and Arts, Belgrade, Serbia, [2]Universidad Carlos III de Madrid, Spain, [3]Science and Technology, University of Sussex, Brighton, UK*

$10^{00}$-$10^{15}$ **LUMINESCENCE OF GALLIUM OXIDE NANOSTRUCTURES**
E. Nogales, J. Á. García, B. Méndez, J. Piqueras
*Dpt.Física de Materiales, Facultad de Ciencias Físicas, Universidad Complutense de Madrid, Madrid, Spain*

$10^{15}$-$10^{30}$ **RADIATION STIMULATED PROCESSES IN DOPED OXIDES: BULK AND NANO-CRYSTALS**
N.A. Kulagin
*Kharkiv National University for Radioelectronics, Kharkiv, Ukraine*

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

$11^{00}$-$11^{15}$ **THE INFLUENCE OF THE CHARACTER OF LAYERED NANOADDITIVES ON PROPERTIES OF ORGANIC-INORGANIC NANOCOMPOSITES**
M. Špírková, A. Strachota, J. Brus, M. Šlouf, M. Urbanová, J. Kotek, B. Strachotová
*Institute of Macromolecular Chemistry ASCR, v.v.i., Prague, Czech Republic*

$11^{15}$-$11^{30}$ **STIMULATING EFFECT OF BORON ADMIXTURE ON HYDROGEN SORPTION-DESORPTION PROPERTIES OF MECHANICALLY ACTIVATED TITANIUM POWDER**
O.S. Morozova[1], T.I. Khomenko[1], A.V. Leonov[2], E.Z. Kurmaev[3], Ch. Borchers[4], A. Moewes[5]
*[1]Institute of Chemical Physics RAS, Moscow, Russia, [2]Moscow State University, Department of Chemistry, Moscow, Russia, [3]Institute of Metal Physics, RAS-Ural Division, Ekaterinburg, Russia, [4]Institute of Material Physics, University of Goettingen, Goettingen, Germany, [5]University of Saskatchewan Department of Physics and Engineering Physics, Saskatoon, Canada*

$11^{30}$-$11^{45}$ **NMR, MÖSSBAUER AND XPS STUDIES OF THE LOCAL STRUCTURE OF NANOCRYSTALLINE COMPLEX OXIDES**
V. Šepelák[1,2], I. Bergmann[3], S. Indris[4], A. Feldhoff[5], P. Heitjans[5], K.D. Becker[2]
*[1]Institute of Geotechnics, Slovak Academy of Sciences, Košice, Slovakia, [2]Institute of Physical and Theoretical Chemistry, Braunschweig University of Technology, Braunschweig, Germany, [3]Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai, Japan, [4]Institute of Nanotechnology, Karlsruhe Institute of Technology, Karlsruhe, Germany, [5]Institute of Physical Chemistry and Electrochemistry, Leibniz University Hannover, Hannover, Germany*

$11^{45}$-$12^{00}$ **EFFECTS OF MIXING CONDITIONS AND AGING ON THE MORPHOLOGICAL BEHAVIOR AND ON MECHANICAL PROPERTIES OF EPDM/LAYERED CLAY NANOCOMPOSITES**
Ç. Karşal[1], M. Tanoğlu[2]
*İzmir Institute of Technology, [1]Material Science and Engineering Programme, [2]Mechanical Engineering Department, Gülbahçe Campus, Urla, İzmir, Turkey*

$12^{00}$-$12^{30}$ **POLYMER AND NANOPARTICLE CHARACTERISATION USING LIGHT SCATTERING TECHNIQUES**
S. Macaulay
*Malvern Instruments Ltd., Malvern, UK*

## SYMPOSIUM E: BIOMATERIALS

*Friday, September 12, 2008*

**Session I:** $09^{00}$-$12^{00}$
Chairpersons: Dj. Koruga, M. Plavšić and N. Ignjatović

$09^{00}$-$09^{15}$ **BIOMIMETICS OF THE GROWTH OF DENTAL ENAMEL USING A CONTINUOUS CRYSTALLIZATION APPROACH**
V. Uskoković[1], J. Kim[2], W. Li[3], S. Habelitz[1]
*[1]Department of Preventive and Restorative Dental Sciences, Division of Biomaterials and Bioengineering, University of California, San Francisco, [2]Department of Molecular and Cell Biology, University of California, Berkeley, [3]Department of Oral and Craniofacial Sciences, University of California, San Francisco, USA*

$09^{15}$-$09^{30}$ **NANO PARTICLES (NPs) OF HYDROXYAPATITE COATED WITH POLY-DL-LACTIDE-CO-GLYCOLIDE AS SYSTEMS FOR LOCAL CONTROLLED DRUG DELIVERY OF TIGECYKLINE**
N. Ignjatović[1], D. Vasiljević-Radović[2], A. Radulović[3], P. Ninkov[4], D. Uskoković[1]
*[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]IChTM- Department of Microelectronic Technologies and Monocrystals, Belgrade, Serbia, [3]Institute of General and Physical Chemistry, Belgrade, Serbia, [4]Faculty of Dentistry, Department of Biomaterials, University of Oslo, Norway*

$09^{30}$-$09^{45}$ **BONE TISSUE REMODELING AT FILLING LARGE BONE DEFECTS WITH DIFFERENT KINDS OF BIOACTIVE CERAMICS**
V. Dubok[1], V. Procenko[2], V. Kindrat[3], A. Shinkaruk[1]
*[1]I.M. Frantsevich Institute for Problems of Materials Science NASU, Kiev, Ukraine, [2]Institute of oncology of Ukrainian AMS, Kiev, Ukraine, [3]N.I. Pirogov Medical University, Vinnitsa, Ukraine*

$09^{45}$-$10^{00}$ **SUPERCRITICAL FLUIDS: NEW APPROACH TO ADVANCED BIOMATERIAL PROCESSING AND MODIFICATION**
V.K. Popov
*Institute of Laser and Information Technologies, Russian Academy of Sciences, Troitsk, Moscow Region, Russia*

$10^{00}$-$10^{15}$ **THE PREPARATION AND CHARACTERISATION OF A CALCIUM PHOSPHATE-POLYCAPROLOCTANE BIOCOMPOSITE**
I. Dunkley, R.W. Smith
*Department of Mechanical and Materials Engineering, Queen's University, Kingston, Ontario, Canada*

$10^{15}$-$10^{30}$ **THE INFLUENCE OF DIMERIC SURFACTANT ON THE TRANSFORMATION OF AMORPHOUS CALCIUM PHOSPHATE**

A. Selmani, D. Jurašin, B. Matasović, N. Filipović-Vinceković, M. Dutour Sikirić
*"Ruđer Bošković" Institute, Zagreb, Croatia*

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

$11^{00}$-$11^{15}$ **HOLOGRAPHIC MEASUREMENT OF DENTAL COMPOSITE CONTRACTION**
D. Pantelić, S. Savić-Šević, D. Vasiljević, B. Murić, L. Blažić, M. Nikolić, B. Panić
*Institute of Physics, Belgrade, Serbia*

$11^{15}$-$11^{30}$ ***IN VITRO* ANALYSIS OF A ZINC BASED GLASS POLYALKENOATE**
O.M. Clarkin, M.R. Towler, D.A. Tanner
*Material and Surface Science Institute, University of Limerick, Ireland*

$11^{30}$-$11^{45}$ **OPTO-MAGNETIC FINGERPRINT OF AMNIOTIC FLUID AND WATER**
Dj. Koruga[1], A. Tomić[1], D. Kojić[1], S. Janković-Ražnatović[1,2]
*[1]NanoLab, Faculty of Mechanical Engineering, Belgrade, Serbia, [2]Cilnic of Gynecology and Obstetrics "Narodni front", Belgrade, Serbia*

$11^{45}$-$12^{00}$ **DRUG RISK ASSESSMENT AS LEADING FACTOR IN DEVELOPMENT AND EVALUATION OF NEW DRUGS AND DEVICE IN MEDICINE**
M. Kriška, J. Rajec, J. Čársky
*Department of Pharmacology and Clinical Pharmacology, Comenius University, Bratislava, Slovak Republik*

## POSTER SESSION I

*Tuesday, September 9, 2008*, 20$^{30}$-22$^{00}$

## SYMPOSIUM A: ADVANCED METHODS IN SYNTHESIS AND PROCESSING OF MATERIALS

*P.S.A.1.* **SYNTHESIS, NMR, DFT AND ANTIMICROBIAL STUDIES OF THE Zn(II) COMPLEXES WITH *N*-BENZYLOXYCARBONYL-*S*-ALANINE**
K.K. Andjelković[1], D.M. Mitić[1], Dj.U. Miodragović[1], D.M. Sladić[1], Ž.J. Vitnik[1], Z.M. Miodragović[1], M.Dj. Radulović[2], N.O. Juranić[3]
*[1]Faculty of Chemistry, University of Belgrade, Belgrade, Serbia, [2]Department of Chemistry, Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [3]Mayo Clinic and Foundation, Rochester, Minnesota, USA*

*P.S.A.2.* **CRYSTAL STRUCTURE OF 2-{1-[(1-(2-PYRIDINIO)ETHYLIDENE) HYDRAZONO]ETHYL}PYRIDINIUM DIPERCHLORATE, THE PRODUCT OF TEMPLATE CONDENSATION IN PRESENCE OF Cr(III)**
D. Radanović[1], G.N. Kaludjerović[1], S. Gómez-Ruiz[2], D.M. Sladić[3], M. Šumar-Ristović[3], I. Brčeski[3], K.K. Andjelković[3]
*[1]Center for Chemistry, Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Departamento de Química Inorgánica y Analítica, E.S.C.E.T., Universidad Rey Juan Carlos, Móstoles, Madrid, Spain, [3]Faculty of Chemistry, University of Belgrade, Belgrade, Serbia*

*P.S.A.3.* **SYNTHESIS AND CHARACTERISATION OF THE Cu(II) AND Ni(II) COMPLEXES WITH THE *IN SITU* PREPARED FORMAMIDINE LIGAND**
B. Holló, V.M. Leovac, K. Mészáros Szécsényi, Lj.S. Jovanović
*University of Novi Sad, Faculty of Sciences, Department of Chemistry, Novi Sad, Serbia*

*P.S.A.4.* **PREPARATION AND IN VITRO EVALUATION OF HYBRID BIORESORBABLE COMPOSITES BASED ON TRICALCIUM PHOSPHATE**
Ch. Tardei[1], S. Hodorogea[1], L. Moldovan[2], O. Craciunescu[2]
*[1]National Institute for Research and Development in Electrical Engineering, INCDIE ICPE-CA, Bucharest, Romania, [2]National Institute for Research and Development for Biological Sciences, Bucharest, Romania*

*P.S.A.5.* **COMBUSTION SYNTHESIS OF CERAMIC COMPOSITES BASED ON Ti–Cr–B–C SYSTEM**
V.A. Shcherbakov, A.V. Chobko, O.N. Sosikova, N.V. Sachkova
*Institute of Structural Macrokinetics and Materials Science, Russian Academy of Science, Chernogolovka, Russia*

*P.S.A.6.* **GLYCINE-NITRATE COMBUSTION SYNTHESIS OF OXYAPATITE $La_{9.33}(SiO_4)_6O_2$**
S. Zec[1], J. Dukić[1], S. Bošković[1], B. Matović[1], R. Petrović[2]
*[1]Institute of Nuclear Sciences Vinča, Materials Science Laboratory, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, Belgrade, Serbia*

*P.S.A.7.* **DETERMINATION OF SURFACE PROPERTIES OF VARIOUS OXIDES AND SULFIDES BY INVERSE GAS CHROMATOGRAPHY**
S.K. Milonjić
*The Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

*P.S.A.8.* **SYNTHESIS AND CHARACTERIZATION OF STABLE AQUEOUS CERIA SOLS**
J.J. Gulicovski, S.K. Milonjić
*The Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

*P.S.A.9.* **DEPOSITION OF HEMATITE FROM FLOWING SUSPENSION ONTO ALUMINUM WALL**
Lj. Čerović[1,2], G. Lefèvre[1], A. Jaubertie[3]
*[1]ENSCP-LECA-CNRS UMR 7575 Paris, France, [2]The Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [3]EDF R&D/MFTT, Chatou, France*

*P.S.A.10.* **MECHANOCHEMICALLY ENHANCED LOW-TEMPERATURE SYNTHESIS OF Y-DOPED $BaTiO_3$ PTCR CERAMIC**
Lj. Vulićević[1], N. Ivanović[2], M. Mitrić[2], Ž. Andrić[2], B. Andjelić[1], M. Plazinić[1], N. Oklobdžija[2], D. Marjanović[2], A. Savić[2]
*[1]Technical Faculty- Čačak, Čačak, Serbia, [2]Institute for Nuclear Sciences "VINČA", Belgrade, Serbia*

*P.S.A.11.* **INFLUENCE OF MECHANICAL ACTIVATION ON BaO-ZnO-$TiO_2$ SYSTEM**
N. Obradović[1], S. Stevanović[1], V. Pavlović[2], M.M. Ristić[3]
*[1]Institute of Technical Sciences SASA, Belgrade, Serbia, [2]Faculty of Agriculture, University of Belgrade, Serbia, [3]Serbian Academy of Sciences and Arts, Belgrade, Serbia*

*P.S.A.12.* **INFLUENCE OF MECHANICAL ACTIVATION ON MgO-$TiO_2$ SYSTEM**

S. Stevanović[1], N. Obradović, V. Pavlović[2], M.M. Ristić[3]
*[1]Institute of Technical Sciences SASA, Belgrade, Serbia, [2]Faculty of Agriculture, University of Belgrade, Serbia, [3]Serbian Academy of Sciences and Arts, Belgrade, Serbia*

*P.S.A.13.* **SYNTHESIS OF MICROCRYSTALLINE SILICON THIN FILMS BY GAS-JET ELECTRON-BEAM PLASMA METHOD**
O.I. Semenova[1], R.G. Sharafutdinov[2], V.G. Schukin[2]
*[1]Institute of Semiconductor Physics SB RAN, Novosibirsk, Russia, [2]Institute of Thermophysics SB RAN, Novosibirsk, Russia*

*P.S.A.14* **SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF MESOPOROUS SILICA THIN FILMS**
K.P. Mogilnikov[1], O.I. Semenova[1], M.K. Kovalev[2], V.N. Kruchinin[2], M.S. Mel'gunov[2]
*[1]Institute of Semiconductor Physics SB RAN, Novosibirsk, Russia, [2]Institute of Catalysis SB RAN, Novosibirsk, Russia*

*P.S.A.15.* **MUSHY LAYER FORMATION DURING SOLIDIFICATION OF BINARY ALLOYS FROM A COOLED WALL: THE ROLE OF BONDARY CONDITIONS**
I.V. Alexandrova, D.V. Alexandrov, A.P. Malygin, S.A. Shubinov, A.A. Ivanov
*Urals State University, Ekaterinburg, Russia*

*P.S.A.16.* **DIRECTIONAL SOLIDIFICATION OF TERNARY ALLOYS**
D.V. Alexandrov, D.L. Aseev, S.V. Bulitcheva, I.G. Nizovtseva
*Urals State University, Ekaterinburg, Russia*

*P.S.A.17.* **ION BEAM MODIFICATION OF Al/Ti MULTILAYERS**
D. Peruško, V. Milinović, M. Mitrić, S. Petrović, M. Milosavljević
*Institute of Nuclear Sciences "Vinča", Belgrade, Serbia*

*P.S.A.18.* **ELECTROCRYSTALLIZATION OF DENSE NANOSTRUCTURED SILVER LAYERS USING PULSE CURRENTS**
R. Batijewski, L. Lipińska, K. Kościewicz, R. Diduszko
*Institute of Electronic Materials Technology, Warsaw, Poland*

*P.S.A.19.* **PREPARATION OF POROUS SILICA CERAMICS USING THE WOOD TEMPLATE**
B. Matović[1], B. Babić[1], A. Egelja[1], J. Dukić[1], V. Logar[2], A. Vučković[1], S. Bošković[1]
*[1]Institute for Nuclear Sciences "Vinča," Laboratory for Materials Science, Belgrade, Serbia, [2]Faculty for Mining and Geology, Belgrade, Serbia*

*P.S.A.20.* **ELECTROCHEMICAL BEHAVIOR OF $V_2O_5$ TREATED WITH $H_2O_2$**
I. Stojković[1], I. Pašti[1], M. Mitrić[2], N. Cvjetićanin[1], S. Mentus[1]

*[1]Faculty of Physical Chemistry, Belgrade, Serbia, [2]The Vinca Institute of Nuclear Sciences,Laboratory for Theoretical and Condensed Matter Physics, Belgrade, Serbia*

*P.S.A.21.* **NANOCRYSTALLINE NICKEL: ELECTROSYNTHESIS, MICROSTRUCTURE AND PROPERTIES**
L. Lipińska, A. Rzepka, K. Kościewicz, R. Diduszko
*Institute of Electronic Materials Technology, Warsaw, Poland*

P.S.A.22. **THE THICKNESS, MORPHOLOGY AND STRUCTURE OF SOL-GEL $Bi_{12}SiO_{20}$ THIN FILMS**
A. Veber, D. Suvorov
*Advanced Materials Department, Jožef Stefan Institute, Ljubljana, Slovenia*

*P.S.A.23.* **INFLUENCE OF UNIPOLAR PULSE BIASING PARAMETERS ON PLASMA NITRIDING PROCESS EFFICIENCY**
I. Popović, M. Zlatanović
*Faculty of Electrical Engineering, Belgrade, Serbia*

*P.S.A.24.* **STUDIES OF ATMOSPHERIC DISCHARGE OF SMALL DIMENSIONS USED FOR TREATMENT OF BIOLOGICAL SAMPLES**
N. Puač[1], S. Lazović[1], G. Malović[1], A. Djordjević[2], Z.Lj. Petrović[1]
*[1]Institute of Physics, Belgrade, Serbia, [2]Faculty of Electrical Engineering, Belgrade, Serbia*

*P.S.A.25.* **CALCULATION OF PULSED PHOTOTHERMAL FIELDS USING *K*-SPACE METHOD: BIOMEDICAL APPLICATIONS**
S. Galović, D. Čevizović, Z. Stojanović
*The "Vinča" Institute of Nuclear Sciences, Belgrade, Serbia*

*P.S.A.26.* **SURFACE CHARACTERISATION OF ALLOYS BY OPTO-MAGNETIC FINGERPRINT**
A. Tomić[1,2], L. Matija[1], D. Kojić[1,2], Dj. Koruga[1]
*[1]NanoLab, Faculty of Mechanical Engineering, Belgrade, Serbia, [2]MySkin Inc., New Jersey, USA*

*P.S.A.27.* **SURFACE CHARACTERISATION BY ATOMIC FORCE MICROSCOPY AND MAGNETIC FORCE MICROSCOPY**
D. Kojić[1,2], L. Matija[1], Lj. Petrov[1,2], Dj. Koruga[1]
*[1]NanoLab, Faculty of Mechanical Engineering, Belgrade, Serbia, [2]TeleSkin d.o.o., Belgrade, Serbia*

*P.S.A.28.* **ELECTRONIC SPECTROSCOPY STUDY OF THE INTERACTION OF BIOLOGICALLY ACTIVE HYDROQUINONE AVAROL AND RELATED COMPOUNDS 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.29.* **FORMATION AND SPECTRA OF PLASMON-COUPLED GOLD NANOPARTICLE DIMERS WITH DNA STRANDS**
S. Zlatanović
*University of California San Diego, San Diego, USA*

*P.S.A.30.* **THEORETICAL CALCULATION OF THE GROUND STATE STRUCTURE OF $BC_2$ GAS PHASE MOLECULE**
J. Radić-Perić, S. Jerosimić
*Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia*

*P.S.A.31.* **RUBY LASER INTERACTION WITH AUSTENITE STRUCTURAL MATERIALS**
A. Milosavljević[1], S. Petronić[1], M. Srećković[2], S. Ristić[3], I. Nešić[1], R. Pljakić[4], V. Negovanović[5]
*[1]Faculty of Mechanical Engineering, University of Belgrade, Serbia, [2]Faculty of Electronical Engineering, University of Belgrade, Serbia, [3]Goša Institute, Belgrade, Serbia, [4]"Prva Petoletka", Trstenik , Serbia, [5]Megatrend University, Belgrade, Serbia*

*P.S.A.32.* **NONISOTHERMAL SINTERING PROCESS OF POROUS BODY AT ULTRA HIGH TEMPERATURE RATE**
A.G. Lanin
*The Research Institute of the SIA 'Luch', Podolsk, Moscow Region, Russia*

*P.S.A.33.* **SYNTHESIS AND CHARACTERIZATION OF SEMICONDUCTING MACROMOLECULAR COMPLEX POLYANILINE–STARCH**
G. Ćirić Marjanović[1], Dj. Trpkov[1], B. Marjanović[2]
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*P.S.A.34.* **OXIDATIVE STABILITY OF COLD-PRESSED HIGHOLEIC SUNFLOWER OILS**
M. Pavlović[1], S. Ostojić[1], M. Kićanović[1], S. Zlatanović[1], M. Živić[1], Z. Sakač[2]
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*P.S.A.35.* **EFFECTS OF THE POSTPOLYMERIZATION TREATMENTS ON AMOUNT OF RESIDUAL MONOMER IN DENTURES**
N. Krunić[1], M. Kostić[2], B. Krunić[2], Lj. Nikolić[3], V. Nikolić[3]
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*P.S.A.36.* **IDENTIFICATION AND DETERMINATION OF POLY(VINYLPYRROLIDONE) BYOFF-LINE PYROLYSIS-GAS CHROMATOGRAPHY/MASS SPECTROMETRY**
V.V. Antić[1], M.P. Antić[2], A. Kronimus[3], B. Jovančićević[4], J. Schwarzbauer[3]
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*P.S.A.37.* **THERMAL BEHAVIOUR AND POROSITY OF CHELATING MACROPOROUS POLY(GMA-*co*-EGDMA)**
V. Rakić[1], A. Nastasović[2], Z. Vuković[3], T. Novaković[3]
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*P.S.A.38.* **IMPROVEMENT OF IMPACT TOUGHNESS OF 7179-T651 ALUMINUM ALLOY BY RETROGRESSION AND RE-AGING PROCESS**
H.R. Zaid[2], A.M. Hatab[1], A. M.A. Ibrahim[1]
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*P.S.A.39.* **STRUCTURE AND PROPERTIES OF COATINGS OF FE–CR–B–SI SYSTEM OBTAINED BY THE LASER CLADDING**
O.G. Devoino, M.A. Kardapolova, U.A. Kalinichenko, O.V. Diyachenko
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*P.S.A.40.* **THEORETICAL ASSESSMENT OF STABILITY OF DUAL-METAL (Cd + Pb) SUBSTITUTED HYDROXYAPATITE MATERIAL**
S. Raičević
*Vinča Institute of Nuclear Sciences, Radiation and Environmental Protection Laboratory, Belgrade, Serbia*

*P.S.A.41.* **TAILORED SANDWICH STRUCTURES IN THE FOCUS OF RESEARCH**
H. Palkowski, G. Lange

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*P.S.A.42.* **PROTECTIVE COATINGS BASED ON EPOXY AND ALKYD RESINS AS BINDERS**
M.C. Jovičić, R.Ž. Radičević, J.K. Budinski-Simendić
*University of Novi Sad, Faculty of Technology, Novi Sad, Serbia*

*P.S.A.43.* **MATHEMATICAL MODEL OF APPLE DRYING KINETICS**
B. Tomić-Tucaković[1], D. Majstorović[1], L. Pezo[1], A. Petrović[2], D. Debeljković[2]
*[1]Eng. Dept. Holding Institute of General and Physical Chemistry, Belgrade, Serbia,*
*[2]Faculty of Mechanical Engineering, Belgrade, Serbia*

*P.S.A.44.* **MATHEMATICAL MODEL OF AIRFLOW THROUGH A WOOD-DRYING KILN**
L. Pezo[1], S. Stanojlović[1], A. Jovanović[1], S. Zlatanović[1], D. Debeljković[2]
*[1]Eng. Dept. Holding Institute of General and Physical Chemistry, Belgrade, Serbia,*
*[2]Faculty of Mechanical Engineering, Belgrade, Serbia*

*P.S.A.45.* **MATHEMATICAL MODEL OF HEAT AND MASS TRANSFER DURING HEAT TREATMENT OF WOOD**
D. Majstorović[1], L. Pezo[1], B. Tomić-Tucaković [1], A. Petrović[2], D. Debeljković[2]
*[1]Eng. Dept. Holding Institute of General and Physical Chemistry, Belgrade, Serbia,*
*[2]Faculty of Mechanical Engineering, Belgrade, Serbia*

*P.S.A.46.* **MATHEMATICAL MODEL OF A SOLAR DRYER WITH NATURAL CONVECTIVE HEAT FLOW**
S. Stanojlović, L. Pezo, A. Jovanović, S. Zlatanović [1], A. Petrović[2]
*[1]Eng. Dept. Holding Institute of General and Physical Chemistry, Belgrade, Serbia,*
*[2]Faculty of Mechanical Engineering, Belgrade, Serbia*

*P.S.A.47.* **MECHANISMS OF DEFORMATION-INDUCED FRAGMENTATION OF NANOSTRUCTURES OF METALS AND ALLOYS**
I.L. Lomayev
*Physical-Technical Institute, Ural Division, Russian Academy of Sciences, Izhevsk, Russia*

*P.S.A.48.* **MECHANISMS OF STRAIN-INDUCED PHASE DISSOLUTION IN NANOSTRUCTURED METALS AND ALLOYS**
I.L. Lomayev
*Physical-Technical Institute, Ural Division, Russian Academy of Sciences, Izhevsk, Russia*

*P.S.A.49.* **FABRICATION AND CHARACTERIZATION OF $Al_2O_3$/MO NANOCOMPOSITE**

M.H. Enayati, F. Karimzadeh, A. Heidarpour
*Department of Materials Engineering, Isfahan University of Technology, Isfahan, Iran*

*P.S.A.50.* **MECHANOCHEMICAL SYNTHESIS OF $Fe_3Al$-$Al_2O_3$ NANOCOMPOSITE**
M.H. Enayati, F. Karimzadeh, M. Khodaei
*Department of Materials Engineering, Isfahan University of Technology, Isfahan, Iran*

*P.S.A.51.* **BALL MILLING ASSISTED SYNTHESIS OF NANOCRYSTALLINE SIALON**
M.H. Enayati, M. Salehi, M. Babashahi
*Department of Materials Engineering, Isfahan University of Technology, Isfahan, Iran*

*P.S.A.52.* **NANOSTRUCTURED WC-CO CERMET POWDER PRODUCED BY BALL MILLING**
M.H. Enayati, G.R. Aryanpour, A. Ebnonnasir
*Department of Materials Engineering, Isfahan University of Technology, Isfahan, Iran*

*P.S.A.53.* **LASER INDUCED REFRACTIVITY, HIGH-SPEED SWITCHING AND LASER STRENGTH IMPROVEMENT OF MATERIALS WITH NANOOBJECTS**
N.V. Kamanina, P.Ya. Vasilyev, V.I. Studenov
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*P.S.A.54.* **IRON GROUP NANOPOWDERS ELECTRODEPOSITON**
L. Rafailović[1], H.P. Karnthaler[1], T. Trišović[3], P.F. Rogl[2]
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## POSTER SESSION II

*Wednesday, September 10, 2008*, $20^{30}$-$22^{00}$

## SYMPOSIUM B: ADVANCED MATERIALS FOR HIGH-TECHNOLOGY APPLICATIONS

*P.S.B.1.* **As3d CORE LEVEL PHOTOEMISSION STUDIES OF (GaMn)As**
I. Ulfat[1,2], J. Adell[1.2], J. Sdaowski[2,3], L. Ilver[1], J. Kanski[1]
[1]*Department of Applied Physics, Chalmers University of Technology, Göteborg, Sweden,* [2]*MAX-lab, Lund University, Lund, Sweden,* [3]*Institute of Physics, Polish Academy of Sciences, Warsaw, Poland*

*P.S.B.2.* **KINETICS OF CATION EXCHANGE IN SPINEL NiGa$_2$O$_4$**
J. Shi, K.D. Becker
*Institute of Physical and Theoretical Chemistry, Technische Universität Braunschweig, Braunschweig, Germany*

*P.S.B.3.* **OPTICAL DESIGN OF METAMATERIAL STRUCTURES BASED ON COORDINATE TRANSFORMATIONS METHOD**
B. Vasić[1], G. Isić[1,2], R. Gajić[1], K. Hingerl[3]
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*P.S.B.4.* **KINETICS OF NON-RADIATIVE ROTATIONAL ISOMER BUTANE TRANSITIONS**
G. Keković[1], D. Raković[1], D.M. Davidović[2,3]
[1]*Faculty of Electrical Engineering, Belgrade, Serbia,* [2]*Vinča Institute of Nuclear Sciences, Belgrade, Serbia,* [3]*School of Electrical and Computer Engineering, RMIT, Melbourne, Australia*

*P.S.B.5.* **THE SYNTHESIS AND DIELECTRIC PROPERTIES OF THE GLASS CERAMIC COMPOSITE MgO–B$_2$O$_3$–SiO$_2$**
U. Došler, M. Maček Kržmanc, M. Udovič, D. Suvorov
*Institute "Jožef Stefan", Ljubljana, Slovenia*

*P.S.B.6.* **MESOPOROUS AND FUNCTIONALIZED MATERIALS IN DRUG SUPPORTS AND DELIVERY SYSTEMS**
D. Krajišnik[1], V. Dondur[2], M. Milojević[2], J. Milić[1]
[1]*Department of Pharmaceutical Technology and Cosmetology, Faculty of Pharmacy, University of Belgrade, Serbia,* [2]*Faculty of Physical Chemistry, University of Belgrade, Serbia*

*P.S.B.7.* **HETEROPOLY COMPOUNDS SUPPORTED ON MONTMORILLONITE AS CATALYSTS FOR WET PEROXIDE OXIDATION OF TOLUENE**
P. Banković[1], S. Sredić[2], I. Holclajtner-Antunović[3], Ž. Čupić[1], M. Davidović[4], U.B. Mioč[3]
*[1]IHTM, Center of Catalysis and Chemical Engineering, Belgrade, Serbia, [2]Institute of Mining, Prijedor, Republic of Srpska, Bosnia and Herzegovina, [3]Faculty of Physical Chemistry University of Belgrade, Serbia, [4]Goša Institute, Belgrade, Serbia*

*P.S.B.8.* **PHYSICOCHEMICAL CHARACTERIZATION OF INSOLUBLE ALKALINE SALTS OF 12-TUNGSTOPHOSPHORIC ACID**
I. Holclajtner-Antunović[1], U.B. Mioč[1], D. Bajuk-Bogdanović[1], M. Davidović[2], Z. Jovanović[3]
*[1]Faculty of Physical Chemistry, Belgrade, [2]Institute Goša, Belgrade, [3] The Vinča Institute of Nuclear Science, Belgrade, Serbia*

*P.S.B.9.* **NICKEL MANGANITE THICK FILM THERMISTORS FOR WATER FLOW SENSOR APPLICATION**
S.M. Savić[1], O.S. Aleksić[2], M.V. Nikolić[2], D. Luković Golić[1]
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*P.S.B.10.* **MAGNETOCALORIC EFFECT IN RARE EARTH MANGANITES**
R. Tetean, I.G. Deac, E. Burzo
*Babes-Bolyai University, Faculty of Physics, Cluj-Napoca, Romania*

*P.S.B.11.* **ANALYSIS OF THERMAL PARAMETERS OF GLASSES FROM SYSTEM $BI_x(AS_2S_3)_{100-x}$ BASED ON DSC THERMOGRAMS**
M.V. Šiljegović, G.R. Štrbac, S.R. Lukić, F. Skuban
*Department of Physics, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia*

*P.S.B.12.* **CHARACTERIZATION OF X-RAY DIAMOND DETECTOR BY MONTE CARLO METHOD**
S.J. Stanković, R.D. Ilić, D. Davidović, M. Petrović
*Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

*P.S.B.13.* **RADIATION ABSORPTION CHARACTERISTICS OF TITANIUM ALLOYS**
S.J. Stanković, M. Petrović, D. Davidović, S. Tadić, M. Kovačević
*Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

*P.S.B.14.* **INFLUENCE OF DEFECTS INDUCED BY MECHANICAL ACTIVATION ON OPTICAL AND ELECTRICAL PROPERTIES OF ZnO**
T. Srećković[1], M. Šćepanović[2], K. Vojisavljević[1], G. Branković[1]
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*P.S.B.15.* **GRAHITE-CONTAINING AND NANOSRUCTURED ELECTRODES FOR ELECTROSPARK DEPOSITION COATINGS WITH IMPROVED TRIBOLOGICAL PARAMETERS**
E.I. Zamulaeva, E.A. Levashov, A.E. Kudryashov, M.I. Petrzhik, Zh.V. Eremeeva
*SHS- Center of Moscow State Institute of Steel and Alloys (Technological University), Moscow, Russia*

*P.S.B.16.* **THE ROLE OF RADICALS IN KINETICS OF PLASMA ETCHERS IN Ar/$CF_4$ MIXTURES**
Ž. Nikitović, V. Stojanović, Z.Lj. Petrović
*Institute of Physics, Belgrade, Serbia*

*P.S.B.17.* **SURFACE AND STRUCTURAL CHANGES OF BORON ION IMPLANTED GLASSY CARBON**
A. Kalijadis[1], M. Laušević[2], Z. Laušević[1]
*[1]Laboratory of Physics, Institute of Nuclear Science Vinča, Belgrade, Serbia,*
*[2]Faculty of Technology and Matallurgy, University of Belgrade, Belgrade, Serbia*

*P.S.B.18.* **SILVER DEPOSITION ON THE CHEMICALLY SURFACE TREATED CARBON MONOLITH**
A. Kalijadis[1], M. Vukčević[2], Z. Jovanović[1], Z. Laušević[1], M. Laušević[2]
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*[2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia*

*P.S.B.19.* **EFFECT OF PROTON IRRADIATION ON SURFACE PROPERTIES OF GLASSY CARBON**
Z. Jovanović[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.B.20.* **INFLUENCE OF PHYSICAL CHARACTERISTIC OF FLAT ALUMINUM CONCENTRATOR ON ENERGETIC EFFICIENCY OF PV/THERMAL COLLECTOR**
Lj. Kostić, T. Pavlović, Z. Pavlović
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*P.S.B.21.* **OPTICAL AND MAGNETIC PROPERTIES OF PbTe(Ni)**

N. Romčević[1], J. Trajić[1], M. Romčević[1], D. Stojanović[1], T.A. Kuynetsova[2], D.R. Khokhlov[2], W.D. Dobrowolski[3]
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*P.S.B.22.* **THE EFFECT OF FREQUENCY AND TEMPERATURE ON MAGNETIC PROPERTIES OF $Fe_{81}B_{13}Si_4C_2$ AMORPHOUS ALLOY**
S. Djukić, V. Maričić, S. Randjić, J. Živanić, N. Mitrović
*Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Technical Faculty Čačak, Čačak, Serbia*

*P.S.B.23.* **NANOCRYSTALLIZATION OF $Fe_{72}Al_5Ga_2P_{11}C_6B_4$ AMORPHOUS ALLOYS BY CURRENT ANNEALING TECHNIQUE**
N. Mitrović[1], A. Kalezić-Glišović[1], A. Maričić[1], R. Simeunović[1], S. Roth[2], J. Eckert[3]
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*P.S.B.24.* **THE EFFECT OF THE HYDRATION OF A CRYSTAL IRON-NICKEL POWDER MIXTURE ON THE MICROSTRUCTURE AND MAGNETIC PROPERTIES**
R. Simeunović, L. Ribić-Zelenović, A. Maričić, M. Spasojević
*Technical Faculty of Agronomy, University of Kragujevac, Čačak, Serbia*

*P.S.B.25.* **THE EFFECT OF PRESSURE AND TEMPERATURE ON ELECTRICAL CONDUCTIVITY OF COLD SINTERED COPPER POWDER**
I. Simeunović[1], L. Novaković[1], A. Kalezić-Glišović[2], N. Mitrović[2]
*[1]Faculty of Physics, Belgrade, Serbia, [2]Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Technical Faculty Čačak, Čačak, Serbia*

*P.S.B.26.* **THE EFFECT OF CURRENT DENSITY ON THE PROPERTIES OF THE ELECTROCHEMICALLY PRODUCED $Ni_xMo_y$ ALLOY POWDERS**
M. Spasojević, L. Ribić-Zelenović, A. Maričić
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*P.S.B.27.* **THE EFFECT OF MICROSTRUCTURE AND STRUCTURAL CHANGES IN NICKEL, MOLYBDENUM AND PHOSPHORUS POWDERS ON ELECTRIC AND MAGNETIC PROPERTIES**
L. Ribić-Zelenović, M. Spasojević, A. Maričić
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*P.S.B.28.* **THE EFFECT OF ANNEALING AND EXTERNAL MAGNETIC FIELD ON THE MAGNETIC PERMEABILITY OF THE $BaO+6Fe_2O_3$ PRESSED POWDER**

A. Maričić[1], B. Zlatkov[2], Lj. Vulićević[1], N. Mitrović[1], M. Spasojević[1]
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*P.S.B.29.* **THE EFFECT OF THE THERMAL PROCESSING TEMPERATURE ON THE MICROSTRUCTURE AND ELECTROCHEMICAL PERFORMANCE OF AN ACTIVE $RuO_2TiO_2/IrO_2$, Pt COATING ON TITANIUM**
L. Ribić-Zelenović, A. Maričić, M. Spasojević
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*P.S.B.30.* **PREPARATION AND CHARACTERIZATION OF PT/C AND $TIO_X$-PT/C CATALYSTS FOR HYDROGEN OXIDATION REACTION**
Lj.M.Gajić-Krstajić[1], N.R.Elezović[2], B.M.Babić[3], Lj. M. Vračar[4], N.V.Krstajić[4]
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*P.S.B.31.* **TIME DELAY IN THIN DIELECTRIC SLABS WITH SATURABLE NONLINEARITY**
P. Beličev[1], I. Ilić[1], J. Radovanović[2], V. Milanović[2], Lj. Hadžievski[1]
*[1]Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [2]School of Electrical Engineering, University of Belgrade, Belgrade, Serbia*

*P.S.B.32.* **ORIENTATION AND RADIATION INDUCED CHANGES IN MICROSTRUCTURE AND CRYSTALLINITY OF ISOTACTIC POLYPROPYLERNE**
E. Suljovrujić, G. Stamboliev, M. Mitrić, A. Leskovac, D. Milićević, S. Trifunović, M. Mićić
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*P.S.B.33.* **THERMAL STABILITY OF MODEL IRREGULAR POLY(URETHANE-ISOCYANURATE) NETWORKS**
J. Pavličević[1], J. Budinski-Simendić[1], R. Radičević[1], L. Katsikas[2], I. Popović[2], K. Meszaros Szecsenyi[3], M. Špirkova[4]
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*P.S.B.34.* **ORGANIC SOLID PROTON CONDUCTING ELECTROLYTES BASED ON AROMATIC SULFONIC ACIDS**
A.V. Pisareva, R.V. Pisarev, G.V. Shilov, A.I. Karelin, Yu.A. Dobrovolsky

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*P.S.B.35.* **ANALYSIS OF ANISOTROPY BEHAVIOR IN UOE FORMING FOR X80 HSLA STEEL**
S. Moeinifar[1], A.H. Kokabi[2], S.H.R. Madah Hoseini[2]
*[1]Engineering Department, Azad University, Shushtar Branch, Iran [2] Material Science and Engineering Department, Sharif University of Technology, Iran*

*P.S.B.36.* **INFLUENCE OF SUBMERGED TANDEM ARC WELDING ON HAZ TOUGHNESS OF X80 MICRO ALLOY STEEL**
S. Moeinifar[1], A.H. Kokabi[2], S.H.R. Madah Hoseini[2]
*[1]Engineering Department, Azad University, Shushtar Branch, Iran [2]Material Science and Engineering Department, Sharif University of Technology, Iran*

*P.S.B.37.* **TO STUDY THE EFFECT OF CRYOGENIC HEAT TREATMENT ON HARDNESS AND THE AMOUNT OF RESIDUAL AUSTENITE IN 1/2304 STEEL**
K. Amini[1], S. Nategh[2], A. Shafyei[3]
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*P.S.B.38.* **THE EFFECT OF CURING SYSTEMS ON THE PROPERTIES OF NATURAL RUBBER / CHLOROSULPHONATED POLYETHYLENE RUBBER BLENDS**
G. Marković[1], B. Radovanović[2], M. Marinović-Cincović[3], J. Budinski-Simendić[4]
*[1]Tigar, Pirot, [2]Faculty of Science, Niš, [3]Institute of Nuclear Science VINČA, Belgrade, [4]Faculty of Technology, Novi Sad, Serbia*

*P.S.B.39.* **THE INFLUENCE OF MACRODIOL TYPE ON MECHANICAL PROPERTIES OF POLYURETHANE MATERIALS**
A. Kuta[1], Z. Hrdlicka[1], M. Spirkova[2]
*[1] Institute of Chemical Technology, Prague, Czech Republic, [2] Institute of Macromolecular Chemistry ASCR, v.v.i., Prague, Czech Republic*

*P.S.B.40.* **MICROSTRUCTURE OF A SINTERED PRODUCT ON THE BASIS OF ILLITE-KAOLINITE CLAYS**
N. Marstijepović[1], M. Ivanović[1], M.M. Krgović[1], I. Bošković[1], R. Zejak[2], M. Knežević[2]

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*P.S.B.41.* **MICROSTRUCTURAL CHANGES OF HIGH TEMPERATURE CONCRETE DURING CREEP DEFORMATION**
A. Terzić[1], Lj. Pavlović[1], A. Milutinović-Nikolić[2]
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*P.S.B.42.* **INFLUENCE OF THE PLATINUM ALLOY MICROSTRUCTURE ON THE OPTIMUM CHARACTERISTICS OF THE PRECISE ANEMOMETERS**
M. Lečić, B. Kokotović, A. Milosavljević, Dj. Čantrak
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*P.S.B.43.* **SYNTHESIS AND PROPERTIES OF SINGLE ISOTOPE POLYCRYSTALLINE CVD-DIAMOND**
A.N. Taldenkov[1], A.V. Inyushkin[1], A.A. Artyukhov[1], A.A. Artyukhov[1], Ya.M. Kravets[1], I.P. Gnidoy[1], A.L. Ustinov[1], V.Ya. Panchenko[1], V.G. Ralchenko[2], A.P. Bolshakov[2], A.F. Popovich[2], A.V. Saveliev[2], M.N. Sinyavskiy[2], V.I. Konov[2], A.V. Khomich[3]
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*P.S.B.44.* **POLYURETHANE FOAMS AND FILMS: PREPARATION AND CHARACTERIZATION**
B. Strachotová, M. Špírková, A. Strachota, M. Urbanová
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*P.S.B.45.* **EXPERIMENTAL INVESTIGATIONS OF CURED AND UNCURED DISILOXANE BISBENZOCYCLOBUTEN (BCB) FILMS**
N. Ivanović[1], N. Marjanović[2], J. Grbović-Novaković[1], M. Manasijević[1], Z. Rakočević[1], M. Srećković[3], V. Andrić[1]
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*P.S.B.46.* **STUDY OF SPACE VEHICLES METAL SURFACE MORPHOLOGYUNDER IMPACT OF HARD HIGH-SPEED MICROPARTICLES**
O.N. Nikitushkina[1], A.N. Petrov[1], L.I. Ivanov[1], L.S. Novikov[2], B.A. Loginov[3]
*[1]A.A. Baikov Institute of Metallurgy and Material Science RAS, Moscow, Russia, [2]D.V. Skobeltsyn Institute of Nuclear Physics, M.V. Lomonosov Moscow State*

*University, Moscow, Russia, [3]Moscow State Institute of Electronic Technology (Technical University), Moscow, Russia*

*P.S.B.47.* **OPTIMIZING CUTTING PARAMETERS FOR SURFACE ROUGHNESS IN TURNING OF THE COMMERCIAL ALUMINUM (1100-H18 Type) ALLOY USING TAGUCHI METHOD**
A.M. Hatab[1], H.R. Zaid[2]
*[1]Department of Mechanical and Industrial Engineering, Al-Fateh University, Tripoli-Libya, [2]Department of Material Science, Faculty of Engineering, Al-Jabal El-Gahrbi University, Garyhan-Libya*

*P.S.B.48.* **CRACK INITATATION AND PROPAGATION OF HAZ SIMULATED SPECIMENS OF STEEL 12H1MF UNDER IMPACT LOADING**
D. Momčilović[1], Lj. Milović[2], I. Atanasovska[3], S. Putić[2], T. Vuherer[4]
*[1]Institute for Testing of Materials, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, Belgrade, Serbia, [3]Institute Kirilo Savić, Belgrade, Serbia, [4]Faculty of Mechanical Engineering, Maribor, Slovenia*

*P.S.B.49.* **STEEL–SIC *CAST IN CARBIDE* COMPOSITES AS ALTERNATIVE TO WEAR RESISTANT Cr-Mo STEELS**
D. Čikara[1], A. Todić[1], D. Čikara-Anić[2]
*[1]Faculty of Technical Sciences, University of Prishtine, Kosovska Mitrovica*
*[2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia*

*P.S.B.50.* **THE PHENOMENON OF CAVITATION IN SHIP'S PROPELLERS IS NOWADAYS OF A GREAT IMPORTANCE**
V. Kasemi, B. Xhaferaj
*University "Ismail Qemali", Vlore, Albania*

*P.S.B.51.* **THE INFLUENCE OF METEOROLOGICAL FACTORS OF VLORE BAY ON CORROSION SPEED OF STEEL A-3**
V. Kasemi
*University "Ismail Qemali", Vlore, Albania*

*P.S.B.52.* **A STUDY OF THE GALLOP PHENOMENON IN ELECTRIC AERIAL LINES. MEASURES AND CHECKING IN ORDER TO REDUCE ITS CONSEQUENCES**
M. Kullolli[1], M. Shehu[2], M. Qarri[2], M. Celo[3]
*[1]Polytechnic University of Tirana, Mechanical Engineering Faculty, Albania, [2]College of Sciences & Engineering, Vlora University, Vlora, Albania, [3]Albanian Electric Corporation, Tirana, Albania*

### *P.S.B.53.* A NEW FORMULATION OF THE DYNAMIC BALANCING CONDITIONS WITH APPLICATION TO LINK OPTIMIZATION FOR THE SLIDER-CRANK MECHANISM

Dj. Ilia[1], M. Shehu[1], M. Kullolli[2], M. Qarri[1]
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## POSTER SESSION III

*Thursday, September 11, 2008*, $20^{30}$-$22^{00}$

## SYMPOSIUM C: NANOSTRUCTURED MATERIALS

*P.S.C.1.* **PHONON CONTRIBUTION IN THERMODYNAMICS OF NANO-CRYSTALLINE FILMS AND WIRES**
J.P. Šetrajčić[1], D.Lj. Mirjanić[2], S.M. Vučenović[2], D.I. Ilić[3], B. Markoski[3], S.K. Jaćimovski[4], V.D. Sajfert[5], V.M. Zorić[2]
*[1]Department of Physics, Faculty of Sciences, University of Novi Sad, Vojvodina – Serbia, [2]Faculty of Medicine, University of Banja Luka, Banja Luka, Republic of Srpska, Bosnia and Herzegovina, [3]Faculty of Technical Sciences, University of Novi Sad, Vojvodina – Serbia, [4]Faculty of Electrical Engineering, University of Belgrade, Serbia, [5]Technical Faculty "M. Pupin" – Zrenjanin, University of Novi Sad, Vojvodina – Serbia*

*P.S.C.2.* **BAND GAP PHOTONIC STRUCTURES IN DICHROMATE PULLULAN**
S. Savić Šević, D. Pantelić, B. Jelenković
*Institute of Physics, Belgrade, Serbia*

*P.S.C.3.* **ELECTRON AND HOLE STATES IN CLOSED SPHERICAL QUANTUM DOT WITH GRADIENT COMPOSITION**
R. Kostić, D. Stojanović
*Center for Solid State Physics and New Materials, Institute of Physics, Belgrade, Serbia*

*P.S.C.4.* **THE INFLUENCE OF THE ELECTRON-PHONON INTERACTION ON PHONON SPECTRA IN THE AlGa CRYSTAL LATTICE**
D. Čevizović, S. Galović
*Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

*P.S.C.5.* **COMPARATIVE STUDY OF EFFECT OF VARIOUS REDUCING AGENTS ON SIZE AND SHAPES OF GOLD NANOPARTICLES**
A. Kumar[1], N. Dhawan[2]
*[1]Materials Science and Engineering Department, Stanford University, CA, USA*
*[2]Metallurgical Engineering Department, Punjab Engineering College, Chandigarh, India*

*P.S.C.6.* **THE SYNTHESIS AND CHARACTERIZATION OF Ca–Ti-BASED ONE-DIMENSIONAL NANOSTRUCTURES**
I. Bračko[1], B. Jančar[1], S. Šturm[2], D. Suvorov[1]
*[1]Advanced Materials Department, Jozef Stefan Institute, Ljubljana, Slovenia*
*[2]Nanostructured Materials Department, Jozef Stefan Institute, Ljubljana, Slovenia*

*P.S.C.7.* **KINETICS INVESTIGATION OF HYDROGEN SORPTION REACTION OF $MgH_2/Nb_2O_5$ NANOSTRUCTURED POWDERS**
A. Aurora, M.R. Mancini, D. Mirabile Gattia, A. Montone, L. Pilloni, E. Todini, M. Vittori Antisari
*ENEA, Department of Physical Methods and Materials, C.R. Casaccia, Rome, Italy*

*P.S.C.8.* **CHARACTERIZATION OF La-DOPED $TiO_2$ NANOPOWDERS BY RAMAN SPECTROSCOPY**
M. Šćepanović[1], V. Berec, S. Aškrabić[1], A. Golubović[1], Z. Dohčević-Mitrović[1], A. Kremenović[2], Z.V. Popović[1]
*[1]Center for Solid State Physics and New Materials, Institute of Physics, Belgrade, Serbia, [2]Faculty of Mining and Geology, Laboratory for Crystallography, University of Belgrade, Serbia*

*P.S.C.9.* **CHARACTERIZATION OF BARIUM TITANATE CERAMIC POWDERS BY RAMAN AND IR SPECTROSCOPY**
Z.Ž. Lazarević[1], Z. Dohčević-Mitrović[1], M. Vijatović[2], N. Paunović[1], N.Ž. Romčević[1], B.D. Stojanović[2]
*[1]Institute of Physics, Belgrade, Serbia, [2]Institute for Multidisciplinary Research, Belgrade, Serbia*

*P.S.C.10.* **SELF ASSEMBLING MONOLAYER DEPOSITION APPROACH TO THE PROTECTION OF GLASS SURFACES**
C. Altavilla, E. Ciliberto, M. Trigilia
*Dipartimento di Scienze Chimiche Università di Catania, viale A.Doria 6, 95125 Catania, Italy*

*P.S.C.11.* **NANOCRYSTALLINE GLASS-CERAMICS**
M.B. Tošić[1], V.D. Živanović[1], N.S. Blagojević[2], S.R. Grujić[2], J.D. Nikolić[1]
*[1]Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, Belgrade, Serbia*

*P.S.C.12.* **THE ELECTRICAL AND MAGNETIC PROPERTIES OF THE COBALTITES $Pr_{1-x}Ca_xCoO_3$**
I.G. Deac, R. Tetean, E. Burzo
*Faculty of Physics, Babes-Bolyai University Cluj-Napoca, Romania*

*P.S.C.13.* **COMBUSTION SYNTHESIS, CHARACTERIZATION AND MAGNETIC STUDIES OF NANOPARTICLE $La_{0.7}Ca_{0.3}MnO_3$**

D. Marković[1], M. Tadić[1], V. Kusigerski[1], N. Cvjetićanin[2], Z. Jagličić[3], V. Spasojević[1]
*[1]The Vinca Institute, Condensed Matter Physics Laboratory, Belgrade, Serbia; [2]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia; [3]Institute of Mathematics, Physics and Mechanics, Ljubljana, Slovenia*

*P.S.C.14.* **UREA-ASSISTED SELF-COMBUSTION AEROSOL SYNTHESIS OF $Y_3Al_5O_{12}:Ce^{3+}$**

K. Marinković[1], L. Mančić[1], V.B. Pavlović[2], M. Dramićanin[3], O. Milošević[1]
*[1]Institute of Technical Sciences of Serbian Academy of Sciences and Arts, Belgrade, Serbia, [2]Faculty of Agriculture, University of Belgrade, Belgrade-Zemun, Serbia, [3]Institute of Nuclear Sciences "Vinča", Belgrade, Serbia*

*P.S.C.15.* **EFFECTS OF SOURCE ON PHYSICOCHEMICAL PROPERTIES OF VANADIUM IMPREGNATED Al_PILCs**

S. Balci, A. Tecimer
*Gazi University, Chemical Engineering Department, Ankara, Turkey*

*P.S.C.16.* **DETERMINING EFFECTS OF DIFFERENT TRANSITION METALS (V, Mo, Nb) TO MCM-41 STRUCTURE**

A. Solmaz[1], S. Balci[1], T. Dogu[2]
*[1]Gazi University, Chemical Engineering Department, Ankara, Turkey, [2]Middle East Technical University, Chemical Engineering Department, Ankara, Turkey*

*P.S.C.17.* **EFFECT OF THE SUPPORT ON THE CHARACTERISTIC PROPERTIES OF THE SILVER BASED NANOCATALYSTS**

Ç. Güldür[1], F. Balikçi Derekaya[2]
*[1]Gazi University, Faculty of Engineering and Arcitecture, Department of Chemical Engineering, Maltepe, Ankara, Turkey, [2]Gazi University, Institute of Science and Technology, Department of Advanced Technologies, Maltepe, Ankara, Turkey*

*P.S.C.18.* **OPEN-FRAMEWORK FLUORINATED ALUMINIUM POSPHATE - THE ANALOGUE OF THE GALLOPHOSPHATE ULM-3**

S. Jevtić[1], N. Rajić[1], Dj. Stojaković[1], N. Zabukovec Logar[2], A. Meden[3], V. Kaučič[2]
*[1]Faculty of Technology and Metallurgy, Beograd, Serbia, [2]National Institute of Chemistry, Ljubljana, Slovenia, [3]Faculty of Chemistry and Chemical Technology, Ljubljana, Slovenia*

*P.S.C.19.* **THE INFLUENCE OF NANOSIZED FILLERS ON THE PROPERTIES OF ELASTOMERS BASED ON DIFFERENT NETWORK PRECURSORES**

V. Jovanović[1], I. Ristić[2], J. Milić[2], J. Pavličević[2], J. Budinski-Simendić[2]
*[1]Faculty of Science, Kosovska Mitrovica, Serbia, [2]University of Novi Sad , Faculty of Technology, Serbia*

*P.S.C.20.* **THE INFLUENCE OF Cr ADDITION ON THE MAGNETIC PROPERTIES OF NiFe-BASIS NANOCRYSTALLINE ALLOYS**

E. Enescu[1], O. Chicinas[2], P. Lungu[1], E. Patroi[1], A. Bratulescu[1], G. Sbarcea[1]
*[1]National Institute for Electrical Engineering-Advanced Research, Bucuresti, Romania, [2]Universitatea Tehnica Cluj-Napoca, Cluj-Napoca, Romania*

*P.S.C.21.* **STRUCTURE OF $Ca_{1-x}Y_xMnO_3$ ($0 \leq x \leq 1$) NANOPOWDERS**

J. Dukić, S. Bošković, B. Matović
*Institute of Nuclear Sciences "Vinča", Materials Science Laboratory, Belgrade, Serbia*

## SYMPOSIUM D: COMPOSITES

*P.S.D.1.* **A MESOMECHANICS MODEL OF FATIGUE CRACK GROWTH FOR NANO ENGINEERING APPLICATIONS**
M.P. Wnuk, A. Rouzbehani
*Department of Civil Engineering and Mechanics, University of Wisconsin - Milwaukee, USA*

*P.S.D.2.* **DENSIFICATION EVOLUTION OF BTS FUNCTIONALLY GRADED MATERIALS DURING SINTERING**
S. Marković, D. Uskoković
*Institute of Technical Sciences of SASA, Belgrade, Serbia*

*P.S.D.3.* **SYNTHESIS, CHARACTERISATION AND APPLICATION OF Fe-PILLARED CLAYS**
P. Banković, A. Milutinović-Nikolić, N. Jović-Jovičić, J. Dostanić, Ž. Čupić, D. Lončarević, D. Jovanović
*IChTM-Department of Catalysis and Chemical Engineering, Belgrade University, Belgrade, Serbia*

*P.S.D.4.* **POLY(NIPAm) HYDROGEL/Ag NANOCOMPOSITE SYNTHESIZED BY GAMMA IRRADIATION**
A. Krklješ, Z. Kačarević-Popović, J. Nedeljković
*Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

*P.S.D.5.* **CHARACTERIZATION OF Me-HISTIDINE COMPLEXES (Me = Cu, Co, Zn, Mn, Fe) INCORPORATED IN FAU-TYPE ZEOLITE FRAMEWORK**
V. Rakić[1], Lj. Damjanović[2], D. Stošić[2,3], R. Hercigonja[2], V. Dondur[2].
*[1]University of Belgrade, Faculty of Agriculture, Zemun, Serbia, [2]University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia, [3]Institute of Nuclear Sciences "Vinča", Belgrade, Serbia*

*P.S.D.6.* **THERMAL BEHAVIOR OF Ag/PMMA NANOCOMPOSITES SYNTHESIZED BY "IN SITU" METHOD**
V. Vodnik[1], E. Džunuzović[2], J. Vuković[3], J. Nedeljković[1]
*[1]Vinča Institute of Nuclear Sciences, Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, University of Belgrade, Serbia, [3]IHTM Center for Chemistry, Belgrade, Serbia*

*P.S.D.7.* **CELLULOSE NANO- AND MICROCOMPOSITES WITH NATURAL AND MODIFIED CLAYS**
I.S. Makarov[1], L.K. Golova[1], E.V. Matukhina[2], V.G. Kulichikhin[1]
*[1]A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences, Moscow, Russia, [2]Moscow State Pedagogical University, Moscow, Russia*

*P.S.D.8.* **MECHANOCHEMICAL SYNTHESIS OF MELOXICAM-BASED COMPOSITES**
S.A. Myz[1,2], M.A. Dyakonova[2], T.P. Shakhtshneider[1,2], A.P. Fedotov[2], V.V. Boldyrev[1,2], N.I. Kuleshova[3]
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*P.S.D.9.* **SYNTHESIS OF POLYVINYLALCOHOL/GRAPHITE NANOSHEETS NANOCOMPOSITES WITH ENHANCED MECHANICAL AND PERMEABILITY PROPERTIES**
C. Borriello[1], A. De Maria[1], N. Jović[3], A. Montone[2], F. Pierdominici[2], M. Schwarz [2], *M. Vittori Antisari[2]*
*[1]ENEA, Department of Physical Methods and Materials, C.R. Portici, Napoli, Italia, [2]ENEA, Department of Physical Methods and Materials, C.R. Casaccia, Roma, Italia, [3]Institute of Nuclear Sciences ''Vinča'', Laboratory of Solid State Physics (020), Belgrade, Serbia*

*P.S.D.10.* **Cu-C COMPOSITE MATERIAL**
S. Emmer[1], J. Bielek[1], J. Kovacik[2]
*[1]Slovak University of Technology, Bratislava, Slovakia, [2]Slovak Academy of Sciences, Bratislava, Slovakia*

*P.S.D.11.* **RESEARCH OF CHARACTERISTICS OF PARTICULATE BASALT – POLYMER COMPOSITES**
A. Todić[1], R. Aleksić[2], D. Čikara[1]
*[1]Faculty of Technical Sciences, University of Prishtine, Kosovska Mitrovica, Serbia*
*[2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia*

*P.S.D.12.* **POLYESTER AND POLYESTERIMIDE COMPOUNDS WITH NANOFILLERS FOR IMPREGNATING OF ELECTRICAL MOTORS**
B. Gornicka[1], E. Prociow[2]
*[1]Electrotechnical Institute Wroclaw Division of Electrotechnology and Materials Science, Wroclaw, Poland, [2]Faculty of Microsystem Electronics and Photonics, Wroclaw University of Technology, Wroclaw, Poland*

*P.S.D.13.* **INSULATING SYSTEM OF INVERTER DRIVEN MOTORS BASED ON NANOCOMPOSITES**

B. Gornicka, K. Prociow
*Electrotechnical Institute Wroclaw Division of Electrotechnology and Materials Science, Wroclaw, Poland*

*P.S.D.14.* **INTERFACIAL MODIFICATION OF WOOD-PLASTIC COMPOSITES BASED ON WASTE AND VIRGIN HIGH-DENSITY POLYETHYLENE**
V. Radojević, D. Stojanović, Dj. Janaćković, P.S. Uskoković, R. Aleksić
*Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia*

*P.S.D.15.* **EFFECT OF BLENDING FILLERS ON TIRE TREAD COMPOSITE PERFORMANCE**
N.L. Lazić[1], J. Budinski-Simendić[2], S. Ostojić[1], M. Kićanović[1], M.B. Plavšić[3]
*[1]Institute of General and Physical Chemistry, Belgrade, Serbia, [2]University of Novi Sad, Faculty of Technology, Novi Sad, [3]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade*

## SYMPOSIUM E: BIOMATERIALS

*P.S.E.1.* **PREPARATION OF $^{99m}$Tc-PLGA AND ITS DISTRIBUTION STUDIES**

M. Stevanović[1], T. Maksin[2], Lj. Veselinović[1], D. Uskoković[1]
*[1]Institute of Technical Sciences of SASA, Belgrade; Serbia, [2]Institute of Nuclear Sciences "Vinča", Belgrade, Serbia*

*P.S.E.2.* **POROUS, POLY (DL-LACTIDE-CO-GLYCOLIDE)-BASED MATERIAL FOR BIOMEDICAL APPLICATION**

M. Stevanović[1], M. Jevtić[1], I. Jovanović[1], V. Pavlović[2], D. Uskoković[1]
*[1]Institute of Technical Sciences of SASA, Belgrade; Serbia, [2]Faculty of Agriculture, University of Belgrade, Serbia*

*P.S.E.3.* **CRYSTALLIZATION OF BIOGENIC CRYSTALS FROM AQUEOUS SOLUTIONS**

V. Babić-Ivančić[1], M. Dutour Sikirić[1], H. Füredi-Milhofer[2]
*[1]"Ruđer Bošković" Institute, Zagreb, Croatia, [2]Casali Institute, Hebrew University of Jerusalem, Jerusalem, Israel*

*P.S.E.4.* **PREPARATION AND CHARACTERIZATION OF POLY-D,L-LACTIDE MICROSPHERES FOR CONTROLLED RELEASE OF HORSERADISH PEROXIDASE AS MODEL PROTEIN**

I. Jovanović[1], M. Mitrić[2], B. Nedeljković[3], N. Ignjatović[1], D. Uskoković[1]
*[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Institute for Nuclear Sciences Vinča, Belgrade, Serbia, [3]Faculty of Technical Sciences, University of Čačak, Serbia*

*P.S.E.5.* **IMPORTANCE OF CATALYTIC PROCESSES FOR POLYMER NETWORK-CELL MECHANICAL CHANGES OF BIO-MEDICAL SYSTEMS**

M.B. Plavšić[1], I. Pajić- Lijaković[1], N. Lazić[2], P. Putanov[3]
*[1]Faculty of Technology and Metallurgy, Belgrade, Serbia, [1]Institute of General and Physical Chemistry, Belgrade, Serbia, [3] Serbian Academy of Sciences and Arts, Belgrade, Serbia*

*P.S.E.6.* **ULTRASONIC DEAGGLOMERATION AND PARTICLE SIZE REDUCTION OF HYDROXYAPATITE BY COATING WITH POLY(D,L-LACTIDE-CO-GLYCOLIDE)**

M. Jevtić[1], M. Mitrić[2], S. Škapin[3], I. Bračko[3], N. Ignjatović[1], D. Uskoković[1]
*[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Institute of Nuclear Sciences "Vinča", Belgrade, Serbia, [3]"Jožef Stefan" Institute, Ljubljana, Slovenia*

*P.S.E.7.* **HYDROTHERMAL SYNTHESIS OF COBALT-EXCHANGED HYDROXYAPATITE NANOPARTICLES**
Z. Stojanović, Lj. Veselinović, S. Marković, N. Ignjatović, D. Uskoković
*Institute of Technical Sciences of SASA, Belgrade, Serbia*

*P.S.E.8.* **XRD ANALYSYS OF COBALT-SUBSTITUTED HYDROXYAPATITE PREPARED BY HYDROTHERMAL METHOD**
Lj. Veselinović, Z. Stojanović, S. Marković, N. Ignjatović, D. Uskoković
*Institute of Technical Sciences of SASA, Belgrade, Serbia*

*P.S.E.9.* **GREATER REGENERATION OF ALVEOLAR BONE RESORPTION BY HIGH ADVANCE BIOACTIVITY COMPOSITES**
Z. Ajduković[1], N. Ignjatović[2], B. Kaličanin[3], V. Savić[4]
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*P.S.E.10.* **NANODIAMOND-REINFORCED HYDROXYAPATITE COATINGS: INTERACTION WITH FIBRONECTIN AND OSTEOBLAST CELLS**
E. Pecheva[1], G. Altankov[2], K. Hristova [2], L. Pramatarova[1]
*[1]Institute of Solid State Physics, Bulgarian Academy of Sciences, Sofia, Bulgaria, [2]Institute for Bioengineering of Cataluna, Parc Cientific de Barcelona, L'Hospitalet de Llobregat, Spain*

*P.S.E.11.* **SUBSTRUCTURE-PROPERTIES RELATIONSHIPS IN NANOCRYSTALLINE Ti PRODUCED BY CRYOMECHANICAL TREATMENT FOR BIOMEDICAL APPLICATIONS**
V.A. Moskalenko, A.R. Smirnov
*Institute for Low Temperature Physics and Engineering of NASU, Kharkiv, Ukraine*

*P.S.E.12.* **SOL-DERIVED HYDROXYAPATITE DIP-COATING OF A POROUS $Ti_6Al_4V$ POWDER COMPACT**
M. Altindiş, M. Gűden
*Department of Mechanical Engineering, Izmir Institute of Technology, Gulbahce Koyu, Urla, Izmir, Turkey*

*P.S.E.13.* **THERMAL COMPRESSIVE FATIGUE BEHAVIOUR OF DENTAL COMPOSITES**
M.R. Javaheri[1], S.M. Seifi[1], J.A. Mohandesi[1], Shafie[2]
*[1]Department of Metallurgical Engineering, Amirkabir University of Technology, Tehran, Iran, [2]Department of Dentistry, University of Medicine Science, Tehran, Iran*

*P.S.E.14.* **THE INFLUENCE OF THERMAL CYCLIC TEST ON THE COMPRESSIVE FATIGUE BEHAVIOUR OF DENTAL COMPOSITES**

S.M. Seifi[1], M.R. Javaheri [1], J.aghazade Mohandesi[1], Shafie[2]
[1]*Department of Metallurgical Engineering, Amirkabir University of Technology, Tehran, Iran,* [2]*Department of Dentistry, University of Medicine Science, Tehran, Iran*

*P.S.E.15.* **NMR CRYSTALLOGRAPHY OF ACTIVE PHARMACEUTICALS INGREDIENTS FOR INDUSTRIAL APPLICATIONS**

M. Urbanova, J. Brus, L. Kobera
*Institute of Macromolecular Chemistry ASCR, v.v.i., Prague, Czech Republic*

*P.S.E.16.* **ACIDE CHARACTERISTIC OF FULLERENOL $C_{60}(OH)_{24}$ IN WATER**

A. Djordjević[1], Dj. Vastag[1], I. Ičević[1], V. Bogdanović[2]
[1]*Faculty of Science, Department of Chemistry, Novi Sad, Serbia,* [2]*Institute of Oncology, Department of Experimental Oncology, Sremska Kamenica, Serbia*

*P.S.E.17.* **RELEASE OF DRUGS AND SILVER NANOPARTICLES FROM SMART COPOLYMERIC HYDROGELS BASED ON METHACRYLATES AND ITACONIC ACID**

M. Mićić[1], T. Vukašinović Milić[1], S. Tomić[2], S. Dimitrijević[2], E. Suljovrujić[1]
[1]*Vinča Institute of Nuclear Sciences, Belgrade, Serbia,* [2]*Faculty of Technology and Metallurgy, Belgrade, Serbia*

*P.S.E.18.* **SURFACE CHARACTERIZATION OF THE GLASS-IONOMER BASED MATERIALS DURING FLUORIDE RELEASE AND UPTAKE**

D. Marković[1], B. Petrović[2], T. Perić[1], V. Jokanović[3], M. Plavšić[4]
[1]*Faculty of Dentistry, Belgrade, Serbia,* [2]*Dentistry Clinic of Vojvodina, Novi Sad, Serbia,* [3]*Institute of Nuclear Sciences Vinča, Serbia,* [4]*Faculty of Technology and Metallurgy, Belgrade, Serbia*

*P.S.E.19.* **NUCLEATION OF THE CALCIUMHYDROXYAPATITE THIN FILMS FROM SBF ON THE SILICA LAYERS OF THE STEEL TAPE SUBSTRATES**

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*P.S.E.20.* **MECHANICAL CHARACTERISTICS WIRE ARCHES IN FIXED ORTHODONTIC TECHNIQUE**

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*P.S.E.21.* **MATERIALS FOR DIRECT CEMENTING OF DENTAL BRACKET**

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*P.S.E.22.* **SHEAR BOND STRENGTH ANALYSIS OF DENTAL SELF-ADHESIVE RESIN CEMENTS**

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# Abstracts

# Oral Presentation

*PL.S.I.1*

# ELECTRON MICROSCOPY OF NANOSCALE MATERIALS AS A DRIVING FORCE FOR THE TEAM PROJECT

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Advanced electron microscopes show us unprecedented views of materials and their unusual behavior on the nanoscale. However, until recently, electron microscopes have remained limited by unavoidable aberrations in round electromagnetic lenses. The TEAM (Transmission Electron Aberration-corrected Microscope) project was initiated as a collaborative effort to redesign the electron microscope around aberration corrected optics. The vision for the TEAM project is the idea of providing a sample space for electron scattering experiments in a tunable electron optical environment by removing some of the constraints that have limited electron microscopy until now. The resulting improvements in spatial, spectral and temporal resolution, the increased space around the sample, and the possibility of exotic electron-optical settings will enable new types of experiments. The TEAM microscope will feature unique corrector elements for spherical and chromatic aberrations, a novel AFM-inspired specimen stage, a high-brightness gun and numerous other innovations that will extend resolution down to the half-Angstrom level. This talk will highlight some recent discoveries in nanoscale materials science using high resolution imaging and dynamic observations. Examples will include observations of the relationship between particle size and melting point, the direct measurement of the mechanism and rate of Brownian motion of liquid inclusions inside a solid matrix, and the critical need for 3D tomography to understand the shape and unique behavior of precipitates at grain boundaries in solids. Finally, this presentation will show some first results demonstrating the extraordinary performance of the TEAM 0.5 microscope and sketch an outline of opportunities for the TEAM project to meet future scientific challenges.

*PL.S.I.2*

# MONODISPERSED $Al_3$(LiScZr) CORE/SHELL NANOSTRUCTURES EMBEDDED IN Al-RICH MATRIX

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Al-Sc-Zr alloys are extremely resistant to recrystallization due to coherent $L1_2$ core/shell precipitates consisting of an $Al_3Sc$ core surrounded by a Zr-rich shell. By adding Li to this ternary alloy, we demonstrate a way of producing monodispersed $Al_3$(LiScZr) core/shell inclusions 32.1±1.9 nm in diameter, as observed by transmission electron microscopy (TEM) and small angle X-ray scattering (SAXS). By combining high resolution phase contrast and high angle annular dark field (HAADF) imaging with energy dispersive spectroscopy (EDS), electron energy loss spectroscopy (EELS) and spectrum imaging, it was found that precipitates consist of a Li- and Sc-rich core surrounded by a Li-rich shell thick 9.2±0.8 nm, with Zr segregating at the core/shell interface. A uniform distribution of particles can be made reproducibly by exploiting kinetic and thermodynamic parameters. This approach to generating precipitate distributions can be applied to a range of alloys and could lead to new types of dispersion-strengthened materials.

*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*

# SCANNING PROXIMITY PROBES FOR NANOSCIENCE

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This presentation is devoted to the realization of Scanning Proximity Probes used as nanotools. It is expected that in the near future major technological breakthroughs in scanning proximal probe nanotools will allow for key scientific impact on analysis and synthesis of nanostructures. All the cantilever sensors described here are based on advanced silicon micromachining and standard CMOS processing. Moreover, using a newly optimized piezoresistive detection scheme process comprising a Wheatstone bridge, we have designed and fabricated piezoresistive cantilevers for atomic force microscopy, which improve surface topography resolution by an order of magnitude to 0.1 nm. The elegance of this concept is that by using an almost identical detection principle and differently functionalized tips or cantilever surfaces, we can detect subtle sample interactions (mechanical, electrical, thermal, and chemical) with a significantly more compact system than with optical beam deflection techniques. Moreover, nowadays the nanoprobes themselves are mechanically, physically, chemically or biologically functionalized for specific physical, chemical or biological applications at high spatial resolutions. Scanning proximity probes (SPP) are uniquely powerful tools for molecular analyses and sensing; they are capable of addressing and manipulating surfaces at the atomic level. Therein lie the keys to unlocking the full potential of nanotechnology.

Key words: cantilever, scanning force microscopy, micro-, nanomachining.

*PL.S.I.5*

# HIGH-RESOLUTION TEM OF LAYERED CRYSTALS AND INCOMMENSURATE MISFIT LAYER COMPOUNDS AND THEIR INTERFACES

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Materials research for advanced nano-scale and thin film materials, layered structures and interfaces has established itself as a fascinating and attractive research field because of its fundamental importance in understanding the chemical and physical properties of these materials and in evaluating their potential for technological applications. Advanced high-resolution imaging and spectroscopic techniques of electron microscopy play a crucial role in characterizing the microstructure and the structure-property relationships and in the metrology of nanomaterials and interfaces. The presentation will summarize investigations of interface and surface phenomena of transition metal dichalcogenide crystals, with a focus on self-assembled surface nanofolds and metal intercalation for layered chalcogenide crystals[1,2,3] and on the effects of interface incommensurability in epitaxial layers[4] and in misfit layer compounds[5,6]. First investigations of the incommensurate misfit layer compound $(PbS)_{1.14}NbS_2$ using aberration-corrected high-resolution TEM under imaging conditions with negative values of the spherical aberration coefficient $C_s$ (NCSI-contrast) demonstrate that direct imaging of light atomic columns (S) and heavy atomic columns (mixed Pb/S) becomes possible, thus enabling to locally investigate interfaces, layer distortions, and stacking disorder[6].

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*O.S.A.1*

# THE SYNTHESIS OF SUPERPARAMAGNETIC BARIUM HEXAFERRITE PARTICLES USING HYDROTHERMAL METHOD

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Ba- hexaferrite exhibits a high ferrimagnetic resonance frequency (FMR) then other ferrites due to their larger magnetic anisotropy and is a technically important material since it can be used in magnetic-recording applications and in magnetic nanocomposites for the absorption of microwave radiation. In this case the fine ferrite particles are required to be single domain, with a narrow particle size distribution. In contrast to other soft ferromagnetic iron oxides i.e. maghemite and magnetite, which are the predominating magnetic material of commercial ferro-fluids (FF) Ba- hexaferrite has an order higher the intrinsic magnetic anisotropy and a high magnetization. In Ba- hexaferrite based FF’s the influence of shape anisotropy is less severe due to its high magnetic anisotropy. Magneto – reological effects will be much more significant in the case of Ba- hexaferrite FF’s. Thus, the Ba-hexaferrite has the potential for the synthesis of ferrofluids with extreme reological properties due to their high magnetic anisotropy.

Up to now the synthesis of superparamagnetic of Ba-hexaferrite particles, was achieved using glass crystallization method. This method is demanding and expensive besides a high quenching rate hinders the crystallization process and consequently the magnetization. On the other hand other methods, as for example sol-gel, co-precipitation and aerosol pyrolysis precipitation yield a broad grain size distribution and exhibit a rather large average grain size. From all these methods seems the hydrothermal synthesis to be the most appropriate for preparing a monodispersed particles with a narrow size distribution size distribution, since here can be the nucleation and subsequently grain growth well controlled. In the present study a controlled hydrothermal synthesis was used to synthesize nanosized particles of Ba-hexaferrites. For the first time superparamagnetic particles of Ba-hexaferrite were prepared using modified hydrothermal synthesis. The precursor and hydroxide [$OH^-$] concentration was optimized and the synthesis temperature and tame were drastic decreased. The post nucleation particle growth was strongly decreased. The super paramagnetic particles with a blocking temperature of 200 K exhibit a round shape with an average particle size of 8 nm, were 3 nm thick and have a room temperature magnetization of 8 emu /g.

*O.S.A.2*

# INFLUENCE OF THE PREPARATION METHOD ON THE PROPERTIES OF $V_2O_5$-$TiO_2$/$SO_4^{2-}$ CATALYSTS

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Encouraged by the promising results obtained using dispersed V containing phases over titania supports as catalysts for the selective oxidation of methanol to dimethoxymethane (DMM), we report in this work on the preparation and characterization of $V_2O_5$-$TiO_2$/$SO_4^{2-}$ (VTiS) catalysts.

Different preparation methods (co-precipitation with/without the addition of polyethylene glycol, sol-gel, and mechanical grinding) were optimized in terms of reactants, synthesis route, and calcination temperature in order to modulate the final $SO_4^{2-}$ content in the samples. The addition of $SO_4^{2-}$ is known to enhance the surface acidity and the redox properties the vanadium oxide phase that are directly related to the catalytic activity of the VTiS catalysts.

The obtained materials were characterized by $N_2$ adsorption at 77 K, chemical analysis by ICP, X-ray diffraction (XRD), infrared spectroscopy (FT-IR), thermogravimetric analysis (TGA) and X-ray photoelectron spectroscopy (XPS). The quantification and strength distribution of the surface acidity were determined by adsorption calorimetry of pyridine, while the nature of acid sites was determined by pyridine adsorption FT-IR. The redox properties of the materials were studied by temperature programmed reduction (TPR).

$V_2O_5$ appeared to be well dispersed on the surface of $TiO_2$ as shown by the XPS results of the calcined samples. Only the samples prepared by mechanical grinding vanadium oxide displayed aggregates as evidenced by XRD.

A single reduction peak centered around 850 K was detected by TPR for the samples prepared by co-precipitation and sol-gel, while a larger peak with shoulders at higher temperatures of reduction (890 and 980 K) was collected for the samples prepared by mechanical grinding, according to the presence of bigger and less reducible vanadium oxide particles.

The oxidation state of vanadium was shown to vary with the preparation methods while titanium was always present at its maximum oxidation state. $V^{5+}$ and $V^{4+}$ were found in all samples, while $V^{3+}$ was observed only for the catalysts prepared by mechanical grinding. The presence of $V^{3+}$ was related to a higher concentration of $SO_4^{2-}$ ions that can facilitate the vanadium oxide reduction once the catalysts are exposed to high vacuum and XPS electron beam.

In general the surface and redox properties of dispersed vanadium oxide were influenced by the preparation method and concentration of sulphate ions. It is possible to tune the $SO_4^{2-}$ amount (and consequently the acidity) by choosing the right preparation route and calcination temperature.

*O.S.A.3*

# INFLUENCE OF THE NATURE OF CHEMICAL REAGENTS ON SINTERING NANOSIZED PIEZOCERAMICS OF LEAD ZIRCONATE-TITANATE

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The main problem which arises while sintering piezoceramics of lead zirconate-titanate $Pb(Zr\ Ti)O_3$ (PZT) is the high volatility of lead oxides. It renders the manufacturing process very unhealthy and makes the stoichiometric composition of products extremely difficult to preserve. As lead and its oxides evaporate from solid PZT solution far less, obtaining $Pb(Zr\ Ti)O_3$ at as low a temperature as possible or even before the beginning of sintering becomes an urgent task. The aim of the present work is to study how the nature of chemical reagents affects the synthesis of PZT of composition $Pb[Zr_{0.52}\ Ti_{0.48}]O_3$ with preliminary mechanochemical treatment of starting materials in a high-energy centrifugal planetary mill AGO-2. The starting components were the following: titanium oxides – $TiO_2$ as rutile and anatase, also TiO as mechanochemically synthesized nanosized powder; zirconium oxide – $ZrO_2$, monoclinic and tetragonal; lead oxides as orthorhombic PbO and tetragonal $PbO_2$; pure metals – zirconium and titanium. The acceleration of the 8 mm milling balls was 20, 40 and 60 g, the ratio of powder weight to balls weight 1:20. The samples were pressed without a plasticizer under a hydraulic press at 1000 kg / cm$^2$ and then sintered in a furnace at temperatures in the range of 400°–1200°C. X-ray studies have shown that PZT can be obtained during the mechanical activation of samples. However, the samples still have quite an amorphous and defect structure. In some systems, mechanical activation produces $Pb_2O$ with a cubic lattice, but sintering at 400°C makes it disappear completely. The change in the chemical composition and structure of the samples during sintering was monitored. At 600°C, perovskite with a fairly good structure is formed. The formation of PZT structure is finished when the samples are sintered at temperatures in the range of 1000°–1100°C, depending on the starting components. Formation of nanosized structure with a grain size of 10 to 40 nm was monitored using the X-ray method and transmission electron microscopy. Finally, the lattice parameters of the samples were calculated: parameter "a" ranges from 3.977 to 4.098 Å, and "c" from 4.017 to 4.209 Å.

*O.S.A.4*

# APPLICATION OF ULTRASOUND IN THE SYNTHESIS OF CATHODE MATERIALS FOR LITHIUM ION BATTERIES

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Materials that found their application as cathode materials for lithium ion batteries were synthesized by the use of an ultrasound radiation. Two ways were applied: ultrasonic spray pyrolysis and sonochemistry. The ultrasonic spray pyrolysis method is based on an ultrasonic formation of aerosol droplets and their direct introduction into the reactor. Due to very rapid rate of the process, the formed particles retain their initial chemical homogeneity and composition achieved in the starting solution. Sonochemical reaction is a chemical reaction that is induced and/or catalysed by the application of powerful ultrasound radiation. Sonochemical processing has proven to be a useful technique for generating novel materials with unusual properties. Here will be presented a comparative study of morphological and electrochemical properties of the cathode materials obtained through both processes.

*O.S.A.5*

# LENGTH CONTROL OF α-$MnO_2$ NANORODS AND THEIR THERMOGRAVIMETRIC STUDY

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α-$MnO_2$ nanorods of different length and diameters were prepared under hydrothermal treatment of acidic $KMnO_4$ aqueous solutions. The hydrothermal treatment temperature, ranging from 90–170 °C, was shown to have a strong influence on morphology of the formed nanoparticles. Nanorods were formed at 150 °C and lower while at 170 °C square shape nanoparticles grown. Changes in reaction temperature have moderate effect on the length of α-$MnO_2$ nanorods but on the other hand we found out than molar concentration of $KMnO_4$ in reaction have a strong effect on length and also on diameter of grown nanorods. Typically, α-$MnO_2$ nanorods synthesized from a reaction mixture with low molar concentration of $KMnO_4$ reach up to 1 μm in length while nanorods synthesized from a reaction mixture with high molar concentration reach 200 up to 300 nm. Length of α-$MnO_2$ nanorods also strongly depend on reaction time. At the highest molar concentration of $KMnO_4$ in reaction mixture, α-$MnO_2$ nanoparticles of similar morphology were grown like at 170 °C. Thermogravimetric analysis (TGA) shows that dehydration occurs up to 300 °C. Transformation from $MnO_2$ to $Mn_2O_3$ happens at around 600 °C. In addition all synthesized samples were characterized with X-ray diffraction (XRD), transmission electron microscopy (TEM), scanning electron microscopy (SEM) in combination with electron dispersive spectroscopy (EDS) and TGA.

*O.S.A.6*

# SYNTHESIS OF MAGNETIC NANOOXIDES BY THE CRUCIBLE-FREE AEROSOL METHOD

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Oxide nanoparticles (10-90 nm in sizes) were prepared via the crucible-free (HF levitation of a suspended drop) aerosol method by vapor condensation of pure and doped ferromagnetic metals in an inert-gas flow accompanied by a split oxygenation process. They had a spherical shape and little change in sizes and were characterized by electron microscopy and X-ray diffraction analyses. The optimum regimes (metal wire feed rate, gas pressure and flow rate) for the synthesis of nanooxides with given average sizes and phase compositions were determined. By conducting the desirable oxidation reactions in a dc applied electric field the associated magnetic properties of the particles were improved. Such materials have promising applications in biomedicine, smart micro devices like gas sensors, electromagnetic field detectors and magnetic recording media.

*O.S.A.7*

# DEVELOPMENT OF MICROWAVE METHODS OF SYNTHESIS OF COORDINATION COMPOUNDS FOR CVD PROCESSES AND FOR OBTAINING OF NANOMATERIALS

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Microwave irradiation is becoming an increasingly popular method of heating samples in scientific laboratories. Effectiveness of microwave heating strongly depends on dielectric behavior of material, on polarity of molecules, on availability ions in system. Thus effectiveness of microwave action on reaction mixtures of various nature and composition will not be identical. Besides, chemical transformations can to occur not only in flow homogeneous medium, but in heterogeneous medium ("solid –liquid") too. Dielectric behavior of medium is able to change during chemical reaction as well. Changing of traditional heating on microwave activation of chemical reactions can lead to quantitative and qualitative different results. Nowadays there is evident insufficiency of experimental data and fundamental representation on microwave synthesis of coordination metal compounds.

This work is devoted to development of new methods of synthesis of volatile beta-diketonates of precious and transition metals using microwave activation to decrease time and energy consumption, and to increase the yield of target products. The reason to start study on these objects is their practical significance and obtaining new fundamental knowledge of physicochemical processes under the effect of microwave activation. First of all, attention was paid to the development of the microwave synthesis of the target products for CVD processes which is difficult to be synthesized by means of usual chemistry involving solutions, due to low yields and long times of chemical transformations. We investigated the possibility of realization of the new routes of chemical transformations as for standard reaction mixtures as for new version of the mixtures of initial components, including those for solution-free technological decisions. The possibilities of new methods to synthesize organometallic compounds involving the processes in the systems "liquid – solid" under active microwave action are revealed. We obtained experimental data on decomposition of volatile metal diketonates in a porous base under microwave action for the purpose of formation of low-sized metal particles as perspective catalyst system.

The achievement of the formulated goals will enable us to set right up to the development of efficient methods of synthesis of new complexes of metals with organic ligands, as well as methods of purposeful obtaining target products with the use of active control of the rate and selectivity of chemical processes under microwave action.

*O.S.A.8*

# HOW CAN MECHANOCHEMISTRY BE USED TO PRODUCE PHARMACEUTICAL SUBSTANCES?

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Mechanochemistry has been used in pharmacy for centuries. A grinding of ingredients in a mortar to prepare a drug has been really a mechanochemical procedure. Nowadays mechanochemistry can be used practically on every stage of remedies preparation. In our research we use mechanochemical approach for isolation of certain natural products, for the dry synthesis of drugs and modifying of their properties. Biologically active compounds (BACs) obtained from medicinal plants are known to be the basis for many remedies. Generally, a synthetic way of BACs production is difficult and unprofitable because of complexity of chemical structures of these compounds. It is the reason why BACs are extracted from plant raw material up to now. This technology requires high consumption of toxic organic solvents produces detrimental waste and becomes environmentally unsafe. Therefore scientists are working to search new effective methods of isolation BACs important to pharmacy from the natural sources. We suggest a new method of solidphase mechanochemical isolation based on combined mechanical grinding of a plant raw material and solid substances of the appropriate chemical nature. As a result of such processing BAC effectively interact with solid substance or is adsorbed on it. The following work-up with minimal quantity of an organic solvent or water allows obtain a concentrated solution of a BAC, which can be easily isolate, purify or dry. We have successfully demonstrated the application of mechanochemical "solidphase extraction" for isolation of natural products, which are important for pharmacy, such alkaloids as lappaconitine (the antiarrhythmic drug "Allapininum" was produced on its base), berberine which is the active component of the "Berberine bisulfate" remedy with hepatoprotecting characteristics, theobromine with cardio-stimulating properties and the natural products such as alantolactones with high anti-microbe and anti-helminthic activity. The yield of BACs obtained under mechanochemical technique is 1.5 –2 times higher than under the usual method. In our research we use mechanical treatment for the solvent-free synthesis of drugs too. Mechanochemical solvent-free reactions have many advantages over commonly applied procedures. These factors are important in industry and help to solve environmental problems. We develop a mechanochemical approach for synthesis of pharmaceutically promising new acyl derivatives of non-steroidal anti-inflammatory agent piroxicam to improve their therapeutic properties. Moreover, mechanochemistry can be used for modifying the properties and bioavailability of drugs through producing amorphous, metastable or zwitterionic states with higher biological activity.

*O.S.A.9*

## MECHANOCHEMICAL SYNTHESIS OF NANOCOMPOSITES OF DRUGS WITH INORGANIC OXIDES

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The nanocomposites of piroxicam and indomethacin with fine porous inorganic oxides, alumina, silica, and magnesia, containing the drugs in X-ray amorphous state were obtained by co-grinding. Except of piroxicam - alumina system, the composites revealed higher rate of dissolution and solubility of the drugs with respect to the initial ones. Under heating or storing the composites, the yellow color of the samples attributed to transformation of piroxicam into zwitter-ionic form was preserved. The observed changes in the IR spectra suggested the interaction of the components during co-grinding. It appears that the formation of new bonds at the contact of particles in the composite leads to stabilization of drugs in metastable state inhibiting their crystallization and transition into initial crystalline form.

*O.S.A.10*

## ACTIVATED ALUMINIUM AS A SOURSE OF PURE HYDRIGEN

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The purpose of this work was to study chemical interaction of the In-Ga eutectic with Al and Al-based alloys. A number of physicochemical characterization techniques were used with the aim of gaining information about the mechanism of this interaction and the processes responsible for the subsequent disintegration of the material and its dissolution in water with the formation of pure hydrogen. Subsequent grain-boundary and volume diffusion of liquid In–Ga mixture into aluminum or its alloys gives rise to the embrittlement of the material and drastically increases its reactivity relative to water. We carried out tensile strength tests on aluminum plates. Specimens that were not activated with liquid In–Ga mixture revealed a well-defined plastic zone. The plastic strain of activated aluminum was substantially lower. The tensile strength of aluminum as a function of activation temperature was also examined.

*O.S.A.11*

## NEW ENERGETIC MATERIALS: METAL- OXIDIZER MECHANOACTIVATED NANO COMPOSITES

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The procedure was developed for manufacturing the mechanoactivated energetic composites (MAEC) Me/Oxidizer (Me=Al, Mg; Oxidizer = Teflon (Tf,), $MoO_3$, $Sb_2O_3$, etc.) with nano-(or sub micro) sized components of energetic materials. The optimal MAEC compositions and the doses of mechanical treatment were determined, the MAEC structure was investigated, and the MAEC properties in burning and shock-induced processes were studied. The experiments on burning showed high velocities (up to 300 - 400 m/s) and temperature (up to 4000 K for Mg/Tf and Mg/$MoO_3$). The obtained results on detonation had demonstrated the possibility of reaching the steady detonation regime in the Al/Tf and Mg/Tf MAEC (detonation velocity up to 1300 m/s), in which the end products of detonation were in the condensed state.

*O.S.A.12*

## NEW APPROACH TO COMBUSTION SYNTHESIS OF FERRITES MATERIALS FOR ELECTROMAGNETIC APPLICATIONS

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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 fulfillment 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.13*

# THERMO-MECHANICAL PROCESSING BY LASER IN MULTIPHASE STEELS

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The investigations deal with processes leading to local bake hardening (BH) effects in multiphase steels. Multiphase steels are characterized by good formability, continuous yielding, high strength and bake hardening effect. Dual phase (DP) and complex phase (CP) steel are under investigation to examine the effect of thermo-mechanical processing parameters on local ageing ability. For this purpose local heat treatment by Nd:YAG laser are studied, as well as ageing stability of the adjusted strength. The local heat treatment leads to an improvement of hardness and strength and to local strengthening of material. The stability of the local strengthening effect could be confirmed. Partial heat treatment of multiphase steels by laser seems to open a new field of application for the local use of the bake hardening effect. The chance is given to influence relevant areas only, thus representing a potential for energy-saving.

*O.S.A.14*

# ALTERNATIVE STAINLESS STEEL GRADES – A EUROPEAN RESPONSE TO HIGHER RAW MATERIAL PRICES

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With the term stainless steels an iron based alloy with minimum 10.5 % Cr and maximum 1.2 % C is described. There are over 200 different stainless steel grades available and one can choose among a wide range of options for a given application.

The most important properties of stainless steels are corrosion resistance, aesthetic appearance, recyclability, biological neutrality and low life cycle costs. The stainless steel family consists of several branches: austenitic, ferritic, martensitic, duplex and precipitation hardening stainless steel.

For several decades the ratio between Cr-Ni austenitics and other steel families remained unchanged and austenitic steel grades strongly dominated the market, because of their good corrosion resistance, ease of fabrication, formability and welding. Two universal steel grades were 1.4301/1.4307 and 1.4401/1.4404 (304/304L and 316/316L).

In the last two years we were faced with increasing raw materials prices for nickel, molybdenum, ferro-chromium, all of them being used in stainless steel production. Higher and extremely volatile prices of alloying element resulted in increased and unstable prices for the users. Due to relatively high Ni content in Cr-Ni austenitic stainless steels, new alternative grades were developed and introduced into the market. The common attribute of the new stainless steel grades are lower prices when compared with Cr-Ni austenitic stainless steels. In most cases that mean adjustment of fabrication processes for users, because of different mechanical, physical or corrosion properties.

The focus of all European stainless steel producers is to make available lower-cost solutions for existing and new applications, where appropriate. Some new alternative steel grades will be presented, including ferritic, duplex and Cr-Mn austenitic stainless steels.

*PL.S.II.1*

## INTRINSIC AND EXTRINSIC DEFECTS IN COLLOIDAL PHOTONIC CRYSTAL FILMS

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Since the proposal of photonic crystal theory in 1987, a large experimental effort has been made to design and fabricate dielectric materials that are structurally periodic on the scale of optical wavelengths. One promising category of photonic crystals are self-assembled colloidal crystal films, which can be grown in a facile and inexpensive manner relative to other forms of photonic crystal. This material, which consists of a close-packed lattice of colloidal spheres, can serve as a template for the infiltration of a material of higher refractive index, such as silicon, for the formation of a material possessing a complete photonic band gap (PBG).

However, the self-assembled nature of colloidal crystal films creates the opportunity for the formation of intrinsic defects. Such defects, disruptions in the periodicity of the colloidal lattice, can be expected to have an influence on the optical properties of this photonic material.

In this work, various intrinsically-formed defects are structurally analyzed by various microscopy techniques. Similarities are drawn between defects in both colloidal and atomic lattices. The optical properties of lattice defects are then individually measured through careful spatially resolved micro-optical spectroscopy. Point, line, and volume defects are found to contribute to incoherent scattering, and the measured optical spectra are shown to be in good agreement with finite-difference time-domain simulations. In all cases, the influence of such defects on the fundamental stop-band is negligible, while influences on the "higher-band" region of the band structure and the PBG are shown to be significant.

Stacking faults, another form of intrinsic defect consisting of variations in the stacking of close packed planes, are shown to occur readily in colloidal crystal films. Through structural and spectroscopic analysis, it is shown that different stacking sequences are associated with a unique optical spectrum. These spectra differ in the higher-band region of the band structure, while leaving the fundamental stopgap unaffected. Additionally, stacking faults are shown to be caused by the incorporation of differently-sized impurity spheres in the lattice, a hard-sphere type mechanism analogous to atomic systems.

Defects can also be deliberately introduced to the colloidal lattice, and through proper design and fabrication can bring desirable photonic functionality to an otherwise bulk, periodic lattice. A fabrication method combining *top-down* photolithographic patterning with *bottom-up* self-assembly for the insertion of embedded linear extrinsic defects into the colloidal lattice is presented.

For the first time, a study of individual lattice defects has been successfully carried out in colloidal crystal photonic crystal films. By better understanding of the structure, optical properties, and formation mechanisms of colloidal crystal defects, the quality of self-assembled photonic crystal films can be improved, resulting in more homogeneous optical properties and allowing the full potential of colloidal photonic crystals to be realized.

*PL.S.II.2*

# CORDIERITE GLASS CERAMICS STUDIED BY X-RAY SCATTERING AND ELECTRON MICROSCOPY

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Glass ceramics are materials composed of a glassy matrix in which nano to micro sized crystallites are embedded. They can exhibit rather special materials properties like for instance low thermal expansion, mechanical shock resistance even at elevated temperatures and act as a low band pass optical filter. The material properties are due to a fine interplay between the differences in the properties of the different phases making up this composite material.

There are several ways in which these materials can be produced but the actual process of formation is still not completely understood even though these materials are widely applied in commercial applications.

We have studied the formation of crystallites in a model glass by X-ray scattering and electron microscopy methods. The glass has the cordierite composition ($Mg_2Al_4Si_5O_{18}$) doped with a small amount (0.34 mol%) of $Cr_2O_3$ which acts as a crystallization enhancer and is subjected to a two step heat treatment. The first step allows the formation of crystallization nucleation sites. The subsequent step, at a higher temperature, allows the nuclei to start growing. By utilizing time-resolved simultaneous SAXS and WAXS we have been able to elucidate the full growth process and make predictions about the final structure that were confirmed by electron microscopy. By utilizing the above mentioned techniques we have been able to distinguish between bulk and surface crystallization, determine the crystalline volume fraction, determine the crystallization energy, the shape and size of the crystalline particles and the internal pressure exerted by the glass matrix onto the crystallites.

We have been able to show that the samples grown in this way are still mainly glass but that the surface consists of a high quartz phase. In the bulk cubic Cr-spinel crystallites with a size polydispersity of less then 4% are found.

*PL.S.II.3*

# RECENT ADVANCES IN TUNABLE MATERIALS DEVELOPMENT

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Voltage-tunable materials play a major role in advanced communication systems, as phase shifters, tunable filters, tunable capacitors, etc. Their implementation requires a distinctive dependence of the dielectric constant on the DC-bias field, i.e., high tunability, as well as low dielectric losses, a low dielectric constant and temperature-stable performance. A great many investigations in the field have focused on paraelectric modifications near the ferroelectric transitions of the displacive type, in particular on $(Ba_{1-x}Sr_x)TiO_3$. However, the tunability of ferroelectrics increases with the dielectric constant and therefore the above requirements are contradictory for pure compounds. Therefore, various $(Ba_{1-x}Sr_x)TiO_3$-based composites have been investigated, which partially overcome some of the drawbacks.

We focused our investigation of tunable materials on ferroelectrics of the relaxor type, in particular on $Na_{0.5}Bi_{0.5}TiO_3$. The temperatures of the $Na_{0.5}Bi_{0.5}TiO_3$ phase transitions and thus the intensities of the dielectric relaxations were modified by the addition of various incipient-type ferroelectric compounds. Improved figures of merit were obtained for samples with increased additive concentrations, which are macroscopically cubic, have paraelectric polar order and show low-temperature dielectric relaxations. The enhanced characteristics of the samples are also expressed by the exceptionally high nonlinear coefficients β, which might be related to the dynamics of the nanosized polar regions present in the samples and their composite nature. In the contribution the voltage-tunable characteristics of the samples will be correlated with their microstructure and stoichiometry as well.

*PL.S.II.4*

# INTERFACIAL SOLID-STATE PROCESS CONTROL FOR MICRO- AND NANOCOMPOSITES

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Significance of controlling interfacial processes for affordable fabrication of smart composite materials is overviewed. One of the key issues is charge transfer across the boundary of dissimilar solid particles that takes place at room temperature under open air. Charge transfer processes are accelerated by enhanced polarization and structural anomaly at near-interface region. These two factors interplay with each other when a solid mixture is subjected to mechanical stressing. Optimization of operation conditions is best done by choosing appropriate combination of starting species and use of moderate mechanical stressing. Case studies, based on the recent experimental works in the author's own laboratory, will cover electroceramic composite oxides, apatite-based bioaffinitive nanocomposites, organic syntheses by a solid-state Diels-Alder reaction, and drug-excipient complexes. Discussion is mostly based on physicochemical viewpoints at solid interfaces. Application for industry is referred by taking a balance between product quality and green chemical processing.

*PL.S.II.5*

# PROCESSING OF POLYMER MATRIX NANOCOMPOSITES

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Carbon nanotubes (CNTs) are carbon structures with extraordinary mechanical, chemical and electrical properties. These unique properties make CNTs potentially valuable in a wide range of end-use applications. In particular, the use of CNT as nanofillers of thermoplastic and thermosetting polymer matrices allows the production of innovative materials with breakthrough structural and functional properties. However, the achievement of these properties requires a careful definition of processing routes and conditions able to produce nanocomposites with designed and controlled nanofiller dispersion, orientation and alignement. It is the aim of this research work to consider the approaches to controlled processing and chemical functionalization of CNT and to account for the advances that have been produced so far in the processing of these innovative materials.

Due to their exceptional mechanical, thermal and electrical properties, carbon nanotubes (CNTs) are extremely promising for the development of high performance nanostructured materials. Since their discovery in 1993 the research in this exciting field has been in continuous evolution, being most of the research focused on the assessment of the CNT properties and the development of advanced structural composites based on CNTs. Single-walled carbon nanotubes (SWNTs) are considered as the simplest member of the family of CNTs, consisting of one graphitic sheet, which has been rolled up into a cylindrical shape. Depending on the arrangement of the hexagon rings along the tubular surface, CNT can be metallic or semiconducting. However, the incorporation of nanotubes is not a trivial task mainly if a good dispersion for a chemical grafting to the polymer matrix are mandatory to maximize the advantage of nanotube reinforcement. In fact, the affinity to adhere to each other, renders as-grown SWNTs intractable and indispersable in common solvents.

On the other hand, it has been demonstrated that CNT can be made soluble when they interact with different classes of compounds. The key challenges that are in the way of realizing composites made out of carbon nanotubes are securing a reliable control over their surface chemistry through either covalent or non-covalent modification and achieving dispersion.

In this project we report some examples of nanocomposites with CNTs highlighting a meshwork of interactions between the mechanical, electrical and optical properties of CNTs and the interface with the polymer matrix with the aim to offer an overview on the approaches of processing and chemical functionalization of CNTs and to account for the advances that have been produced so far.

The use of electrical and magnetic fields as processing aids for the production of aligned nanocomposites is also reported.

*PL.S.II.6*

# SYNTHESIS AND IONIC CONDUCTIVITY OF NANOCRISTALLINE Y-DOPED $Bi_2O_3$ THIN FILMS

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The. $\delta$-$Bi_2O_3$ phase is of considerable potential technological importance because this phase adopts an anion–deficient fluorite structure, with a concentration of oxygen vacancies close to 25 mol %. Consequently, this phase has an exceptionally high ionic conductivity, on the order of 1 $ohm^{-1}cm^{-1}$. Unfortunately, this structure is stable over a narrow range of temperature (729<T<825°C). To stabilize the $\delta$-form at lower temperatures the most widely used method consists of doping $Bi_2O_3$ with large amounts of trivalent or heterovalent cations. In this work, dense nanocrystallized Y-doped $Bi_2O_3$ films were prepared by means of pulsed laser deposition method (PLD). The depositions were carried out in an oxygen atmosphere using a Nd-YAG laser with wavelength of 355 nm and laser fluency ranging from 8 $J/cm^2$ to 12 $J/cm^2$. Scanning and transmission electron microscopy, as well as X-Ray diffraction were used to characterize the films. Depending of the deposition time, the film thickness varied from 140 to 240 nm and the grain sizes from 5 to 30nm.

The electrical conductivity was investigated by impedance spectroscopy. Measurements were conducted in the temperature range of 24-430 °C and for oxygen partial pressures included between 1 atm and $10^{-5}$ atm. The obtained values are one order of magnitude higher compared to those proposed for pure microcrystalline $\delta$-$Bi_2O_3$ polycrystals, due likely to grain size effects. They do not varied with the oxygen partial pressure and a plot of $\ln\sigma T$ vs $T^{-1}$ yields activation energy of $Ea \approx 0.29$ eV. Furthermore, it is important to point out that the nanostructured Y-doped $Bi_2O_3$ thin films exhibit an ionic conductivity about five order of magnitude higher compared to Gd-doped ceria polycrystals.

*PL.S.II.7*

# NANO-STRUCTURED MATERIALS DEVELOPED BY CONTROLLED PHASE TRANSFORMATIONS AND SYNTHESIS PROCESSES

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One of the major goals of Materials Science is to design alloys with pre-specified, desirable, technological properties. To reach this goal it is necessary to have a thorough understanding of the fundamental mechanism underline materials behavior. Of central importance is the understanding the effects on materials properties as response of changes in composition and how combination of processing parameters, such as temperature, time, and applied deformation affect the microstructure. In addition to the equilibrium phase to the information available in phase diagrams, non-equilibrium dynamic processes and meta-stable phases are known to be crucial in determining materials properties. Diffusion-controlled nucleation and growth processes affect long-term phases and micro structural stability. A comprehensive understanding of the basic, underlying phenomena is indispensable in controlling these factors.

Given the above mentioned perspective, this contribution will address a variety of phase transformations taking place in the solid state, as a mechanism for tailoring materials structure at the nano and micro scales. For the purpose of a phenomenological treatment, it is common to consider two major categories of diffusional phase transformations: transformations controlled by interphase diffusion and those controlled by lattice diffusion. The former correspond to classical heterogeneous and segregation phenomena at stationery grain boundaries and also to discontinuous precipitation, coarsening and dissolution processes in polycrystalline alloys. The latter is related to a number of homogeneous transformations such as meta-stable precipitation, spinodal decomposition and ordering reactions. After presenting the fundamentals underline the above mentioned phenomena, a number of examples will be presented as occurring in metallic and ceramic systems of a technological importance. It will be shown, by means of well-documented examples that the application of analytical electron microscopy (AEM) and high-resolution of electron microscopy (HREM) allows one to obtain, respectively, nano-scale compositional data together with structural information, down to the atomic level. The synthesis, processing and characterization procedures apply to these materials will, thereby, be presented based on worked examples aiming at illustrating the control of phase transformations at the nano-scale level together with the physical and mechanical properties of structural materials and devices. Several examples of research on these guide lines, currently in progress in our laboratory, will be presented.

*O.S.B.1*

# SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS OF HIGH-TEMPERATURE SUPERCONDUCTORS (SHS HTSC)

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A wide range of known oxide high-$T_c$ superconductors (HTSC) including Bi- and Tl-based ones have been obtained by SHS. Mechanisms of phase and structure formation in both the "classical" $Y_{123}$ with $T_c \sim 91K$, as well as in isostructural rare-earth based compounds ($LnBa_2Cu_3O_{7-x}$, Ln = Y or rare-earth) were studied. The maximum $T_c$ achieved for SHS produced materials is at present 115 K for Tl-based ones ($Tl_2Ba_2Ca_2Cu_3O_x$). Besides the pure structures the alkaline or transition metals doped HTSC have been synthesized by using an external (air, balloon etc.) oxygen source and by using only internal solid oxidizers such as alkaline or alkaline-earth superoxides, peroxides and perchlorates. Combustion synthesis of HTSC $YBa_2Cu_3O_{7-x}$ under constant electric fields up to 500 kV/m has also been studied by using only internal solid oxidizers. The thermal programmed desorption (TPD) method with associated mass-spectrometry (MS) was used to measure the oxygen and water release from SHS made HTSC $Y_{123}$ powder. Measurements were made both before and after treatment in gaseous hydrogen or fluorine over the range 293-973 K. Possible mechanisms of oxygen desorption, leading to the reduction of superconducting properties as well as the reasons of complex TPD spectra characteristics for hydrated or fluorinated ceramic are discussed. The $T_c$ dependence on oxygen content, particle sizes, synthesis and treatment conditions (including ultrasonic and organic treatment) are also presented for SHS produced HTSC. The process of using pure sodium perchlorate decomposition (as widely used as an internal solid oxidizer in the SHS-processes) under conditions of contactless electric fields (up to 220 kV/m) was quantitatively characterized for the first time. It was established that the maximum thermal release and thermal effect of the perchlorate decomposition process was increased under electric fields of any voltage. Thus, a hypothesis regarding the influence of electric fields on the process of solid oxidizers decomposition and the intensification of oxygen release under electric fields in SHS processes were quantitatively and qualitatively determined. SHS produced HTSC powders are used to manufacture targets for magnetron spraying and shields. The 1 mm thick films made from this powder exhibit a critical current density up to $10^6$ A/cm$^2$. The laboratory (1 ton/year) and pilot-scale (up to 10 ton/year) facilities has been introduced in ISMAN and other plants as a result of our experimental discovery.

*O.S.B.2*

# ELECTRODE MATERIALS DISPERSION-STRENGTHENED WITH NANOPARTICLES FOR PULSE ELECTROSPARK DEPOSITION (PED) OF MULTIFUNCTIONAL COATINGS

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Nanoparticles dispersion-strengthened electrode materials for PED based on titanium carbide and diboride with modified structure were developed and applied. Electrode materials were produced by SHS (self-propagating high-temperature synthesis) technique using focused alloying by refractory compounds nanoparticles which are modificators affected to the process of structure formation thought the liquid phase and lock the recrystallization. Another group of nanostructured electrode materials based on tungsten carbide was also developed and applied in PED technology. Mechanisms of the effect of nanoparticles addition on phase and structure formation are discussed. The macrokinetics of the combustion process, phase composition, structure, physical and mechanical properties of new SHS-electrode materials were studied. The follow requirements to electrodes are proposed: high volume of grain boundaries; average grain size of refractory compound phases could be around 100 nm or less; nanosized particles must be distributed homogenously on the grain boundaries around refractory phases; refractory compound phases of electrode material could be wetted by the melt of substrate metal. Coatings deposited by PED using dispersion-strengthened and nanostructured electrode materials on different substrates (Ti-, Ni-, Fe- alloy) has a raised hardness, elastic recovery, adhesion strength to substrate, wear and heat resistance, and reduced friction coefficient. Simulations of the polarity mass-transfer coefficient in electrospark discharge for micro- and nanostructured electrode materials were carried out using Palatnik's criteria. Phase- and structure formation mechanism of coatings are discussed. Coatings thickness more than 50 microns at high density up to 100 % and lower roughness were achieved due to high erosion capability of new SHS-electrode materials (anodes) at high frequency and respectively lower pulse discharge energy of the deposition process. SHS-electrode materials have already found successful industrial application in PED technology for strengthening of different instruments like die blocks, forming rolls, cutters, and machine parts, for example, exhaust Ti-alloy valves in internal-combustion engines. Recently, TiC- based electrode materials containing nanosized powder additives were applied for modification of the surface of Ti-alloy components used in the air-conditioning system of aircrafts. At present, flight tests are in progress.

*O.S.B.3*

## METALLIC GLASS-TUNGSTEN COMPOSITES

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Preparation of a Zr-based metallic glass-W composite is investigated. Metallic glasses exhibit unique mechanical properties: high strength (1.5 GPa) and Young modulus (90 GPa). But a low ductility limits their structural applications. The tungsten undergoes plastic deformation and obviously enhances density. An attempt is made to use the viscous flow behaviour of the amorphous alloys at high temperature to form a sintered composite. Mechanical milling and atomisation techniques were used to prepare the glass powders. Pressure assisted compaction and sintering of the mixed powders were carried out at high temperature. In addition spark plasma sintering was used, which allows limiting sintering time then restraining the crystallisation of the matrix. The mechanical behaviour of the composite was studied in relation with their microstructure.

*O.S.B.4*

## STRUCTURAL AND LUMINESCENT PROPERTIES OF $Y_4Al_2O_9$ (YAM*)* NANOCRYSTALS OBTAINED VIA SOL-GEL METHOD

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In this work, we have succeeded in preparing of nanopowders YAM: pure, doped by Nd, Yb, codoped by Nd and Yb cations via modified sol-gel method. The obtained nanopowders had crystalline structure confirmed by XRD method. The size and morphology of nanopowders were analyzed by SEM and HRSEM. The average size of crystallites was 60 nm. Excitation and luminescence spectra of YAM powders were recorded. Spectra recorded for YAM:Nd show that the $Nd^{3+}$ ions occupy two types of sites in this matrix. Findings obtained for YAM:Nd, Yb implies an occurrence of efficient transfer of excitation energy between Yb and Nd cations.

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*O.S.B.5*

## THE EFFECT OF CHLORIDE AND WATER ON THE CORROSION OF COPPER IN 1-BUTYL-3-METHYLIMIDAZOLIUM TETRAFLUOROBORATE

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Low temperature ionic liquids have been discussed in terms of their technological applications, but their reactivity with metals has seldom been visited. Corrosion of metals is an important factor which should be considered with respect to practical applications of low temperature ionic liquids. In the present study the linear polarization method was applied to study the effect of chloride and water on the corrosion of copper in 1-butyl-3-methylimidazolium tetrafluoroborate. The density of corrosion current was measured and anodic polarization curves were analyzed. The ionic liquid contained 0.87, 1.33, and 1.78 % of Cl and 1.07, 3.38, and 4.91 % of water by mass. Moreover a sample containing simultaneously water (1.3 %) and Cl (0.87 % by mass) and a water- and chloride-free sample have been studied. The electrochemical measurements were carried out at 25, 35 and 50 $^{o}$C. Copper is resistive to corrosion in dry and chloride-free 1-butyl-3-methylimidazolium tetrafluoroborates over the entire studied temperature range. According to the expectation the rate of corrosion in enhanced at elevated temperature, and in the presence or Cl or of water. The activation energy of corrosion is 44 kJ/mole in a water- and chloride-free ionic liquid, and 18 kJ/mole in the ionic liquid containing simultaneously water and Cl. Water of Cl separately also depress the activation energy, but the effect is less significant (30 kJ/mole in the presence of 1.78 % of Cl or 4.91 % of water).

*O.S.B.6*

## ELECTROCHEMICAL BEHAVIOR OF $Li_{3-x}M1_xV_{2-y}M2_y(PO_4)_3$ (M1=K, M2=Sc) /C COMPOSITE CATHODE MATERIAL FOR LITHIUM-ION BATTERIES

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Lithium conducting phosphates, $Li_3M_2(PO_4)$, (LVP) and materials based on these compounds have emerged as promising candidates for cathode materials for lithium batteries. The reversible cycling of $Li_3V_2(PO_4)_3$ would correspond to a theoretical capacity of 197 mAh/g. In this work solid solutions $Li_{3-x}M1_xV_{2-y}M2_y(PO_4)_3$ (M1=K, M2=Sc) were obtained using a two-stage solid state reaction from $LiOH{\cdot}H_2O$, $V_2O_5$, $(NH_4)_2HPO_4$ in the presence of reducing agents in (Ar+6%$H_2$) atmosphere. The samples consisted of single phase LVP with monoclinic $P2_1/n$ structure and contained carbon. The electrochemical cycling of the samples as cathode materials was carried out. Four plateaus were observed at average voltages of 3.6-3.8 and 4.0-4.1 V with the total charge capacity of 80-120 mAh/g. The influence of cationic substitutions upon properties of LVP is analyzed and discussed.

*O.S.B.7*

## ELECTROCHEMICAL PROPERTIES OF COMPOSITE SOLID ELECTROLYTES $LiClO_4$-MgO

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Composite solid electrolytes (CSE) of type $Li_nX$ - A where X - anion, A –dispersed oxide, are known to be good cationic conductors. In this work CSE in the binary system $LiClO_4$ – MgO (the specific surface area $S_s = 5 – 200\ m^2/g$) were synthesized and their structural, thermodynamic and electrical properties investigated. It was shown, that $LiClO_4$ is characterized by good adhesion and easily spreads on MgO surface with formation of composites. The conductivity increases with the specific surface area and reaches the maximum of ~ $10^{-2}$ S/cm at $200^oC$ for 80-90 m/o (40-50 v/o) MgO ($S_s = 200\ m^2/g$). Similar behavior is typical for CSE where the conductivity occurs via ionic salt-oxide interface regions. Comparison of ac-conductivities and volt-ampere dependences measured in dry and humid atmospheres suggests that the conductivity is governed by lithium cations.

*O.S.B.8*

## STRUCTURAL, PHYSICAL AND ELECTRICAL PROPERTIES OF IRON DOPED VANADIUM BORATE GLASSES

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The structural, physical and electrical properties of $xFe_2O_3\ (40-x)\ B_2O_3\ 60V_2O_5\ (0 \leq x \leq 20)$ glass system have been investigated. The samples were prepared by normal melt-quench technique. The structural changes were inferred by means of FTIR spectroscopic technique by monitoring the IR spectra in the spectral range 600-4000 $cm^{-1}$. No boroxol ring formation was observed in the structure of these glasses. The absence of boroxol ring (806 $cm^{-1}$) suggests that the present glass system consist of randomly connected $BO_3$ and $BO_4$ units. The conversion of $BO_3$ to $BO_4$ and $VO_5$ to $VO_4$ tetrahedra along with the formation of non-bridging oxygen's attached to boron and vanadium takes place in the glasses under investigation. The density and molar volume of the present glass system are found to depend on $Fe_2O_3$ content. DC conductivity of the glass system has been determined in the temperature range 310-500 K. It has been observed that the general behavior of electrical conductivity is similar for all glass composition and found to increase with iron content ($x$) as well as with temperature. The parameters such as activation energy, polaron radius and average separation between transition metal ions have been calculated in adiabatic region and are found reasonable and consistent with Mott's model of phonon-assisted polaronic hopping.
Keywords: Vandate borate glasses, Semiconductors, FT-IR, Electrical properties.

*O.S.B.9*

# THERMODYNAMIC PROPERTIES OF LIQUID TRANSITION METALS AND ALLOYS FROM INTERATOMIC PAIR INTERACTIONS

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In the present study, the Wills-Harrison approach for the effective pair interaction between atoms is applied to the description of liquid transition metals and their binary alloys. Within that formalism the Oli-Bretonnet-Silbert local model pseudopotential, which takes into account the *s-d* hybridization, is used. Then, obtained pair potentials are used in the framework of the thermodynamic perturbation theory to calculate the thermodynamic properties of Fe, Co, and Fe-Co melts. The agreement with the experimental data is quite satisfactory.

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*O.S.B.10*

# FLUORINE INFLUENCE ON ANODIC FILM COMPOSITION AND SURFACE MORFOLOGY OF InAs (III)A

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Properties of MIS-structures on $A_3B_5$ with silicon dioxide as a dielectric depend greatly on surface cleaning and modification. We have shown earlier that introduction of the fluorine component in electrolytes during anodic oxidation of InAs leads to decreasing of the density of surface states ($N_{ss}$) in InAs-$SiO_2$-$In_2O_3$ structures from ~$10^{12}$ $cm^{-2}eV^{-1}$ down to < $5\cdot10^{10}$ $cm^{-2}eV^{-1}$. The focus of our research was the study fluorine influence on the composition of thin (5-15nm) anodic oxides (AO) on InAs and understanding the cause of lowering $N_{ss}$ on the basis of difference in composition of anodic layers. Oxidation were formed in basic aqueous (pH=11.5) and acidic waterless (pH=1.5) electrolytes. The composition of oxide films was studied by XPS on the setup of the surface analysis LAS-3000 facility furnished with electrometer MAC-2 with Mg anode (hν=1253.6 eV) and VG ESCALAB HP spectrometer with Al anode (hν=1486.6 eV). The surface morphology was studied with atomic force microscopy (AFM, Solver P-47H) using semicontact topographic and phase contrast regimes. The morphology of substrates consists of monoatomic steps and step bunches. It was found that the chemical treatment influenced on the morphology of epitaxially grown films, whereas anodic oxidation covered the surface without changes of morphology and roughness of the substrate surface. Anodic film composition obtained in the fluorine containing electrolytes strongly differs from the one formed in the electrolyte without fluorine. For example, the films obtained in basic electrolyte without fluorine consist of $In_2O_3$ and $As_2O_3$. Anodic oxide formed in fluorine contained electrolyte consists of $InF_3$ and $AsOF_3$. The composition of the oxide is affected by pH of the electrolyte. The obtained results have been justified on the basis of thermodynamic and kinetic factors of combination of InAs oxidation and dissolution of anodic film components. $As_2O_3$ component has nonbonding occupied orbital that act as hole trap at the interface. Oxidation of the arsenic molecule to a pentavalent state would remove these dangling bonds and might produce a chemically stable InAs-AO interface with the low density of the surface states. In addition, formation of As (V) oxyfluoride on the interface leads to the situation as if the "electronic" structure characteristic of the bulk of the semiconductor is expanded

*O.S.B.11*

## SELF-SIMILAR SOLIDIFICATION OF BYNARY ALLOYS

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We present a mathematical model for mushy region which often forms during the solidification of alloys. Mathematical analyses of solidification are complicated by the need to apply boundary conditions at solid/mushy and mushy/liquid interfaces. In this paper we present a comparison of numerical calculations and approximate analytical solution of the model describing the self-similar regime of solidification.

*O.S.B.12*

## THE CHARACTERIZATION OF DEFECTS IN MULTI-LAYERED COMPOSITE MATERIALS BY THERMAL TOMOGRAPHY METHODS

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In medical diagnostics the tomography is used for examining body organs by scanning them with X rays and using a computer to construct a series of cross-sectional scans along a single axis. The idea of thermal tomography is to slice the specimen along depth layers corresponding to the distribution of thermal properties at specific depths by analogy with X-ray tomography. Thermal tomography is based on the surface temperature evolution of the component inspected following the initial thermal perturbation. Thermal stimulation of the specimen is realized by pulse heating with duration ranging from a few milliseconds for high-conductivity material (metal) to a few seconds for low-conductivity samples (composite material). The stimulation source must stay nondestructive and thus must not damage the inspected surface. The temperature distribution on the surface of testing sample is recorded with an infrared camera. The thermal tomography uses the standard procedures of nondestructive thermal testing but processing of the thermogram sequence is an essence of the method.

The thermal tomography makes possible to:

- Perform the slice analysis of testing object
- Decrease influence of surface noises on thermogram quality
- Improve detection of hidden defects
- Define the depth of defects with a satisfactory precision.

In the paper the exemplary characterization of defects in multi-layered Carbon Fibre Reinforced Plastic specimen (the plate contained Teflon square inclusions of different lateral sizes and depths) is presented to illustrate the efficiency of two thermal tomography methods. The "classic" method uses the pattern and the second method uses the thermal model of temperature behavior in zones without defects, instead.

*O.S.B.13*

# USE OF THE POWDER LIQUID METHOD FOR ALUMINIDE DIFFUSION COATINGS FORMATION ON INCONEL 713lc Ni-BASED SUPERALLOY

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The powder liquid method was used for aluminide diffusion coatings formation on the Inconel 713LC nickel based superalloy. Two different powder mixtures (Al and Al+Si) in organic binder solution were prepared. Deposition of the coatings onto the substrate surface was done by spraying. Two-stage heat treatment under the argon-flow atmosphere was designed. First stage (200°C) was used to decompose organic binder. In the second stage (1000°C) elements from the coating interact with the substrate. Protective intermetallic layer and an interaction zone between the layer and substrate starts to form. Elements interaction and phase transformations during annealing at 1000°C up to 10hrs were studied. For this study the light microscopy, scanning electron microscopy, energy dispersive microanalysis, microhardness measurement and image analysis methods were used.

*O.S.B.14*

# AN EXPERIMENTAL STUDY OF RESIDUAL STRESSES INDUCED IN COMPOSITE PRESSURE VESSELS (CPV)

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The advantages and superior properties of composite materials made it more popular in its usage and they started to replace all other materials such as ferrous or non- ferrous, especially in the last two decades. The composite materials were started to be used extensively in aerospace and aeronautics fields, because the composites have high strength and stiffness to weight ratios. Hence, they are widely used in long range missiles particularly in vessels. This led us to investigate about composite pressure vessels during pressurized cycle; since residual stresses were developed. The residual stresses subject of extensive investigation in the past as they determine the overall strength and durability of polymeric composites. There are two main reasons for the residual stresses: thermal stresses due to differences in expansion coefficients, and stresses due to shrinkage during curing or solidification of the matrix or the inclusion. According to theoretical consideration, these residual stresses are induced in fibrous composite material acting around liner of composite vessels and in such case important consideration have to be taken in order to prevent such problem or minimize it. Since such type of stresses may cause failure or even collapse of the liner itself prior to ultimate failure of the pressurized vessel.

So mainly the main aim of this paper is to present an experimental procedure for analyzing the composite pressure vessels and compare the results with theoretical calculations. Hence, the work contain an introductory part of composite pressure vessels and its usage, followed by theoretical analysis of composite vessels and manufacturing steps, the experimental prove for residual stresses through the testing of the vessels were clearly pointed out. Finally results and discussion with important conclusions and remarks were presented.

*PL.S.III.1*

# THE MEETING OF MEMS AND NANOTECHNOLOGY

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The emerging area of micro- and nano- science and engineering is leading to an unprecedented comprehension of the fundamental building blocks of nature. This technology will most profoundly affect the nature of science, engineering and medicine in the 21st century. Device structures with characteristic dimensions significantly below 1 micron have led to the investigation of a whole range of novel physical and chemical phenomena. In turn, these new phenomena promise to give rise to a new generation of materials and devices working on completely different physical and chemical principles. The major technological barrier to fabricate functional nanostructures is the ability to synthesize nano-structures of sufficiently small dimension, specific pattern and uniform size distribution. Most importantly, these structures must be directly fabricated into microsystems to allow functionality of the structures.

Therefore, the implementations of these systems require advanced technologies to integrate the nanostructures to Microsystems as well. Without such integration, the functionality of the nanosystems cannot be realized. New technology such as laser induced self-assembly of nanoarray platforms (SNAP), novel materials synthesis, and atomic-layer engineering are key for the development of devices for applications in biological and chemical sensing systems, microfluidic drug and chemical delivery systems, microimaging systems, and chronically implantable micro and nano devices. As an example, materials synthesis, micromachining and integration in microsystems will be presented for applications of a neurological implant for vision, guided growth of neurons for spinal cord injuries, structures for biological detection, and artificial sensor arrays for robotics with 108 greater sensitivity then human skin.

*PL.S.III.2*

# STRUCTURAL AND FUNCTIONAL (SUPERFICIAL) BIOCOMPATIBILITY OF NEW AMORPHOUS / QUASICRYSTALLINE Ti-BASED COMPOSITES

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Titanium and its alloys are frequently used as implants due to their high mechanical strength, low elastic modulus (structural biocompatibility) and biocompatibility (functional or superficial biocompatibility). However, as these materials have a poor wear resistance, tribo-chemical reactions during use produce debris accumulation, resulting in adverse cellular response. It is then possible to generate different micro (nano) structures for the bulk and for the superficial parts of the specimen, by different thermal treatments (composite).

After a quick survey on the structural biocompatibility, this work deals with biocompatibility of new amorphous quasicrystalline Ti-based composites displaying high functional properties. We focussed on the $Ti_{45}Zr_{38}Ni_{17}$ system which is able to form amorphous phase as well as quasicrystals (QC) by rapid-quenching techniques. Their high wear resistance and hardness make them potential candidates for improving tribological properties of metallic implants. Up to far, no studies have dealt with the biocompatibility of such non periodical structures.

In order to control and to understand the formation of amorphous and quasicrystalline structures, we characterize first the microstructures of planar-flow cast $Ti_{45}Zr_{38}Ni_{17}$ ribbons, using different quenching rates. Microstructural analyses highlight the possibility by adapting elaboration parameters, to control the as-quenched structure from nanostructured amorphous to $\beta$ + QC states.

Since improved knowledge of the chemical composition of biomaterial surfaces and a better understanding of interactions between biomolecules and substrates will allow a more rational design of biomaterials, surface characterisation of alloys is an essential aspect of this approach. First of all, native oxide layer was characterized using X-ray photoelectron spectroscopy. At the surface of these nanostructured ribbons, the oxide layer is composed by $TiO_2$ and $ZrO_2$. Ni is mainly present at the oxide/alloy interface. Fibronectin adsorption on a Ti-based quasicrystals-forming alloy were also studied by XPS and compared to those obtained on pure titanium substrates (cpTi). The results indicate that fibronectin is adsorbed on $Ti_{45}Zr_{38}Ni_{17}$ in the similar way than on cpTi. Concerning general biocompatibility of these ternary alloys, the osteoblastic cells, cultured on $Ti_{45}Zr_{38}Ni_{17}$, have the same behavior whatever the microstructure. The cellular development from adhesion to differentiation evidences the middle-term biocompatibility of $Ti_{45}Zr_{38}Ni_{17}$.

Keywords: titanium, rapid-quenching, quasicrystal, amorphous, biomaterial, oxidation, cells cultures.

*PL.S.III.3*

# MAGNETIC AND OTHER METALLIC NANOPARTICLES FOR POSSIBLE MEDICAL APPLICATIONS

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There is increasing interest in the application of nanoparticles in medical research, particularly for early cancer detection and therapy. Our work concentrates on their structural characterization. Magnetic nanoparticles can be used for MRI diagnoses, noble metal nanoparticles significantly enhance Raman spectroscopy signals. We have synthesized magnetic nanoparticles by chemical means and stabilized them with a graphite coating. The phases present are not always those predicted from the bulk phase diagram. We have also successfully imaged silver nanoparticles attached onto leukemia cells by a variety of electron microscopy techniques. The successful conjugation of nanoparticles onto cells is also analyzed by surface enhanced Raman spectra.

This work is supported by the Stanford Center for Cancer Nanotechnology Excellence Focused on Therapy Response (CCNE-TR) grant (NIH U54). Use of the facilities at the Stanford Nanocharacterization Laboratory and the National Center for Electron Microscopy, Lawrence Berkeley Lab, which is supported by the U.S. Department of Energy under Contract # DE-AC02-05CH11231, is recognized.

*PL.S.III.4*

# MAGNETIC AND ELECTRONIC PROPERTIES OF IRON OXIDE NANOPARTICLES OF CONTROLLED SIZE AND SHAPE

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Magnetic nanoparticles (NP) are an ideal system to study finite-size and surface effects, all these yielding new interesting phenomena and enhanced properties with respect to their bulk counterpart [1]. Besides, the potential application of magnetic NP for biomedical purposes relies on the synthesis of high quality materials, from both the crystalline and magnetic points of view. In this work, we report on the influence of a variety of parameters on the synthesis of iron oxide nanoparticles (magnetite/maghemite $Fe_3O_4/Fe_2O_3$) by both thermal decomposition of an organic iron precursor in an organic media [2] and co-precipitation methods. It is well known that the former allows the preparation of highly crystalline NP with excellent magnetic parameters [3, 4]. We study the role of the reductor and surfactant on the shape, size distribution and the magnetic and electronic properties. Iron oxide NPs in the 5-50 nm range were synthesized in the presence of a variety of coatings (oleic and decanoic acids, PVA, TMAOH, dextrane…), with controlled shape from pseudo-spherical to cubic and cube-octahedral, thus opening a new range of sizes not reachable before. All the materials show a narrow size distribution with high crystal quality, as revealed by transmission electron microscopy (TEM). Surprisingly enough, saturation magnetization $M_s$ is size independent in the 5-20 nm range and almost reaches the expected value for bulk magnetite at low temperatures, being higher in those NP for which the surfactant is covalently bonded to the surface. A variety of colloidal suspensions of quasi non-interacting NP and mean diameter of about 5 nm were studied in further detail. We have developed a new analytical model to account for the surface contribution to the effective energy barrier distribution of anisotropy, which is still under hot debate in literature. X-ray absorption spectra (XAS) in the $L_{2,3}$ edges suggest charge transfer to the surfactant due to covalent bond. X-ray magnetic circular dichroism (XMCD) confirms the dependence of the magnetic moment on the surface bond and suggests that the orbital momentum is more effectively quenched in covalently bonded NP. High resolution TEM suggests that all the foregoing is related to the crystal quality of the NP associated with the temperature of the synthesis procedure. All in all, covalently bonded NP show bulk-like magnetic and electronic properties, while NP with just protective coatings shows particle-like properties. The funding from the Spanish MEC (NAN2004-08805-CO4-02, NAN2004-08805-CO4-01, CONSOLIDER CSD2006-12 and MAT2006-03999), and from the Catalan DURSI (2005SGR00969) is acknowledged.

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*PL.S.III.5*

# NANOSTRUCTURED APATITES: THE NEXT GENERATION OF BIOACTIVE MATERIALS?

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Bone is a composite on a number of different structural scales. At the macrostructural scale two morphologically distinct forms of the tissue may be identified in long bones; these are referred to as cortical and cancellous bone. On the microscopic level, a collagen-bone mineral composite is formed into densely packed concentric lamellar structures called osteons. At the ultrastructural level, bone contains both a nano-scale mineral component, apatite and an organic component, collagen. However, in spite of its elegant structure, bone suffers from a number of degenerative diseases and with an ageing population World-wide, there is an ever increasing need to find long term solutions for bone replacement.

Synthetic hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) has been of interest as an orthopaedic biomaterial for more than 30 years due to its chemical similarity to bone mineral. Bone will bond directly to the material in its pure, sintered form. One approach to bone repair has been to produce synthetic bone grafts with chemically substituted apatites to encourage more rapid bone attachment and, in particular, investigations in to effects on biological response of the incorporation of carbonate and silicate ions in the hydroxyapatite crystal lattice. This area of research has proved to be particularly successful with evidence of very rapid bone repair and the rapid formation of a synthetic-natural material composite.

We have continued to build on the ideas of biomimetic materials development and characterization and a number of projects are now on-going to produce bioactive and biodegradable composites. It has been found that the dimensions of the bioactive reinforcing phase can have a significant influence on the mechanical- and biological performance of the materials. There are a number of methods of applying bioactive coatings on metallic and polymeric biomaterials and the techniques that are available include vacuum plasma spraying, electrohydrodynamic atomization and RF magnetron sputtering to provide surfaces with a range of topographical and compositional characteristics.

This lecture will describe the ideas and research activities on-going in the area of substituted apatites and will explore the prospects for a new generation of orthopaedic biomaterials.

*PL.S.III.6*

# SIZE-DEPENDENT AND INTERFACE EFFECTS IN PROPERTIES OF NANOSTRUCTURED MATERIALS

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Size-dependent effects (SDE, i.e. the characteristic size influence of grains, particles, phase inclusions, pores, etc., on the properties of materials and substances) have been studied in physics, chemistry and materials science for a long time. The development of advanced nanotechnology manifests some new problems such as the SDE identification in nanometer interval. The SDE role in nanostructured (nanocrystalline, nanophase or nanocomposite) materials is of great importance both for fundamental considerations and modern technology. The effect of the nanoparticle/nanocrystallite size on surface energy, melting point, phase transformations and phase equilibriums is considered as applied to nanostructured materials. The role of size-dependent effects in phonon, electronic, superconducting, magnetic, and mechanical properties is also analyzed. Special attention is paid to the contribution of other factors such as the interface structure, grain boundary segregations, residual stresses and pores, non-uniform distribution of grain sizes and so on. The most interesting examples of the interface effect on the melting point (superheating) and strength/ductility of nanomaterials are described in detail. In particular, the importance of computer experiments and the study *in situ* of nanosubjects in electron microscopy is pointed. The little explored and unresolved problems are pointed and discussed.

*PL.S.III.7*

# CAN CARBON NANOTUBES BE COMPETITIVE IN CHIP INTERCONNECT APPLICATIONS

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Chip interconnects present one of the big challenges in gigascale integration. As the technology scales and interconnect wire width is getting down to 40 nm, copper resistance is increasing, due to atom scattering off the grain boundaries and rough edges, and percentage increase of high resistivity cladding around the copper wires. Projection is that the resistivity will double as the copper wire widths get down to 20 nm. This will significantly slow down chip signal propagation and increase interconnect temperature. Smaller wire cross sections will also create reliability problems due to increasing electro-migration. Carbon Nano-Tubes (CNTs) have recently been given a lot of research attention as possible replacement for copper wires in VLSI circuit interconnect. CNTs are graphene sheets rolled up as cylinders. They have high mechanical stability, high thermal conductivity, extremely high current caring capacity, and effectively no electro-migration, which all make them very attractive as a replacement for copper in chip interconnect application. There are, however, serious obstacles for the application. It is still a challenge to make the nanotubes with consistent properties and to arrange them in the desired patterns for chip interconnect applications, or to grow them where needed at the chip processing temperatures. In addition, high nanotube/metal contact resistance requires use of CNT bundles which poses additional challenges in CNT based interconnect implementation and characterization. This presentation will provide a comprehensive analysis of opportunities and challenges of CNT application in future VLSI circuit interconnect. A model developed for calculation of equivalent circuit parameters will be used to compare performance of CNT-based interconnects to copper-based one and to identify necessary technology requirements to make CNT-based interconnect viable in future application in various levels of chip interconnect. Special attention will be given to CNT applications as vias, in now prevailing 2D, as well as in emerging 3D chip manufacturing technologies.

*PL.S.III.8*

# NANOANALYSIS OF MATERIALS BY MEANS OF EELS SPECTRUM IMAGING IN A TRANSMISSION ELECTRON MICROSCOPE

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The characterisation of nanostructured devices and functional materials at a nanometre scale is paramount for the understanding of the physical and/or chemical properties. With recent progress in electron energy-loss spectroscopy (EELS) using a monochromated transmission electron microscope (TEM) it becomes now possible to solve advanced materials science problems which have not been accessible before. In particular, one can obtain improved information not only about the local chemical composition of a sample [1], but also about chemical bonding [2] and physical properties [3]. Advances in EELS spectrum imaging, i.e. the collection of EELS data along the spatial and the energy-loss dimensions has progressed to the point, where sophisticated spectrum image data processing now can be carried out routinely. This became possible with the advent of combined spectral aberration-, energy- and spatial drift corrections schemes, carried out simultaneously, giving access to high quality spectrum images [3]. In the presentation we will focus on practical aspects and applications of spectrum imaging by means of energy-filtered TEM (EFTEM). The advantages of EELS and EFTEM spectrum imaging and its extended mapping capabilities will be demonstrated using typical materials science examples. In the first case, nanometre sized precipitates in a Cr-steel have been analysed using inner-shell ionisation edges. Furthermore, the interfaces between organic and inorganic layers in organic optoelectronic devices and in multilayered ceramics and semiconductors are investigated using the low-loss region of the EELS spectrum.

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*R.T.*

# CALLS AND TENDERS DEALING WITH NEW MATERIALS FOR INCO COUNTRIES AND HOW TO WRITE A SUCCESSFUL PROPOSAL: PARTICIPATION RULES AND CALLS FOR FP7 – FOCUSED ON BIOMATERIALS AND INCO COUNTRIES

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The Seventh Research Framework Programme (FP7) is the largest funding instrument of the European Union to foster collaboration in research and technological development in selected thematic fields, such as health, information and communication technologies, nanotechnologies, new materials, energy and environment. Additionally to the access of industry and research institutes from the European countries all thematic priorities in FP7 are open for the participation of "International Cooperation Partner Countries" from Eastern Europe, Western Balkan, development countries and the emerging economical countries like China, India and Russia as well. Particularly in the sector of new materials and processing technologies worldwide collaborations in science and technology will support the progress in these areas. Experienced EU consultants from Germany will give an overview about the current funding relevant activities within FP7 in the materials sectors and important rules and instructions for the participation as well. Open calls as well as expected calls will be explained under consideration of potential participants from non-EU member states. The presentation includes recommendations for proposal writing, contract negotiation and project management. Visitors from science and industry are welcome.

*O.S.C.1*

## USING DIELECTRIC RELAXATION SPECTROSCOPY (DRS) AND DYNAMIC MECHANICAL SPECTROSCOPY (DMS) TO STUDY MOLECULAR DYNAMICS OF DENDRIMERS IN HYDROPHOBIC/HYDROPHILIC MEDIA

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Dendrimers have globular morphology which allows them to encapsulate important molecules such as therapeutic drugs within the interstitial space of their branches for subsequent targeted delivery. To understand and assess these capabilities and to allow for the optimization of dendrimers for highly specific tasks in complex environments, such as *in vivo* targeting applications, it is essential that we acquire a comprehensive knowledge of the dynamics of dendrimers and theirs blends on the molecular level. The principal objective of this work is to elucidate how dynamics vary as a function of concentration and generation of dendrimers and hydrophilicity of polymer matrices. A complete quantitative picture of blends dynamics and a comparative analysis of Dielectric Relaxation Spectroscopy (DRS) versus Dynamics Mechanical Spectroscopy (DMS) results is offered.

*O.S.C.2*

## ON THE PENTAHEPTITE NANOTUBES

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Full symmetry of the nanotubes rolled up from pentaheptite carbon lattices along an arbitrary chiral vector is determined and symmetry preserving relaxation of a large number of the simply rolled up tubular structures is performed in order to assess stability and conducting properties of the pentaheptite nanotubes (57NTs) relative to the classical graphitic nanotubes. Density functional tight binding calculations are performed by full-symmetry implemented POLSym code. Vast majority of 57NTs is found to be metallic having considerably higher electronic density of states at Fermi level than their metallic conventional counterparts. Pathway for synthesis of certain types of pentaheptite nanotubes directly from the conventional hexagonal nanotubes by putting them under uniaxial tension is proposed. Release of the strain goes through formation of double pentagon-heptagone pairs. This transition relates each 57CNT to particular 6CNTs, and reversely. In fact, most of 57NT, can be obtained from two different C6NT, and some of them from only one but in three ways. The findings promise application as mechanically induced electrical nanoswitches.

*O.S.C.3*

# SYNTHESIS AND APPLICATIONS OF NOVEL VANADIUM OXIDE NANOTUBES

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The main aim of this work is to produce specialized nanostructures from transition metal oxide for potential applications in electrochemical devices and for catalytic applications. Vanadium oxide nanotubes (VOx-NT) have been prepared by mixing hexadecylamine with V2O5.nH2O gels. This procedure was followed by a hydrothermal treatment (150–180°C, 2–7 days), which leads to a large quantity of VOx-NT. The structure and morphology of the nanotubes is investigated by SEM and TEM and a model describing nanotubes peculiar morphology has been discussed. The vanadium oxide nanotubes are redox-active and can electrochemically insert lithium reversibly. Further, applications of these transition metal nanotubes in electrical transport and sensor materials have also been outlined.

*O.S.C.4*

# ULTRASONIC AEROSOL ROUTE FOR THE SYNTHESIS OF RARE EARTH OXIDE NANOPARTICLES

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Synthesis of ultrafine, spherical phosphor particles with uniform component and phase distribution is of great importance for modern display devices since they significantly improve device characteristics. Aerosol route represents synthesis through dispersion phase and it enables generation of fine, naophased powders with improved properties due to high surface reaction and short residence time. In this work, $Gd_2O_3$:Eu, $Y_2O_3$:Eu and $(Y,Gd)_2O_3$ phosphor particles were prepared from aerosol of the corresponding nitrate solutions generated ultrasonically at 1.3 or 2.1 MHz and thermally decomposed at 700-900°C within a tubular flow reactor. Obtained powders were additionally thermally treated at 1000-1200°C. Scanning and field emission scanning electron microscopy (SEM-FESEM) in combination with quantitative EDS analysis revealed submicronic particles with spherical morphology, high material purity and compositional homogeneity. Structural properties were investigated by means of X-ray powder diffraction (XRPD) while an insight into the phase development and structural changes, obtained through Rietveld refinement, showed nanocrystalline inner structure with crystallite size below 20 nm. In the case of as-prepared samples two different cubic phases were identified: a bcc (S.G. *Ia3*) and a fcc (*Fm-3m*), while the thermally treated samples were consisted only of cubic *Ia3* phase. HR-TEM and SAED analyses confirmed these findings but they also revealed local appearance of the metastable monoclinic *C2/m* structure at temperatures around 1100°C. The stabilization of the higher density metastable monoclinic structure is associated with high heating/cooling rates and short residence time during aerosol synthesis and is probably attributed to the Gibbs-Thomson effect in which increased surface tension, as a characteristic of nanoscaled particles, converts the particle to the denser metastable phase.

*O.S.C.5*

## LUMINESCENCE OF GALLIUM OXIDE NANOSTRUCTURES

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In this work $Ga_2O_3$ nanowires and other nanostructures have been grown by annealing compacted powder of the oxide, with disk shape, under argon flow at 1500 ºC. The nanowires grow on the surface of the disk without the use of a catalyst or a foreign substrate. The nanowires were doped either by using a mixture of powders of gallium oxide and the dopant oxide as precursor or by diffusing the dopant during the thermal growth. Doping of the nanowires with Cr, Er and Eu and other dopants was achieved by these methods. The spatial and spectral properties of the luminescence from individual wires have been studied both by cathodoluminescence (CL) in a scanning electron microscope and micro-photoluminescence (micro-PL) in an optical microscope.

*O.S.C.6*

## RADIATION STIMULATED PROCESSES IN DOPED OXIDES: BULK AND NANO-CRYSTALS

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Experimental and theoretical results of study of crystallographic and spectral (optical, ESR, X ray etc) properties of doped oxide materials as bulk, nano-scale size crystallites and clusters with chemical formula AO, $A_xO_y$, ABOz, $A_xB_2C_{y-5}O_z$ are presented this review. Detail investigation of optical, ESR spectra, thermo-stimulated luminescence, conductivity and X ray structure of the samples after irradiation or plasma treatment on one hand and ab initio theoretical approach have been used for identification of radiation colour centers in oxides and quasi-ordered crystallites on the surface of the doped oxides.

The following main tasks are focused:
- change of the electronic and crystallographic structure and spectral properties of oxides after irradiation or plasma treatment;
- properties and application of nano-scale size crystallites on the surface of irradiated oxides.

*O.S.C.7*

# THE INFLUENCE OF THE CHARACTER OF LAYERED NANOADDITIVES ON PROPERTIES OF ORGANIC-INORGANIC NANOCOMPOSITES

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Layered nanoadditives differentiating in the size and origin. (*natural*, e.g., unmodified or modified montmorillonite, bentonite for water systems or *synthetic*, Laponite XLG) were used as nanoadditives in hybrid organic – inorganic (O-I) nanocomposite systems. Inorganic nanostructures in the O-I matrix were formed in-situ by sol-gel process (hydrolysis, polycondensation) followed by organic network formation (polyaddition). Already tenths to units wt. % of layered nanodditives influence considerably final properties. For example, compared with nanoadditive-free matrix, (i) 1 wt. % of Laponite XLG decreases significantly polyaddition, but not polycondensation degree, (ii) 1 wt. % of bentonite for water systems decreases glass transition temperature by 10 $^{0}$C. All nanoadditives form self-assembled clusters of miscellaneous shape and size on the surface.

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*O.S.C.8*

# STIMULATING EFFECT OF BORON ADMIXTURE ON HYDROGEN SORPTION-DESORPTION PROPERTIES OF MECHANICALLY ACTIVATED TITANIUM POWDER

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Titanium is well known as light-weight hydrogen storage material. In practice, it is applied as component of hydrogen storage composites together with Mg and other metals.

Amorphous boron was used as an additive for improving Ti - $H_2$ reactivity during the ball-milling due to its anti-sticking and matrix-forming properties. Ti – $H_2$ reaction was carried out in flow mechanochemical reactor (50 vol. % $H_2$/He flow) combined on-line with a gas chromatograph for permanent monitoring effluent gas composition. 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 and B atoms were studied by X-ray emission spectroscopy (XES). Temperature-programmed desorption and reaction techniques were applied for testing thermal stability of Ti-hydride prepared under the ball-milling, as well as for studying the number and nature of occupational sites available for H atoms in Ti/B system. The following effects of boron admixture were observed: (I) A significant fragmentation of Ti powder and (II) A modification of the surface and subsurface layers of Ti and Ti-hydride nano-fragments by B atoms through formation Ti/B amorphous composition. Several types of occupation sites available for hydrogen and responsible for low-temperature $H_2$ desorption (desorption temperature decreases from ~ 1000 K to ~600 K) were detected in Ti/B mixture milled in $H_2$/He flow. Dynamics of these sites formation, and redistribution of hydrogen between different occupation sites in dependence on phase composition and morphology of as-milled powder, were studied.

This work was partly supported by RFBR, project No 07-03-00610, INTAS, project No 05-1000005-7672, Research Council of the President of the Russian Federation (Grant NSH-1929.2008.2), the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Canada Research Chair program.

*O.S.C.9*

# NMR, MÖSSBAUER AND XPS STUDIES OF THE LOCAL STRUCTURE OF NANOCRYSTALLINE COMPLEX OXIDES

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Owing to the structural flexibility of complex oxides, providing a wide range of physical and chemical behavior, these materials have been considered as a convenient model system for the investigation of the structure-property relationships in ionic systems. In the present work, it is demonstrated that spectroscopic methods (nuclear magnetic resonance spectroscopy, Mössbauer spectroscopy and X-ray photoelectron spectroscopy) can provide valuable insight into the local structure of nanooxides. Several interesting features are involved in the work, e.g., the nonequilibrium cation redistribution, the canted spin arrangement, the modified nearest-neighbor cation configuration, the deformed polyhedron geometry and the core-shell configuration of nanoparticles. Quantitative information is obtained on the particle size dependent ionic and spin configurations in nanosized oxides.

*O.S.C.10*

# EFFECTS OF MIXING CONDITIONS AND AGING ON THE MORPHOLOGICAL BEHAVIOR AND ON MECHANICAL PROPERTIES OF EPDM/LAYERED CLAY NANOCOMPOSITES

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The materials which are able to meet difficult conditions with better performance / cost ratio have been demanded by large number of industrial applications. Polymer-layered clay nanocomposites recently have attracted significant research interest due to their improved strength and modulus, better thermal and chemical stabilities and enhancement of flame retardancy. The improved properties can be obtained if a relatively better dispersion of clay layers in the polymer matrix can be achieved. Clay is comprised of silicate layers having a 1 nm thick planar structure. Because of having such property, the silicate layers can be dispersed at the molecular level (nanometer level) in a polymer matrix with the polymer existing between the silicate layers. In this study, the effects of process parameters and the chemical (detergent) aging on the mechanical and physical properties of organoclay reinforced EPDM were investigated. In this study, montmorillonite is modified by octadecylamine to ease the dispersion of inorganic clay in polymer matrix. Such a modification of clay results in becoming clay hydrophobic, diminishing the surface energy, making the silicate layers compatible with polymer. EPDM/clay NCs are prepared by a direct melt compounding method by blending of 5-10 wt. % of the clay particulates within the polymer matrix. In order to measure the change of gallery distance of organoclay after being modified with octadecyl ammonium ion and also after mixing with EPDM, the basal spacing of the clay is studied by means of X-Ray Diffraction (XRD) technique. According to XRD results, the peak between 5 and $7^o$ is disappeared and there is a rise in the pattern at low scattering angle after modification of clay. The silicate layers are exfoliated and dispersed uniformly in EPDM. Dispersibility of the silicate layers in the polymer matrix is evaluated using SEM. The effects of blending conditions (process temperature of 120 and 150ºC, speed of 60 and 90 rpm and time of 10, 15, 20 min) on mechanical properties of EPDM/OMMT NCs were investigated. It was observed that addition of OMMT into EPDM matrix significantly improve the tensile strength of the polymer matrix. With blending temperature of 120ºC, addition of 5 and 10 wt. % of OMMT increases the average tensile strength of neat EPDM by 148% and 281%, respectively. Also, samples were embedded in detergent water, cured at 175°C for 300 hour, and subsequently the tensile measuring tests were repeated. The mechanical test results showed that the properties of nanocomposites were significantly improved with the addition of OMMT. As a result of the aging test, it was found that the loss in mechanical properties of the nanocomposites is lower as compared to those of neat EPDM due to aging.

*O.S.C.11*

# POLYMER AND NANOPARTICLE CHARACTERISATION USING LIGHT SCATTERING TECHNIQUES

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Dynamic light scattering (DLS) is a non-invasive technique used to characterise macromolecules in solution and particles in suspension. In this technique, a beam of monochromatic light is directed through a sample and the intensity of the light scattered by the molecules or particles is measured. DLS, also known as quasi-elastic light scattering (QELS) or photon correlation spectroscopy (PCS), measures the time-dependent fluctuations in the intensity of scattered light that occur because the particles are undergoing Brownian motion. The velocity of this Brownian motion is measured and is called the translational diffusion coefficient D. This diffusion coefficient can be converted into a hydrodynamic diameter ($D_H$) using the Stokes-Einstein equation.

Dynamic light scattering is well suited to the measurement of the size of colloidal dispersions. Traditionally, measurements of large particle sizes or particles that are highly scattering would require high dilution of the sample in order to avoid multiple scattering effects. Conversely, measurement of very small and/or poorly scattering particles or samples that are very dilute are difficult unless high-powered lasers are used. These problems have been addressed in a light scattering instrument incorporating novel non-invasive backscatter optics (NIBS®). This novel optic arrangement maximises the detection of scattered light while maintaining signal quality.

Results of dynamic light scattering measurements from various polymer and nanoparticle applications will be presented which will illustrate the capabilities of the technology.

*O.S.E.1*

# BIOMIMETICS OF THE GROWTH OF DENTAL ENAMEL USING A CONTINUOUS CRYSTALLIZATION APPROACH

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Amelogenesis is one of the most fascinating mineralization processes in the biological realm. Not only does it produce dental enamel, the hardest tissue among vertebrates, but it is also a process during which the extracellular matrix disintegrates as it gives rise to a 96 - 98 wt% mineralized tissue. The latter is composed of hydroxyapatite fibers with aspect ratios of up to 10 000, forming an ordered structural organization at multiple scales. Owing to the unusual, constructive degradation of the protein matrix, the proteolysis of the enamel matrix is supposed to play a crucial role in the formation of enamel. The aim of our research is to explore the effects of the proteolytic interaction between amelogenin, the major protein of the developing enamel matrix, and matrix-metalloprotease-20, one of the two main proteases involved in the hydrolysis of amelogenin, on the crystallization of hydroxyapatite. The basic experimental setting employed we named "continuous crystallization experiment", during which a titration of calcium and phosphate ions is carried out with a preprogrammed control, typically under either pH-stat or constant titration rate conditions. Atomic force microscopy, spectrophotometric ionic content analyses, MALDI-TOF mass spectrometry, and Raman spectroscopy have presented the basic characterization techniques used. The project is supported by the NIH/NIDCR grants R01-DE017529 and R01-DE015821.

*O.S.E.2*

## NANO PARTICLES (NPS) OF HYDROXYAPATITE COATED WITH POLY-DL-LACTIDE-CO-GLYCOLIDE AS SYSTEMS FOR LOCAL CONTROLLED DRUG DELIVERY OF TIGECYCLINE

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Composite biomaterials in NPs form may have significant advantages over those in micro- or submicro-particulate form. Composite biomaterials based on NPs HAp with bioresorbable polymers proved successful in reconstruction of bone tissue due to their bioactivity. NPs HAp based composites may have improved applicative characteristics such as, for instance, easy manipulation, close contact with the surrounding tissue, fast resorption, etc. Spheres of NPs HAp/DLPLG composite biomaterial 40-50 nm in diameter can, in combination with physiological solution, be applied as injectable paste, which is not the case with microparticles of the same material.

This paper investigates possibilities of synthesizing hydroxyapatite/poly-DL-lactide-co-glycolide/tigecycline (HAp/DLPLG/T) composite biomaterial formed as NPs suitable as local controlled delivery systems for release of tigecycline. Tigecycline appears to be a potential drug in the treatment of severe orthopaedic infections. Chronic osteomyelitis is an intractable inflammation of the bone caused by pathogenic micro-organisms, and is associated with the destruction of bone tissue and vascular channels.

Characterization was performed with wide-angle X-ray structural analysis (XRD), atomic force microscopy (AFM) and infrared spectroscopy (FT-IR). Release of tigecycline from HAp/DLPLG/T was analysed by ultraviolet (UV) spectroscopy.

HAp/DLPLG/T composite biomaterial was synthesized in the form of nanosized spherical granules by modified two-step emulsion process and centrifugal post process. Each nanosized particle of HAp is coated with amorphous DLPLG polymer. Tigecycline (T) is immobilized in DLPLG with efficiency of 70%. Weigh share of T in HAp/DLPLG/T are 0.6, 3 and 5%. Average diameters of NPs are from 30 to 90 ± 10 nm**.**

XRD analyses confirmed that the NPs are a composite of non-calcined, poorly crystalline calcium phosphate. FT-IR analyses proved that calcium phosphate is coated with DLPLG polymer. Antibiotics tigecycline is immobilized into DLPLG.

The degradation of the HAp/ DLPLG with tigecycline within the physiological solution has been tracked *in vitro* for eight weeks. It has been determined that DLPLG completely degrades within this period, fully releasing all immobilized tigecycline.

*O.S.E.3*

# BONE TISSUE REMODELING AT FILLING LARGE BONE DEFECTS WITH DIFFERENT KINDS OF BIOACTIVE CERAMICS

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Traumas and the surgery resections of non-cancerous and malignant bone tumours result in formation of large bone defects with volumes up to 100 $см^3$ and more. Therefore the actual problem is selection of bone-plastic materials that ensure the best stimulation of osteogenesis and the full bone tissue remodelling. The presented data summarize the outcomes of bone-plastic surgery operations made to 172 patients due to giant cell myeloma and non-cancerous bone tumours, made in Institute of oncology of Ukrainian AMS during last 7 years. For filling bone defects one of two kinds of synthetic bone-plastic materials have been utillized: stoichiometric hydroxyapatite (HAP) and bioceramic composite consisting of several kinds of bioactive glasses, glass-ceramics and two-phase disperse powder: tricalcium phosphate (TCP) 70 % - HAP 30 %. These materials were used in the form of pellets (diameter 1 - 5 mm) or blocks (up to 40 mm), porosity 25 - 55 %. With the purpose to control remodelling processes and to prevent tumor relapses the biopsies were taken in the sites of implantation in different terms (2 - 9 months) after surgeries. The study was made by gistology, morphology and electron microscope methods. Summarizing the obtained outcomes allows to single out the common features of bone tissue remodelling for both utilized materials: activation of phagocytosis of tissue detritus by macrophages, proliferation of vascular endothelium and osteoblasts, active generating of bone tissue islands through classic stages of random collagen osteoid formation with transition to ordered osteogenesis, absence of implants' immune and inflammation tearing away. The specific features of these processes at bioceramic composite applications: reduced lymphahistocyte infiltration, considerable decreasing of fibrous connective tissue quantity in the place of implantation, higher rate and degree of resorption of the implant, higher rate of collagen osteoid formation followed by its ossificatiom and creation of bone islands around and instead of implant's fragments, greater density of created bone and its resistance to lead-acid decalcification, smooth and more quick healing of the bone defect.

*O.S.E.4*

## SUPERCRITICAL FLUIDS: NEW APPROACH TO ADVANCED BIOMATERIAL PROCESSING AND MODIFICATION

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This paper describes the recent progress made in the use of supercritical fluids (mainly supercritical carbon dioxide) to process polymers for variety of biomedical applications. Four highlighted examples include cleaning of custom-designed acrylate implants produced by laser stereolithography, fabrication of three dimensional bioresorbable porous scaffolds for tissue engineering, synthesis of polymer/metal nanocomposites with enhanced antibacterial, tribomechanical and tribochemical properties for orthopedics and encapsulation of bioactive species into biodegradable polyesters particles prepared via free from organic solvent supercritical route for advanced drug delivery systems.

*O.S.E.5*

## THE PREPARATION AND CHARACTERISATION OF A CALCIUM PHOSPHATE-POLYCAPROLOCTANE BIOCOMPOSITE

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The current treatment options for patients suffering from collapsed, damaged or degenerative discs in the vertebral column have a poor short term success rate and can lead to long term problems due to the implants persistence in the body. A significant improvement on the available implant options could be made with the incorporation of advanced biomedical materials engineered specifically to possess the appropriate biological and mechanical properties to meet the clinical requirements for fusion of the cervical vertebra. A composite in which a polymer's processability and controllable degradation complements the ceramics osteoconductivity would provide for an ideal biomaterial for use in this load-bearing orthopaedic application should it possess adequate mechanical performance. The methodology by which a primarily mineral, ceramic-polymer biocomposite may be prepared is detailed as well as the effect of composite composition on density, closed porosity, bending strength and compressive strength.

*O.S.E.6*

## THE INFLUENCE OF DIMERIC SURFACTANT ON THE TRANSFORMATION OF AMORPHOUS CALCIUM PHOSPHATE

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The influence of the cationic dimeric surfactant, ethanediyl-1,2-bis(dimethyldodecylammonium) bromide (12-2-12) on the transformation of amorphous calcium phosphate (ACP) was investigated. ACP was precipitated in the absence and presence of 12-2-12 surfactant monomers or micelles of various sizes and shapes. Both, 12-2-12 monomer and micelles promoted ACP to crystalline phase transformation, the size of the effect decreased in order monomers > spherical micelles > wormlike micelles. The proposed mechanism involves surfactant adsorption (electrostatic and hydrophobic) at the surface of ACP growing particles which modifies the aggregation kinetics and transformation to crystalline phase.

*O.S.E.7*

## HOLOGRAPHIC MEASUREMENT OF DENTAL COMPOSITE CONTRACTION

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We have developed a real time holographic technique to observe deformation induced by dental composite contraction. The standard split beam method was used, in conjunction with *in situ* holographic plate processing. In order to observe the whole deformation field, real image of the back (otherwise invisible) side of an object was produced, using spherical mirror. By that means, it was possible to observe both sides of the object. Experiments were performed on a mechanical model of a tooth with cavity. A real human tooth was used to manufacture a silicon mold, which was, further, used to produce a number of identical casts. In this way, we didn't have to take care of variability of real human teeth. A LED lamp was used to induce photo-polymerization reaction in a composite. The aim was to analyze different polymerization methods: bulk, two-step, and spatially separated.

*O.S.E.8*

## *IN VITRO* ANALYSIS OF A ZINC BASED GLASS POLYALKENOATE

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It has been postulated that the requirement for a biomaterial to bond to living bone is its ability to form a crystalline apatite layer on its surface *in vivo* and that such a system can be replicated in simulated body fluid (SBF), a synthetic analogue to blood plasma. Glass Poly(alkenoate) Cements (GPCs) exhibit a strong bond to bone. However, in a recent SBF study, no apatite growth was observed on the surface of conventional GPCs. In the present study, aluminium, present in conventional GPCs, was eliminated from the glass compositions and zinc, an antibacterial ion, was used in its place to produce a glass of composition $0.04SrO/0.12CaO/0.36ZnO/0.48SiO_2$ (mole fraction). A GPC was produced using a glass:solution ratio of 2:1.5 with 50wt.% concentration of poly(acrylic acid), Mw 28,700, and 10wt.% trisodium citrate dihydrate. Cement discs were immersed in a calculated volume of SBF for 1, 7, 30 and 90 days. Precipitation of calcium phosphate on the surface of the cement occurred after 1 day and increased with time. The layer was amorphous, attributed to the stabilizing effect of zinc ions releasing from the glass and incorporating into the surface layer. Thus, GPCs based on Sr-Ca-Zn-$SiO_2$ glass chemistry exhibit potential as bone cements as indicated by *in vitro* growth of a bioactive surface layer in SBF.

*O.S.E.9*

## OPTO-MAGNETIC FINGERPRINT OF AMNIOTIC FLUID AND WATER

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Amniotic fluid is a substance that fills the amnion to protect the embryo from desiccation and shock. In goal to test different acoustic influences (speech, white noise, music, unpleasant sound) on embryo we developed method to test amniotic fluid by opto-magnetic fingerprint of matter. This method is based on electron properties in mater links (covalent bonds, hydrogen bonds make major links in matter network. The orbital velocity of valence electron in atoms is about $10^6$ m/s, what gives ratio between magnetic force ($F_M$) and electrical force ($F_E$) of about $F_M/F_E \approx 10^{-4}$. Since force related directly to quantum action (Planck action, $h = F \times d \times t = 6.626 \text{ x } 10^{-34}$ *Js*) it means that magnetic force is four of order closer to quantum action than electrical. Picture of surface of classical optical microscope is based on electromagnetic property of light. However, some optical microscopes are based on polarized light and picture of surface represents electrical property of light. We tested amniotic fluid samples collected from pregnant women in delivery room, during parturition. There is difference between amniotic fluids and between them and ordinary water (tap and mineral). Ordinary water is not too much sensitive on sound influence, while amniotic fluids are. This approach could be useful for pregnant women protection and embryo treatment.

*O.S.E.10*

## DRUG RISK ASSESSMENT AS LEADING FACTOR IN DEVELOPMENT AND EVALUATION OF NEW DRUGS AND DEVICE IN MEDICINE

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Needs for innovation in medicine are strongly expressed in increased activities with the development of new drugs and devices. Growing interests in research investment in the pharmaceutical industry support various activities in this sector and in academia as well. Latest problems in introducing a new drug to the practice with unaccepted risk of medicine as rofecoxib (MSD), torceprabid (Pfizer) and others initiated changes in the system of drug risk assessment, monitoring and its prevention. The pharmacovigilance covering these issues asked to be more proactive with effective communications in various levels of innovative drug and devices development. Except for improving toxicity testing on molecular and tissue level in preclinical studies aimed to look for target of organ toxicity, there is an increased demand on detecting an early signaling of unpredictable adverse effects. This signaling of serious adverse effects should not be improved only in clinical studies of I-III phase within the process of drug registrations, but there is also increased demand for innovations of methods in pharmacovigilance during the drug use in broad clinical practice. This corresponds with the postmarketing phase of a new drug evaluation. Authors will discuss the new strategy in risk assessment of new drugs using own experience and results of the experimental chemistry. Special attention will be focused on drug risk perception. This is a main psychological factor influencing decesion making in the process of drug development during all levels of drug toxicity testing. Methods of testing drug risk perception will be discussed. Growing number of new chemical entities as candidates for innovative medicines were withdrown from II-III fase of pre-registration testing for the reason of unacceptable risk. The FDA policy is changing according the US senat strategy for next period 2007-2017: The safe drug for people. The same policy is accepted basically in EMEA (European drug evaluation agency).

# Poster Presentation

*P.S.A.1*

## SYNTHESIS, NMR, DFT AND ANTIMICROBIAL STUDIES OF THE Zn(II) COMPLEXES WITH *N*-BENZYLOXYCARBONYL-*S*-ALANINE

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In this study the first complexes of Zn(II) with *N*-benzyloxycarbonyl-*S*-alaninato ligand (*N*-Boc-*S*-ala) were synthesized. The new complexes have been characterized by elemental analysis, conductometric measurements, IR, $^1$H NMR, $^{13}$C NMR and 2D NMR spectroscopy. On the basis of experimental data tetrahedral geometry of the Zn(II)-complexes was proposed. A very good agreement of NMR and DFT calculated data was obtained. Investigation of antimicrobial activity of the newly synthesized complexes was also performed. It was established that [Zn(*N*-Boc-*S*-ala)$_2$] was selective and acts only on *Candida albicans*.

*P.S.A.2*

## CRYSTAL STRUCTURE OF 2-{1-[(1-(2-PYRIDINIO)ETHYLIDENE) HYDRAZONO]ETHYL}PYRIDINIUM DIPERCHLORATE, THE PRODUCT OF TEMPLATE CONDENSATION IN PRESENCE OF Cr(III)

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In the template condensation of the 2`-[1-(2-pyridinyl)ethylidene] oxamohydrazide in presence of chromium(III) ion the 2-{1-[(1-(2-pyridinio)ethylidene)hydrazono]ethyl} pyridinium diperchlorate was obtained and characterized by NMR spectroscopy and X-ray crystallography.

The 2-{1-[(1-(2-pyridinio)ethylidene)hydrazono]ethyl}pyridinium diperchlorate crystallizes in the monoclinic crystal system (space group $P2_1/n$) with three independent molecules per asymmetric part of the unit cell . The crystal structure of the investigated compound showed significant changes with respect to that of the corresponding unprotonated compound. The significant structural differences between 2-{1-[(1-(2-pyridinio)ethylidene) hydrazono]ethyl}pyridinium salt and 2-{1-[(1-(2-pyridyl)ethylidene)hydrazono]ethyl}pyridine are manifested in considerably different orientation of the aromatic rings with respect to the imine nitrogens as well as in their crystal packing. The *syn* orientation established in the crystal structure of the investigated compound is also found in the crystal structures of metal complexes with 2-{1-[(1-(2-pyridyl)ethylidene)hydrazono]ethyl}pyridine.

*P.S.A.3*

# SYNTHESIS AND CHARACTERISATION OF THE Cu(II) AND Ni(II) COMPLEXES WITH THE *IN SITU* PREPARED FORMAMIDINE LIGAND

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In the last two decades the pyrazole derivatives and their metal complexes, due to interesting physicochemical, structural and biological characteristics, have attracted considerable attention of a number of researchers of different profile. This paper deals with the syntheses and structures of Cu(II) and Ni(II) complexes of coordination formulas $[Cu(ampf)(NO_3)MeOH]\cdot MeOH$ and $[Ni(ampf)(MeOH)_2\ NO_3\ ]NO_3$, respectively, where ampf is *in situ* formed tridentate NNO ligand N,N' –bis(4-acetyl-5-methylpyrazole-3-yl)formamidine. The complexes were obtained by template syntheses in the reaction of warm methanolic solutions of $M(NO_3)_2\cdot nH_2O$ (M=Cu, Ni) and 4-acetyl-3-amino-5-methylpyrazole (aamp) in the presence of triethylorthoformate. The ligand ampf was formed by fusion of two aamp molecules through the reaction of their amino groups and CH-group of triethylorthoformate. In both complexes the NNO coordination of ampf is realized through pyridine nitrogen of one pyrazole moiety, nitrogen atom from the condensed amino group and acetyl oxygen from other pyrazole derivative residue. The X-ray analysis has shown that both complexes have a deformed octahedral structure, *i.e*. trans($NO_3$) (copper complex), and cis(MeOH) (nickel complex). The complexes were characterized, in addition to the X-ray analysis, by also the IR- and UV-vis spectra, magnetochemical and conductometric measurements and thermal analysis.

*P.S.A.4*

# PREPARATION AND IN VITRO EVALUATION OF HYBRID BIORESORBABLE COMPOSITES BASED ON TRICALCIUM PHOSPHATE

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Calcium phosphate biomaterials has an excellent biocompatibility due to their close chemical and crystal resemblance to bone mineral, possess osteoconductive properties and may bind directly to bone under certain conditions. Since beta-tricalcium phosphate (β-TCP) is much greater resorbable than hydroxylapaptite, the combination β-TCP and collagen (COL) can act as a good scaffold material. The COL/TCP hybrid composites were obtained by the reaction of two sorts of β-TCP powders (micro and nanometric powders) with type I collagen, under physiological conditions. Microcrystalline β-TCP were obtained at high temperature by solid-state sintering reactions, and the nano-powders were produced by a precipitation technique involving the use of aqueous solutions of calcium nitrate and diammonium hydrogen phosphate. Ceramic powders were evaluated using various techniques including X-ray diffraction analysis (XRD), termogravimetric analysis (TG/ATD), scanning electron microscopy (SEM), differential scanning calorimetry (DSC). The biocompatibility of the materials was evaluated by cytotoxic effects (cell death and cell proliferation). The biocompatibility of the obtained scaffolds was tested by biochemical and histological methods on human fibroblast cultures. The student's t-test was used for all statistical analyses. Results showed that these scaffolds were non-toxic and displayed excellent cell growth during the 72 hours of the in vitro culture, and using nanopowders of β-TCP in place of conventional ones could be a solution for enhanced the bioactivity of the implant materials.

*P.S.A.5*

# COMBUSTION SYNTHESIS OF CERAMIC COMPOSITES BASED ON Ti–Cr–B–C SYSTEM

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Ceramic composites are promising materials for applications as cutting tools, wear parts and high temperature structural components. SHS is an attractive technique for the preparation of these materials thanks to very high heating rate and very fast reaction, but yields products with poor mechanical properties.

This research is devoted to combustion synthesis of the ceramic composites with uniform and fine microstructure based on Ti–Cr–B–C system. The aim of this work is the preparation of $TiB_2$–$Cr_3C_2$ and TiC–CrB ceramic composites with improved mechanical properties, thanks to the achievement of fine microstructure by one step SHS and densification. These systems were selected on the basis of thermodynamic analysis as suitable to realize regimes of synthesis with formation of liquid phase allowing a full densification. The liquid phase is given by either melted $Cr_3C_2$ or CrB. In experiments the following reactions were used:

$$(1\text{-}x)\{Ti + 2B\} + x\{Cr + 2B\} \rightarrow (1\text{-}x)TiB_2 + xCr_3C_2 \qquad (1)$$

$$(1\text{-}x)\ \{Ti + C\} + x\{Cr + B\} \rightarrow (1\text{-}x)TiC + x\ CrB \qquad (2)$$

Formation of dense SHS ceramic composites with uniform and fine microstructure was investigated. It was shown that $TiB_2$–TiC–CrB and $TiB_2$–$(Ti,Cr)_xC_y$–$(Cr,Ti)_xC_y$, ceramic composites were successfully produced at near theoretical density using a combustion synthesis process. XRD analysis and SEM observations showed the ceramic composites prepared by reaction (1) are characterized by low homogeneity. It was shown that the grain size of $TiB_2$ and TiC decrease with an increase in the amount of chromium in reactant mixture. The main reason of non-uniform composite formation is poor wettability between liquid CrB and $TiB_2$/TiC solid particles. Opposite reaction (2) yields the ceramic composite with very fine microstructure. In this case the solid solutions $(Ti,Cr)_xC_y$ and $(Cr,Ti)_xC_y$ were formed. It was established that liquid phase $(Cr,Ti)_xC_y$ wets the $TiB_2$ and TiC solid particles very nice. Therefore the ceramic composite has uniform and fine microstructure. It was shown that the grain size can be controlled by changes in the amount of the liquid phase and combustion temperature.

*P.S.A.6*

## GLYCINE-NITRATE COMBUSTION SYNTHESIS OF OXYAPATITE $La_{9.33}(SiO_4)_6O_2$

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Due to the high oxide-ion conductivity lanthanum silicates with the apatite-type structure are the potential solid electrolytes for solid oxide fuel cells. We have synthesized one of them, $La_{9.33}(SiO_4)_6O_2$, by sol-gel self-combustion procedure using glycine as a fuel and nitrate as an oxidizer. Lanthanum nitrate hexahydrate, tetraethyl orthosilicate (TEOS), water and glicine were added into 20 ml of ethanol and stirred at room temperature until a clear solution was formed. The sol was transformed into a gel during heating at 60°C. Dry gel undergoes the self-sustaining combustion when heated on a hot plate. The produced ash was calcined at 600 °C to burn out the remained organic components. The phase identification and the crystal structure examination were performed by X-ray powder diffraction. Only the $La_{9.33}(SiO_4)_6O_2$ phase was obtained from the solution precursor with the molar ratio of TEOS to $H_2O$ equal 1:20. Amorphous ash was produced after self-combustion at the 0.33 molar ratio (R) of glicine to $NO_3^-$, while the crystallized ash of $La_{9.33}(SiO_4)_6O_2$ was directly synthesized at the higher molar ratio R of 0.56. Well-crystallized $La_{9.33}(SiO_4)_6O_2$ structure was obtained from both powders sintered at 1200°C, significantly lower temperature in comparison with the one in solid-state reaction. The lattice parameters $a$ = 9.7156(9) and $c$ = 7.1810(8) Å confirmed the composition of $La_{9.33}(SiO_4)_6O_2$.

*P.S.A.7*

## DETERMINATION OF SURFACE PROPERTIES OF VARIOUS OXIDES AND SULFIDES BY INVERSE GAS CHROMATOGRAPHY

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The surface properties of various oxides ($ZrO_2$ and $Fe_3O_4$) and sulfides (HgS and FeS) were investigated by the inverse gas chromatography method (IGC). The retentions of several organics were measured in the temperature range from 330 to 500 K. The dispersive component of surface free energies ($\gamma_s^d$) and the acid-base character of used adsorbent surfaces were estimated using retention times of different non-polar and polar organics at the infinite dilution region. The calculated $\gamma_s^d$ values decrease with temperature increase. The obtained results proved that IGC is an efficient and successful technique for the characterization of the surface properties of this kind of materials.

*P.S.A.8*

## SYNTHESIS AND CHARACTERIZATION OF STABLE AQUEOUS CERIA SOLS

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Stable colloidal aqueous dispersions (sols) of cerium (IV) oxide of uniform size distribution were obtained by forced hydrolysis of cerium (IV) ions in the presence of diluted sulfuric or nitric acids. Synthesis of ceria sols was carried out using two commercially available precursors: $Ce(SO_4)_2$ $4H_2O$ salt and 1 N $Ce(NO_3)_4$ aqueous solution. The precursors were dissolved in different concentrations of diluted sulfuric or nitric acid. Then, these solutions were added drop-wise to the boiling diluted aqueous acid solutions, continuously stirred. After aging for various periods of time (2-24 h), the sols were cooled at room temperature. Sulfate and nitrate ions were removed from the sols particles by ultrafiltration.

Characterization of the synthesized ceria sols have been made by X-ray, nitrogen adsorption/desorption and DSC-TGA thermal analysis, as well as IR spectroscopy. Particle sizes, measured using a Zetasizer Nano equipped with a MPT-2 Autotitrator, range from 20 to 600 nm.

*P.S.A.9*

## DEPOSITION OF HEMATITE FROM FLOWING SUSPENSION ONTO ALUMINUM WALL

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Fouling, defined as an accumulation of undesired solid particulate matter suspended in a fluid at the phase interfaces, often found in industrial equipment, causes reduction in their efficiency. The ability to predict and control the rate at which the particles deposit is important, in particular to the power generating industry.

An experimental set-up, allowing the quantification of physico-chemical parameters and hydrodynamics has been constructed to study the deposition of hematite (one of the possible corrosion products) on the pipe walls of the circuit. The circuit was made of polypropylene, while the test section was an Al-tube. These materials were chosen due to the large gap in their points of zero charge. The analysis method was based on the real-time turbidimetric measurement of particles concentration remaining in suspension, leading to the amount of those deposited. The influence of the suspension pH on the deposition process has been investigated under the turbulent flow.

Knowing that the deposition process is governed by the combined influence of the transport mechanism and chemical interactions described by the DLVO theory, the obtained results were discussed in the light of the surface properties of the materials used, hematite, polypropylene and aluminium. Good agreement between experimental data and predictions was found; significant deposition occurred at the pH where hematite and Al were oppositely charged.

*P.S.A.10*

## MECHANOCHEMICALLY ENHANCED LOW-TEMPERATURE SYNTHESIS OF Y-DOPED $BaTiO_3$ PTCR CERAMIC

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The positive-temperature-coefficient-resistivity (PTCR) effect is characterized by a rapid increase of the resistance (several orders of magnitude) when the temperature is raised through the ferroelectric–paraelectric phase transition temperature (Curie point). The barium titanate powders can be modified with some additives (dopants) in order to obtain ceramic products with a PTCR behavior during heating in the vicinity of their Curie temperature. The reagent grade BaTiO3 and 0.3mol%$Y_2O_3$ were weighted and milled in a planetary ball mill during various time of mehanochemical treatment. As obtained powder mixtures were uniaxially pressed (P=150MPa) and isothermally heated at T=1423K during one hour, in the presence $B_2O_3$ vapor phase, in a closed alumina crucibles. Under the defined (optimal) conditions of mechanochemical pretreatment, Y-doped $BaTiO_3$ PTCR ceramic was obtained, significantly bellow the commonly used sintering temperature, from 1570K to 1650K. On this way, high-temperature reaction step between the $BaTiO_3$ and $Y_2O_3$ can be replaced by appropriate mechanohemical treatment at room temperature. During heating of the mechanochemically treated, Y-doped $BaTiO_3$ powders, in the presence $B_2O_3$ vapor phase, the amount of boron oxide was kept constant: about 0.5 mol% $B_2O_3$ powders were placed beside the samples obtained after various time of mechanochemical treatment under the bottom-up alumina crucible. On this way, sintering in the presence of the liquid phase allow to obtain some samples with the electrical resistivities $\rho<300\Omega m$, far bellow from ones characteristic for the undoped $BaTiO_3$ dielectric ceramics. This value was obtained only for the some samples mechanochemically treated under defined (optimal) milling conditions.

*P.S.A.11*

## INFLUENCE OF MECHANICAL ACTIVATION ON BaO-ZnO-$TiO_2$ SYSTEM

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The influence of mechanical activation on BaO-ZnO-$TiO_2$ sistem was observed. Mixtures of BaO-ZnO-$TiO_2$ were mechanically activated using high-energy planetary ball mill during 0, 5, 10, 20, 40 and 80 minutes. XRD analyses were imployed in order to give information about powder’s phase composition. Microstructure parameters were revealed from an approximation method. As the time of mechanical activation increased, the decrease in particle size was observed. The effect of milling on microstructure was investigated by scanning electron microscopy as well.

*P.S.A.12*

# INFLUENCE OF MECHANICAL ACTIVATION ON MgO-TiO$_2$ SYSTEM

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In this paper the influence of mechanical activation on MgO-TiO$_2$ system has been investigated. Mixtures of MgO-TiO$_2$ were mechanically activated using high-energy planetary ball mill during 0, 5, 10, 20, 40, 80 and 120 minutes. XRD analyses were performed in order to give information about phase composition and to determine variety of microstructure parameters using approximation method. The decrease in powder's particle size was noticed as the time of mechanical activation increased. Also, the effect of tribophysical activation on microstructure was investigated by scanning electron microscopy.

*P.S.A.13*

# SYNTHESIS OF MICROCRYSTALLINE SILICON THIN FILMS BY GAS-JET ELECTRON-BEAM PLASMA METHOD

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Micro- and nano crystalline Si thin films on foreign cost-effective substrates have received attention recently from photovoltaic community. Growth of microcrystalline silicon thin films using plasma enhanced or hot wire CVD is carried out at low temperatures but at low deposition rate. We developed the method for high-rate deposition of micro- and nano crystalline Si films. The method is based on the activation of a gas mixture jet by electron beam plasma and fast convective transfer of generated radicals by supersonic free jet to a substrate. The jet protects the substrate from background gases. Fast convective transfer of active particles by the jet inhibits undesirable gas-phase processes and dust formation. A series of samples were deposited by changing the $SiH_4$ /Ar dilution ratio, substrate temperature, electron beam current and bias potential. The films were characterized by means of high-resolution electron microscopy HREM (JEOL JEM 200 CX microscope) and Raman spectroscopy (Triplemate SPEX). The dark and photoconductivity were obtained by I-V measurements using the four-point method on samples with Al coplanar electrodes. It was found that the structure of Si films deposited on $Si/SiO_2$ substrates with a growth rate 5nm/s in the temperature range 100 – $250^o$ C is mostly dependent on Ar flow rate and the distance between the substrate and the nozzle. At a larger distance Si films are found to be fully amorphous. At short distance crystalline are damaged due to irradiation by heavy argon ions existing in the plasma. Silicon films grown at optimal distance contains well shaped crystalline grains (size about 2-10 nm) embedded with amorphous phase. The crystalline volume fraction was estimated by the deconvolution of the Raman TO phonon band into three Gaussian peaks corresponding to amorphous component ($480cm^{-1}$), crystalline component ($515\text{-}520cm^{-1}$) and intermediate component, arising due to bond dilation at the grain boundary. This procedure was useful to obtain the correlation of conductivity and photosensitivity with film crystallinity. It was shown that for volume fraction of crystallite larger than 40% (critical percolation concentration) dark conductivity would be approximately the conductivity of crystalline fraction. We demonstrate a high-rate method without $H_2$ dilution for deposition of micro- and nano crystalline silicon films available for solar cell application.

*P.S.A.14*

# SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF MESOPOROUS SILICA THIN FILMS

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Mesoporous materials found application in various fields from physics to biology. Synthesis of periodically organized mesoporous films have already opened new application in micro-optics and photonic devices, microelectronics, sensors, catalysis, fuel cells, biomaterials etc. Usually self-assembly mesoporous thin films are obtained through templated growth in the presence of molecular polymeric surfactants. One of the main problems in the field of surfactant- templated films is the control of pore orientation and morphology. We developed new version of method to control the porous structure of thin films - ellipsometric porosimetry (EP). The principal feature of EP is to utilize the change of optical characteristics of the porous films during the vapor adsorption and desorption to determine the mass of an adsorbate condensed/adsorbed in pores. The pore size distribution is calculated from desorption isotherm by Kelvin equation. Additional information concerning films microstructure was obtained by transmission electron microscopy (TEM) on JEOL JEM 200 CX. We demonstrate that ordered mesoporous $SiO_2$ films has been synthesized via sol-gel deposition on mono-Si wafer as substrate. A sol containing nonionic surfactant Pluronic P123, silica precursor tetraethoxy silane (TEOS), ethanol, water and hydrochloric acid was used as precursor solution. After spin-coating films were dried at room temperature and annealed in air at $550^{o}C$ leading to the further condensation of the silicate matrix and the removal of the surfactant. To optimize the film properties several processing parameters such as composition and solution aging time were studied. It was obtained that porous structure of films stabilized after 3 hours of solution aging and was stable at least for 5 days of solution aging. Porous in these films are mainly oriented perpendicularly to the surface of silicon wafer and have the uniform dimensions of four nanometers in diameter. Porosity of these films was 40% by volume. Inner surface of pores (equal 282 $m^2/m^3$) was calculated from adsorption isotherm obtained by EP. Porosity of films and porous dimensions started to decrease after one week of solution aging. After 14 days of solution aging porosity of the film was 35% and porous size distribution was shifted to the less value. TEM picture shows that porous in this film are oriented in the plane of the surface of silicon wafer. It was concluded that to obtain films with uniform porous structure a solution of composition studied should be used after 3 hours but before 5 days of preparing of this solution.

*P.S.A.15*

## MUSHY LAYER FORMATION DURING SOLIDIFICATION OF BINARY ALLOYS FROM A COOLED WALL: THE ROLE OF BONDARY CONDITIONS

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Unidirectional solidification processes are well-known methods for obtaining of solid ingots. A structure of solid materials depends, first of all, upon the conditions of solidification regime; the simplest theoretical model of which is based on the classical Stefan thermodiffusion problem. We present a theory and numerical calculations of incipience of a mushy layer using different regimes of solid wall cooling (rate of solidification, front position, temperature and solute concentration distributions, time of mushy layer incipience are found). This work was made possible in part due to the financial support of grants Nos. 08-01-00298, 07-03-96069 Ural (Russian Foundation for Basic Research) and MD-4563.2008.2 (President Grant).

*P.S.A.16*

## DIRECTIONAL SOLIDIFICATION OF TERNARY ALLOYS

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We present a model for non-convecting diffusion-controlled solidification of a ternary (three component) alloy cooled from below at a planar boundary. The modeling extends previous theory for binary alloy solidification by including a conservation equation for the additional solute component. A primary mushy layer, which corresponds to solidification along a liquidus surface in the ternary phase diagram, forms above a secondary (or cotectic) mushy layer, which corresponds to solidification along a cotectic line in the ternary phase diagram. We obtain a one-dimensional solution and compare our predictions with known experimental results. This work was made possible in part due to the financial support of grants Nos. 08-01-00298, 07-01-96091 Ural, 07-03-96069 Ural (Russian Foundation for Basic Research) and MD-4563.2008.2 (President Grant).

*P.S.A.17*

## ION BEAM MODIFICATION OF Al/Ti MULTILAYERS

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Aluminum/titanium multilayers were sputter deposited on (100) Si wafers and irradiated with 200 keV $Ar^+$ and $N_2^+$ ions. Implanted fluences were in the range from $5\cdot10^{15}$ to $4\cdot10^{16}$ ions/cm$^2$, for argon ions, and $1\cdot10^{17}$ and $2\cdot10^{17}$ ions/cm$^2$ for nitrogen. The samples were analyzed by Rutherford backscattering spectroscopy, transmission electron microscopy and X-ray diffraction. Irradiation with argon ions induces mixing between Ti and Al layers, which is more pronounced in the vicinity of the projected range of implanted species. TEM cross section analysis show significant growth of grain size with the increase of Ar ion fluence. It was found that implantation with nitrogen ions, up to these high fluences, causes a full intermixing of Al/Ti layers, resulting in multilayered structures with different content of Al, Ti and N. In the latter case, nitrogen ion irradiation, probably, induces the formation of titanium-, aluminum- and intermetalic nitrides.

*P.S.A.18*

## ELECTROCRYSTALLIZATION OF DENSE NANOSTRUCTURED SILVER LAYERS USING PULSE CURRENTS

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Application of pulse current for metal electrodeposition has many advantages. It permits using high pick current density what is favourable for nanostructuring. In this work we applied square waveforms with pick current density up 50 A/dm$^2$ and very short pulses 1-100 ms. Silver layers were deposited from new and reported in literature noncyanide electrolytes. Microstructure and surface morphology of these electrodeposits were examined by SEM, HRSEM, AFM and XRD techniques. Silver layers deposited by pulse plating had nanocrystalline structure, they were more ultrafine and compact in comparison with layers obtained under direct plating.

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*P.S.A.19*

## PREPARATION OF POROUS SILICA CERAMICS USING THE WOOD TEMPLATE

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Porous silica ($SiO_2$) ceramic with a wood like structure was prepared by wet impregnation from tetraethylorthosilicate (TEOS) into biological template derived from linden wood (tilia amurensis). Repeated pressure impregnation and subsequent annealing in air atmosphere at 800°C resulted in burn out of the template and consolidation of the oxide layers. The products exhibit structures corresponding to negative replication of biological templates. X-ray diffraction (XRD), scanning electron microscopy (SEM), infra red (IR), and BET measurements were employed to characterize the phases and crystal structure of biomorphic ceramics. It was found that the bioorganic structure is converted into oxide ceramics ($SiO_2$). At low temperature (800°C), pore radius varied between 2 and 10 nm indicating that the samples were mostly mesoporous. Samples treated at higher temperature (1300°C) lost the mesoporous behaviour, however, they were yet porous with the microstructural features of the biological perform.

*P.S.A.20*

## ELECTROCHEMICAL BEHAVIOR OF $V_2O_5$ TREATED WITH $H_2O_2$

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$V_2O_5$ can be used as cathode material in rechargeable lithium-ion batteries. The dissolution of solid precursors (oxide or metal) into hydrogen peroxide solutions ($H_2O_2$) is commonly used procedure for the wet synthesis of transition metal oxides. In this work, a commercial $V_2O_5$ powder was modified in the vigorous reaction with 30% solution of $H_2O_2$. Physical characterization of the obtained powder was performed by X-ray powder diffraction (XRPD), SEM, while electrochemical behavior was examined by cyclic voltammetry (CV) in saturated solution of $LiNO_3$ and galvanostatic cycling in 1M $LiClO_4$ in propylene carbonate. For treated sample, the XRPD analysis showed mixture of vanadium oxides while SEM images revealed fibrous structure. First five CV curves in saturated $LiNO_3$ for $V_2O_5$ treated with 30% $H_2O_2$ showed increase of current in every next cycle. Initial discharge capacity of commercial $V_2O_5$ was found to be 337 $mAhg^{-1}$ which decreased to 306 $mAhg^{-1}$ after 5 cycles. $V_2O_5$ treated 30% $H_2O_2$ showed initial discharge capacity of 319 $mAhg^{-1}$ while after 5 cycles discharge capacity increased to 337 $mAhg^{-1}$.

*P.S.A.21*

# NANOCRYSTALLINE NICKEL: ELECTROSYNTHESIS, MICROSTRUCTURE AND PROPERTIES

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Electrodeposition is technologically feasible and inexpensive process for fabricating dense metallic nanostructures. This study presents the effects of pulse plating and composition of electrolyte on the structure of nanocrystalline nickel deposits. Also, their mechanical properties e.g. microhardness (by Vickers method), roughness and corrosion resistance (potentiodynamic curves) were investigated. Nickel was obtained from new electrolytes. The electrodeposition experiments were carried out under direct and pulse current conditions. The microstructure of the layers was examined by SEM, HRSEM, AFM and XRD measurements. These analyses confirmed their nanostructured character.

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*P.S.A.22*

# THE THICKNESS, MORPHOLOGY AND STRUCTURE OF SOL-GEL $Bi_{12}SiO_{20}$ THIN FILMS

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The sol-gel method was used to synthesize thin films with the composition $Bi_{12}SiO_{20}$. The sol was prepared with the use of $Bi(NO_3)_3.5H_2O$ or $Bi(CH_3COO)_3$ and $Si(OC_2H_5)_4$ as the precursors, 2-ethoxyethanol and acetic acid as the solvents, and ethanolamine as the stabilizer. The two solvents – 2-ethoxyethanol and acetic acid – were compared. Thin films were deposited on a $Pt/TiO_2/SiO_2/Si$ substrate by spin-coating and heat treated at $700^0$C. The thickness, structure and morphology of the films were characterized by means of x-ray diffraction (XRD), scanning electron microscopy (SEM) and atomic force microscopy (AFM). We found that the solvent has a strong effect on the morphology. The solution prepared with the glacial acetic acid had a shorter gelation time and, therefore, less uniform thin films. These films were thicker than those prepared from 2-ethoxyethanol. Therefore, 2-ethoxyethanol is the preferable solvent. The influence of the precursors and the solvent on the thickness, morphology and structure of $Bi_{12}SiO_{20}$ (BSO) thin films will be reported.

*P.S.A.23*

## INFLUENCE OF UNIPOLAR PULSE BIASING PARAMETERS ON PLASMA NITRIDING PROCESS EFFICIENCY

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Optimization of unipolar plasma nitriding process efficiency requires setting of various system parameters. Number of adjustable system parameters is quite large and their influence on process efficiency is often opposite. The influence of unipolar pulse plasma generator parameters like pulse frequency and duty cycle ratio on nitriding process efficiency was analyzed in more details. From previous investigation it was found that the increase of pulse frequency results in decreased process efficiency, but on the other hand it leads to decreased gas discharge instabilities occurrences and provides more stable operation. Thus, plasma nitriding process relays on the compromise between the process efficiency and process stability. The overall process efficiency could be estimated through the optical emission signal analysis, since the data on the active species generation responsible for physical and chemical processes in the discharge are stored in optical emission signals. Emission spectra of active species were analyzed in parallel with power supply pulses. It was found that in the case of high frequency and low duty cycle pulsed plasma the stationary state concentration of the excited active species for nitriding process cannot be attained. This resulted in less efficient chemical processes on the cathode surface. Charge particles generation is related to pulse power characteristics and is strongly influenced by generator properties, interconnection line and the most significantly, on the vacuum chamber properties including workpiece shape and physical properties. The results of thermochemical plasma processing of two steel grade samples in nitrogen containing discharge at various pulse power parameters were presented and related to emission spectra of active species for plasma nitriding.

*P.S.A.24*

## STUDIES OF ATMOSPHERIC DISCHARGE OF SMALL DIMENSIONS USED FOR TREATMENT OF BIOLOGICAL SAMPLES

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Advantage of atmospheric non-equilibrium plasmas is that it is possible to treat samples that are sensitive to low pressures and plasma can easily be put in contact with samples that need to be treated. Because of its mild plasma and geometry, plasma needle is especially convenient for medical applications. Non contact disinfection of dental cavities and wounds and minimum-destructive precise treatment and removal of diseased tissue can be done by plasma needle. Radicals generated by plasma itself may play a very important role in such interactions. Mass spectrometry was done to provide better insight into plasma-cell interactions. For the power measurements the derivative probes were used. The volume and intensity of plasma were obtained by using images taken by the fast ICCD camera. Plasma needle was used for treatment of plant cells taken from *Polypodium vulgare L.* (fam. Polypodiaceae).

*P.S.A.25*

## CALCULATION OF PULSED PHOTOTHERMAL FIELDS USING *K*-SPACE METHOD: BIOMEDICAL APPLICATIONS

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Biomedical applications of photothermal techniques require efficient models of photothermal wave propagation that can incorporate realistic properties of soft tissue, such as thermal inhomogeneities both for purposes of simulation and for use in model-based image reconstruction models. In the paper two numerical models that calculate the time-dependent temperature field produced by an arbitrary thermal source in a sample, such as that generated by the absorption of a short laser pulse, are presented. It is demonstrated that these models can achieve the same accuracy as the conventional finite element and finite difference models, and larger time-steps can be taken without loss of stability or accuracy. They are also straightforward to encode numerically, making them appealing as a general tool for biomedical imaging.

*P.S.A.26*

## SURFACE CHARACTERISATION OF ALLOYS BY OPTO-MAGNETIC FINGERPRINT

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Valence electrons, ion-electron and hydrogen bonds make major links in matter network. The orbital velocity of valence electron in atoms is about $10^6$ m/s, what gives ratio between magnetic force ($F_M$) and electrical force ($F_E$) of about $F_M/F_E \approx 10^{-4}$. Since force related directly to quantum action (Planck action, $h = F \times d \times t = 6.626 \text{ x } 10^{-34}$ $Js$) it means that magnetic force is four of order closer to quantum action than electrical. Picture of surface of classical optical microscope is based on electromagnetic property of light. However, some optical microscopes are based on polarized light and picture of surface represents electrical property of light.

We develop opto-magnetic method to characterized surface and thin depth under surface of matter. During surface characterization we become aware that it is possible to identify difference of alloys by their composition. In paper we present our recent results of investigation. We believe that this method open very chip, efficient and simple procedure to identified different materials and characterize materials surfaces.

*P.S.A.27*

## SURFACE CHARACTERISATION BY ATOMIC FORCE MICROSCOPY AND MAGNETIC FORCE MICROSCOPY

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In this paper we present research results of surface characterization of different materials (metal, alloys, skin and other) conducted by atomic force microscopy (AFM) and magnetic force microscopy (MFM). Our analysis shows clear possibilities for analysis of surface topography in the range of several nanometers and, with the application of phase contrasting technique, the accuracy that may go below one nanometer. In combination with magnetic force microscopy, this method gives us three-way analysis method that allows us to determine sensitive surface-roughness and magnetic properties of materials (in paramagnetic and diamagnetic range) that, combined, yield the localities within material that significantly vary in their magnetic behavior.

*P.S.A.28*

## ELECTRONIC SPECTROSCOPY STUDY OF THE INTERACTION OF BIOLOGICALLY ACTIVE HYDROQUINONE AVAROL AND RELATED COMPOUNDS WITH DNA

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A number of sesquiterpenoid quinones and hydroquinones of marine origin have been described. These compounds 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 results of the interaction of avarol, avarone, and methylamino derivatives of avarone are reported here. The interactions of avarol, avarone and its 3'-, and 4'-methylamino derivatives (in increasing concentrations of compounds) with linear high-molecular calf thymus DNA were investigated by UV-Vis absorption and fluorescence measurements. Absorption spectra of DNA showed an induction of a hyperchromic effect by these compounds, which is the most pronounced in case of 4'-methylamino derivative, which is very active to melanoma Fem-X cells, indicating a possible significance of DNA binding to antitumor activity of the compound. Fluorescence spectra showed influence of avarol, avarone and its derivatives on the interaction of ethidium bromide with DNA, by a decrease in intensity of ethidium fluorescence. The fluorescence profiles of the ethidium bromide in the presence of increasing concentration of compounds exhibit shift in wavelength maximum and hypochromism. The effects are again most pronounced with 4'-methylamino derivative.

*P.S.A.29*

# FORMATION AND SPECTRA OF PLASMON-COUPLED GOLD NANOPARTICLE DIMERS WITH DNA STRANDS

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A major challenge in the area of deoxyribonucleic acid (DNA) detection is the development of methods that do not rely on polymerase chain reaction (PCR) or comparable target-amplification systems. In exploration of novel techniques to probe binding strengths between molecules the gold nanoparticle dimer as a transducer of molecular properties is investigated. When two metal nanoparticles are brought close together their plasmon oscillations couple in a distance dependent manner. This coupling causes the change in color and intensity of light scattered from gold nanoparticles. Gold nanoparticle dimmers used in our investigation comprise of pair of gold nanoparticles linked with DNA oligonucleotides. To investigate distance dependent behavior of gold nanoparticles, modeling with three-dimensional Finite Element Method (FEM) was conducted. Though theoretical responses of gold nanoparticle dimers distance properties were previously reported, they all use effective refractive indices to determine the wavelength shift. 3D FEM gives freedom to define all the components of the system, including layers attached to gold nanoparticles without need for effective refractive indices. The goal of the simulations was to find the resonant wavelengths of coupled-gold nanoparticles and investigate shift in the peaks position due to change in interparticle distance. Spectra of coupled gold nanoparticles coated by 3nm thick layer of protein in water solution on microscope slide were calculated for a range of distances from 2nm to 14nm. To form dimmers consisting of two gold nanoparticles connected with DNA sequence particle functionalization was performed. Gold nanoparticles 40nm in diameter (BBI International) were first coated by streptavidin monolayer. In subsequent experiments biotinylated complimentary DNA oligonucleotides were used to form nanoparticle dimmers. The streptavidin-modified gold nanoparticles were attached to biotinylated-BSA on the surface of the microscope slide. One group of modified gold nanoparticles was coated by single stranded wild type DNA while the second group was coated with complementary DNA. Binding of nanoparticles coated with complementary DNA to nanoparticles coated with wild type DNA resulted in dimmers formation. The Princeton instruments PIXIS100B thermo-elastically cooled camera was used in combination with Acton Instruments 2150 imaging spectrograph to record scattering spectra of gold nanoparticles. The 300 l/mm grove grating blazed at 500nm was used for spectroscopy. The camera and spectrograph are attached to the side port of Nikon TE200 microscope. The 100W halogen lamp was used for illumination and 40x 0.6NA adjustable working distance objective for collecting the light. The dark field oil immersion condenser 1.36NA was used to form dark-filed illumination. Spectra were recorded with integration time from 0.5-2s at 100kHz readout rate of the camera to increase signal to noise ratio. Scattering spectra of gold nanoparticles and dimmers were recorded and compared with FEM simulation results.

*P.S.A.30*

# THEORETICAL CALCULATION OF THE GROUND STATE STRUCTURE OF $BC_2$ GAS PHASE MOLECULE

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Boron carbide is an important non-metallic material with outstanding qualities. It has been widely used because of its high hardness, low density, high melting and boiling points and chemical inertness. It is semiconductor and it possesses a large neutron capture cross section. Important techniques to produce solid boron carbide are chemical vapour deposition (CVD), plasma enhanced chemical vapour deposition (PECVD), laser assisted chemical vapour deposition (LCVD) [1,2]. In the vapour, used in the synthesis of boron carbide *via* these methods, different species (atoms, molecules, ions and electrons) are formed, among them the initial molecules for cluster formation, as a connection between the individual (isolated) molecules and the solid state structure. Mixed boron/ carbon species could present the species of that kind [3]. The subject of this contribution is a theoretical investigation of the ground-state structure of the $BC_2$ isolated molecule. It is determined using MOLPRO software package. We found that the most stable configuration corresponds to a triangle arrangement close to the $C_{2v}$ symmetry, with a low barrier that separates two symmetrically placed total minima. Only two vibrational levels are computed to lie below the potential barrier. For these levels the tunnelling probabilities are calculated. Besides, there is a local minimum corresponding to the linear geometry of the molecule. It is separated from the global minimum by a barrier of roughly 16 kJ/mole. All the mentioned specific structural characteristics are expected to play significant role in both the solid [4] and the gas phase, and particularly in the process of sublimation.

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*P.S.A.31*

## RUBY LASER INTERACTION WITH AUSTENITE STRUCTURAL MATERIALS

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The investigations were carried out on chrome nickel steel and various nickel based superalloys which are widely used in many industrial applications due to their extraordinary mechanical properties at elevated temperature and a very good corrosion resistance. The damages occurred by exposing of the chrome nickel steel and nickel based superalloy samples to the ruby laser were observed by an optical microscope. The characteristic damaged areas were detected by SEM. In this paper, the influence of laser power density (MW/mm$^2$) to the microstructural changes of heat treated chrome nickel steel and nickel based superalloys are analysed and discussed . Also, the effect of various number of drilling in the same point to the microstructural transformation of mentioned materials is discussed. The ruby laser had following characteristics: pulse length 30 ns, wavelength 694,3 nm, coherent beam length 1m and focal length of a lens 100mm. The focused beam and various positions of samples placed to the lens focus were used. Laser was adjusted to work with 1J output energy because of technical reasons and thereby the laser power was 30MW. Power density at the sample surface fluctuated from 10-30 MW/mm$^2$.

Key words: ruby laser, drilling, microstructure, chrome nickel steel, nickel based superalloy.

*P.S.A.32*

## NONISOTHERMAL SINTERING PROCESS OF POROUS BODY AT ULTRA HIGH TEMPERATURE RATE

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Rapid nonisothermal sintering is one way of making nanocrystalline high strength materials. The present investigation considers process influence of heating parameters on structural ZrC behavior and strength. The sintering under rapid heating rate up to ~ 600 K/s of porous ZrC increases the shrinkage rate 10$^3$ times in comparison with isothermal sintering and. retains low initial grain size. Achieved fine-grained regular-pore structure raises strength level up 650 MPa. Possible sintering mechanism is examined for powder compacts with temperature gradient and originated local thermal stresses. Densification of the porous body is accelerated due to increasing of dislocations mobility on rough powder surfaces under activity of thermal stresses and enhanced viscous sliding.

*P.S.A.33*

## SYNTHESIS AND CHARACTERIZATION OF SEMICONDUCTING MACROMOLECULAR COMPLEX POLYANILINE–STARCH

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Novel semiconducting macromolecular complexes of polyaniline (PANI) and starch were synthesized by the oxidation of aniline with ammonium peroxydisulfate as an oxidant in aqueous solution, in the presence of soluble potato starch. The influence of aniline to oxidant molar ratio on the electrical conductivity, molecular and supramolecular structure of PANI–starch complexes was studied. The electrical conductivity of protonated macromolecular complexes is in the range $(1.2–7.6)\times10^{-4}$ S cm$^{-1}$. Layered supramolecular structure of the samples was revealed by scanning electron microscopy. Strong interactions between macromolecular chains of PANI and starch, as well as the partial oxidation of starch with ammonium peroxydisulfate were proved by FTIR spectroscopy.

*P.S.A.34*

## OXIDATIVE STABILITY OF COLD-PRESSED HIGHOLEIC SUNFLOWER OILS

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Lipid oxidation is resposible for chemical changes in fats and oils that lead to food spoilage and flavor deterioration.

Oxidative stability of cold-pressed sunflower oils with enhanced oleic acid and β tocopherol content was analysed in bulk oils and emulsions, using differential scanning calorimetry method, lipid hydroperoxide and free fatty acid determination. Oleic:linoleic acid ratio influenced oxidative stability of both bulk oils and emulsions, although bulk oils appear to be more stable. A good understanding of lipid oxidation kinetics in vegetable oils can improve our abilities to formulate food products that maintain the existing oil quality in food system and minimize production of undesirable breakdown components. Kinetic data are essential for predicting oxidative stability of vegetable oils under various heat processing, storage and distribution conditions Oxidation kinetic parameters, for bulk oils, from Arrhenius eqation, activation energy (Ea), pre-exponential factor (A), and oxidation rate constant (k) were calculated usig the Ozawa-Flynn-Wall method by differential scanning calorimetry method.

*P.S.A.35*

## EFFECTS OF THE POSTPOLYMERIZATION TREATMENTS ON AMOUNT OF RESIDUAL MONOMER IN DENTURES

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Poly (methyl methacrylate) is used for producing a denture bases. It is a material made by the polymerization process of methyl methacrylate. Despite of the polymerization type, there is a certain amount of free methyl methacrylate (residual monomer) incorporated in the denture, which can cause irritation of the oral mucosa. The purpose of this study was to determine the amount of the residual monomer in 4 different denture base acrylic resins by liquid chromatography and the possibility of its reduction. After the polymerization, a postpolymerization treatment was performed in 3 different ways: in boiling water for 30 minutes, with 500W microwaves for 3 minutes and in steam bath at 22$^0$C for 1-30 days. The obtained results denote a less content of residual monomer in the samples witch have undergone the postpolymerization treatment.

Key words: PMMA, denture, residual monomer.

*P.S.A.36*

## IDENTIFICATION AND DETERMINATION OF POLY(VINYLPYRROLIDONE) BY OFF-LINE PYROLYSIS-GAS CHROMATOGRAPHY/MASS SPECTROMETRY

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Pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) is an instrumental method that enables a reproducible characterization of non-volatile samples like synthetic polymers which can be detected in the natural environment as a result of pollution. In this work off-line Py-GC/MS was used to determine trace levels of poly(vinylpyrrolidone), PVP, in environmental water samples. The samples were pre-extracted with hexane and diethyl-ether in order to decrease an amount of organic substrate available for pyrolysis and then were heated to a temperature of 500 °C to cause rapid polymer fragmentation into volatile products – compounds capable of being analyzed using GC/MS. The main fragmentation product of PVP was *N*-vinyl-2-pyrrolidone, NVP. The amount of generated NVP was used for the calculation of PVP level in the analyzed water sample.

*P.S.A.37*

# THERMAL BEHAVIOUR AND POROSITY OF CHELATING MACROPOROUS POLY(GMA-*co*-EGDMA)

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In this study, the effect of the modification with amine and metal immobilization on the thermal properties and porosity of macroporous poly(glycidyl methacrylate-*co*-ethylene glycol dimethacrylate), PGME was investigated. PGME was synthesized by suspension copolymerization and modified by ring-opening reaction of the pendant epoxy groups with ethylene diamine, EDA. The specific surface area of initial PGME, the sample modified with amine (PGME-en) and PGME-en with immobilized Cu(II) and Au(III) ions (PGME-en/Cu and PGME-en/Au) was determined by the BET method from the low-temperature nitrogen adsorption isotherms (77 K). Morphology of samples was investigated with scanning electron microscopy. The amount of Cu(II) and Au(III) immobilized on PGME-en was determined from the metal concentration in filtrate, by atomic absorption spectrometry.

Thermal stability of PGME, PGME-en, PGME-en/Cu and PGME-en/Au was investigated using a Setaram DSC 111 equipment coupled with a mass spectrometer (Thermostar from Pfeifer) as a detector. Capillary-coupling system was used. The experiments were carried out in a flow, with either oxygen or helium as the carrier gas, up to 450ºC. During this temperature increase, the mass $m/e = 44$ corresponding to carbon dioxide was monitored. In oxygen flow, complete combustion of organic component happened: exothermic processes with peak maxima in temperature range between 200ºC and 300ºC were noticed. Different DSC profiles that have been recorded proved that PGME-en and PGME-en/Au are more thermally stable then PGME and PGME-en/Cu samples. Similar results were obtained in helium flow: endothermic peaks that can be assigned to phase transformations were recorded at ~300°C for PGME and PGME-en/Cu and at ~400°C for PGME-en and PGME-en/Au samples.

*P.S.A.38*

## IMPROVEMENT OF IMPACT TOUGHNESS OF 7179-T651 ALUMINUM ALLOY BY RETROGRESSION AND RE-AGING PROCESS

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The age hardenable high strength aluminum alloys such as 7079-T6 was developed for use in heavy sections of forged products. The higher strength 7079-T6 aluminum alloy (T6-temper) exhibits low resistance to stress corrosion cracking (SCC). The resistance of the alloy may be improved by overaging (T7-temper) with sacrifice in strength, or by retrogression and re-aging (RRA) heat treatment process, maintaining higher strength of the T6 temper. In this study, electrical conductivity, impact and hardness measurements are conducted to determine the effects of ~70% in an impact toughness (17J RRA vs 10J) and ~17% in an electrical conductivity (37.41%IACS RRA vs 31.85% IACS), and a decrease in hardness by ~ 13% (172HB RRA vs 194HB), when the alloy exposed to retrogression temperature at $200^0$C for 20 minutes, and then re-aged at $160^0$C for 18 hours.

*P.S.A.39*

## STRUCTURE AND PROPERTIES OF COATINGS OF FE–CR–B–SI SYSTEM OBTAINED BY THE LASER CLADDING

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Structure and properties of coatings of the system Fe-Cr-B-Si obtained by the plasma spraying of powders as well as slicker coatings with the same composition after the subsequent laser remelting have been investigated. The carried out experiments have allowed establishing that depending on modes of laser remelting the formation from cast equilibrium up to fine quasi-eutectic structures is possible. The generated coatings are characterized by a high degree of non-equilibrium state both solid solutions and reinforcing phase. The dependences connecting physico-mechanical and operational properties of coatings with parameters of structure and modes of a laser processing have been obtained. At optimum modes the average microhardness about 12000 MPa is reached and the increase of wear resistance makes 2.5 … 4 times in comparison with the coatings formed by traditional methods.

*P.S.A.40*

## THEORETICAL ASSESSMENT OF STABILITY OF DUAL-METAL (Cd + Pb) SUBSTITUTED HYDROXYAPATITE MATERIAL

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Immobilization of toxic metals by hydroxyapatite (HAP) and apatite like-materials is an effective approach for water and soil remediation and waste stabilization. Efficacy and safety of this process mainly depend on the stability of the final product which incorporates metals. It was previously demonstrated that the ion-ion interaction potential (IIIP), representing the main term of the cohesive energy, can be successfully applied for assessment of stability of the metal substituted apatites. Here, the IIIP parameters were calculated for simultaneous dual substitution of Cd and Pb into the HAP structure, using the new version of "WasteMatrix 3.0" software. Results of this calculation are presented as a 2D color graph, where IIIP values are represented by colors. The obtained results demonstrate that simultaneous incorporation of Cd and Pb into HAP decreases the stability of the system, especially in the range of the lower metal concentrations. Presented theoretical results can be used for assessment of the optimal range of the Cd/Pb ratio for efficient removal of these pollutants by HAP.

*P.S.A.41*

## TAILORED SANDWICH STRUCTURES IN THE FOCUS OF RESEARCH

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The investigations deal with the manufacturing and subsequent treatment of partially strengthened, three layered, symmetrical sandwich structures with skin layers of austenitic stainless steel and a core layer of a polypropylene foil. Those materials have the advantages to combine the properties of the used mono-materials. Furthermore they have a good damping behaviour because of the soft polymer core, a good stiffness and a good corrosion resistance using stainless steel sheets as skin materials. The specific local influence of the sandwich material with partial reinforcement improves the quality profile of those structures. With this type of strengthening, complex material properties can be developed, e.g. high strength with high stiffness, good thermal joining properties at the place of strengthening, as well as an improved strength and strength absorbing ability. The forming behaviour for these specific structures is still only partially investigated and understood up to now.

*P.S.A.42*

## PROTECTIVE COATINGS BASED ON EPOXY AND ALKYD RESINS AS BINDERS

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Coating composition in general includes a polymer binder, pigments, fillers, carrier components and a number of functional additives. Synthetic resins are used as binders in protective coatings and they have the greatest impact on the performance of the coatings and define their properties. In this work the effects of the type (epoxy and alkyd resins) and the concentration (from 25 to 40 wt. %) of the binder on the following coating film properties: the hardness, drawing and twist elasticity, impact resistance and the degree of film adherence have been investigated. Experimental results were statistically developed by regression analysis on a computer. The mathematical model "Statmode 3" (JPC SOFTWARE) has been used. It is estimated that epoxy resin is the more convenient binder than alkyd resin in prepared protective coatings, and its optimal concentration should be 30 wt. %.

*P.S.A.43*

## MATHEMATICAL MODEL OF APPLE DRYING KINETICS

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The influence of air temperature, microwave application and vacuum impregnation or pulsed vacuum osmotic dehydration, as pre-treatments undertaken prior to convective drying, on the drying kinetics of apple has been studied. The effect of the above pre-treatments on the optical and mechanical characteristics of dried samples has also been investigated. Empirical equations (linear and page) were used to assess the effect of these factors on drying kinetics, with a good fit being observed between experimental data and model. The effect of microwave on the decrease in drying time was significantly greater than the effect of increasing the air temperature. A dehydrated product with less colour change and a more rigid and firmer structure was obtained at higher air temperature or when applying microwave. However, the higher temperatures during microwave treatment increased pigment degradation. The increase in the liquid phase volume occurring with pre-treatments prolonged the convective drying time process and also implied greater colour changes in the samples. Nevertheless, they enhance the resistance to deformation and fracture of the dehydrated product.

*P.S.A.44*

# MATHEMATICAL MODEL OF AIRFLOW THROUGH A WOOD-DRYING KILN

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A two-dimensional pore-scale model is used to predict air flow through a wood drying stack for which both the interstitial and the average flow can be considered as two-dimensional. Timber-drying kilns consist of two parts, a centre region and staggered end sections, each with different flow characteristics. In the centre region the flow resembles flow through a duct and empirical models from literature were used for the evaluation of the pressure loss across the timber stack. The staggered ends, resulting from the stacking method, were analyzed by considering them as porous media. A unified modelling theory for the prediction of the pressure drop of crossflow in a prismatic structure was proposed. The model was derived by volumetrically averaging the equations of motion over an arbitrary two-phase system of stationary solids and a traversing fluid. Closure was obtained by using a formerly introduced rectangular representation of the pore space morphology. The predicted results compared favourably to the test results.

*P.S.A.45*

# MATHEMATICAL MODEL OF HEAT AND MASS TRANSFER DURING HEAT TREATMENT OF WOOD

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During the heat treatment process, the heat and mass transfer takes place between the solid and the drying medium, and the moisture evaporation occurs within the solid due to the capillarity action and diffusion. In this work, the three-dimensional Navier–Stokes equations along with the energy and concentration equations for the fluid coupled with the energy and mass conservation equations for the solid (wood) are solved to study the conjugate heat treatment behaviour. Whitaker's continuum approach has been used to obtain the equations for the liquid and vapour migration within the solid. Three moisture phases are accounted for: free water, bound water, and water vapour. The model equations are solved numerically for the temperature and moisture content histories under different treatment conditions. The model validation is carried out via a comparison between the predicted values with those obtained experimentally. The comparison of the numerical and experimental results shows good agreement, implying that the proposed numerical algorithm can be used as a useful tool in designing high-temperature wood treatment processes.

*P.S.A.46*

## MATHEMATICAL MODEL OF A SOLAR DRYER WITH NATURAL CONVECTIVE HEAT FLOW

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A direct type natural convection solar dryer mathematical model is developed and afterwards tested with acquired experimental data in fruit drying. This study relates mainly kinetics and establishment of drying heat balances. The influence of significant parameters governing heat and mass transfers, such as solar incident radiation, drying air mass flow and effectiveness, is analyzed in order to evaluate its thermal performances. Experimental data can be represented by empirical correlations of the form for representation of drying process. The resolution of these drying equations makes possible to predict total drying time of each product. Moreover, this drying process allows the reduce the moisture content of fruit approximately to 80% in 19 and 22 h, respectively to reach the safety threshold value. This value permits the conservation of these products about one year without deterioration. The determination of parameters, like ambient temperature, drying chamber temperature, drying air mass flow and incident heat fluxes, allow the prediction the drying effectiveness for modeling and refining the dimensioning of the elaborate prototype.

*P.S.A.47*

## MECHANISMS OF DEFORMATION-INDUCED FRAGMENTATION OF NANOSTRUCTURES OF METALS AND ALLOYS

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Wide applications of nanostructured materials in various fields of science and technology evoked considerable interest to the development of the methods for their production. In this respect SPD-related techniques are recognized to be the most promising. Though they have been developed for already several decades, the question of the mechanisms of deformation-induced fragmentation of nanostructures still remains. In the present work it was shown that the formation of new intercrystalline boundaries in the nanostructure of the metal with $2R \sim 100$ nm is affected by non-dislocation mechanisms. They include deformation-induced twinning and martensitic-type polymorphic transformations. Moreover, for each metallic system and each SPD method, there exists a minimum average nanocrystallite size, which characterizes the limiting nanostructure that is possible to achieve.

*P.S.A.48*

# MECHANISMS OF STRAIN-INDUCED PHASE DISSOLUTION IN NANOSTRUCTURED METALS AND ALLOYS

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Nanostructured materials are characterized by increased ability to dissolve phases and chemical compounds. Mainly this is due to the presence of a large number of boundaries. In the present study possible mechanisms of the deformation-induced dissolution of phases in metals subjected to severe plastic deformation (SPD) are studied. The extended metastable and equilibrium phase diagram, which takes into account both the system of the bulk phases and the systems of planar, linear, and point defects, is used for the analysis. The mechanisms of impurity absorption by new interphase and grain boundaries formed under SPD are shown to be the most effective ones. Possible dislocation mechanisms have little effect. In carbon steels, stress-induced dissolution of cementite continues until the nanostructure absorbs about 10–12 % (at.) of carbon.

*P.S.A.49*

# FABRICATION AND CHARACTERIZATION OF $Al_2O_3$/MO NANOCOMPOSITE

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Mechanochemical reactions involving displacement reactions between a reactive metal and a metal oxide often led to the formation a nanocomposite structure. The Mechanochemical reactions fall into two categories, namely (a) those which occur during the mechanical activation process and there the reaction enthalpy is highly negative (e.g. adiabatic temperature $T_{ad}$ = 1300–1800 K), and (b) those which occur during subsequent thermal treatment and here the reaction enthalpy is only moderate (e.g. $T_{ad}$ <1300 K). The first type of reaction takes place in two distinct modes, i.e., either combustion reaction or a progressive reaction. Whenever a reaction is highly exothermic, it can occur abruptly after a certain time of milling and, once started, it proceeds in a self-sustained way. In this case, the reaction requires a given time to begin. This time is called ignition time and, due to the exothermic reaction, can be determined by an increase of temperature. A number of studies have been focused on the development of $A1_2O_3$/metal nanocomposites by different routes including synthesis of nanometer-sized α-$A1_2O_3$-M composite (M=Fe, V, Cr, Mn, Co, Ni, Cu, Zn, Nb, Mo, W, Si, Fe) by ball milling of an appropriate metal oxide and Al. In this study fabrication and mechanical properties of alumina-based ceramic matrix nanocomposite reinforced by Mo (15 and 26.6 vol.%) was investigated. $Al_2O_3$-Mo nanocomposite was synthesized by ball milling of aluminum and molybdenum oxide powders mixtures in a SPEX8000 type ball mill. The evaluation of powder particles after different milling times and also after subsequent annealing was studied by x-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and differential thermal analysis (DTA). The molybdenum oxide was found to be reacted with Al through a rapid self-sustaining combustion reaction process forming an $Al_2O_3$-Mo nanocomposite powder. After annealing at 800°C for 60min, crystallite size of Mo and alumina remained constant. In addition annealing caused formation of different polymorphic, γ-$Al_2O_3$ with a crystallite size of 50nm. The powder particles were consolidated by cold uniaxially pressing followed by sintering in vacuum atmosphere at 1300 ºC and 1400 ºC. Results showed a significant improvement in flexural strength of $Al_2O_3$-Mo nanocomposites in comparison to alumina which increases by Mo content.

*P.S.A.50*

## MECHANOCHEMICAL SYNTHESIS OF $Fe_3Al$-$Al_2O_3$ NANOCOMPOSITE

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$Fe_3Al$ intermetallic compound is an important class of materials because of a combination of its high tensile strength, low density, good wear resistance, ease of fabrication and low cost. It also has excellent oxidation, sulfidation and corrosion resistance at high temperature. These properties have led to the identification of several potential usages including structural applications and protective coatings in hostile environments. Two major problems that restrict the application of $Fe_3Al$ are poor low-temperature ductility and inadequate high-temperature creep resistance. These limitations can be overcome by introducing ceramic particles as reinforcements. The goal of this work was to fabricate $Fe_3Al$ intermetallic compound containing $Al_2O_3$ reinforcement via mechanochemical process. Different compositions including 3Fe+Al, $Fe_2O_3$+2Al, $3Fe_2O_3$+8Al and $Fe_2O_3$+3Al+Fe were chosen in this study. The phase transformation and microstructural characterization during mechanochemical reaction were investigated by X-ray diffractometery (XRD) and scanning electron microscopy (SEM), transmission electron microscopy (TEM) and thermal analyzing (TA). Mechanochemical behavior of powder mixtures was studied according to the calculated adiabatic temperature of $Fe_2O_3$/Al reactions, vial temperature measurement during milling, and structural investigations. The results showed that during ball milling $Fe_2O_3$, Al and Fe react to form $Fe_3Al$–$Al_2O_3$ nanocomposite. The presence of pure Fe in initial powder mixture changed the modality of mechanochemical process from sudden to gradual reaction. The $Fe_3Al$ intermetallic compound obtained during ball milling of 3Fe+Al and mechanochemical reaction of $Fe_2O_3$+3Al+Fe powder mixtures had a nanocrystalline structure with a crystallite size of 37 and 28 nm. $Fe_3Al$–$Al_2O_3$ powders were compacted and then sintered at 1400° C for 1 h. The consolidated parts had an ultrafine and homogeneous structure without "core-rim" feature consisting of $Fe_3Al$ and $Al_2O_3$ phases. In addition, $Fe_3Al$–$Al_2O_3$ was also fabricated by mechanical alloying of Fe, Al and $Al_2O_3$ nanopowder. The results showed that the $Fe_3Al$–$Al_2O_3$ fabricated through mechanochemical process had higher three-point fracture stress and hardness than $Fe_3Al$–$Al_2O_3$ fabricated by addition of $Al_2O_3$ nanopowders.

*P.S.A.51*

## BALL MILLING ASSISTED SYNTHESIS OF NANOCRYSTALLINE SIALON

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Silicon nitride-based ceramics are considered to be among the most promising materials for advanced structural applications. However, the usage of sialon in industry is still on a small scale due to the high costs of sialon parts made by conventional ceramic processing. Sialons can be synthesized by a number of routes including carbothermal and silicothermal reactions of oxides and clay minerals, and direct solid-state reaction of the oxide and nitride components. All these processes are endothermic, requiring high temperatures. The temperatures of solid-state reactions can be lowered by mechanochemical activation of the reactant mixture in a high energy ball mill. The aim of this study was to investigate the effect of ball milling on synthesis of sialon starting from AlN and $SiO_2$ powder mixture. Powder mixture of AlN (crystalline) and $SiO_2$ (amorphous) was subjected to high energy ball milling for 10 and 20 h. The milled powder was subsequently annealed for 2 and 4 h at 1473 and 1573 K. Milling of powder mixtures did not lead to any reaction between $SiO_2$ and AlN. Only the transition of amorphous $SiO_2$ into the stishovite phase (tetragonal) occurred. Stishovite is usually obtained from quartz at very high pressures. The formation of stishovite during ball milling is therefore due to the high impact force of colliding balls. Results also showed that the ball milling of starting powder mixture reduces the formation temperature of beta sialon. The composition of beta sialon was found to be $Si_3Al_3O_3N_5$ in all cases. However, annealing of 20 h milled powder at 1573 K resulted in an additional phase which was identified as $SiAl_7O_2N_7$ compound. An average crystallite size of about 25 nm was calculated for beta sialon.

*P.S.A.52*

# NANOSTRUCTURED WC-CO CERMET POWDER PRODUCED BY BALL MILLING

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Nanostructured WC-Co materials have been previously produced and applied as protective coatings and cutting tools. Both applications utilize the enhanced hardness, wear resistance and toughness of the nanostructured WC-Co in comparison to the conventional, coarser-grained materials of this kind. The replacement of coarse-grained WC-Co by nanostructured WC-Co alloys improves the mechanical properties by up to one order of magnitude. This improvement does not seem to be the upper conceivable limit because these new materials are not yet optimized in any way. This work investigates the possibility of producing WC-Co nanocomposite powder by mechanical alloying through two different routes; *Route 1:* ball milling of WC-17 wt.% Co powder and *Route 2:* mechanical alloying (MA) of W-Co-graphite powder mixture. Mechanical alloying was carried out nominally at room temperature in Ar atmosphere using two different types of ball mills; Spex8000 and planetary ball mills. The as-milled powders were characterized by X-ray diffractometery and scanning electron microscopy. In case of ball milling of WC-17 wt.% Co powder WC readily achieved a nanocrystalline structure. The WC crystallite size was about 30 nm after 5 h of milling time and decreased to 15 nm as milling time increased to 40 h. The WC crystallite size appeared to approach a constant value, saturated value, as ball milling proceeds. To study the thermal behaviour of ball milled nanostructured WC-17 wt.% Co, powder sample after 10 h of milling was isothermally annealed at 800 $^{o}$C for 1 and 2 h. Annealing even for short period, lead to the development of $Co_6W_6C$ phase and simultaneous vanishing of WC phase. The formation of $Co_6W_6C$ phase is promoted by numerous high speed diffusion paths such as dislocation networks and grain boundaries created during milling process which permit a high diffusion rate and therefore, allow the WC-Co reaction to take place kinetically. To check the formation of WC compound during ball milling a mixture of elemental W, Co (17 wt.%) and graphite powders was mechanically alloyed. No evidence of the formation of WC phase was observed on XRD patterns even after 80 h MA. Furthermore the crystalline diffraction peaks did not shift indicating that no alloying occurred during MA. In order to provide further insight into the W-C behaviour during MA a mixture of elemental tungsten and graphite powder was milled in a planetary ball mill up to 100 h. It was possible to produce nanocrystalline WC phase by mechanical alloying of W-C powder mixture.

*P.S.A.53*

# LASER INDUCED REFRACTIVITY, HIGH-SPEED SWITCHING AND LASER STRENGTH IMPROVEMENT OF MATERIALS WITH NANOOBJECTS

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The great interest has been expressed in photophysics properties of organic conjugated systems doped with nanoobjects as well as in improvement of laser and mechanical parameters of the inorganic materials ($BaF_2$, $MgF_2$, ZnSe, KCl, etc.) covered with nanoobjects and treated with surface electromagnetic waves. As effective dopants, the fullerene, nanotubes, nanoparticles, J-aggregates, nanofibers, etc. can be considered. The promising nonlinear optical, photoconductive, and laser-induced dynamic properties can be activated, as well as the self-organization phenomena and increase in the polarizability and order parameters can be found under condition of nanoobjects sensitization. Some evidence to form quasi-photonic organic systems can be revealed. Some improvement of the laser and mechanical characteristics can be revealed.

*P.S.A.54*

# IRON GROUP NANOPOWDERS ELECTRODEPOSITON

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From scientific and technological aspects, there is an increasing interest in amorphous and nanocrystalline of ferromagnetic powders. They are usually used for production of sintering materials, and for other purposes such as magnetic memories or catalysts.

Nanostructured powders of ferromagnetic nickel, iron and cobalt alloys were obtained by electrochemical deposition from solutions of their salts. In the present study the composition, the morphology and microstructure of electrodeposited ferromagnetic nickel, iron and cobalt powders were investigated.

It is shown by analysis with X-ray diffraction and SEM methods that composition, phase, structure, shape and size of the electrochemically obtained particles of nickel, iron and cobalt alloy strongly depend on current density and bath composition. X-ray diffraction analysis shows that an increase of current density does affect only the particle size but not other characteristics ( e.g. grain size, phase, composition…) of the electrochemically obtained alloy powders. The average grain size of NiFe and NiCoFe alloy powders is about 10 nm.

The powders were electrodeposited on Ti cathode in the galvanostatic (constant current) regime at selected high current densities larger than limiting diffusion current density. Polarization diagrams show that Ni and Fe start to deposit at the most negative potential while their alloys starts to deposit at the more positive potential indicating that alloy formation catalyzes deposition. Co deposition takes places at the most positive potential. Simultaneously hydrogen evolution occurred during powder deposition since the surface of the deposited alloy powder acts as a catalyst for the hydrogen evolution.

The phenomenon of anomalous co-deposition (characteristic for the electrodeposition of iron group metals) is more pronounced in the deposition of compact deposits. In the case of powder deposition anomalous co-deposition is much less pronounced, so that the composition of the alloy powder is almost identical to the composition (percentage) of the metal ions in the electrolyte.

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*P.S.B.1*

## As3d CORE LEVEL PHOTOEMISSION STUDIES OF (GaMn)As

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Using synchrotron-based photoemission, we have investigated normal emission core level spectra of As3d in (GaMn)As for different stages in sequential annealing process. All the spectra were excited by 81 eV photons. The results presented here show that electronic properties of (GaMn)As are sensitive to thermal treatment.

*P.S.B.2*

## KINETICS OF CATION EXCHANGE IN SPINEL $NiGa_2O_4$

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In complex ionic oxides, the cations are often found to occupy different sites. The internal cation distribution state in such complex oxides determines their structure, physical and chemical properties. Spinel structure is one of such systems, in which the cations are distributed on tetrahedral and octahedral sites, respectively. In case of a temperature dependent cation distribution, the kinetics of the cation exchange can be studied using temperature-jump relaxation experiments. In this presentation we report on an in situ optical relaxation experiments on a NiGa2O4 spinel prepared on a $\beta$-$Ga_2O_3$ single crystal substrate using chemical diffusion reaction at high temperatures. The experimental relaxation data are analyzed and discussed in terms of a microscopic cation exchange model.

*P.S.B.3*

## OPTICAL DESIGN OF METAMATERIAL STRUCTURES BASED ON COORDINATE TRANSFORMATIONS METHOD

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We discuss metamaterial structures in order to manipulate electromagnetic field in an unique way. The design of these structures is based on the coordinate transformation method by which a spatial transformation of a domain is mapped to properties of transformation media implemented using metamaterials. It is shown that anisotropic metamaterials with spatially varying parameters are required in order to achieve the desired electromagnetic field behaviour. In this paper several novel devices based on appropriately designed metamaterials are introduced. These are reflectionless due to inherent impedance matching of the transformation media to the surrounding. The proposed devices enable control of electromagnetic wave propagation, phase shifts and field rotation. Validity of the coordinate transformations method and the functionality of the proposed devices are confirmed by results of full wave finite element simulations. We expect that these devices will be interesting in various waveguiding and optical applications.

*P.S.B.4*

## KINETICS OF NON-RADIATIVE ROTATIONAL ISOMER BUTANE TRANSITIONS

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In this paper a theoretical model of calculating equilibrium concentrations of isomeric forms of the butane molecule is considered, which can be applied to other forms of hydrocarbons of the alkene series. The model is represented by Gribov's system of kinetic equations for isomer-isomer transitions, combined with the concept of canonic ensemble applied to calculate the room temperature probabilities of the rotoisomer conformational states dependent on dihedrial angle. The calculations based on the model are in good agreement with previously obtained ones, based on the free energy difference between final and initial states of the system.

*P.S.B.5*

## THE SYNTHESIS AND DIELECTRIC PROPERTIES OF THE GLASS CERAMIC COMPOSITE MgO–$B_2O_3$–$SiO_2$

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Modern microelectronic packages are the result of intense developments deriving from the need to produce more efficient electronic devices. Various studies have focused on the development of glass-ceramic systems for Low-Temperature Cofired Ceramic (LTCC) technologies. The materials that are used as LTCC substrates have to fulfil requirements such as a low permittivity $_r$, low dielectric losses (tan $_{..}$and a stable temperature coefficient of resonant frequency. In this study the densification behavior and the dielectric properties of glass ceramics from the MgO–$B_2O_3$–$SiO_2$ system were investigated. In particular, we studied the influence of the composition and different synthesis conditions on the crystallization. The results showed that glass with the composition 43wt.%MgO–35wt.%$B_2O_3$–22wt.%$SiO_2$ could be well sintered at temperatures from 800 to 950°C for 5h. The main goal of our work was the preparation of an LTCC material with dielectric properties suitable for microwave substrate applications.

*P.S.B.6*

## MESOPOROUS AND FUNCTIONALIZED MATERIALS IN DRUG SUPPORTS AND DELIVERY SYSTEMS

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Functionalized carriers and delivery systems comprising different zeolite types and mesoporous materials are recognized as very useful materials for pharmaceutical applications. Relatively small number of systems with potential usage in this field is investigated. In this work we investigated different zeolitic structures (mesoporous, FAU and BEA zeolites) modified with surfactants and tested them as supports for a variety of drugs. Surfactants used in this work were Benzalkonium chloride and Cetyltrimethylammonium bromide while HPLC method was used for their content determination. In addition, measurements of zeta potential were performed on surfactant-modified samples. Adsorption of non-steroidal antiinflammatory drugs and their controlled release was also investigated.

*P.S.B.7*

## HETEROPOLY COMPOUNDS SUPPORTED ON MONTMORILLONITE AS CATALYSTS FOR WET PEROXIDE OXIDATION OF TOLUENE

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In present work catalytic wet peroxide oxidation (CWPO) of toluene on montmorillonite based catalysts with different heteropoly compounds was further investigated. Samples with heteropoly acid (WPA) before and after calcination were compared with its neutral and acidic Cs salts, and with Al-Cu pillared bentonite clay as the reference sample. Catalytic performance of the catalysts was examined using gas chromatography. Under investigated conditions (310 K and stirring) tested catalysts show significant toluene degradation. Reaction model is chosen to fit kinetic data, and rate constants were evaluated. It appears that the preparation procedure and resulting chemical composition have complex influence on the reaction kinetics and rate constants, giving the opportunity for further optimization of the reaction system. Second order rate constant is higher for all tested samples than for the reference one.

*P.S.B.8*

## PHYSICOCHEMICAL CHARACTERIZATION OF INSOLUBLE ALKALINE SALTS OF 12-TUNGSTOPHOSPHORIC ACID

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Because of diverse compositional range and significant structural versality, heteropoly acids (HPAs) and their metal salts have found numerous applications in catalysis, electrochemistry, medicine, ecology, sensor technology etc. The properties of Keggin type HPAs can be improved by total or partial exchange of protons by cations.

In this study characteristics of insoluble alkaline salts of 12-tungstophosporic acids, with big cations such as $Cs^+$, $K^+$ or $Rb^+$, were investigated. The nature of HPAs and their neutral salts are generally known, but different models of insoluble acidic salts, have been proposed in literature. In order to contribute to the better explanation of nature and mechanism of activities of these salts as catalysts and proton conductors, their study has been done.

For that purpose FTIR and Raman spectrophotometry, XRD, DTA and TGA, electric and dielectric measurements were performed. The surface properties were investigated by SEM-XRF and the influence of calcination temperature on alkaline salts morphology was discussed. IR spectra were applied for identification of different kinds of protonic species in these salts and consideration of proton conductivity of these materials.

The obtained characteristics were compared with those of parent acid.

*P.S.B.9*

# NICKEL MANGANITE THICK FILM THERMISTORS FOR WATER FLOW SENSOR APPLICATION

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Nickel manganite $NiMn_2O_4$ (NTC thermistor powder), an organic vehicle and 5% glass frit ($PbO$-$B_2O_3$-$SiO_2$) were used to prepare thick film paste. The paste was screen printed on alumina substrates (size 51x6.3x 0.5 mm) to form a segmented thermistor with 9 cells (segments), designed and miniaturized for gradient temperature measurements. The sensor was thermally connected to the heat exchange layer with a capillary enabling cooling by water flow. The thermistor sensor was self-heated with a constant voltage (DC power supply). The thermistor current was measured as a function of water flow and input water temperature. The water flow sensor actually works on heat loss, and is thermally insulated by the air around the sensor and a chamber (housing of styropore foam). Calibration was performed on room temperature using an ice /water mixture to measure the range of sensor sensitivity. The sensor stability and inertia was analyzed additionally.

*P.S.B.10*

# MAGNETOCALORIC EFFECT IN RARE EARTH MANGANITES

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Colossal magnetoresistance phenomena were observed in the perovskite-type hole-doped manganites in which the double-exchange ferromagnetic metal phase and the charge–orbital ordered antiferromagnetic phase compete with each other. The chemical randomness or the impurity doping may cause major modifications in the electronic phase diagram as well as in the magnetoelectronic properties At present, the perovskite manganites are the most representative materials system which can show versatile unconventional electronic-lattice structural changes or insulator–metal transitions upon stimulation by external stimuli, like magnetic field, irradiation with light, x-rays or electron-beams.

Many of the manganites compounds, $R_{1-x}M_xMnO_3$, where R = rare-earth metal and M = Ca, Sr or Ba exhibit large or unusual magnetocaloric effect, (MCE), values. On the other hand, these materials display considerably small magnetic hysteresis and their Curie temperature can be tuned easily. The former is beneficial for the magnetic cooling efficiency and the latter is advantageous to the wide working temperature ranges. The MCE on the $R_{1-x}M_xMnO_3$ compounds, where R = La, Pr and M = Ca, Sr or Ba. is reported. The samples were prepared by conventional ceramic method. The X-ray analysis showed the presence of one phase only, in all samples. From electrical resistence measurements was found that the samples show large negative magnetoresistence behaviour. The magnetic measurements were performed in a large temperature range, 4.2-750 K and external magnetic fields up to 7T. The adiabatic magnetic entropy changes, $|\Delta S|$, were determined from magnetization data. Large MCE has been obtained in all samples.

The potential use of these materials in magnetic refrigeration is discussed, including a comparison with Gd as a near room temperature active magnetic refrigerator material.

*P.S.B.11*

# ANALYSIS OF THERMAL PARAMETERS OF GLASSES FROM SYSTEM $BI_x (AS_2S_3)_{100-x}$ BASED ON DSC THERMOGRAMS

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Within the research of thermal characteristic of the glass from system $Bi_x(As_2S_3)_{100-x,}$ an investigation by differential scanned calorimetry metod of samples with x=0.5, 2, 4, 6, 8 i 10 at.% Bi has been conducted. Thereby, the characteristic temperatures ($T_g$, $T_{onset}$, $T_c$, $T_m$) and enthalpies of the processes ($H_c$, $H_m$), which are unwinding in the sample during it's thermal treatment, were defined. By analysis of DSC sample thermograms, with the same heating rate, behavior of $T_g$ parameter had been characterized in conditionality with content of impurity atoms, and in accordance with criteria of chemical bond configuration in disordered materials.

Samples with 4 i 6 at.% Bi were treated thermally with different heating rates for the purpose of defining thermal stability parameters, inter alia. The estimation has been conducted based on three different criteria. Higher tendencies towards crystallization of the glass with the major content of Bi have been registered, which are in accordance with the previous results. Furthermore, rising trend of the glass transition temperature towards higher values with the heating rate increase has been registered, in accordance to Lasock formula.

*P.S.B.12*

# CHARACTERIZATION OF X-RAY DIAMOND DETECTOR BY MONTE CARLO METHOD

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The use of diamond as materials for X-ray detector is subject of investigation and practice in radiotherapy, space and material science and technology. This paper presents the application of Monte Carlo method for simulation of photons transport through diamond detector. The aim is restitution and demonstrating of numerical technique for characterisation of electrical properties for different detector conditions and configurations. The FOTELP Monte Carlo code has been adopted for determining the energy deposited and 3D dose distribution in structure of diamond detector. Upgrading of calculation methods originates the improving of design of diamond detector systems.

*P.S.B.13*

## RADIATION ABSORPTION CHARACTERISTICS OF TITANIUM ALLOYS

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Titanium alloys have found numerous applications in space research, and nuclear industry and research. Since X-rays constitute an important part of the space radiation environment, numerical simulations of radiation absorption characteristics of titanium alloys has been studied in this paper. The photon transport Monte Carlo software has been used for determining the energy deposited in titanium samples. The numerical results show the pronounced dependence of radiation absorption properties of different combination components in alloy. The results obtained are encouraging in respect of optimization of structure of alloys regarding their required features in radiation shilding.

*P.S.B.14*

## INFLUENCE OF DEFECTS INDUCED BY MECHANICAL ACTIVATION ON OPTICAL AND ELECTRICAL PROPERTIES OF ZnO

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Zinc oxide has recently gained growing interest due to its unusual electrical and optical properties which strongly depend on synthesis and processing methods. For this purpose a commercial ZnO powder firstly was modified by mechanical activation in a high-energy vibro-mill and after that was pressed and sintered at 1100˚C for 2 h. Optical properties of these samples were investigated by Raman and photoluminescence spectroscopy and electrical properties of grain boundaries of ZnO ceramics were studied using ac impedance spectroscopy. The activation energies of conduction were obtained using Arrhenius equation. Donor densities were calculated from Mott-Schottky measurement. It was shown that mechanical activation affects the optical and electrical properties of ZnO ceramics because contributes to a great modification of the microstructure and fine defects structure.

*P.S.B.15*

# GRAHITE-CONTAINING AND NANOSRUCTURED ELECTRODES FOR ELECTROSPARK DEPOSITION COATINGS WITH IMPROVED TRIBOLOGICAL PARAMETERS

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Titanium alloys with deposited wear-resistant and antifriction coatings can find their application in assembly units with strict requirements on friction losses and wear rate. Of current importance is elaboration of a process for deposition of coatings with low surface roughness and friction coefficient. For the purpose, the method of electrospark deposition (ESD) can applied in one of the following ways: (a) use of low-energy discharge pulses, (b) deposition of thick coatings followed by a finishing process, (c) use of nanostructured electrodes, and (d) smoothing the coatings with graphite-based electrodes.

In this work, we explored the effect of the type of carbon-containing electrode material on the composition, tribological properties, and roughness of ESD coatings deposited with nanostructured (WC grain size below 0.1 μm) and microstructured (WC grain size 1–2 μm) electrodes compound 92% WC–8% Co onto VT20 titanium alloy. Fine-pored graphite and carbon–carbon fiber composite were used as smoothing electrodes.

The use of nanostructured electrodes was found to result in formation of fine-grained, hard, and wear-resistant coatings. Surface treatment with graphite-containing electrodes was found to decrease the friction coefficient and improve the wear resistance of coatings deposited with nano- and microstructured electrodes due to lower surface roughness, change in the phase composition of coatings, and formation of free graphite playing a role of solid lubricant.

*P.S.B.16*

## THE ROLE OF RADICALS IN KINETICS OF PLASMA ETCHERS IN Ar/$CF_4$ MIXTURES

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In order to achieve high resolution plasma processing for future generations of integrated circuits, the empirical development of the plasma processing tools has to be replaced by a real understanding of the physics and chemistry of plasmas. For that purpose comprehensive realistic geometry codes have been developed with an aim to not only facilitate the development of new devices but also provide real time control of the process. A description of electron kinetics in non-equilibrium plasma modeling necessarily includes calculation of transport coefficients which is based on compilation of cross sections from different sources. So far only kinetics for the electron-parent gas collisions has been included. It was shown that even at small abundances some coefficients may change drastically and the best example is the attachment rate. Requirement to establish reliable transport coefficients for Ar/$CF_4$ plasmas is especially demanding as the practical conditions include many reactive species. In this paper we show transport data for electrons in mixtures of Ar and $CF_4$ and with abundances of radicals that are close to those found in practical processing devices.

*P.S.B.17*

## SURFACE AND STRUCTURAL CHANGES OF BORON ION IMPLANTED GLASSY CARBON

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In this work surface and structural changes of modified glassy carbon (GC) by boron ($B^{3+}$) implantation were examined. $B^{3+}$ ion implantation into GC plates was performed at energy of 50 keV at the two different doses, $5x10^{16}$ and $2x10^{16}$ ion/$cm^2$. Surface characterization was performed by scanning electron microscopy (SEM) and temperature-programmed desorption (TPD). SEM photos showed changes in surface topography after $B^{3+}$ ion implantation. TPD results showed that implanted boron not only enlarged the total number of acidic groups, but also changes their distribution and thermal stability, especially carboxylic groups. Structural characterization was performed by X-ray diffraction and Raman spectroscopy and the results obtained suggested that graphitic structure in GC is destroyed by $B^{3+}$ implantation.

*P.S.B.18*

## SILVER DEPOSITION ON THE CHEMICALLY SURFACE TREATED CARBON MONOLITH

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In this work, carbon monolith (CM) was treated with $HNO_3$, KOH and $H_2O_2$. The effects of these treatments on the specific surface area, on the surface functional groups and on the amount of silver deposited at the CM surface, were studied by BET method, temperature-programmed desorption (TPD) and atomic absorption spectrometry (AAS), respectively. The obtained results showed that used chemical reagents had different influence on surface chemistry of CMs samples. Specific surface area remained almost constant after chemical treatment, while the amount of surface oxygen groups and the amount of silver deposit increased. By comparing the amount of silver deposit with decrease in amount of surface oxide after silver deposition, it can be concluded that we are dealing with different mechanisms of silver deposition.

*P.S.B.19*

## EFFECT OF PROTON IRRADIATION ON SURFACE PROPERTIES OF GLASSY CARBON

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In this work we present the results referring to the proton irradiation process and its implication on glassy carbon (GC) surface properties. The irradiation was performed at room temperature using 15 keV $H^+$ ions up to doses of $1\cdot10^{16}$ ion $cm^{-2}$. Temperature programmed desorption (TPD) measurements have been used for characterization of surface changes caused by proton irradiation. Semi-empirical quantum-chemical calculations based on AM1 method was used to elucidate interaction of proton with carbon on atomic level. Protons effects on surface properties of GC are manifested few days after irradiation process. Peaks in TPD spectra are shifted toward lower temperatures for all examined species: $H^+$, $H_2$, $H_2O$, CO, $CO_2$ comparing to untreated GC. Calculations illustrate proton coexistence with H atom bonded to edge-carbon atom, formation of $H_2$ molecules and creation of diamond like structures as a consequence of proton interaction with basal-plane carbons.

*P.S.B.20*

# INFLUENCE OF PHYSICAL CHARACTERISTIC OF FLAT ALUMINUM CONCENTRATOR ON ENERGETIC EFFICIENCY OF PV/THERMAL COLLECTOR

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We have investigated the influence of physical characteristics of flat aluminum concentrator on energetic efficiency of PV/Thermal solar collector. The results of measurements of reflectivity of aluminum obtained with spectrophotometer with Ulbricht sphere, SEM images of aluminum surface, the chemical composition using EDS and the emission spectroscopy will be presented. We will also report the results of our investigation of the influence of the position of aluminum reflector on energetic efficiency of PV/Thermal collector of solar radiation.

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*P.S.B.21*

# OPTICAL AND MAGNETIC PROPERTIES OF PbTe(Ni)

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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(Ni). Also, we used two models to describe magnetic and phonon structure. Agreement between experimental results and models prediction is very good.

*P.S.B.22*

# THE EFFECT OF FREQUENCY AND TEMPERATURE ON MAGNETIC PROPERTIES OF $Fe_{81}B_{13}Si_4C_2$ AMORPHOUS ALLOY

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In this study it was investigated influence of frequency, magnetic field and temperature on coercivity and permeability of $Fe_{81}B_{13}Si_4C_2$ amorphous alloy. It was shown that after annealing at 410 $^{O}$C coercivity decrease about 60% at all frequencies and at magnetic fields intensity from 25 to 100 A/m. Dependence of coercivity on magnetic field is specially observed at 50 A/m. For higher values of magnetic field coercivity is independent. Magnetic permeability measurements performed in nonisothermal and isothermal conditions was confirmed that structural relaxation was occurred at temperature of 410 $^{O}$C. This process was performed in two steps, the first one is kinetic and the second one is diffuse. Activation energies of these processes are: $E_{a1}$=52.02 kJ/mol for kinetic and $E_{a2}$=106.9 kJ/mol for diffuse.

*P.S.B.23*

# NANOCRYSTALLIZATION OF $Fe_{72}Al_5Ga_2P_{11}C_6B_4$ AMORPHOUS ALLOYS BY CURRENT ANNEALING TECHNIQUE

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In this study, the evolution of the (nano)structure on dc current annealed (CA) $Fe_{72}Al_5Ga_2P_{11}C_6B_4$ metallic glass ribbons have been investigated. Besides the benefits of energy and time saving due to relative short time treatment, Joule heating brings development of specific structural transformations that could not be attained by conventional (furnace) annealing.

Ribbons samples were processed by *dc* CA for 60 s in air and then slow-cooled by ramping down annealing current at rate of 5 mA/s. Heating power per square area ($P_S$) was ranging between 0.8 to 7.1 W/cm$^2$ in order to get various stages of relaxation or nanocrystallization. The thermal stability and crystallization behaviour were examined by differential scanning calorimetry and X-ray diffraction. Transmission electron microscopy (TEM), on-line and post-annealing electrical resistivity measurements, Mössbauer spectroscopy, as well as hysteresis B-H loops were used for characterization of structural changes evolved during current annealing (CA) treatments.

The wide supercooled liquid region between crystallization temperature and glass transition temperature ( $T_x$ =$T_x$-$T_g$= 65 K), Curie temperature ($T_C$ = 589 K) and coercive field ($H_C \approx 7$ A/m) were observed in the as-cast state. The crystallization starts after applying $P_S \approx 4.35$ W/cm$^2$ and the sample consist of residual amorphous matrix, a magnetic crystalline component and also a non-magnetic crystalline component. From Mössbauer spectra it was calculated that the relative abundance of Fe in the crystalline phase ranging between 33 to 53%. XRD measurements show that crystalline samples after CA treatments consist of $Fe_3B$, FeC, FeP and $Fe_3P$ compounds. In the very early stage of crystallization featureless contrast typical for amorphous phase with few nanograins was observed on TEM micrograph. The average size of the crystallized particles increases with increasing heating power. A broad distribution of shapes and sizes is noticed, the latter range from about 60 to 350 nm. The polycrystalline structure is inhomogeneous and very vague and in many cases the grain boundaries are difficult to be seen. The decrease of the electrical resistivity after each CA treatment is rather small in comparison with other Fe-based amorphous alloys (only about 1 % for the highest $P_S$). However, partial nanocrystallization leads to magnetic hardening, i.e. increase of coercive field attributed to precipitation of magnetically harder compounds ($Fe_3B$ and FeC) was observed.

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*P.S.B.24*

## THE EFFECT OF THE HYDRATION OF A CRYSTAL IRON-NICKEL POWDER MIXTURE ON THE MICROSTRUCTURE AND MAGNETIC PROPERTIES

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A mixture of crystal $Fe_{20}Ni_{80}$ powders was hydrated at 713 K and at p=101.3 kPa. A broad peak on the X-ray of the hydrated powder for the (111) reflection of the FCC nickel phase and the absence of the (200), (220), (311) and (222) reflection peaks suggested that the hydration process resulted in powder amorphisation. The annealing of the amorphous powder in the relaxation temperature range caused an increase in magnetic permeability. The crystallisation of the $Fe_{20}Ni_{80}$ powder induced a decrease in magnetic permeability. Magnetic permeability increased with an increase in the pressure of the cold pressing of the $Fe_{20}Ni_{80}$ powder.

*P.S.B.25*

## THE EFFECT OF PRESSURE AND TEMPERATURE ON ELECTRICAL CONDUCTIVITY OF COLD SINTERED COPPER POWDER

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Excertion of pressure on polycrystal copper powder - cold sintering, results in plastic deformation followed by a number of changes both in crystal lattice and in electrical structure of the matter. Various types of defects are formed endothermically in crystal structure, accompanied by suitable rearrangement of electrical structure. The established metastable state is further stabilized through heating process up to certain temperature, which induces defects annihilation and release of energy which was accumulated during the cold sintering process. Simultaneously, electrical structure is being stabilized.

The paper examines temperature dependence of samples resistivity, which were obtained through cold sintering of polycrystal copper powder under pressures of 450 MPa, 600 MPa, 750 MPa and 900 MPa. The differential scanning calorimetry method showed that the recovering process of deformed crystal structure for all pressing pressures is exothermal, thus, regardless of how high the applied pressure is all samples behave in the same qualitative manner, but not quantitative as the released energies vary.

The research results regarding resistivity temperature dependence show that the samples obtained under pressing pressure of 600 MPa have the greatest resistivity at room temperature, which is probably due to an increase in degree of electron concetration under pressing pressures of around 600 MPa, that is Fermi level movement towards the area of lower energies. Stabilisation kinetics of electron state has been analysed by the method of isothermic resistivity change during specified time interval. It has been shown that the stabilisation process of electron state occurs in two stages for all the examined samples.

*P.S.B.26*

## THE EFFECT OF CURRENT DENSITY ON THE PROPERTIES OF THE ELECTROCHEMICALLY PRODUCED $Ni_xMo_y$ ALLOY POWDERS

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The current density of the electrodeposition of the $Ni_xMo_y$ alloy powders produced from ammonia solutions affected directly and indirectly through the molybdenum content their microstructural and morphological properties. A current density increase caused a decrease in the molybdenum content of the alloys. Increases in both the molybdenum content of the alloys and the electrodeposition current density induced development of smaller nanocrystals with a higher density of chaotically distributed dislocations and higher internal strain. The powder morphology was also dependent on the deposition current density. The SEM image showed that two morphological forms were developed: larger cauliflower-shaped particles and smaller dendritic particles. The dendrites developed on the surface of the cauliflower-shaped particles. The dendrite density on the cauliflower surface increased with an increase in current density. Dendrites with more pronounced secondary and higher-order branches developed at higher current densities. The EDS spectra showed a lower molybdenum content of the dendrites as compared to that of the cauliflower-shaped particles produced at the same current density.

*P.S.B.27*

## THE EFFECT OF MICROSTRUCTURE AND STRUCTURAL CHANGES IN NICKEL, MOLYBDENUM AND PHOSPHORUS POWDERS ON ELECTRIC AND MAGNETIC PROPERTIES

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Nanostructured $Ni_xMo_yP_z$ alloy powders were produced electrochemically from an ammonia bath. The electrodeposition current density and molybdenum and phosphorus contents affected the microstructural properties of the obtained powders. An increase in the molybdenum and phosphorus contents of the alloy resulted in a decrease in the average crystal grain size as well as in increases in both the density of chaotically distributed dislocations and internal microstrain. The electric and magnetic properties of the electrochemically obtained $Ni_xMo_yP_z$ alloy powders were dependent on the chemical composition and microstructure. Powder annealing in the temperature range for structural relaxation induced a decline in electric resistivity and an increase in magnetic permeability. The crystallisation of the nanostructured $Ni_xMo_yP_z$ alloy powders caused decreases in both electric resistivity and magnetic permeability.

*P.S.B.28*

## THE EFFECT OF ANNEALING AND EXTERNAL MAGNETIC FIELD ON THE MAGNETIC PERMEABILITY OF THE $BaO+6Fe_2O_3$ PRESSED POWDER

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Thermomagnetic measurements of relative magnetic permeability of the $BaO + 6Fe_2O_3$ pressed powder were performed in an argon atmosphere using a Faraday balance within temperature interval from 293 K to 773 K. The Curie temperature of the powder is 723 K. After heating in external magnetic field of 8 kA/m relative magnetic permeability (on the room temperature) was increased 9 times. Measurements have been performed without external magnetic field when recorded increase of relative magnetic permeability of 2.9 times was. After that the same sample has been annealed in external magnetic field when increase was 7.2 times. Therefore, it was concluded that the influence of external magnetic field on increase of relative magnetic permeability is about 60% and the influence of heating is 40%. These results were discussed in order to analyze separated thermal and magnetic effects on magnetic permeability.

*P.S.B.29*

## THE EFFECT OF THE THERMAL PROCESSING TEMPERATURE ON THE MICROSTRUCTURE AND ELECTROCHEMICAL PERFORMANCE OF AN ACTIVE $RuO_2TiO_2/IrO_2$, Pt COATING ON TITANIUM

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A nanostructured electrochemically active film was produced thermally on titanium substrate from a solid ruthenium-titanium dioxide solution phase, an iridium-dioxide phase and a solid metal platinum-iridium solution phase. The microstructural properties and the electrochemical performance of the active film were dependent on the thermal processing temperature. The coating produced at 500°C showed the best electrochemical properties. The coatings produced at temperatures exceeding 500°C had cracks, larger crystal grains, lower catalytic activity and lower corrosion stability. At temperatures below 500°C, coatings of lower corrosion stability are developed due to incomplete conversion of metal chlorides into metal oxides.

*P.S.B.30*

## PREPARATION AND CHARACTERIZATION OF PT/C AND TIO$_X$-PT/C CATALYSTS FOR HYDROGEN OXIDATION REACTION

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The hydrogen oxidation reaction (HOR) was studied at home made Pt/C and TiO$_x$-Pt/C nanocatalysts in 0.5 mol dm$^{-3}$ HClO$_4$ solution at 25$^0$C. Pt/C catalyst was synthesized by modified ethylene glycol method (EG) on commercially used carbon support (Vulcan XC-72). TiO$_x$-Pt/C catalysts were prepared by the polyole method followed by TiO$_x$ post-deposition. Synthesized catalysts were characterized by X-ray diffraction (XRD), TEM and EDX techniques. It was found that Pt/C catalyst nanoparticles were homogenously distributed over carbon support. Mean particle size was found to be about 2.2 nm. The quite similar, homogenous distribution and particle size were obtained for Pt/C doped by TiO$_x$ catalyst. These results confirmed that TiO$_x$ post-deposition did not lead to a significant growth of the Pt nanoparticles. The actual exposed surface area of catalyst was determined by using cyclic voltammetry technique.

The kinetics of hydrogen oxidation was investigated by linear sweep voltammetry technique, at the rotating disc electrode (RDE). The kinetic equations used for the analysis were derived considering a reversible or an irreversible nature for the kinetics of the HOR. It was found that hydrogen oxidation reaction at both investigated catalysts is electrochemically reversible reaction. Determined values for the kinetic parameters - Tafel slope of 30 mV dec$^{-1}$ and exchange current density about 0.7mA cm$^{-2}$ are in good agreement with usually reported values for hydrogen oxidation reaction at platinum catalysts in acid solutions.

Key words: Pt/C nanocalyst, TiO$_x$-Pt/C catalysts, hydrogen oxidation reaction, acid solutions.

*P.S.B.31*

## TIME DELAY IN THIN DIELECTRIC SLABS WITH SATURABLE NONLINEARITY

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Time delays for an intense transverse electric (TE) wave propagating through a slab with saturable nonlinearity are investigated. The nonlinearity is assumed in a form of Vinetskii-Kukhtarev model, which is relevant for the slabs made by nonlinear photorefractive crystals, as GaAs and LiNbO3, which feature a saturable nonlinearity. The expressions for the group delay and the dwell time are derived and the relation between them is studied. It is shown that the difference between them has three different contributions. The first one corresponds to the self-interference associated with the dispersion of the medium surrounding the slab. The other two appear due to the nonlinearity of the slab and oblique incidence of the TE wave. All results are compared with the case of dielectric slabs with cubic (Kerr) nonlinearity.

*P.S.B.32*

# ORIENTATION AND RADIATION INDUCED CHANGES IN MICROSTRUCTURE AND CRYSTALLINITY OF ISOTACTIC POLYPROPYLERNE

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Orientation and radiation processing of polymeric materials are main steps in certain modern technologies and have extensive applications. In this work, samples of isotactic polypropylene (iPP) were oriented via solid-state stretching at elevated temperature (up to draw ratio $\lambda$=20) and gamma-irradiated in air to various absorbed doses (up to 900 kGy). Since the iPP is very sensitive to orientation and irradiation, surface microstructure was analyzed by optical (OM) and scanning electron microscopy (SEM). Wide-angle X-ray diffraction (WAXD) and differential scanning calorimetry (DSC) were used to monitor changes in structure and crystallization behaviour. The presented results reveal two stage evolution of iPP due to orientation; the first stage is characterized by significant increase in crystallinity after which saturation occurs with further increase of draw ratio, at second stage. Furthermore, for the case of irradiated iPP the role of strained tie molecules is more than evident. Absence of strained tie molecules in unoriented iPP structure leads to slow decay in crystallinity with absorbed dose. On the other hand, for the case of highly oriented fibrile structure the role of strained tie molecules is more than evident; radiation-induced increase in crystallinity at doses lower than 250 kGy is discussed in terms of the scission and strain-energy relief process on the crystals followed by the growth of new, thin-crystal, lamellae. At higher doses radiation-induced decrease in crystallinity of oriented iPP is explained by crosslinking and introduction of defects in crystalline fraction.

*P.S.B.33*

# THERMAL STABILITY OF MODEL IRREGULAR POLY(URETHANE-ISOCYANURATE) NETWORKS

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Although polyurethane elastomers provide good mechanical properties, they are not suitable for the applications that require heat resistance. In order to improve thermal stability, polyurethane networks can be prepared by substituting some of the NCO groups with more heat resistant isocyanurate(hexahydro-1,3,5-triazin-2,4,6-trion) rings as a crosslinks, by catalytic cyclotrimerisation of telechelic diisocyanate. The aim of this work was to find the correlation between thermal properties and structure of these model irregular poly(urethane-isocyanurate) networks based on 2.4-tolylenediisocyanate and $\alpha,\omega$,dihydroxypoly(oxypropylene). Samples with controlled amounts of dangling chains were prepared by varying the fraction of OH groups from diol and 2-(2-metoxyetoxy)ethanol, as monool component, in network precursor preparation. Network structural parameters were calculated using the theory of branching processes based on experimentally determined gel content. The non-isothermal thermogravimetric analysis were utilized for investigation of thermal stability, using a TGS-2 instrument (Perkin Elmer) and DSC-TGA (Q600 Ta Instruments), in a nitrogen and oxidative atmosphere within the temperature range from 30 to 300°C. It was concluded that isocyanurate rings as cross-links enhanced thermal stability of these elastomeric materials for use in high-temperature environments.

*P.S.B.34*

# ORGANIC SOLID PROTON CONDUCTING ELECTROLYTES BASED ON AROMATIC SULFONIC ACIDS

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Proton-conductive solid electrolytes are the most promising materials for use in different electrochemical devices for power generation (fuel cells).

A literature review shows that the investigation of proton conducting properties of individual organic compounds still remains a little-studied area. On the other hand the researchers focus efforts mostly on the field of polymer electrolyte membranes. The proton transport mechanisms studies in simple model systems allow explaining processes in more complicated polymer systems.

The individual aromatic acids containing carboxylic (–COOH), hydroxyl (–OH), alkyl (–$CH_3$), amino- (–$NH_2$) and necessarily sulfonate (–$SO_3H$) groups were selected as objects for investigation. We studied the effect of composition and crystal structures of aromatic sulfonic acids with different substitutes and functional groups quantity on proton transport parameters. Conductivity measurements were carried out as a function of environment: temperature and relative humidity.

The crystal and molecular structures of substituted benzenesulfonic acids solved by X-ray diffraction method. It is shown that all compounds except aminobenzenesulfonic acids are in crystalline hydrate forms. Water molecules in the structures exist in hydroxonium $H_3O^+$, or dioxonium $H_5O_2^+$ ions confirmed by vibrational spectroscopy data. AC conductivity measurements were carried out according to the impedance spectroscopy technique. The measured values of proton conductivity for all solid sulfonic acids under investigation extend over the range $10^{-7}$ – $10^{-5}$ $S{\cdot}cm^{-1}$ at $25^oC$ and conductivity run up to $10^{-4}$ – $10^{-3}$ $S{\cdot}cm^{-1}$ with humidity growth.

As is well known the structures of isomeric aminobenzenemonosulfonic acids exist as a zwitterion $^+NH_3C_6H_4SO_3^-$ in the solid state. Their high melting points (> 200 $^oC$), in contrast with other sulfonic acids, strongly favor this structure. The proton conductivity of aminobenzenesulfonic acids in vacuum is $10^{-8}$ $S{\cdot}cm^{-1}$ in the temperature range 25 – $250^oC$. With relative humidity increasing the proton conductivity greatly increased up to value $10^{-6}$ – $10^{-5}$ $S{\cdot}cm^{-1}$, which appears to be closely connected with increasing the level of material hydration. At the same time the total number of surface adsorbed water molecules per sulfonic group not exceeds 0.2 moles.

The most important condition for effective proton transport in similar systems is the sulfonate groups water shell depend on relative humidity of environment. The hydrophilic properties of organic solid sulfonic acids restrict to their area of application, but clear the way to potential use of them as low molecular additions for polymer proton conducting electrolytes.

*P.S.B.35*

## ANALYSIS OF ANISOTROPY BEHAVIOR IN UOE FORMING FOR X80 HSLA STEEL

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In modern industry, the development tendency and prospect for production of HSLA steel to refine acicular ferrite microstructure with high strength and toughness. Mechanical properties of low grade line pipe steels can be anisotropic due to the plate manufacturing and pipe forming processes. The anisotropy can potentially affect the integrity of the line pipes, such as their buckling and collapse resistance. The purpose of this letter is to report our recent interesting observation in tensile and impact fracture toughness properties in different directions in high strength X80 HSLA steel that formed with UOE process. Tensile and impact fracture toughness samples selected from 90 and 180 degrees of pipe in longitudinal and transverse directions. Charpy impact fracture toughness tests were conducted at various temperatures from -50 °C to 0 °C. Tensile tests were conducted at room temperature (about 25 °C) with full thickness strip samples. Microstructure characterization was done by means of LOM and SEM microcopies. The microstructures of the rolled plate have a fine acicular ferrite microstructure with some (M/A) that dispersed in the matrix phase. This Microstructure has high angle grain boundary with high fracture toughness but present of M/A phase as a crack initiation site can affected fracture toughness. Yield and tensile strength are different for samples in each pipe locations and orientations. Tensile properties in 90° (transverse) are highest. Yield strength is about 6% higher that before UOE forming. Minimum amount of charpy impact appears in 90° (transverse) that amount of toughness decrease is about 5.5% in this orientation. Test temperature decrease from 0 °C to -50°C show toughness impact energy decrease about 0.4-0.9% related to degree and orientation of samples. Therefore impact fracture toughness in all degree and orientation low dependent to decrease in temperature up to -50 °C in X80 HSLA steel after UOE forming.

*P.S.B.36*

# INFLUENCE OF SUBMERGED TANDEM ARC WELDING ON HAZ TOUGHNESS OF X80 MICRO ALLOY STEEL

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In modern industry, the developing tendency and prospect for production(s) of the low carbon micro alloy steels is to refine microstructure, so as to further improve its strength and toughness. API X80 is a high grade micro alloy steel that is used for this research. Tandem submerged arc welding with two or excess electrode is an economic process for joining high thickness micro alloy steels. In this research the welding process is done with four wires but a major problem is lowering in heat affected zone toughness for high grade micro alloy steels. Toughness properties in heat affected zone (fusion line, coarse grain HAZ and fine grain HAZ) studied. Welding done in different amount of heat input. Microstructure and Impact energy with CVN (charpy V notch) studied in -50°C. Heat affected zone in micro alloy steels is complex due to many phases (polygonal ferrite, quasi polygonal ferrite, widmanstatten ferrite, acicular ferrite, granular ferrite, bainite, M/A, inclusions) that exist in this region. Impact energy changes with heat input up to optimum and increased about fifty percent. Microstructure study with SEM shown that M/A island, austenite grain growth and ferrite side plate is a major factor in CGHAZ toughness.

*P.S.B.37*

# TO STUDY THE EFFECT OF CRYOGENIC HEAT TREATMENT ON HARDNESS AND THE AMOUNT OF RESIDUAL AUSTENITE IN 1/2304 STEEL

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1/2304 steel is a kind of steel which is used very much for manufacturing cold rolling. In these parts, percent of residual Austenite has considerable effects on the life of roll, because in working conditions due to applied stresses, there is possibility for transformation of residual Austenite to martensite. In this manner, the obtained martensite can cause the roll to be broken. In the present study the effect of cryogenic heat treatment on hardness and the amount of residual Austenite in the structure of the said steel was surveyed. Results indicated that the best Austenitization temperature is 1000C and duration is 45 minutes. Then with exertion of these conditions and quenching the samples in each air and water their hardness was determined 64 HRC and residual Austenite was determined between 6–7 %. Then, immediately after the stage of samples quenching, with putting them under cryogenic heat treatment ( in liquid nitrogen) for a duration of 6 hours, hardness of samples increases to 67 HRC and the amount of their residual Austenite decreases to about 1.5 to 1.7 %. Therefore performance of cryogenic heat treatment can decrease the amount of residual Austenite in addition to increasing hardness (about a few HRC).

For performance the best heat treatment cycles with using dilatometric tests critical temperature Ac1 and Ac3 were determined respectively equal to 797C, 849C and Ms temperature was determined 265C.

Key Words: cryogenic heat treatment, hardness, residual Austenite.

*P.S.B.38*

## THE EFFECT OF CURING SYSTEMS ON THE PROPERTIES OF NATURAL RUBBER / CHLOROSULPHONATED POLYETHYLENE RUBBER BLENDS

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The aim of this work was to study the influence of accelerators on curing characteristics and mechanical properties of rubber blend based on natural rubber (NR and chlorosulphonated polyethylene (CSM). For compound preparation the three groups of commercial accelerator were used: sulfenamide type (CZ), thiuram type (TMTD) and mercapto types (MBT and MBTS). The curing characteristics were determined using oscillating disk rheometer. The results reveal that the accelerator type not only affects the cure characteristics, but also has great inffluence on compound viscosity. It is estimated that CZ provides the best processing safety and also the relatively high level of crosslinking. In addition, TMTD and MBT also provide superior mechanical properties probably due to the increase of crosslink density (associated to the reactive compatibilization promoted by the reaction between accelerators and rubber macromolecules). Due to their lower reactivity, the accelerators TMTD and MBTS give a relatively low level of crosslinking. Therefore, the obtained vulcanizates possess low modulus and hardness. Surprisingly, it was determined that the tensile strength of rubber blends cured in the presence of MBTS was relatively high.

Keywords: Natural rubber; Chlorosulphonated polyethylene rubber; Rubber blend; Accelerator; Mechanical property, Curing behavior.

*P.S.B.39*

## THE INFLUENCE OF MACRODIOL TYPE ON MECHANICAL PROPERTIES OF POLYURETHANE MATERIALS

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Polyurethane (PUR) materials based on hexamethylene diisocyanate, 1,4-butanediol and a macrodiol were prepared by the one-step procedure. Polycarbonate diol, polyoxypropylene diol and polybutadiene diol (MW ca 2000 in all cases) were used as macrodiols, dibutyltin dilaurate as a catalyst. Some PURs contained also nanofiller. Common tensile test and Dynamical Mechanical Analysis were used for mechanical properties evaluation at temperature range from –100 °C to +150 °C. The effect of macrodiol type on mechanical behaviour is discussed as well as the influence of the shape of prepared materials (bulk, film) on tested properties.

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*P.S.B.40*

## MICROSTRUCTURE OF A SINTERED PRODUCT ON THE BASIS OF ILLITE-KAOLINITE CLAYS

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In this paper the microstructure of a sintered product on the basis of illite-kaolinite clays has been analysed.

The aim of the paper was to determine the influence of chemical and mineral content of illite-kaolinite clays on the microstructure of a sintered product. The samples have been formed by plastic shaping in a mould corresponding to a parallelepiped with dimensions of 7.7 cm x 3.9 cm x 1.6 cm. In order to compare microstructures of a sintered product two clay types, marked as "BP" and "PV", have been used.

The samples have been fired at the temperatures of 800°C, 900°C, 1000°C, 1100 °C and 1200 °C. Previously, chemical and mineral content of clays, granulometric content and microstructure content of a sintered product had been determined. The microstructure of a sintered product has been determined by the microscopic analysis, SEM.

The influence of mineral content of clays on microstructure, as well as the influence of the firing regime, has been determined.

*P.S.B.41*

## MICROSTRUCTURAL CHANGES OF HIGH TEMPERATURE CONCRETE DURING CREEP DEFORMATION

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Usage of the refractory concrete, as an „unshaped" refractory material, in monolithic elements of metallurgical furnaces and other plants operating at high temperatures is, today, irreplaceable. This paper is concerned with investigation of the secondary state creep (steady state creep) resistance tested on two types of refractory concrete varying in, both, chemical and mineralogical composition. Sintering process during secondary state creep within refractory concrete has isothermal character. Thus, attempt was made to describe mentioned process quantitatively. Creep was investigated at three different temperatures: 1200, 1300 and 1400ºC. Approximate activation energy during secondary state creep and rate of sintering process was calculated. Variation of microstructure of concrete samples, exposed to constant static pressure and constant temperature during certain time-interval, was investigated using scanning electron microscope. Obtained results of the investigation proved that creep resistance is an irreplaceable method when decision about the best possible type of refractory concrete for application in metallurgical furnaces is required. Results of the investigation are confirmed with following phenomenon: secondary mullite is formed in interaggregate space at extremely high temperatures and it positively affects creep resistance.

*P.S.B.42*

# INFLUENCE OF THE PLATINUM ALLOY MICROSTRUCTURE ON THE OPTIMUM CHARACTERISTICS OF THE PRECISE ANEMOMETERS

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Acquiring reliable velocity data in experimental fluid mechanics needs precise probes. In this paper are analyzed sensor materials, used in original probe constructions designed and manufactured in our labs, used in the research of fluid flow phenomena. They have better space and time resolution than other commercial probes of the same type. They are made for very accurate measurements in the turbulent swirl pipe flow. Probe prongs, are made of inox, sharpened at the top to the size of 75μm. They are positioned in a cylindrical metal pipe of small diameter, and fixed in a defined position with a special nonconductive epoxy glue, which, also, makes them being parallel to each other. This small pipe is fixed inside the probe, made of hard plastic. Sensor fibre, of different platinum alloy with iridium or rhodium, has a various diameters in the range of 0.5-2.5μm and a length size of 0.7mm, depending on the probe geometry. Silver probe, sensor fibre and prongs are precisely positioned, during spot welding process, with high precision micromanipulator. The whole process is performed under the stereo microscope. It is of great significance that this welded spot has an adequate mechanical strength, as probe works in extremely turbulent flows. Structure changes in materials are analyzed depending on the mass percent of iridium or rhodium in platinum alloy, their atomic and crystal structure, thermal conductivity coefficient, electrical resistivity of used elements and alloys and optimal welding regime. They directly influence alloy mechanical characteristics and probe reliability in the working regime.

Keywords: alloys, microstructure, anemometers, turbulence.

*P.S.B.43*

# SYNTHESIS AND PROPERTIES OF SINGLE ISOTOPE POLYCRYSTALLINE CVD-DIAMOND

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Diamond is a unique crystal in many respects. In particularly, it has the highest thermal conductivity ≈ 23 W $cm^{-1}K^{-1}$ among all known materials at room temperature. The diamond has also the highest Debye temperature of ≈ 2240 K. Since the Debye temperature sets a temperature scale for a given material, the room temperature (298 K) is low temperature for the diamond. As the result the isotope disorder play an important role in phonon scattering, despite the natural abundance of the "impurity" isotope $^{13}C$ is 1.07%. Isotopically enriched carbon in the form of oxide $^{12}CO$ with concentration of isotope $^{12}C$ of 99.96% was produced by cryogenic rectification method at complex "Column" (RRC Kurchatov Institute, Moscow) designed for the carbon isotope separation. The carbon oxide was converted chemically into methane $^{12}CH_4$ without loss of the isotopic enrichment by catalytic reaction with hydrogen. The methane then was purified from undesired chemical impurities (mainly from nitrogen) by means of cryogenic rectification. In GPI RAS (Moscow), the plate of polycrystalline CVD-diamond with diameter of 57 mm containing 99.96% of $^{12}C$ was grown with using of the enriched methane $^{12}CH_4$. The temperature dependence of thermal conductivity of CVD-diamonds with natural isotope abundance and isotopically enriched mixture has been measured in the temperature range from 5 to 410 K. The enriched diamond demonstrates substantial rise of thermal conductivity as compared to the "natural" counterpart at temperatures above 80 K. The thermal conductivity reaches 25.1 W $cm^{-1}K^{-1}$ at room temperature, and the isotope effect amounts approximately 32%. Hence, the thermal conductivity of polycrystalline single isotope CVD-diamond exceeds that of best natural and artificial single crystals of diamond with natural isotopic composition.

*P.S.B.44*

## POLYURETHANE FOAMS AND FILMS: PREPARATION AND CHARACTERIZATION

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The preparation and characterization of two polyurethane (PUR) systems: (i) PUR foams and (ii) PUR elastomeric films containing nanoadditives will be presented. The influence of the concentration and composition of catalyst mixtures on the foam formation and end-use properties on PURs, made from polyether polyol, aromatic diisocyanate, foam stabilizer and water was tested. The comparison of catalysts and catalyst mixtures in view of economic and environmental aspects is carried-out. PUR elastomeric films are prepared from polycarbonate diol, aliphatic diisocyanate and 1,4-butandediol. Natural or synthetic layered nanoadditives in the concentration of 1 wt. % are used. Solid-state NMR spectroscopy is used for the study of interaction of the polymer matrix with nanoadditives. Their influence on mechanical and surface properties is discussed.

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*P.S.B.45*

## EXPERIMENTAL INVESTIGATIONS OF CURED AND UNCURED DISILOXANE BISBENZOCYCLOBUTEN (BCB) FILMS

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The benzocyclobuten (BCB) based dielectric polymers have found numerous applications in micro and optoelectronics. They provide excellent dielectric properties, gap-fill and planarisation, low moisture absorption, rapid cure, and high thermal and chemical stability. Its low optical losses, high transparency, and refractive index make them suitable for optical applications in integrated circuits. The main challenge in the large-scale commercial applications of BCB dielectrics is to perform their curing rapidly and efficiently at low temperatures, to obtain large area, high quality, pinhole free dielectric thin films. For that purpose we investigated numerous uncured and cured BCB films, approximately 2 μm thick, spin-coated on glass/ITO surface, using optical, SEM and AFM microscopy, IR spectroscopy and optical parameters measurements. That way we established relations between the microscopic changes taking place during curing and macroscopic properties of the polymer, which are important for its practical applications.

*P.S.B.46*

# STUDY OF SPACE VEHICLES METAL SURFACE MORPHOLOGY UNDER IMPACT OF HARD HIGH-SPEED MICROPARTICLES

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In this paper we have present the results of experimental study of hard high-speed microparticles collisions with metal targets and specimens exposed on open cosmic space. The impacts of natural and artificial space particles can lead to structural changes of both surface and bulk properties of constructional and electronic materials. The results of our analysis of aluminum and copper specimens under micrometeorite action in near-Earth space environment by scanning electron (SEM) and atomic forth microscopy (AFM) have shown that not only well-pronounced craters, but also microcrater fields and unipolar arcs can be formed. The insight of this phenomenon is of a great importance for development of space vehicles advanced protection methods, as well as, for methods of registration and analysis of objects included into meteoric matter and space dust structure.

*P.S.B.47*

# OPTIMIZING CUTTING PARAMETERS FOR SURFACE ROUGHNESS IN TURNING OF THE COMMERCIAL ALUMINUM (1100-H18 Type) ALLOY USING TAGUCHI METHOD

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The continuing demand for cost effective solutions to materials and manufacturing problems remains the driving force for product improvement and development. The machining of commercial aluminum has a tendency to form a build-up-edge (BUE) on the cutting tool that is affected the surface finish of the alloy. Improving surface finish by optimizing cutting parameters or factors, using Taguchi design of experiment (DOE) method would be beneficial for industrial applications. In this study, applications of the $L_{16}$ orthogonal array (OA) with 2-levels for each factor and the $L_9$ OA with 3-levels for each factor are carried out to investigate the effects of factors and interactions on performance measurement of surface roughness ($R_a$). The analyses of the signal-to-ratio (S/N) and variance (ANOVA) are employed in determining the optimal cutting parameters in turning process. The results of the $L_9$ orthogonal arrays indicate that the surface roughness is improved by ~348% (from as received 0.8 μm to 0.23 μm) using the optimal cutting parameters of 188 m/min (1500 rpm) cutting speed, 0.05 mm/rev feed rate, and 0.8 mm insert radius. Also, the results show that there are no strong interactions between the main factors. While the most significant factors affected the surface roughness in turning, is the insert radius and feed rate.

*P.S.B.48*

# CRACK INITATATION AND PROPAGATION OF HAZ SIMULATED SPECIMENS OF STEEL 12H1MF UNDER IMPACT LOADING

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Pipelines are high-responsible constructions subjected to complex service conditions of creep and low-cycle thermal fatigue on elevated temperatures. Periodic control doesn't give full insight of mechanical properties of pipeline weldments, mainly due to the fact that this control is NDT based. All welded joint are points of local geometrical and microstructural inhomogeneity. This is particularly valid for heat affected zone (HAZ) and therefore HAZ usually weakest link of one welded joint. Because the usual size of HAZ is small, it is very difficult to establish real mechanical properties of HAZ or the weakest zones within the HAZ. By registration of thermal cycle during welding and subsequent HAZ simulation, on thermal cycle simulators (TCS) it is possible to obtain target microstructure, similar to HAZ, but with the size appropriate to perform standard destructive tests. This paper describes impact toughness of simulated specimens made of 12H1MF steel from service and from new, unused steel. This steel is in use in domestic power plants, and at present time is at the end of service life. After simulation of single pass and multi pass welding simulated specimens were tested on instrumented Charpy pendulum. Metallographic and fractographic analysis is also performed, on all specimens. Correlation between microstructure and impact toughness is discussed.

Key words: Pipeline, steel 12H1MF, simulated HAZ, Charpy pendulum, impact toughness.

*P.S.B.49*

# STEEL–SIC *CAST IN CARBIDE* COMPOSITES AS ALTERNATIVE TO WEAR RESISTANT Cr-Mo STEELS

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In the papir was studied the possibilities of making and appliance *Cast-in-Carbide* composites based on carbon steel and SiC, for production of wear resistance machine parts like mill hammers, escavator teets, etc. Materials which usually use for the making these wear resistant parts, the high-alloyed Cr-Mo steels, in practice has shown the very good results and enable considerably the larger safety of work of different devices in which these materials have been built in.

However, wear-resistant parts, use in the mining, industry, civil engineering and traffics are, in the exploitation, exposed to the strong abrasive acting of the silica, corundum, feldspath and other minerals, and by this, often comes to the strikes in present stones and rocks. These strikes are especially dangerous because can lead to breakdown of the construction part or complete device, since that mentioned materials have relatively small impact toughness. The best variant of the construction is to make the wear resistant parts of the material which, beside hardness, possess high impact toughness, dynamic strength and fracture toughness. So far, used materials, mostly the high-alloyed Cr-Mo steels, have not this combination of the properties, and the aim this research was to check the possibility of production and application of the new, MMC materials, based on steel matrix and SiC as reinforcement particles, which have just such characteristic. Optimized content and disposition of SiC particles in the steel, combine extreme hardness and wear resistance of casting surface, rich on SiC, with high strength and toughness of metal base.

*P.S.B.50*

# THE PHENOMENON OF CAVITATIONIN SHIP'S PROPELLERS IS NOWADAYS OF A GREAT IMPORTANCE

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And relevance for it is mobility. The all time tendencies if transport in general and of naval transport in particular have been to achieve and greater speed and construct vessels with ever greater dimensions. As to the first, it can be said that it is a distinctive characteristic and aspiration of human nature, whereas the second is conditioned by economic factors.

Today's ship's propellers have grown progressively with respect to their diameter to the present propellers of 7 meters in turbo cistern ships with a containing capacity of 100000 DVT, the power in the axis significantly surpassed 50000 KF, the specific push for $cm^2$ of the propeller's sheet has begun to significantly surpass the total static pressure (atmospheric + water's charge which acts upon the propeller's sheets.

In such extreme conditions of charge several anomalies are found out in the function of the propeller accompanied by a degradation of materials of the propeller's appearance as well as its output anomalies which are due to this phenomenon of cavitations.

*P.S.B.51*

# THE INFLUENCE OF METEOROLOGICAL FACTORS OF VLORE BAY ON CORROSION SPEED OF STEEL A-3

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This article is about the role that corrosive environment plays to steel corrosion speed used in the outward covering of means of naval transport. By the complex study of these phenomena, corrosion speed is increased as a result of temperature, pressure, waving, salting and by manoeuvrable factors during the navigation and floating of means naval transport at different time periods.

The direct study, the specification of factors and the influence of these factors on corrosion speed are specified and concreted through the fulfilments of experiments in the seawater of Vlore Bay distinguished for its specific characteristics.

The problem of centre to the corrosion of metal materials and the influence of different technologic and constructive factors (microstructure, interior tensions ,superficial treatments geometric shapes etc as well as environmental factors on it (temperature and corrosive environment) consist one of the sharpest issues of materials' theory in the field of constructions and in the choice of materials.

The process of the corrosion of metals causes a great considerable damage to the economy .According to many authors is calculated that 1/3 ( one third) of the total world production of metals is out of order as a result of its erosion –corrosion, while1/3 of this irrevocable loss causes pollution of the environment.

The corrosion of metals in direct contact with seawater and sea atmosphere causes a great damage. There is corroded about 0,8 kg metal for every square meter metallic surface dived in the seawater a year. As a result the dived part of boats in the seawater is damaged by the corrosion with a speed about 0.008 -0.13 mm a year that in port areas reaches the value 0.8 to 3 mm/ a year.

Keywords: corrosion fatigue, resistance, steel, low cycle fatigue, meteorological characteristics, corrosion speed.

*P.S.B.52*

# A STUDY OF THE GALLOP PHENOMENON IN ELECTRIC AERIAL LINES. MEASURES AND CHECKING IN ORDER TO REDUCE ITS CONSEQUENCES

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This article focuses on the importance of the study of the Gallop phenomenon in the electric power transmission lines, because it is crucial to increase the safety of the electric power system. Various transmission lines in our (Albanian) electric system are spread in locations with such climate conditions that favor the appearance of the gallop phenomenon. Thus, it is indispensable to check if there is a likelihood of the appearance of such a phenomenon in the transmission lines both during their design and the working stages.

Key words: Gallop phenomenon, electric power transmission lines, safety, measures and checking.

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*P.S.B.53*

# A NEW FORMULATION OF THE DYNAMIC BALANCING CONDITIONS WITH APPLICATION TO LINK OPTIMIZATION FOR THE SLIDER-CRANK MECHANISM

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Many authors had treated the dynamic balancing of planar mechanisms. All of these started by the condition that total center of mass for the mechanism were stationary or the first derivation of momentum with_respect to time were zero, in different ways, have formulated the conditions of dynamic balancing of mechanism. In this paper started by the condition that the total center of mass of mechanism were stationary are formulated the conditions of dynamic force balancing of mechanism based on the method of dynamic modeling with natural orthogonal complement

First the dynamic modeling with natural orthogonal complement of the system is made and based on this modeling the dynamic balancing conditions are formulated. The balancing problem is solved as an optimization one, which aim to render the links as inertial symmetric as possible. Finally a numeric example has been presented and solved in Math lab environment, the result of witch is an optimal mechanism both inertial and minimum shaking force point of view.

Keyword: Dynamic balancing of mechanism, Math lab environment, inertial, orthogonal complement.

*P.S.C.1*

## PHONON CONTRIBUTION IN THERMODYNAMICS OF NANO-CRYSTALLINE FILMS AND WIRES

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Spectra of possible phonon states, as well as thermodynamic characteristics of nano-crystals (ultrathin film and quantum wire) of simple cubic crystalline structure are analyzed in this paper, using the method of two-time dependent Green's functions. From energy spectra and internal energy of the system the thermal capacitance of these structures in low temperature region is found. The temperature behavior of specific heat is compared to that of corresponding bulk structure. It is shown that at extremely low temperatures thermal capacitance of quantum wire is considerably lower than the thermal capacitance of film as well as the bulk sample. Consequences of this fact are discussed in detail and its influence to kinetic and thermodynamic properties of materials is estimated.

*P.S.C.2*

## BAND GAP PHOTONIC STRUCTURES IN DICHROMATE PULLULAN

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One - dimensional photonic crystals are fabricated in a dichromate-sensitized pullulan by holography. Pullulan is a biopolymer with linear polysaccharide structure. Photonic crystals are created as volume reflection holograms. A single-frequency, diode pumped Nd-YAG laser, at 532 nm, is used for exposure. Band gaps in the visible range are observed. The spectral measurements show that by increasing of dichromate concetration the band gap is shifted towards the short wave region.

*P.S.C.3*

## ELECTRON AND HOLE STATES IN CLOSED SPHERICAL QUANTUM DOT WITH GRADIENT COMPOSITION

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The theoretical investigation of the electron and hole spectra in a quantum dot (QD) of gradient composition within the effective mass approximation (EMA) is presented. The particular example is β-HgS surrounded by CdS. β-HgS core of radius $R_C$ is surrounded by concentric spherical layers of $Hg_{1-x}Cd_xS$ composition (x is function of r) and finally, from radius $R_S$ by CdS that spread out to infinity. The existence of these intermediate layers, as model of gradient composition, influence rapidly to electron and hole spectra, and their probability density on the distance from the center of the heterosystem.

*P.S.C.4*

## THE INFLUENCE OF THE ELECTRON-PHONON INTERACTION ON PHONON SPECTRA IN THE AlGa CRYSTAL LATTICE

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The theoretical model that enables determination of extra-electron influence to long wave longitudinal acoustic oscillation of a GaAs crystal lattice has been developed in the article. The famous ADP model has been used as a theoretical base for our model. The influence of electron-phonon interaction to LO phonons has been also studied. The obtained results indicate significant change of both acoustic and optical phonon spectra, especially in low temperature range and for electron which weakly interact with crystal lattice. It could significantly affect to charge transport in microelectronic devices based on GaAs semiconductor.

*P.S.C.5*

## COMPARATIVE STUDY OF EFFECT OF VARIOUS REDUCING AGENTS ON SIZE AND SHAPES OF GOLD NANOPARTICLES

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Nanoparticles have attracted considerable interest because of their unique optical, electromagnetic and catalytic properties that differ from bulk ones. The origin of these properties is their large surface to volume ratio and from the coherent oscillation of the conduction electrons that can be induced by interactive electromagnetic fields. Since these electromagnetic properties vary with the size and shape of the novel metal particles, the focus of many studies has been on methods for controlling the size and shape of gold Nanoparticles. The aim of this work has been to deliver the effect of various reducing agents on size and shapes of gold Nanoparticles formed. The morphology of gold Nanoparticles along with their size and shape has been outlined in this paper. Gold Nanoparticles formed by hydrazine sulphate as a reducing agent have branched or the so-called sea urchin shape resembling to the shape that of familiar sea animal. This shape was synthesized for the first time and may find applications in various biomedical or related fields.

*P.S.C.6*

## THE SYNTHESIS AND CHARACTERIZATION OF Ca–Ti-BASED ONE-DIMENSIONAL NANOSTRUCTURES

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The alkali layered titanates with the general formula $A_2Ti_nO_{2n+1}$ have been particularly intensely investigated due to their ion-exchange ability and possible applications arising from their structure, which is conducive to the good mobility of cations. Firstly, Na–Ti-based one-dimensional nanostructures were synthesized by the hydrothermal treatment of $TiO_2$ in a highly alkaline solution of NaOH. In a subsequent hydrothermal procedure the interlayer cations were ion-exchanged with $Ca^{2+}$ cations. In order to examine the morphology and the crystal-structure transformation we performed a thermal post-treatment of the as-prepared products. The morphology and the composition of the Ca–Ti-based nanostructures were examined by using high-resolution transmission electron microscopy (HRTEM), energy-dispersive x-ray spectroscopy (EDS) and electron energy-loss spectroscopy (EELS).

*P.S.C.7*

## KINETICS INVESTIGATION OF HYDROGEN SORPTION REACTION OF $MgH_2/Nb_2O_5$ NANOSTRUCTURED POWDERS

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The limitation of $MgH_2$ for practical application in hydrogen storage is the slow hydrogen sorption kinetic and the high thermodynamic stability. The major and promising improvements toward technological application have been reached by increasing the number of defects of the $MgH_2$ powders by mechanical milling and by adding transition metal oxides in the milling process in order to assist the phase transformation. Up to now, $MgH_2/Nb_2O_5$ system is one of the most promising candidates for the hydrogen delivery, owing to the fast kinetics. However, the elementary mechanisms underlying the absorption/desorption reaction and the factors responsible for this improvement are still largely unknown. In order to elucidate the mechanism, the effect on the reaction kinetics induced by nanometric and micrometric $Nb_2O_5$ powders has been experimentally investigated. The nanometric additive imparts excellent performances in comparison to the micrometric one. In fact, after only 10h of milling, $MgH_2$ containing 1mol% releases at 300°C at the pressure of 0,2 bar, 80% of its hydrogen content in 120 s and, at the same temperature at a pressure of 8 bars, absorbs the same amount in 100 s. Fast kinetic are achieved also at 200°C, absorbing the same amount in 200 seconds. The sorption kinetic has been studied by the classical analysis of the time dependence of isothermal phase transformation rate. This kind of studies has been supported with the metallographic SEM observation of cross-sectioned and partially desorbed samples. Owing to an original approach this analysis can in fact provide the spatial distribution of the phases involved in the adsorption/desorption reaction.

*P.S.C.8*

## CHARACTERIZATION OF La-DOPED $TiO_2$ NANOPOWDERS BY RAMAN SPECTROSCOPY

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Titanium dioxide ($TiO_2$) nanopowders doped with 0.65, 1, 2, 3 and 4 wt. % of lanthanum ions ($La^{3+}$) are synthesized by sol-gel technology. Dependence of structural and morphological characteristics of nanopowders on $La^{3+}$ content and synthesis conditions is investigated by Raman spectroscopy. Very intensive modes observed in Raman spectra of all nanopowder samples are assigned to anatase phase of $TiO_2$. Additional Raman modes of extremely low intensity can be related to the presence of small amount of brookite amorphous phase in nanopowders. Dependence of the intensity ratio of the Raman modes which originate from anatase and brookite on syntheses conditions are specially analyzed. In order to estimate the variation of nanocrystallite size with dopant content, shift and asymmetrical broadening of the most intensive $E_g$ Raman mode of anatase are analyzed by phonon confinement model. Obtained results are compared with the results of XRD spectroscopy. Special attention is dedicated to the anharmonic behavior of all anatase Raman modes observed in high temperature Raman spectra of nanopowders synthesized with different $La^{3+}$ content.

*P.S.C.9*

## CHARACTERIZATION OF BARIUM TITANATE CERAMIC POWDERS BY RAMAN AND IR SPECTROSCOPY

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Barium titanate ceramics were prepared by mechanochemical synthesis and by Pechini method. A powder mixture of BaO and $TiO_2$ was treated in a planetary ball mill in an air atmosphere for up to 12 h, using zirconium oxide vial and zirconium oxide balls as the milling medium. After 60 minutes $BaTiO_3$ phase was formed. In both ways $BaTiO_3$ ceramics were sintered after 120 min on 1300 $^{o}$C without pre-calcinations step. The heating rate was 10 $^{o}$C min$^{-1}$. The formation of phase and crystal structure of $BaTiO_3$ was approved by XRD analysis and Raman and IR spectroscopy. The morphology and microstructure of obtained powders were examined by SEM method. Dielectric properties are well performed. Sharp phase transition from ferroelectric to paraelectric state was observed. The hysteresis loop is very well performed with regular sharp characteristic for ferroelectric materials.

*P.S.C.10*

## SELF ASSEMBLING MONOLAYER DEPOSITION APPROACH TO THE PROTECTION OF GLASS SURFACES

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In spit of the common belief that glass is a material quite stable it often shows a deep surface decay induced by basic and acid rains, steam or atmospheric agents. This phenomenon is generally induced by leaching and corrosion processes and to avoid this kind of degradation we prepared protective nano-coatings in order to change the glass wetting properties, without modifying the aesthetic properties of handicrafts, and to prevent water induced surface degradation. The use of suitable coating molecules allow to change glass-water contact angle, making the substrate surface hydrophobic. We have considered the SAM (Self Assembling Monolayer) deposition useful to this goal and the alkyltrichlorosilanes and fluoroalkylsilanes (FAS) molecules suitable for this assembling process.

The wetting properties of the FAS and alkyltrichlorosilanes layers were estimated by using a contact angle meter while the chemical composition of the coatings was studied by X-Ray Photoelectron Spectroscopy (XPS). AFM and colorimetric measurements were also used to understand and to quantize the impact of the treatments on the handicrafts.

Resistance of the SAMs to acid and basic solutions was evaluated by following the variations of contact angle and chemical composition vs time after immersion of samples in pH controlled solutions.

On the basis of obtained results, FAS coating seems to be an excellent tool in glass protection and candidate to the use in preservation of several glass artefacts.

*P.S.C.11*

## NANOCRYSTALLINE GLASS-CERAMICS

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Nanostructures are the entry into a new realm in chemical, physical, biological and materials science. Crystallization of glass is one of the effective methods for fabrication of nanostructures. Nanocrystallized glasses, have received much interest, because such materials have high potentials for applications in electronic devices. The key factor for nanocrystallization is the homogeneous nucleation In this paper the crystallization of $K_2O{\cdot}Nb_2O_5{\cdot}4SiO_2$ glass was investigated. This composition corresponds to the tetragonal crystal of $KNbSi_2O_7$ phase, which possess a high optical nonlinearity responsibles for the second harmonic generation. The glass was melted in platinum crucible at T=1500 $^{o}$C during t=1 h. The glass transition temperature $T_g$=707$^{o}$C and temperature crystallization peak $T_p$=917$^{o}$C were determined. The glass was crystallized by heating at 900-950 $^{o}$C for t = 1-5 h. The crystalline phase $KNbSi_2O_7$ was formed by the surface crystalliation mechanism. The size of crystals were in the range of 20-30 nm.

*P.S.C.12*

## THE ELECTRICAL AND MAGNETIC PROPERTIES OF THE COBALTITES $Pr_{1-x}Ca_xCoO_3$

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We report studies of polycrystalline samples of the transition metal oxides $Pr_{1-x}Ca_xCoO_3$ through measurements of the resistivity, magnetization, and ac magnetic susceptibility in the temperature range of 4 K to 350 K for magnetic fields up to 9 T. The static magnetic susceptibility was also measured up to 1000 K. The phase and lattice parameters of the compounds were determined by X-ray powder diffraction that indicated that the samples are mainly clean single phase. In the doping range studied ($0 \leq x < 1$) the electronic properties of the material exhibit a crossover from semiconducting (insulating) to metallic behavior showing negative magnetoresistance behavior. The data suggest the presence of correlated magnetic clusters at low temperatures as confirmed from the frequency dependence of the ac susceptibility and from non-linear ac susceptibility measurements. The results suggest the occurrence of a spin state transition (SST) of $Co^{3+}/Co^{4+}$ ions from intermediate (IS) to low spin state (LS) as temperature and Ca content change. A phase separation scenario is discussed and a phase diagram was drawn.

*P.S.C.13*

## COMBUSTION SYNTHESIS, CHARACTERIZATION AND MAGNETIC STUDIES OF NANOPARTICLE $La_{0.7}Ca_{0.3}MnO_3$

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The self-combustion glycine nitrate method was applied to the synthesis of nanoparticle $La_{0.7}Ca_{0.3}MnO_3$.The starting single-phase sample was prepared for the first time by this method without additional heating, and then was annealed at temperature of 900°C. The structural characterization of the samples was done by Rietveld analysis of their X-ray diffraction patterns. The structure was described in orthorhombic space group Pnma. Rietveld analysis showed that increased particle size can cause cell volume contraction. The average particle size of both samples determined by TEM analysis was in agreement with the crystallite size obtained by the refinement of the diffraction data. DC magnetization and AC susceptibility measurements of the as-prepared sample showed remarkable differences of the magnetic properties comparing to the heat-treated sample of $La_{0.7}Ca_{0.3}MnO$: a considerable reduction in both para-to-ferromagnetic transition temperature $T_c$ and saturation magnetization have been observed, with the simultaneous increase of the coercivity value. It was found that the spin-glass like state at temperatures below 95 K exists in as-prepared sample. This observation can be interpreted in terms of core-shell model with the core thickness estimated to be ~ 10% of particle size.

*P.S.C.14*

## UREA-ASSISTED SELF-COMBUSTION AEROSOL SYNTHESIS OF $Y_3Al_5O_{12}:Ce^{3+}$

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Spray pyrolysis, as a representative aerosol route, is a promising synthesis method that can assure particle morphological and structural features needed for the application in modern functional materials. One such material is $Y_3Al_5O_{12}:Ce^{3+}$ (YAG:Ce) and owing to its excellent thermal stability, good mechanical and luminescence properties, it is applied in lasers, display devices, white LED's etc. A simple route to pure garnet phase synthesis is hard to achieve, due to the formation of other stable phases of $Y_2O_3$-$Al_2O_3$ system (monoclinic, perovskite and hexagonal). In this study, urea-assisted spray pyrolysis was employed, in the effort to synthesize a pure YAG phase with good structural and morphological characteristics. This route can be regarded as a self-combustion synthesis confined within a droplet. Urea acts as an in-situ source of thermal energy, that is, the combustion enthalpy released as a result of urea decomposition aids the formation of the high temperature stable phases and it influences structural properties of the final powder. The process involved ultrasonic aerosol formation (1.3 MHz) from the urea-modified nitrate precursor solution and consequent control over the aerosol decomposition united with self-combustion of droplets within a high-temperature tubular flow reactor with temperature range up to 900°C. The as-prepared particles were additionally thermally treated in air at 1000 and 1100°C for 6h. Morphological features were investigated by means of SEM analysis. XRD analysis gave insight into the structural properties and the obtained data were refined by Rietveld method. Luminescent properties were investigated as well.

*P.S.C.15*

## EFFECTS OF SOURCE ON PHYSICOCHEMICAL PROPERTIES OF VANADIUM IMPREGNATED Al_PILCs

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Intercalated/interlayered materials are obtained by holding the pillars into the solid matrix to allow regular sized porous structure with high surface area, porosity and attractive surface groups. Pillared clays are known examples of these materials. The catalytic activity is enhanced especially by the use of mixed metal pillars or incorporation of the second metal to the pillared layered clay support. Supported vanadium-containing catalysts were prepared by the impregnation of Al-PILC using clay from Middle Anatolian by use of $NaVO_3$ and $VOSO_4.3H_2O$ precursors. Samples with basal spacing values from 1.75 to 1.35 nm were obtained. TG/DTA showed that weight losses continued up to $700^0$C giving high endotermic peak below $150^0$C. An exothermic peak was observed above $800^0$C for all PILCs. XPS analysis showed that Al/Si ratio decreased from 0.46 down to 0.35 by vanadium impregnation.

*P.S.C.16*

# DETERMINING EFFECTS OF DIFFERENT TRANSITION METALS (V, Mo, Nb) TO MCM-41 STRUCTURE

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MCM-41 and modified MCM-41 which incorporated V, Mo, Nb separetely or together with different contents were synthesized by direct hydrotermal synthesis method. Crystalline and pore structure of these materials were determined with different characterization techniques such as XRD, EDS, TG/DTA, $N_2$ adsorption/desorption isotherms, SEM and TEM. By means of rising metal/Si contents in the solid, thermal stability of samples were increased and it was seen that the micro and mesopore volume and spesific, external (mesopore) and micropore surface area were decreased and average micro and mesopore diameter were increased. The crystalline structure of MCM-41 was not affected with loading metal. It was observed that all the samples have hexagonal ordering pores.

*P.S.C.17*

# EFFECT OF THE SUPPORT ON THE CHARACTERISTIC PROPERTIES OF THE SILVER BASED NANOCATALYSTS

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In this study five different catalysts ($Ag_2O$, $Co_3O_4$, $CeO_2$, 50/50 Ag-Co mixed oxide, 50/50 Ag-Ce mixed oxide) were prepared by the co-precipitation technique and calcined at $450^0$C. In order to see the effect of the support on the characteristic properties of the silver based catalysts, pure silveroxide, pure cobaltoxide and pure ceriumoxide were synthesized. All catalysts were characterized by using different techniques. The phases present in the catalysts and average crystallite size of the catalysts was observed by using the X-Ray diffactometer system; the surface atomic composition and oxidation state of the atoms on the surface were determined by the X-Ray photoelectron spectroscopy; surface area, pore volume and average pore diameter of the catalysts were determined by the $N_2$ phsisorption measurements; and finally surface morphology of the catalysts was determined by the scanning electron microscopy (SEM). The x-Ray diffraction studies showed that the biggest average crystallite size obtained from the pure $Ag_2O$ catalyst since $Ag_2O$ decomposed to the metallic silver at $450^0$C. But all catalysts have average crystallite size between 5nm-12nm. The $N_2$ phsisorption measurements showed that biggest surface area obtained from pure $Co_3O_4$ and than pure $CeO_2$ catalysts. Since the metallic silver phase obtained at $450^0$C, the surface area of the 50/50 Ag-Co mixed oxide and 50/50 Ag-Ce mixed oxide smaller than the surface area of the pure $Co_3O_4$ and pure $CeO_2$ catalysts. On the other hand, pure Co3O4 support increased the surface are of the pure silveroxide catalyst greater than the pure CeO2 support. All catalysts gave the average pore diameter between the 2.2nm-4.0nm which is in the mesopore diameter range. Pure cobaltoxide catalyst has second average pore diameter as a 33 nm in addition the first 2.5nm average pore diameter. Because of the $Co_3O_4$ support, 50/50 Ag-Co mixed oxide has two average pore diameters which are 2.5nm and 31nm. X-Ray photoelectron spectroscopy measurements revealed that the oxidation state of the Ag, Co and Ce atoms on the surface are +1, +3 and +4 respectively.

*P.S.C.18*

## OPEN-FRAMEWORK FLUORINATED ALUMINIUM POSPHATE – THE ANALOGUE OF THE GALLOPHOSPHATE ULM-3

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The fluorinated aluminophosphate analogue of the gallophosphate ULM-3 has been prepared in the presence of HF and 3-methylaminopropylamine as a structure-directing agent under hydrothermal conditions. The structure exhibits a three-dimensional network consisting of specific structural units $Al_3(PO_4)F_2$ in which aluminium adopts two coordination environments: two trigonal bipyramidal geometries, $AlO_4F$, and one octahedral geometry, $AlO_4F_2$. The connection of the Al-containing building blocks and $PO_4$ units leads to the formation of two pore systems: 10-ring channel along [010] and 8-ring one along [010] in which 3-methylaminopropylamine species are located. The structural investigations of the ULM-3 using linear diamines with variable chain lengths have indicated that the ULM-3 can be obtained exclusively in the presence of linear diamines as structure-directing agents. This work shows that it is not solely the amine itself which affects the structural topology.

*P.S.C.19*

## THE INFLUENCE OF NANOSIZED FILLERS ON THE PROPERTIES OF ELASTOMERS BASED ON DIFFERENT NETWORK PRECURSORES

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Most usage of elastomers would be impossible without the reinforcing character of active fillers. With an implicit reference to rubber technology, reinforcement is usually defined as the improvement in abrasion, tear, cutting and rupture resistance, in stiffness and hardness of crosslinked materials through the incorporation of finely divided particles. The phenomena concerns finished rubber materials, but it is quite remarkable that flow properties of compounds begin to significantly differ from those of unfilled materials when the filler has reinforcing capabilities. The aim of this applicative project was to study the curing characteristics of rubber compounds and the viscoelastic behavior of dense elastomer. The acrylonitrile-butadiene rubber (NMR) and ethylene-propilene-ethylidenenorbornene rubber (EPDM) were used as network precusores. The compounds were prepared either with one type of filler (high abrasion furnace carbon black, precipitated silica) or its combination. Vulcanizates were obtained in a compression molding machine. The curing time was adjusted by using the mowing die rheometer. Examination of the cryogenic fracture surface was carried out using a scanning electron microscope (SEM). The dynamic-mechanical behavior of elastomers was investigated in temperature range from -100 to 100°C at 6 frequencies (DMTA instrument).

*P.S.C.20*

## THE INFLUENCE OF Cr ADDITION ON THE MAGNETIC PROPERTIES OF NiFe-BASIS NANOCRYSTALLINE ALLOYS

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Ni-Fe alloys around the Mumetal composition NiFe20 were obtained by mechanical alloying in a planetary mill. The Ni and Fe components were partially substituted with 5% wt. Cu and variable amounts of Cr: 0,5; 1; 1,5 and 2% wt. The resulted compositions were: Ni76Fe18,5Cu5Cr0,5; Ni76Fe18Cu5Cr1; Ni76Fe17,5Cu5Cr1,5; Ni76Fe17Cu5Cr2. Cu addition helps increase of nucleation rate. The milling parameters for obtaining nanosized materials were established by means of XRD analysis of powders. The amorphous nanopowders obtained by ball milling were recrystallized by a thermal treatment under Ar atmosphere. The influence of Cr addition on the magnetic properties of NiFe alloys was observed from the magnetic measurement performed with a VSM apparatus. The optimum amount of Cr addition was determined.

*P.S.C.21*

## STRUCTURE OF $Ca_{1-x}Y_xMnO_3$ ($0 \leq x \leq 1$) NANOPOWDERS

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Manganites with general formula $Ca_{1-x}A_xMnO_3$, in which the A is a trivalent rare earth ion exhibit colossal magnetoresistance phenomena and acceptable levels of electrical conductivity for cathode materials used for SOFC.

Nanopowders with the following nominal compositions $CaMnO_3$, $Ca_{0.95}Y_{0.05}MnO_3$, $Ca_{0.85}Y_{0.15}MnO_3$, $Ca_{0.75}Y_{0.25}MnO_3$, $Ca_{0.5}Y_{0.5}MnO_3$, $Ca_{0.25}Y_{0.75}MnO_3$ and $YMnO_3$ were synthesized using a modified glycine-nitrate procedure. After calcination at 800 ºC for 2 hours, XRD analysis and structure refinement was carried out using the program FullProf and Rietveld refinement. Microstructure size-strain analysis was performed and these results are in nanometric range.

Influence of Y ions on unit cell volume of the perovskite compound, occupation numbers, distances between atoms and octahedral tilting were analysed.

The results showed that except for $YMnO_3$, all phases were orthorhombic (space group *Pnma*) adopting the perovskite structure type. Hexagonal $YMnO_3$ (space group $P6_3cm$), on the other hand, has a non-perovskite structure at atmospheric pressures.

*P.S.D.1*

# A MESOMECHANICS MODEL OF FATIGUE CRACK GROWTH FOR NANO ENGINEERING APPLICATIONS

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In this paper we present a model of a propagating fatigue crack based on energy dissipated within the process zone. This model heavily relies on the mesomechanical concepts applicable in the region immediately adjacent to the leading edge of the propagating crack. The model applied here, based on the cohesive crack concepts, seems to be a good approximation of the mesomechanical phenomena that govern nonlinear discrete deformation and fracture processes. The model suggests that the displacement just ahead of the crack tip is not zero, but it gradually approaches zero over a finite length, which measures the extent of the decohesion zone. Consequently, there is no singular stress at the crack tip. A certain distribution of the cohesive stress is used to model the finite stresses within highly nonlinear end zone preceding the crack. Such approach appears to be in agreement with Panin's concepts of the sequence of deformation and pre-fracture processes occurring at the mesomechanical level.

Analytical methods such as a power law and an exponential law were used to describe high cycle and low cycle fatigue processes, respectively. Numerical values for the ratio of the upper plateau to the threshold level of the cyclic R-curve derived from Wnuk's "final stretch" model of subcritical crack propagation are provided. The relations derived here and based on the principles underlying mechanics of fracture at nano-levels, can be used as a bridge between continuum description of material response to fracture and the more fundamental, microstructural representation of material behavior.

Key words: Fatigue, fracture, crack growth, energy dissipation, process zone, deformation, Mesomechanics, scaling effects, discrete fracture.

*P.S.D.2*

# DENSIFICATION EVOLUTION OF BTS FUNCTIONALLY GRADED MATERIALS DURING SINTERING

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An important processing goal for functionally graded materials (FGMs) is to obtain high quality microstructure with desired density. However, fabrication of FGMs by powder technology brings significant problems of anisotropic densification and consequently shape distortion of the components. At the same thermal conditions, barium tin-titanate ($BaTi_{1-x}Sn_xO_3$, BTS) powders with different tin content show different shrinkage rates and different extents of shrinkage during sintering, as well as different final density. This phenomenon can lead to excessive shape distortion, warping, delamination, developments of cracks and microstructural damage in the sintered FGMs. Therefore, it is desirable to predict the sintering process (shrinkage and anisotropy) for every layer in FGM and design sintering strategies to achieve high quality FGM without any form of deformation.

We investigate the deformation of BTS FGMs during sintering using by heating microscopy. Four systems with functionally graded microstructure were prepared by uni-axial pressing, using $BaTi_{1-x}Sn_xO_3$ powders ($0.025 \leq x \leq 0.15$). Combinations of the layers were 2.5-15, 2.5-5-7, 15-5-7 and 2.5-5-7-10 (numbers denotes mol% of Sn). The sintering shrinkage of cylindrical compacts was recorded in axial and radial directions. A shrinkage anisotropy factor was determined based on experimental measurements. It was found that shrinkage and anisotropy factor of the functionally graded materials depend on the ceramic's composition (concentration gradient) as well as on the heating rate during sintering. We have shown that smart choice of combination of the BTS layers and heating rate during sintering of components is important for preparation of high-quality FGMs, without any form of defects.

*P.S.D.3*

## SYNTHESIS, CHARACTERISATION AND APPLICATION OF Fe-PILLARED CLAYS

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Metal oxide pillared interlayered clays (PILCs) represent a new class of materials that have found a wide range of potential applications in catalytic, adsorption and separation processes. In this work domestic clay from Bogovina was prepared according to a common procedure comprising the following steps: grinding, sieving, Na exchange, pillaring, drying and calcination, in order to obtain Fe pillared clay. The change in the chemical and phase composition, as well as textural properties of the starting clay and synthesized PILCs was monitored using X-ray diffraction, inductively coupled plasma optical emission spectrometry, UV-Vis diffuse reflectance spectrometry and physisorption of nitrogen. Catalytic wet peroxide oxidative degradation of aromatic compounds that are resistant to biodegradation on the synthesized PILC catalyst was investigated. The catalyst showed significant catalytic activity in the tested reaction and might be regarded as efficient for the elimination of aromatic pollutants from water.

*P.S.D.4*

## POLY(NIPAm) HYDROGEL/Ag NANOCOMPOSITE SYNTHESIZED BY GAMMA IRRADIATION

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This work describes a novel radiolytic procedure of the in situ synthesis of silver (Ag) nanoparticles within thermoresponsive poly(N-isopropylacrylamide), poly(NIPAm), hydrogel. The poly(NIPAm) hydrogels undergo discontinuous volume phase transition behavior around the lower critical solution temperature (LCST) of the corresponding aqueous solution of polymer ($32^{o}$C for poly(NIPAm)). LCST of poly(NIPAm) hydrogels, ground and nanocomposite, was determined by the swelling procedure at different temperatures and by DSC measurement. Absorption spectra of poly(NIPAm) hydrogel/Ag nanocomposite indicated the presence of surface plasmon absorption band around 400 nm which confirmed formation of Ag-nanoparticles. The size of Ag-nanoparticles (about 10 nm in diameter) was determined by TEM microscopy and XRD measurement. Interaction between nanoparticles and polymer matrix was investigated by IR spectroscopy.

*P.S.D.5*

### CHARACTERIZATION OF Me-HISTIDINE COMPLEXES (Me = Cu, Co, Zn, Mn, Fe) INCORPORATED IN FAU-TYPE ZEOLITE FRAMEWORK

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Transition metals are present in living systems; for example, $Cu^{2+}$ ions are well-known to play a key role in the working mechanism of several important metalloenzymes, such as galactose oxidase and superoxide dismutase. Generally, transition metals are very often included in metalloenzymes, which are catalysts in many important biochemical processes. These systems have unique catalytic properties; therefore, the syntheses, materials that can be used in chemical industry are often the subject of investigation.

Each naturally occurring amino acid can form the complexes with transition metal cations. In the form of complexes incorporated into the inorganic support, such systems become thermally stable; what is an important feature of synthetic catalysts.

In this work, the incorporation of Me-histidine (Me = Cu, Co, Zn, Mn, Fe) complexes was done at pH=7.3 (physiological value); previously prepared Me-histidine complex was incorporated into the $\alpha$ cages of Y zeolite by occlusion at room temperature. Approximately 4 metallic cations per unit cell of zeolite was incorporated. The characterisation of obtained samples was performed using Diffuse Reflectance Ultraviolet-Visible Spectroscopy (DRUV-Vis), X-ray Diffraction (XRD) and infrared spectroscopy (FTIR). Importantly, the state of transition metal cation was studied by Electron Paramagnetic Resonance (EPR). Possible catalytic activity was the main interest in this work for investigation of this kind of systems.

*P.S.D.6*

### THERMAL BEHAVIOR OF Ag/PMMA NANOCOMPOSITES SYNTHESIZED BY "IN SITU" METHOD

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The influence of the surface modified silver nanoparticles (Np) used as a filler, on the thermal properties of poly(methylmethacrylate) (PMMA) matrix, synthesized by "in situ" radical polymerization process, was studied. The colored transparent nanocomposites (NCs) films were characterized by IR spectroscopy and thermal techniques (TGA, DSC). The molar mass and polydispersity of synthesized samples were estimated by gel permeation chromatography. The chemical composition of the PMMA matrix is not changed in the presence of the metal nanoparticles, but the thermooxidative stability of the polymer is enhanced with an increase of silver loading. On the other hand, the glass transition temperatures of nanocomposites are lower compared to the pure polymer.

*P.S.D.7*

# CELLULOSE NANO- AND MICROCOMPOSITES WITH NATURAL AND MODIFIED CLAYS

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The biodegradable composites based on cellulose with natural and modified layered silicates: natural Na-montmorillonite (Cloisite $Na^+$) and montmorillonite modified by (dioctadecyldimethylammonium)chloride (Cloisite 20A) have been prepared from solutions in strongly polar solvent of a donor type - N-methylmorpholine-N-oxide (NMMO). The composites structure evolution along all process stages: from solid-phase activation up to coagulation of the formulation from a solution has been studied by X-ray diffraction method.

It is shown, that at solid-phase activation of a system "cellulose – NMMO - Cloisite $Na^+$" the induced solid-phase interaction between molecules of cellulose, NMMO and Cloisite $Na^+$ takes place. In the case Cloisite 20A along with formation of H-complexes between cellulose and NMMO molecules there runs a reaction of solid-phase intercalation of cellulose molecule surrounded by NMMO into interlayer spaces of modified clay.

At joint action of temperature and shear rate the solid-state mixed pre-solution is melting and transforms to the liquid state. At the same time the mixed solution preserves structural peculiarities inherent for solid pre-solutions and is characterized by the high degree of orientation of clay particles in the flow direction.

Addition of clay to cellulose without dependence from its nature and, accordingly, the presence or absence of intercalation in a system, allows us to control the processes of cellulose structurization, directing them to the formation of 2D mesophase, thereby excluding the possibility of crystallization processes.

Novel nanostructured composed of cellulose/clay fibers possess by high mechanical properties exceeding the values of strength and modulus inherent to cellulose in 1,5-2 times.

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*P.S.D.8*

# MECHANOCHEMICAL SYNTHESIS OF MELOXICAM-BASED COMPOSITES

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Drug - carrier solid dispersions have been used in drug formulations because of improved properties with respect to stability, solubility, and bioavailability of the drugs. In the present work, the composites of meloxicam with polyvinylpyrrolidone, polyethylene oxide, chitosan, hydroxypropylmetylcellulose, tri-sodium citrate were obtained. The samples were prepared by co-grinding using AGO-2 planetary centrifugal mill with water-cooled vials. They were characterized by X-ray powder diffraction and infrared spectroscopy. Dissolution studies showed that in the case of mechanocomposites, the release rate and solubility of meloxicam increased compared with those of the physical mixtures of the components and pure crystalline drug. The results should be potentially useful in improving the oral bioavailability of poorly water-soluble drug.

*P.S.D.9*

# SYNTHESIS OF POLYVINYLALCOHOL/GRAPHITE NANOSHEETS NANOCOMPOSITES WITH ENHANCED MECHANICAL AND PERMEABILITY PROPERTIES

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Recently, fabrication of polymer graphite nanocomposites attracted great interests since graphite is inexpensive and available in large quantity, even if it does not readily exfoliate to yield individual graphene sheets. Graphite nanoparticles and nanosheetes can be produced by chemical or mechanical methods. In order to avoid impurities due to the chemical treatments during the process of chemical exfoliation, the mechanical milling process is an alternative method for the production of graphite nanopowder and nanosheets. We have successfully produced graphite nanosheets by prolonged milling under low intensity pure shear stress using water or KOH as lubrificant. These two different types of graphite nanosheets have been directly immersed into a hydrophilic polymer matrix, PVOH, to obtain the corresponding nanocomposites (PVOH/GW and PVOH/GKOH). PVOH/graphite nanocomposites have shown enhanced mechanical and barrier properties respect to homopolymer. Both nanocomposites PVOH/GW and PVOH/GKOH have showed an increase of Young's modulus (up to 49 % and 56% respectively) respect to that found for PVOH homopolymer but the best results have been obtained in presence of GKOH which increases tensile strength too. The presence of nanoparticles influences the water permeability. The permeability of PVOH/GKOH sample is reduced of more that 12% changing from 9.68 $g/m^2d$ value for PVOH to 8.57 $g/m^2d$ for PVOH/GKOH. The better performances PVOH/GKOH can be explained by a more homogeneous dispersion of the charging particles in the polymeric matrix, as evidenced by SEM images of fracture surfaces.

*P.S.D.10*

# Cu-C COMPOSITE MATERIAL

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Cu-C composite material for sliding applications prepared by powder metallurgy was investigated over the years for the composition dependence of physical and mechanical properties. Cu-C composite materials were prepared by HIP-ing of copper and graphite powders. Various composite systems were prepared using the same graphite powder: It was particulate composite system made from a simple mixture of copper and graphite powders prepared in the range of 0 – 90 vol. % of graphite. Further the same graphite powder was electroless copper coated and mixed with copper powder to prepare Cu – C system in the range of 0 – 50 vol. % of graphite. Finally multi walled carbon nanotube aggregates were used to prepare composites in the range of 0 – 10 vol. % of nanotubes. The following physical and mechanical properties were investigated with respect to composition dependence: coefficient of thermal expansion, electrical conductivity, thermal conductivity, sliding properties as well as modulus of elasticity and 0.2 proof stress. The computer image analysis was performed to evaluate the composite microstructure. The obtained results were modelled using general effective media theory and percolation theory to include synergic effect of the composition into effective property of composite. It was observed that besides concentration the size and homogeneity of the graphite phase rule the effective properties of prepared composites.

*P.S.D.11*

# RESEARCH OF CHARACTERISTICS OF PARTICULATE BASALT – POLYMER COMPOSITES

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Basalt, as construction material, has exceptionally good physical and mechanical properties (high hardness, high strength, good wear resistance, color and shine). However, it's shaping and processing is very difficult because of these, already mentioned mechanical characteristics. Retaining of the mechanical and physical characteristics of basalt and its processing into more complex forms is possible only by mixing particles of basalt with polymeric resins, whereby we would get the particulate composite, which can be manufactured into different geometric forms by a cold casting process. Characteristics of such composites and parameters of the production process are not well-known in technical literature.

Research which has been carried out is reported in this paper and describes the properties of the composites, as well as how the physical and mechanical characteristics are influenced by the technological parameters of the production process.

Tested samples of basalt–polymer composites have been made with different ratios of basalts, polymeric matrixes and additives and with different grain size composition of basalt particles. Testing results have shown the dependence of the composite mechanical properties on the mention parameters, and on this basis we can determine the most favorable basalt/polymer ratio in the composite.

Presented data can be of importance for the development of new composite materials (composite basalt stones) which certainly will have significant application in the future.

*P.S.D.12*

## POLYESTER AND POLYESTERIMIDE COMPOUNDS WITH NANOFILLERS FOR IMPREGNATING OF ELECTRICAL MOTORS

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Polyester and polyesterimide compounds for impregnating of electrical motors have been modified with three different nanofillers: zinc oxide, fumed nanosilica and titanium dioxide. Nano-sized particles of fillers were homogenously dispersed in the polyester and polyesterimide matrix by means of the ultrasonic and laboratory high torque dispersers at the rate of 1wt%. The mechanical, electrical and barrier properties of the standard and nanofilled compounds were measured and compared. Generally, when fillers were nano-sized, the electrical and bonding strength of impregnating compounds increased, while water absorption decreased. The thermal analysis TGA/DTA proved that also the thermal stability of nanofilled compounds was significantly higher. The best properties have been obtained for compounds with nanosilica filler.

*P.S.D.13*

## INSULATING SYSTEM OF INVERTER DRIVEN MOTORS BASED ON NANOCOMPOSITES

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The usage of the inverter-driven induction motor in industries is being increased in recent years because of the demand for variable speed drives and the potential for energy savings. However, these modern inverters impose the additional stresses to the motor's polymer insulation system. The application of the new materials, like polymer nanocomposites, with improved resistance under pulse voltage would enable to overcome the problem and to prevent the premature motor failure. Nanofilled polymers were prepared using special method of dispersing. The properties of both standard polymers and those with nanofillers were measured and compared. It was found that nanocomposites considerably increase the life of inverter-fed motors insulation because of their excellent corona resistance, better dielectric and mechanical properties. They also exhibit the better barrier characteristics.

*P.S.D.14*

## INTERFACIAL MODIFICATION OF WOOD-PLASTIC COMPOSITES BASED ON WASTE AND VIRGIN HIGH-DENSITY POLYETHYLENE

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This study investigated the stability on water absorption, mechanical properties, and the microstructure of wood–plastic composites, which were made using either wasted or virgin high-density polyethylene (HDPE) with wood flour particles as filler. The post-production waste HDPE was collected from plastics manufacturing plant and wood flour particles were obtained from a local sawmill. Adding maleated polyethylene (MAPE) by 0.5–1.5 wt% significantly improved the stability and mechanical properties. Microstructure analysis of the fractured surfaces of MAPE modified composites confirmed improved interfacial bonding and state of dispersion of wood particles in composite. Crystallization behavior, water absorption, and strength properties of the composites can be improved by increasing the wood particle and coupling agent content.

*P.S.D.15*

## EFFECT OF BLENDING FILLERS ON TIRE TREAD COMPOSITE PERFORMANCE

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It is generally accepted that dynamic hysteresis, wet friction and abrasion resistance of tread compounds play dominant roles in rolling resistance, wet skid resistance and wear resistance of tires, respectively. For cured filled composites, these properties are significantly affected by the filler morphology and the surface characteristics. In recent twenty yeas numerous studies have been carried out to describe the roles played by the type, loading and morphology of the fillers, with regard to the effects of fillers on hysteresis, wet friction and abrasion resistance. In this paper we have been studied the effects of blending two different functional fillers carbon black (N220) and silica (Sil-3) in model tire tread compound on the dynamic modulus and hysteresis and thermal properties using Dynamic Mechanical Analyses (DMA) and Modulated Differential Scanning Calorimetry (MDSC). Both, theoretical and practical aspects of these effects are discussed.

*P.S.E.1*

## PREPARATION OF $^{99m}$Tc-PLGA AND ITS DISTRIBUTION STUDIES

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Poly(DL-lactide-co-glycolide) (PLGA) is a widely investigated bioresorbable polymer and it has been extensively used in several biomaterials applications as well as drug delivery systems. PLGA systems have been developed for the delivery of active compounds and pharmaceutical products at controlled release rates. The investigation of distribution and pharmacokinetics of degraded products of PLGA is crucial for effective prediction of host responses to PLGA in particular applications. Thus we present a method of labeling PLGA with $^{99m}$Tc ($T_{1/2}$=6.02h, E_=141keV), which binds outside, leaving the cage intact. This enables quick and convenient investigation of pharmacological behavior and metabolism of PLGA. The samples were characterized by X-ray diffraction (XRD), Scanning Electron Microscopy (SEM) and Ultraviolet Spectroscopy (UV). For the determination of radiochemical purity of all $^{99m}$Tc-labelled samples standard paper (Whatman No1) and instant thin layer chromatography (ITLC-SG) with two solvents (acetone and saline) were used.

*P.S.E.2*

## POROUS, POLY (DL-LACTIDE-CO-GLYCOLIDE)-BASED MATERIAL FOR BIOMEDICAL APPLICATION

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Polyesters, such as poly(lactic acid) (PLA) and poly(lactic-co-glycolic acid) (PLGA), have been used in pharmaceutical and biomedical fields as delivery vehicles, (such as, microspheres and nanoparticles) and scaffold materials owing to their biodegradability and relative biocompatibility. Polymer degradation, dynamics of the release (rate and concentration) of drugs from the polymer matrices depends on the morphology of particles (size, shape, uniformity, pore size structure, etc). The properties of polymer particles, such as size, uniformity, porosity etc., can be tailored to alter polymer degradation and the consequent drug release profiles. Porous, PLGA-based particles with and without encapsulated water-soluble vitamin were prepared by physicochemical solvent/non-solvent method with PVP as a surfactant and with silicone oil, sodium chloride or paraffin as a porogen. The obtained PLGA particles are non-agglomerated, uniform and with particle size on the submicron scale. Water soluble vitamin (ascorbic or folic acid) has been encapsulated into the polymer matrix by means of homogenization of water and organic phases. The samples were characterized by Infrared Spectroscopy (IR), Scanning Electron Microscopy (SEM) and Ultraviolet Spectroscopy (UV).

*P.S.E.3*

## CRYSTALLIZATION OF BIOGENIC CRYSTALS FROM AQUEOUS SOLUTIONS

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Crystallization is a process occurring in both biological (eg. bone, teeth) and pathological mineralization (eg. calculi, caries etc.) as well as in the controlled production of biomaterials. In organisms inorganic salts precipitate from complex body fluids (blood, urine) inside organic matrix. The interactions of growing biogenic crystals (calcium phosphates, carbonates and oxalates) with small organic molecules and/or macromolecules have important role in these processes. In this work, processes of the formation of some biogenic minerals in model systems mimicking conditions of pathological (urinary stones) and biological mineralization (composite bone implant materials) were investigated and compared.

*P.S.E.4*

## PREPARATION AND CHARACTERIZATION OF POLY-D,L-LACTIDE MICROSPHERES FOR CONTROLLED RELEASE OF HORSERADISH PEROXIDASE AS MODEL PROTEIN

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Biodegradable microspheres such as those made of poly-D,L-lactide (PDLLA) are widely investigated delivery systems for drugs or antigens. PDLLA microspheres can protect proteins against biological inactivation and can release them for long time frames, and at specific times. In this work, the model protein was horseradish peroxidase (HRP), which was incorporated into PDLLA spheres. The aim of this study was to examine experimental conditions in order to produce PDLLA microspheres with the best properties for controlled and sustained delivery of HRP. The ability to control size of spheres should facilitate investigations of their scope for drug delivery. For this purpose the following parameters were varied: co-solvent (methanol or ethanol), the concentration of stabilizer polyvinyl alcohol (PVA) and chloroform to water ratio and particles were characterized in terms of size, morphology and encapsulation efficiency. The nanoparticles displayed good morphology as evident from scanning electron micrographs. In addition, the smallest particles were obtained with ethanol and 5% PVA. The mean diameter of the particles was 530 nm, and encapsulation efficiency was 46 %.

*P.S.E.5*

# IMPORTANCE OF CATALYTIC PROCESSES FOR POLYMER NETWORK-CELL MECHANICAL CHANGES OF BIO-MEDICAL SYSTEMS

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Understanding and control of polymer-living cells interactions at the interface of biomaterials and corresponding different devices for bio-medical applications relate a number of issues of very high importance for modern technologies. Polymer networks provide especially convenient structures for such materials. When swollen in liquids some polymer networks give soft materials permeable for body liquids and nutrients very similar to living tissues but mechanically strong and compact due to internal connections provided by he network bonds. Such structures are very convenient for different bio-medical applications.

On the other side, in tissue engineering, in some artificial- organ production, by cell immobilization in bio-technologies etc., cell cultures are supported by polymer scaffolds, by (semi-permeable) membranes or incorporated into polymer matrix designed with network structure (as a kind of cage). Naturally, different mechanical interactions arise between such polymer structures and cells, especially in the course of a cell culture growth. In this contribution are considered mechanical interactions between growing cell cultures and swollen polymer network both, from experimental point and from the point of network elasticity theories. The results indicate importance of GTPase catalytic activity controlling establishment of cell polarity, e.g. for yeast cell cultures. So orchestrated protein activity fit very well to "two time scale model". Coupling of the two kind of responses gives stability to the action of growing system and the average force effects can be represented by equation of Langevine type.

*P.S.E.6*

# ULTRASONIC DEAGGLOMERATION AND PARTICLE SIZE REDUCTION OF HYDROXYAPATITE BY COATING WITH POLY(D,L-LACTIDE-CO-GLYCOLIDE)

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The bone mineral, a calcium phosphate complex dominated by hydroxyapatite, is deposited on the organic matrix, 90% of which is collagen. Plate- and rod-like particles are the chief trait of the morphology of natural hydroxyapatite. In some parts of bone tissue, these structures are parallelly oriented and laterally connected. Such structure is maintained due to polymeric, proteinous matrix within which it is enclosed. Rod-like particles of hydroxyapatite enclosed within polymeric matrix are 8-15 nm thick, 20-40 nm wide and 200-400 nm long. These dimensions are functionally related to the part of the skeleton, but they are always in nanometer scale.

The main goal of bioengineering process is to develop biomaterials with characteristics comparable to natural ones. Synthetic hydroxyapatite (HAp) is biomaterial obtained in the biomimetic process. This bioceramic is meant to be chemically and morphologically similar to the mineral component of mammals' hard tissue.

In this work, plate-like particles of hydroxyapatite, obtained by sonochemical homogeneous precipitation method, were deagglomerated in a high-intensity ultrasonic field and a small volume of inert medium. The so-formed HAp particles were coated with poly(d,l-lactide-co-glycolide) in order to obtain rod-like structures with nanometer dimensions. Samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and transmission electron microscopy (TEM).

*P.S.E.7*

# HYDROTHERMAL SYNTHESIS OF COBALT-EXCHANGED HYDROXYAPATITE NANOPARTICLES

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Phosphates with an apatite-like structure $M^{2+}{}_{10}(PO_4)_6(OH)_2$, represent a large family of materials used in various applications such as ion exchangers and adsorbers, catalysts, luminescent materials, in different biomedical applications as bioceramics for implantation, drug delivery. Calcium hydroxyapatite CaHAp has a hexagonal unit cell, whose composition is highly flexible. The calcium ions can be exchanged with most divalent cations without affecting the stability of the phosphate. Exchange abilities of cations $Cu^{2+}>Pb^{2+}>Zn^{2+}>Cd^{2+}>Co^{2+}$ is generally accepted. The kinetics of exchange is governed by the nature and the radius of the cation. Substitution of calcium ions in CaHAp with different metal ions have been revealed to have different surface configurations, morphologies, and crystal architectures, magnetic properties according to various amounts of metal ions. We prepared series of cobalt exchanged CaHAp powders by hydrothermal method with different ratio of Co/Ca. The crystal structure and cell parameters of synthesized Co/CaHAp were examined by XRPD method. Also, FTIR and Ramman spectroscopy were used for structural investigation. The morphology and magnetization were studied by SEM and SQUID.

*P.S.E.8*

# XRD ANALYSYS OF COBALT-SUBSTITUTED HYDROXYAPATITE PREPARED BY HYDROTHERMAL METHOD

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The major inorganic component in the mammalian bones is a poorly crystalline hydroxyapatite (HAp) $Ca_{10}$ $(PO_4)_6(OH)_2$. Therefore, hydroxyapatite has been extensively used as an implant material because of its excellent biocompatibility and osteoconductive properties. The basic HAp structure consists of the hexagonal network of $PO_4^{3-}$ tetrahedra with $Ca^{2+}$ in the interstitial sites and columns of anions oriented along the *c*-axis. Such structure can incorporate a wide variety of ions that can affect both the cationic and anionic substitution. This fact enables development of HAp properties as well as creating of novel materials.

Cobalt-substituted hydroxyapatite powders were prepared by hydrothermal treatment at 100°C, 150°C, 200°C and 250°C with different Co/Ca ratio. Obtained powders were analyzed using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR) and Raman spectroscopy.

Based on X-ray powder diffraction we demonstrated the grain size and crystallinity of investigated samples increase with hydrothermal temperature increased.

On the other hand, XRD patterns of cobalt-substituted samples show extinction of the intensity of reflections, crystallinity as well as lattice parameters with increase of the Co content. Also, we can see that the (002) reflections of powders containing $Co^{2+}$ shifted to higher angles by increasing the Co content. This indicates that the $Ca^{2+}$ cations were substituted by $Co^{2+}$ in the HAp structure. The effects of cobalt on the structure and microstructure properties of investigated powders were characterized by Rietveld structural refinement.

*P.S.E.9*

## GREATER REGENERATION OF ALVEOLAR BONE RESORPTION BY HIGH ADVANCE BIOACTIVITY COMPOSITES

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The problem of losing bone tissue in process of resorption of alveolar ridge in systematic osteoporosis takes a significant place in stomatology. In cause of fixing the problem of deficiency of bone tissue created in systematic osteoporosis, intermitted in high advance bioactivity composite. Research was done on rats, where in this case the resorption of alvelar ridge was created artificially. The results showed that in the porcess of regeneration and recovery the alveolar bones weakened by osteroporsis after inplantation of high advance bioactivity nanocomposite. The effect of high advance bioactivity composite was monitored by hystomorphometric analysis and contents of calcium phosphate, as well as the base of hydroxyapatite. High advance bioactivity nanobiocomposite used in reaserches alleviate the rehabilitation of weakened alveolar bone, its osteoconductive effect can be the material of choice for bone substitution in the future.

*P.S.E.10*

## NANODIAMOND-REINFORCED HYDROXYAPATITE COATINGS: INTERACTION WITH FIBRONECTIN AND OSTEOBLAST CELLS

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Nanodiamond-reinforced hydroxyapatite (HA-ND) coatings were electrodeposited on stainless steel AISI 316L from simulated body fluid. As-obtained stress-free homogeneous coatings were characterized by improved mechanical strength, adhesion to stainless steel, cohesion and ductility. In this work we report the fibronectin (FN) adsorption and its effect on the interaction of MG-63 osteoblast cells with the HA-ND coatings. The results revealed enhanced and homogeneous FN adsorption on the HA-ND coatings in comparison to pure HA. MG-63 osteoblasts incubated for 3-4 h on the HA-ND samples reorganized the protein coating in a matrix-like network. The cell number of osteoblasts incubated for 5 h on the HA-ND coatings was slightly higher than on HA surfaces, but cells on both coatings exhibited round cell shapes and no focal contacts and filaments were observed, i.e. the spontaneous cell adhesion to the both types of coatings was low and had to be enhanced. FN pre-coating of the HA-ND and HA surfaces improved and supported the cell adhesive properties and cell-substrate interactions, as indicated by the extended cell morphology and short streaks of focal adhesions.

*P.S.E.11*

# SUBSTRUCTURE-PROPERTIES RELATIONSHIPS IN NANOCRYSTALLINE Ti PRODUCED BY CRYOMECHANICAL TREATMENT FOR BIOMEDICAL APPLICATIONS

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Materials used for biomedical applications must meet both biofunctionality and biocompatibility. In this respect, nanocrystalline materials, in particular widely usable titanium can be very promising to resolving current problems associated with orthopedic and vascular implants materials. International cooperation in this field is one of the purposes of INCOMAT - project of consolidation scientific potentials of EU with Western Balkan Countries and New Independent States. Nanocrystalline material contains a high density of grain boundaries (imperfect interfaces). In the case nanocrystalline materials with grain sizes smaller than ~20 nm the volume fraction of interfaces can be as 50 %. This imperfect interfaces significantly improve physicochemical and mechanical properties of nanocrystalline materials. Bulk nanostructured materials are usually produced by applying severe plastic deformation (SPD) methods, such as equal channel angular pressing and high pressure torsion. However, SPD processes require a large amount of plastic deformation and special equipment. Therefore, in general SPD-processed microstructures fall within only UFG regime (grain size > 300 nm). In present paper for the purpose to produce the nanocrystalline Ti we used cryomechanical treatment method which is alternative to SPD methods. The deformation microstructures of both high purity (HP) and commercial purity (CP) titanium after cryorolling and low temperature annealing by dark field TEM were studied. It was showed, that after cryorolling (true strain $\varepsilon \approx 1$ for HP Ti and $\varepsilon \approx 2$ for CP Ti) the average coherent scattering region sizes are 29 nm and 36 nm, respectively. Yield strength of nanocrystalline Ti achieves 850 -900 MPa in both cases. Remarkably, that yield strength of nanocrystalline HP Ti increases more than in seven times and achieves values comparable with properties of typical alloys used in medicine. Ductility of modified titanium is good. In addition the high volume fraction of grain boundaries (i.e. interfaces with high free energy and high chemical and biological activity) will maximize cell response with substratum and increase velocity of osteoblast adhesion comparing with metal with micron grain size. Enhanced biological response on nanocrystalline structures can lead to a stronger initial biointegration with surrounded tissue to increase bonding between appropriate tissues and implant. Thus, cryomechanical treatment method has opened new perspectives to optimize both bulk and surface properties of unalloyed Ti as biomaterial.

*P.S.E.12*

# SOL-DERIVED HYDROXYAPATITE DIP-COATING OF A POROUS $Ti_6Al_4V$ POWDER COMPACT

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Porous implants have inherent advantages over the bulk forms. They allow the circulation of the body fluids in a three dimensional matrix resulting in a faster healing and fixation to the surrounding tissue; avoid implant loosening by extensive stress shielding (elastic mismatch) and reduce the strength mismatch between the implant alloy and the bone. Calcium Phosphate (CaP) coating of porous surfaces including Ti mesh and the sintered powder surface coatings has beneficial effects on the bone-generating properties, improving the implant fixation to bone. The aim of this study is to investigate the effect of dip-coating soaking time on the Hydroxyapatite (HA) coating layer thickness of a Ti6Al4V sintered powder compact. The sintered powder compacts were prepared using spherical Ti6Al4V alloy powders. The particle size ranged between 100 and 200µm with a mean particle size of 157 µm. The powder was compacted at room temperature under a pressure of 400 MPa, using PVA (5-10% by volume) as a binder. The sintering of the compacts was conducted at 1200°C for 2h under high purity Ar atmosphere. A mean pore size of 63µm and an average porosity of 37±1%. HA powder and dip coating solution were prepared according to the method proposed by Maviş and Taş. The dipcoating solution composition in wt% was as follows: 7.3% HA powder, 66.2% ethanol, 13.8% distilled water, 10.2% glycerol, 2.2% Poly(ethylene glycol) and 0.3% gelatin. Dip-coating of the cylindrical compacts, ~15 mm in diameter and ~10 mm in height, were performed in a dip coater at soaking times from 1 to 5-minute with one minute interval and with a dipping and removal rate of 100 mm/min. The compacts were heat-treated under Ar atmosphere at a temperature of 840 °C (2 h of peak soaking time). The coating started from the particle sintering necks and cracks on the coating layer particularly at the sintering necks were observed in all dip-coated compact samples The surface SEM micrographs of sol-derived HA powder coated compact samples after different soaking times. The coating thickness increases with increasing soaking time, from 1.87 µm at 1-minute soaking to 9 µm at 5-minute soaking on the average. At increasing soaking times, the originally open pores start to close, while at low soaking times the Ti6Al4V particles are partially coated. The coating layer was further shown to be nano porous and the depth of coating was observed to be relatively shallow: only few particles near the compact surface were HA-coated. The present results have shown that the dip-coating soaking time has a great effect on the film thicknesses and the openness of pores particularly at the surface. The soaking times until about 3-minute are sufficient to form a relatively thick HA layer on Ti6Al4V particles. Nevertheless, the effects of certain microstructural features including coating layer thickness, coating depth and the coating defects on bone in-growth properties of the powder compacts should be further assessed.

*P.S.E.13*

## THERMAL COMPRESSIVE FATIGUE BEHAVIOUR OF DENTAL COMPOSITES

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The object of this study is to investigate the thermal-compressive fatigue behaviour of three dental composites. Cylindrical specimens (6mm in length ×3 mm in diameter) were made considering manufacturers' recommendation and stored for 48 hours in distilled water at 37°C. The compressive fracture strength was measured and fatigue tests under frequency of 10 Hz were carried out with cyclic flowing cold and hot-water with period of 8seconds.The compressive strength of the three material Clearfill AP-X (AP-X), Tg fine Glass (Tg) and Extra Low Shrinkage (ELS) were obtained which the (AP-X) showed the highest compressive strength and the (ELS) was the lowest. The Thermal compressive fatigue strength obtained using staircase method for $10^5$ cycles (n=15) under sinusoidal loading and based on compressive fracture strength, the acquired data were analyzed using ANOVA and Weibull statistics.

The results indicate that the (AP-X) and (ELS) composites hold the highest and lowest fatigue strength, respectively. This seems to be caused by the superior matrix properties associated with the different type of fillers alongside the highest ratio of Wt% Vol%.

Key Words: dental composites, thermal compressive fatigue, composite filler.

*P.S.E.14*

## THE INFLUENCE OF THERMAL CYCLIC TEST ON THE COMPRESSIVE FATIGUE BEHAVIOUR OF DENTAL COMPOSITES

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The object of this study is to compare between compressive fatigue and thermal compressive fatigue behaviour of three dental composites. Cylindrical specimens (6mm in length ×3 mm in diameter) were made considering manufacturers' recommendations and stored for 48 hours in distilled water at 37°C. The compressive fracture strength was measured and fatigue tests under frequency of 10 Hz were carried out with cyclic flowing cold and hot water with period of 8seconds.The compressive strength of these three material (with the rate of strain of 0.4 mm/min) obtained for Clearfill AP-X (AP-X),Tg fine Glass(Tg) and Extra Low Shrinkage (ELS) dental composites. The compressive fatigue and Thermal compressive fatigue strength obtained using staircase method for $10^5$ cycles (n=15 for each test) under sinusoidal loading and based on compressive fracture strength, the acquired data were analyzed using ANOVA and Weibull statistics. The obtained thermal compressive fatigue strength for the mentioned materials was comparable with the same amounts in the compressive fatigue test.

It seems that these results are due to the effect of thermal fatigue on the matrixes of composites and descending of resistance to the fatigue crack growth.

Key Words: dental composites, Thermal compressive fatigue, compressive strength.

*P.S.E.15*

## NMR CRYSTALLOGRAPHY OF ACTIVE PHARMACEUTICALS INGREDIENTS FOR INDUSTRIAL APPLICATIONS

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Atorvastatin is a member of the drug class known as statins, which are used to cure hypercholesterolemia. It is necessary to study the complexity of his polymorphs and amorphous form by new analytical techniques of NMR crystallography make for the control of pharmaceuticals manufacture. We have synthesized and subsequently characterized the series of various polymorphism atorvastatin forms by $^{13}C$ and $^{19}F$ MAS NMR spectroscopy. It is possible to obtain the chemical shifts of these nuclei in very short time and hence to gain significant structural information. This contribution contains the comparison of predicative $^{19}F$ and $^{13}C$ values of chemical shifts with the respect to the measurement sensitivity, capability of different crystal form resolution and their quantitative determination.

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*P.S.E.16*

## ACIDE CHARACTERISTIC OF FULLERENOL $C_{60}(OH)_{24}$ IN WATER

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Since the discovery of fullerenes, various biological activities for fullerene derivatives have been found: antiviral and antibacterial properties, antioxidative and neuroprotective activities, cell signaling and apoptosis. Some compounds have potential to develop as anticancer drugs and diagnostic agents. Polyxydroxylated fullerenes, fullerenol $C_{60}(OH)_{24}$ have been recently recognized as exogenous redox balance modulators, capable to exert anti-oxidative effects in both in vitro and in vivo systems. Thus, the antioxidative activity of fullerenols is their most exploited property in medicinal chemistry. Our recently published results showed: the in vivo radioprotective efficiency of fullerenol in irradiated rats, as well as its nitric oxide (NO) – quenching activity in both in vivo and in vitro systems, might be a potential cardioprotector in doxorubicin-treated. Fullerenol $C_{60}(OH)_{24}$ (Figure 1) was synthesized and characterized by Djordjevic et al. In this work we were measured pH values of water solution of fullerenol $C_{60}(OH)_{24}$ in different concentrations ($4.4\ 10^{-3}$ mol/dm$^3$, $4.4\ 10^{-4}$ mol/dm$^3$, $4.4\ 10^{-5}$ mol/dm$^3$, $4.4\ 10^{-6}$ mol/dm$^3$ and $4.4\ 10^{-7}$ mol/dm$^3$ ) and determined constant of disotiation. In this work we were measured a stability of polidentate complex with $Cu^{2+}$. These data are very important to biological investigation.

*P.S.E.17*

# RELEASE OF DRUGS AND SILVER NANOPARTICLES FROM SMART COPOLYMERIC HYDROGELS BASED ON METHACRYLATES AND ITACONIC ACID

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In this study, different copolymeric hydrogels (P(HEMA/IA), P(HEMA/BIS) and P(HEMA/IA/BIS)) based on 2-hydroxyethyl methacrylate (HEMA), poly(alkylene glycol) (meth)acrylates (BIS) and itaconic acid (IA) were prepared by gamma irradiation, in order to examine the potential use of these hydrogels for biomedical applications. Interesting pH and temperature sensitive swelling behavior of obtained hydrogels was observed. Gentamicin sulphate (GS) was used as a model therapeutically active drug for the investigation of controlled release behavior governed by Fickian diffusion. The microbe penetration test showed that neither *Staphylococcus aureus* nor *Escherichia coli* passed though the hydogel dressing. P(HEMA/IA) hydrogels loaded with gentamicin prevent *S. aureus* bacteria growth during whole investigation period. Lower antibacterial activity against *E. coli* was observed, too. Furthermore, different Ag-Poly(/HEMA/IA/BIS) nanocomposites are prepared via in situ reduction of silver salt embedded in swollen polymer gels by employing gamma irradiation. Evolution of plasmon absorption detected by UV–Vis spectrophotometry conformed generation of Ag nanoparticles in polymer hydrogels obtained by SEM. Release of silver nanoparticles from hydrogel matrics was conducted by inductively coupled plasma mass spectrometry. Antimicrobial activity of these composite materials was investigated against *Esherichia coli, Staphylococcus aureus* and *Candida albicans*; the antibacterial efficiency of the hydrogel composites was demonstrated at extremely small silver concentrations.

*P.S.E.18*

## SURFACE CHARACTERIZATION OF THE GLASS-IONOMER BASED MATERIALS DURING FLUORIDE RELEASE AND UPTAKE

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The aim of this study was to assess quantitative and qualitative changes at the surfaces of glass-ionomers during the fluoride release and uptake. 5 materials, Fuji Triage (FT), Fuji II (FII), Fuji VIII (FVIII), Fuji IX (FIX), and Ketac N100 (KN) were analysed. 5 disks of each material were stored in 4 storage media (I- saline, II- ph=2.5, III- ph=5.5, IV- NaF solution). After 7 days, two disks of each material were transferred from media I, II and III to the NaF solution. SEM/EDS analysis was conducted in 3 selected spots of each disk. FT showed the highest fluoride content. The lowest amounts of fluoride were detected at the FT disks stored at low pH ($p<0.001$). After immersion in the NaF solution, fluoride concentrations increased compared with previous storage media (FT>FVIII>KN>FII>FIX). SEM analysis revealed numerous microporosities in all materials, except for KN. The tested materials possess high fluoride content, but also the ability to extensively reabsorb fluoride ions, especially in acidic environments.

*P.S.E.19*

## NUCLEATION OF THE CALCIUMHYDROXYAPATITE THIN FILMS FROM SBF ON THE SILICA LAYERS OF THE STEEL TAPE SUBSTRATES

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The study of the mechanisms of growth and nucleation of calcium hydroxyapatite in fluid media has been investigated in this paper, in order to find the most efficient method of the coverage of the metal implants for its full biocompability inside the body.

Therefore, special attention has been addicted to the SiO2 coatings on the metal surfaces, because they have potential to facilitate Ca apposition and thus have been described as apatite nucleation inducers. Kinetic aspects of the deposition of calcium phosphate in a biomimetic system also have been reported, reinforcing the idea of growth dominated by the transport of the structural ions on their way to the substrate.

The used methods were: SEM, AFM, FTIR-ATR.

*P.S.E.20*

## MECHANICAL CHARACTERISTICS WIRE ARCHES IN FIXED ORTHODONTIC TECHNIQUE

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In this work analyzed will be the physical capacities of wire arches depending on the shape, cross-section and its chemical composition in fixed orthodontic technique. When choosing a wire arch, besides the kind of material which is used for the production of wires, shapes and forms which determine their mechanical characteristics, an important factor is also the area in which it is being applied. After a conducted analysis, recommendations will be given for clinical research.

*P.S.E.21*

## MATERIALS FOR DIRECT CEMENTING OF DENTAL BRACKET

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The dental brackets are elements used in fixed orthodontic techniques. They are usually applied on the labial tooth surface, with function to transfer the force, i.e. momentum from the wire arc to the tooth. Depending of the materials of which are made, we have metallic, ceramics and plastic brackets, with possibility of direct or indirect fasten. In this paper we have analyzed materials for direct cementing of the brackets, in the first place composite, two-component materials (paste-paste, mixed techniques) and composite contact materials (no-mixed techniques), and finally photo-polymeric and ionomer materials. After performed analyzes it would be suggested certain recommendations for implementation of these materials in clinical investigation.

*P.S.E.22*

# SHEAR BOND STRENGTH ANALYSIS OF DENTAL SELF-ADHESIVE RESIN CEMENTS

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The availability of newly-developed dental self adhesive resin cements in the market coupled with demands of daily clinical practice, have pointed out the need of new experimental and calculative techniques for evaluation of their mechanical properties. This study evaluates the shear bond strength of three types of ceramics (glass and zirconium-based) cemented by four different composite dental self-adhesive resin cements produced in various ways. Shear bond strength tests were measured using an Instron servo hydraulic testing machine with self-designed special tools by applying parallel shear forces to until the complete bond failure - specimen fracture. Analysis of the specimen fracture surface was performed by SEM. Additionally, finite element analysis was performed in order to evaluate measured shear bond stress values in order to avoid influence of possible specimen bending.

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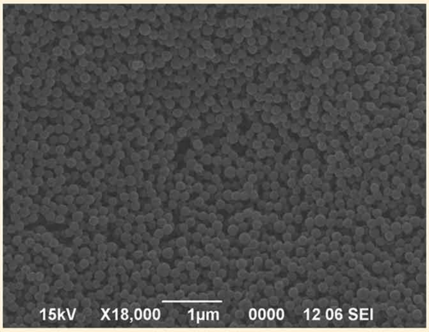

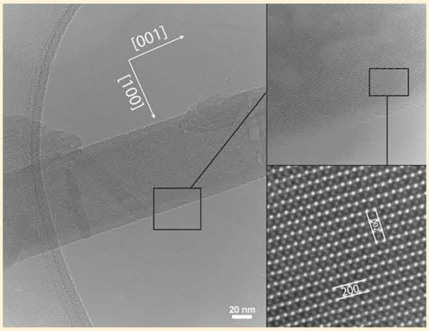

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