
# Serbian Ceramic Society Conference
# ADVANCED CERAMICS AND APPLICATION III
## New Frontiers in Multifunctional Material Science and Processing

**Serbian Ceramic Society**
**Institute of Technical Sciences of SASA**
**Institute of Chemistry Technology and Metallurgy**
**Institute of Physics**
**Institute for Technology of Nuclear and Other Raw Mineral Materials**
**Institute for Testing of Materials**
**Archeological Institute of SASA**

# PROGRAM AND THE BOOK OF ABSTRACTS

**Serbian Academy of Sciences and Arts, Knez Mihailova 35**
**Serbia, Belgrade, 29th September-1st October, 2014.**

**Serbian Ceramic Society Conference**
**ADVANCED CERAMICS AND APPLICATION III**
**New Frontiers in Multifunctional Material Science and Processing**

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**Institute of Technical Sciences of SASA**
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# PROGRAM AND THE BOOK OF ABSTRACTS

**Serbian Academy of Sciences and Arts, Knez Mihailova 35**
**Sep 29th - Oct 1st, 2014, Belgrade, Serbia**

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Prof.dr Vojislav Mitić
Prof. dr Olivera Milošević
Dr Nina Obradovic
Dr Lidija Mančić

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Dear Colleagues, Dear Friends,

We have great pleasure to welcome you to the Advanced Ceramic and Application Conference III organized by the Serbian Ceramic Society in cooperation with the Institute of Technical Sciences of SASA, Institute of Chemistry Technology and Metallurgy, Institute of Physics, Institute for Technology of Nuclear and Other Raw Mineral Materials, Institute for Testing of Materials and Archeological Institute of SASA,

Advanced Ceramics play an important role in the European Union's prioritized materials to enable the transition towards to a knowledge-based low carbon, cost competitive and efficient societies. The chosen Conference topics open the new frontiers in designing of advanced ceramic materials since they cover fundamental theoretical research, modeling and simulation, controlled nanostructured materials synthesis and optimization of the consolidation process, which all together should provide practical realization of the new ideas towards device miniaturization, energy-materials-information integration and preservation of cultural heritage. This ACA III Conference gathers the researchers, engineers, academy staff and PhD students trying to emphasize the key advanced materials research, processing, characterization and innovation activities.

Serbian Ceramic Society has been initiated in 1995/1996 and fully registered in 1997 as Yugoslav Ceramic Society, being strongly supported by American Ceramic Society. Since 2009., continued as Serbian Ceramic Society in accordance to the Serbian law procedure. Serbian Ceramic Society is almost the only one Ceramic Society in the South-East Europe, with members from more than 20 Institutes and Universities, active in 16 sessions, by program and the frames which are defined by the American Ceramic Society activities.

Prof. Dr Vojislav Mitić
*President of the Serbian Ceramic Society*
*World Academy Ceramics Member*
*European Academy of Sciences&Arts Member*

Prof. Dr Olivera Milošević,
*President of the General Assembly of the Serbian Ceramic Society*
*Academy of Engineering Sciences of Serbia Member*

**General Conference Topics**

- Basic Ceramics Science
- Nanostructural, Bio- and Opto-ceramic
- Materials and Nanotechnologies
- Multifunctional Materials
- Magnetic and Amorphous Materials
- Construction Materials and Eco-ceramics
- Composite Materials, Catalysis and Electrocatalysis
- Artistic Ceramics and Design, Archaeology and Heritage
- Young Researchers
- Sintering processes
  -kinetics
  -microstructure
  -thermodinamics
  -modeling

**Conference Co-chairmen:**

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Prof. Dr. Olivera Milošević SRB
Prof. Dr. Marcel Van de Voorde EU
Prof. Dr. Rainer Gadow GER

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# Conference Program and Abstracts

Institute of Technical Sciences
of the Serbian Academy of Sciences and Arts

David W. Johnson, Jr., PhD
5 Oakura Lane
Bedminster, NJ 07921
David.Johnson@stevens.edu
908-658-9766
908-658-9797 fax

September 15, 2014

**An open letter to the organizers and attendees of the Serbian Ceramic Society Conference titled: Advanced Ceramics and Application III: New Frontiers in Multifunctional Material Science and Processing**

Dear Conference organizers and attendees:

It is again my honor to introduce myself and remark on your forthcoming Serbian Ceramic Society Conference titled: Advanced Ceramics and Application III: New Frontiers in Multifunctional Material Science and Processing.

I am retired from the position of Director of the Materials Research Department at Bell Laboratories. I am currently an Editor-in-Chief of the Journal of The American Ceramic Society and Senior Advisor at Stevens Institute of Technology. I am a member of the National Academy of Engineering (USA) and a past president of the American Ceramic Society. I have come to be familiar with the Serbian Ceramic Society through your President, Prof. Dr. Vojislav Mitić, who is also well known in the American Ceramic Society.

I am pleased to be a member of your Scientific Committee for this meeting and to see that as in the past, you have a strong and interesting program. I personally applaud your emphasis on research toward low carbon energy sources. Your list of speakers includes names known around the world. The topics are timely and diverse. All this allows me to predict a very successful meeting.

I have been unable to attend your previous two Serbian Ceramic Society Conferences on Advanced Ceramics and Application and again regret that I will not be able to attend this forthcoming meeting. Therefore, I offer to all organizers and attendees my greetings and my sense of assurance that this will be a most rewarding meeting.

Sincerely,

David W. Johnson, Jr.

**********

I am sorry that I cannot attend your meeting. However, I wish you a productive and successful meeting and that your society grows in strength.
David

**********

David J. Green
Emeritus Professor, The Pennsylvania State University
President, The American Ceramic Society
Senior Editor, Journal of the American Ceramic Society

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List of Participants.....131

## Conference Information:

**Venue:** Serbian Academy of Sciences and Arts, Great Hall (second floor) and Halls 1, 2 (first floor), Knez Mihailova 35, Belgrade, Serbia

**Conference fee:** Standard fee: 6000 RSD; Members of SCS, Invited lecturers, Key-note speakers and PhD Students: 50% reduced fee; plenary lectures and last year winners for oral and poster presentations: free of charge;

**Invoice and bank details for Conference fee payment:** Banka Intesa ad Beograd, Count No. 160-380150-55, notification: Conference fee – participant name.

**Abstracts and papers publication:** The official language of the conference is English. Conference abstracts will be published in the Book of Abstracts Conference. Papers presented at the conference can be submitted for publishing in peer-reviewed Journals and Monographs: Science of Sintering, Journal of Multifunctional Materials and Ceramics and in Special Edition of Foundation Andrejević.

**Type of presentation:** Visuals for oral presentations should be in Microsoft PowerPoint, versions up to 2007 (.ppt or .pptx, or Adobe Acrobat Reader 9 (.pdf)). Any animation or video files must be compatible with Windows 7 and Windows Media Player. Please bring your presentation to the reception desk at the beginning of the Conference on flash memory. Posters should be prepared in dimension: 70x100 cm. The official language of the conference is English.

**Additional Conference information**
Phone: +381-11-2027247 or 2185-437 or 2637-239, E-mail: nina.obradovic@itn.sanu.ac.rs

# Program Over View

| Date | Time | | Programme | | Floor, Room |
|---|---|---|---|---|---|
| **September, 29, Monday** | **08.00-09.00** | | **Registration<br>Poster Session 1 Installation** | | 2nd Floor, Hall |
| | **09.00-09.55** | | **Opening Ceremony** | | 2nd Floor, Great Hall |
| | **09.55-10.00** | | **Short Break** | | 2nd Floor, Hall |
| | **10.00-12.00** | | **Plenary Session 1** | | 2nd Floor, Great Hall |
| | **12.00-12.20** | | **Coffee Break&Photo Session** | | 2nd Floor, Hal |
| | **12.20-14.20** | | **Plenary Session 2** | | 2nd Floor, Great Hall |
| | **14.30-15.30** | | **Buffet Lunch** | | 1st Floor, Club SASA, Mezzanine Hall |
| | **15.30-17.30** | | **Plenary Session 3** | | 2nd Floor, Great Hall |
| | **17.30-18.30** | | **Coffee Break & Poster Session 1** | | 2nd Floor, Hall |
| | **19.30** | | **Conference Dinner** | | Hotel Royal, Kralja Petra street 56 |
| **September, 30, Tuesday** | **08.00-09.00** | | **Registration<br>Poster Session 2 Installation** | | 1st Floor, Hall |
| | **09.00-12.40** | **09.00-11.05** | **Session 1<br>Nanostructures & Functional Materials-Part I,** Blue Hall 2 | **Session 3<br>Basic& Sintering-Part I,** Red Hall 1 | 1st Floor |
| | | **11.05 – 11.25** | **Coffee Break** | | |
| | | **11.25-12.40** | **Session 1<br>Nanostructures & Functional Materials-Part II,**<br>Blue Hall 2 | **Session 3<br>Basic& Sintering-Part II**<br>Red Hall 1 | |
| | **13.00 – 14.00** | | **Buffet Lunch** | | 1st Floor , Club SASA, Mezzanine Hall |
| | **14.00-16.00** | | **Session 2<br>Basic & Multifunctional,**<br>Blue Hall 2 | **Session 4<br>Traditional &Bio& Heritage,**<br>Red Hall 1 | 1st Floor |
| | **16.00-17.00** | | **Coffee Break & Poster Session 2** | | 1st Floor, Hall |
| | **17.30** | | **Sightseeing or Commercial Visit** | | |
| **October, 1, Wednesday** | **09.00-09.30** | | **Round Table 1** | | 1st Floor, Blue Hall 2 |
| | **09.30-10.00** | | **Round Table 2** | | |
| | **10.00-10.30** | | **Coffee Break** | | |
| | **10.30-11.45** | | **Session 5** | | |
| | **11.45-12.15** | | **Closing Ceremony** | | |

## Monday, September 29th, 2014

**08.00 – 09.00** **Registration**
**Poster Session 1 Installation**

## Hall, 2nd Floor

**09.00 – 09.55** **Opening Ceremony of The Third Serbian Ceramic Society Conference »Advanced Ceramics and Application«**

## Great Hall, 2nd Floor

**Prof. Dr. Vojislav Mitić, President of the Serbian Ceramic Society**
**Prof. Dr. Olivera Milošević, President of the General Assembly of the Serbian Ceramic Society**
**Prof. Marcel Van de Voorde, Delft University of Technology**
**Prof.Dr. Felix Unger, President of the European Academy of Sciences & Arts**
**Dr. Nebojša Nešković, Secretary General of the World Academy of Art and Science**
**Representatives of SASA, Ministry of Science &Serbian Government** (tbc)

**09.55 – 10.00** **Short Break**

**10.00 – 12.00** **Plenary Session 1**
**Chairpersons: Sheldon M. Wiederhorn & Makio Naito**

**10.00 – 10.30** **PL1 Structural Ceramics for Extreme Environments**
William Bill Lee
*Dept. of Materials and Centre for Advanced Structural Ceramics (CASC), Imperial College London*

**10.30 – 11.00** **PL2 2D Atomic Layers from Layered Ceramics**
Minoru Osada
*International Center for Materials Nanoarchitectonics (WPI-MANA), National Institute for Materials Science (NIMS), Tsukuba, Japan*

**11.00 – 11.30** **PL3 Nonclassical Materials: Single Crystalline $BaTiO_3$ Nanocube, Supra Crystal and Their Properties**
K. Kato[1], K. Mimura[1], Q. Ma[1], F. Dang[1], H. Imai[2], S. Wada[3], M. Osada[4], H. Hajime[4], M. Kuwabara[5]
*[1]National Institute of Advanced Industrial Science and Technology, 2266-98 Anagahora, Shimoshidami, Moriyama, Nagoya, Japan*
*[2]Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, Japan*
*[3]University of Yamanashi, 4-3-11, Takeda, Kofu, Japan*
*[4]National Institute for Materials Science, 1-1 Namiki, Tsukuba, Japan*
*[5]Kyushu University, 6-1 Kasuga-kouen Kasuga, Fukuoka, Japan*

**11.30 – 12.00 PL4 Advanced Ceramics from Preceramic Polymers and Fillers**
Paolo Colombo[1,2,3], Enrico Bernardo[4]
[1]*Department of Industrial Engineering, University of Padova, Italy*
[2]*Adjunct Professor of Materials Science and Engineering, Department of Materials Science and Engineering, The Pennsylvania State University, USA*
[3]*Visiting Professor, Department of Mechanical Engineering, University College London, UK*
[4]*Department of Industrial Engineering, University of Padova, Italy*

## 12.00 – 12.20 Coffee Break and Photo Session

## 12.20 – 14.20 Plenary Session 2
**Chairpersons: Rainer Gadow & Jose Manuel Torralba**

**12.20 – 12.50 PL5 The Birth of Fracture Mechanics: A Perspective on Toughness**
Sheldon M. Wiederhorn
*National Institute of Standards and Technology,Gaithersburg, MD, 20899-8500*

**12.50 – 13.20 PL6 One-step Mechanical Method to Create Nanocomposite Structure and its Applications for Advanced Materials**
Makio Naito, Akira Kondo, Takahiro Kozawa JWRI,
*Osaka University, 11-1, Mihogaoka, Ibaraki city, Osaka 567-0047, Japan*

**13.20 – 13.50 PL7 Tailoring Ceramic Nanostructures for Nanodevice Applications**
Branislav Vlahovic, Igor Filikhin, and Serge Matinian,
*Department of Physics, North Carolina Central University, 1801 Fayetteville Street, Durham, NC 27707, USA*

**13.50 – 14.20 PL8 FAMA – facility for Modification and Analysis of Materials with Ion Beams**
N. Nešković
*Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia*

## 14.30 – 15.30 Buffet Lunch

**Club SASA,**
**Mezzanine Hall, 1st floor**

## 15.30 – 17.30 Plenary Session 3

**Chairpersons: Paolo Colombo & William Bill Lee**

**15.30 – 16.00 PL9 Electrical Discharge Machining (EDM) of High Performance Ceramics–Materials and Process Development for Wear Resistant Precision Tools with High Geometrical Complexity**

Rainer Gadow, Richard Landfried and Frank Kern
*Institute for manufacturing technologies of ceramic components and composites, IMTCCC, University of Stuttgart, Allmandring 7b, D-70569 Stuttgart, Germany*

**16.00 – 16.30 PL10 Development of Zircon by Powder Injection Moulding**

José M. Torralba[1,2], Carolina Abajo[1], Javier Hidalgo[1], Antonia Jiménez-Morales[1]
[1]*Department of Materials Science and Engineering, Universidad Carlos III Madrid, Spain*
[2]*IMDEA Materials Institute, Madrid, Spain*

**16.30 – 17.00 PL11 Aqueous Processing of Water Sensitive Powders. How to Overcome the Hurdles?**

José M.F. Ferreira
*Department of Materials and Ceramics Engineering (DEMaC), CICECO, University of Aveiro, 3810-193, Aveiro-Portugal*

**17.00 – 17.30 PL12 Ozone Decay on the Metal Oxides Ceramics**

S. Rakovsky, T. Batakliev, V. Georgiev, M. Anachkov, G. Zaikov[1]
*Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria*
[1]*Institute of Biochemical Physics – Russian Academy of Sciences, Moscow, Russia*

## 17.30 – 18.30 Coffee Break and Poster Session 1

**Hall, 2st floor**

## 19.30 Conference Dinner

**Hotel Royal,**
**Kralja Petra street 56**

## Tuesday, September 30th, 2014

**08.00 – 09.00** **Registration**
**Poster Session 2 Installation**

**Hall, 1st floor**

**09.00 – 12.40** **1st Session – Nanostructures & Functional Materials**
**Part I-Chairpersons: Minoru Osada & Kazumi Kato**

**Blue Hall 2, 1st floor**

**09.00 – 09.30** **PL13 Chemical Nanotechnologies: From Molecules to Functional Nanostructures for Energy and Health Applications**
Sanjay Mathur
*Inorganic and Materials Chemistry Dpt., University of Cologne, Germany*

**09.30 – 09.55** **KN1 Multifunctional Self-organized Nanowires and Nanowire Arrays**
Srdjan Milenkovic[1], Achim Walter Hassel[2]
*[1]IMDEA Materials Institute, Eric Kandel 2, 28906, Getafe, Spain; [2]Institute for Chemical Technology of Inorganic Materials, Johannes Kepler University Linz, Altenberger Str. 69, A-4040 Linz, Austria*

**09.55 – 10.20** **KN2 Magnetic and Structural Properties of $ZrO_2$(Fe, Mn) and CdO(Fe) Nanoparticles**
I. Kuryliszyn-Kudelska[1], M. Arciszewska[1], A. Małolepszy[2], M. Mazurkiewicz[2], L. Stobinski[3], R. Minikayev[1], W. Paszkowicz[1], N. Nedelko[1], A. Grabias[4], M. Kopcewicz[4], W. Dobrowolski[1]
*[1]Institute of Physics, Polish Academy of Sciences, Al. Lotników 32/46, 02-668 Warsaw, Poland*
*[2]Warsaw University of Technology, Faculty of Materials Science and Engineering, 02-507 Warsaw, Wołoska 141, Poland*
*[3]Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 44/52, 01-224 Warsaw, Poland*
*[4]Institute of Electronic Materials Technology, Wolczynska 133, 01-919 Warsaw, Poland*

**10.20 – 10.45** **KN3 NanoTools for Ultrafast DNA Sequencing**
Radomir Zikic
*Institute of Physics, Pregrevica 118 Belgrade, Serbia*

**10.45 – 11.05 INV1 Synthesis and Characterization of Magnesium Hydroxide Nanoparticles via Hydrothermal Method**

A. Sierra-Fernandez[1,2], G. Flores-Carrasco[3], L.S.Gomez-Villalba[1], O.Milosevic[4], R. Fort[1], M.E.Rabanal[2]

[1]*Instituto de Geociencias (CSIC, UCM), C/ José Antonio Novais 2, 28040 Madrid, Spain*

[2]*University Carlos III of Madrid and IAAB, Department of Materials Science and Engineering and Chemical Engineering, Avda.Universidad 30, 28911 Leganes, Madrid, Spain*

[3]*CIDS-ICUAP Benemérita Universidad Autónoma de Puebla, Av. San Claudio y 14 sur, Edif. 103C C.U., Col. San Manuel, Puebla 72570, México*

[4]*Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, 11000 Belgrade, Serbia*

**11.05 – 11.25 Coffee Break**

## Blue Hall 2, 1st floor

### Nanostructures & Functional Materials

**Part II-Chairpersons: Sanjay Mathur & Srdjan Milenkovic**

**11.25 – 11.50 KN4 Transport Properties of Electron-doped $Sr_{1-x}La_xCu_2O_\delta$ Superconducting Thin Films**

V. P. Jovanović[1], Z. Z. Li[2] and H. Raffy[2]

[1] *Institute of Physics, University of Belgrade, Pregrevica 118, 11000 Belgrade, Serbia*

[2]*Laboratoire de Physique des Solides, UMR 8502-CNRS, Université Paris-Sud, 91405 Orsay, France*

**11.50 – 12.10 INV2 Electrical and Dielectric Characterization of Nanostructural Ceramic Materials by Complex Impedance Spectroscopy**

D. L. Sekulić[1], Z. Ž. Lazarević[2], N. Ž. Romčević[2]

[1]*Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia*

[2]*Institute of Physics, University of Belgrade, Belgrade, Serbia*

**12.10 – 12.25 OR1 Synthesis and Characterization of Nanostructured Hybrid Systems of Ag&ZnO Obtained by Solvothermal Method for Photocatalytic Applications**

L. Muñoz[1], A. Sierra-Fernandez[1,2], L.S.Gomez-Villalba[2], O.Milosevic[3], M.E.Rabanal[1]

[1]*University Carlos III of Madrid and IAAB, Department of Materials Science and Engineering & Chemical Engineering, Avda.Universidad 30, 28911 Leganes, Madrid, Spain*

[2]*Instituto de Geociencias (CSIC, UCM), C/ José Antonio Novais 2, 28040 Madrid, Spain*

[3]*Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, 11000 Belgrade, Serbia*

**12.25 – 12.40 OR2 Ultrasonic Processing of Hierarchically Organized $TiO_2$ Functional Nanomaterials**

Ivan M. Dugandzic[1], Dragana J. Jovanovic[2], Lidija T. Mancic[1], Zoran V. Saponjic[2], Jovan M. Nedeljkovic[2], Olivera B. Milosevic[1]
[1]*Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000, Belgrade, Serbia,*
[2]*Vinča Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

**13.00 – 14.00 Buffet Lunch**

## Club SASA, Mezzanine Hall, 1st floor

## Blue Hall 2, 1st floor

**14.00 – 16.00 2st Session – Basic & Multifunctional &Electroceramics**
**Chairpersons: Branislav Vlahovic & Karel Maca**

**14.00 – 14.25 KN5 Magnetic Interactions and Magnetotransport in $Ge_{1-x}TM_xTe$ Diluted Magnetic Semiconductors**

L.Kilanski[1], R.Szymczak[1], E.Dynowska[1], M.Gorska[1], A.Podgorni[1], W.Dobrowolski[1], M.Romcevic[2], V.E.Slynko[3] and E.I.Slynko[3]
[1]*Institute of Physics, Polish Academy of Sciences, al. Lotnikow 32/46, 02-668 Warsaw, Poland*
[2]*Institute of physics, University of Belgrade, 11080 Belgrade, Republic of Serbia*
[3]*Institute of Materials Science Problems, Ukrainan Academy of sciences, Chernovtsy, Ukraine*

**14.25 – 14.45 INV3 A- and B-site Substitutions Effect on the Dynamic Relaxation Processes in Tetragonal Tungsten Bronzes**

Andrei Rotaru[1,2,3] and Finlay D. Morrison[3]
[1]*University of Craiova, Faculty of Mathematics and Natural Sciences, Department of Chemistry,A.I. Cuza 13, Craiova, Romania*
[2]*INFLPR-National Institute for Laser, Plasma and Radiation Physics, Laser Department, Bvd. Atomistilor, Nr. 409, Magurele (Ilfov), Bucharest, Romania*
[3]*University of St Andrews, EaStCHEM, School of Chemistry, North Haugh, KY169ST, St Andrews,Fife, Scotland, United Kingdom*

**14.45 – 15.10 KN6 Towards Electronic Materials Fractal Theory**

Ljubiša M. Kocić[1] and Vojislav V. Mitić[2]
[1]*University of Niš, Faculty of Electronic Engineering, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*

**15.10 – 15.30 INV4 Electronics Ceramics Materials Fractal Nature and Entrophy**
Vojislav V. Mitić[1,2], Ljubiša Kocić[1], Vesna Paunović[1], S. Jankovic[3], Vlada Pavlović[2,4]
[1]*University of Niš, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*
[3]*Mathematical Institute of SASA, Belgrade, Serbia*
[4]*University of Belgrade, Faculty of Agriculture, Belgrade, Serbia*

**15.30 – 15.45 OR3 Influence of $Sm_2O_3$ on the Microstructure and Dielectric Characteristics of Codoped $BaTiO_3$ Ceramics**
Vesna Paunović[1], Vojislav Mitić[1,2], Ljiljana Živković[1], Ljubiša Kocić[1]
[1]*University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*

**15.45 – 16.00 OR4 The Research of the Physical and Chemical Mechanism and Kinetics of Reactionary SPS-sintering of $TiB_2$ – TiN Composition**
Petukhov O.[1], Khobta I.[1], Herrmann M.[2], Rathel J.[2],Ragulya A.[1]
[1]*Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine. 03680, Kiev -142, 3, Krzhyzhanovsky St., Ukraine*
[2]*Fraunhofer IKTS, Winterbergstrasse 28, 01277, Dresden, Germany*

## 16.00 – 17.00 Coffee Break and Poster session 2

## 17.30 Sightseeing or Commercial Visit

# Red Hall 1, 1st floor

## 09.00 – 12.40 3rd Session - Basic & Sintering

**Part 1 - Chairpersons: Nina Obradovic & Slavcho Rakovsky**

**09.00 – 09.25 KN7 Characterizing Griffith Cracks in Glass: a Measurement Problem**
S. M. Wiederhorn
*National Institute of Standards and Technology, Gaithersburg, MD, 20899-8500*

**09.25 – 09.50 KN8 Computer Simulation of Grain Coarsening Due to Diffusion and Deformation in Liquid Bridge**
Zoran S. Nikolic[1] and Kazunari Shinagawa[2]
[1]*University of Niš, Faculty of Electronic Engineering, Serbia*
[2]*Kagawa University, Faculty of Engineering, Japan*

**09.50 – 10.15 KN9 Recycling of the Advanced Ceramic Materials**
Srecko Stopic, Bernd Friedrich
*IME Process Metallurgy and Metal Recycling, RWTH Aachen University, Germany*

**10.15 – 10.35 INV5- The Sintering Activation Energy of Various Advanced Ceramics and Composites**
Karel Maca
*Dept. of Ceramics and Polymers, Brno University of Technology, Technicka 2, 616 69 Brno,Czech Republic*
*CEITEC BUT, Brno University of Technology, Technicka 10, 616 00 Brno, Czech Republic*

**10.35 – 10.55 INV6 Application of Integral Characteristics in Thermodynamics and Quantum Mechanics**
Dimitrije Stefanović[1], Janja Nedović[1] , Časlav Stefanović[2]
*[1]Faculty of Electronic Engineering 18000 Niš, Serbia*
*[2]Faculty of Mathematics and Natural Science, Kosovska Mitrovica, Serbia*

## 11.05-11.25 Coffee Break

### Basic & Sintering
**Part II-Chairperson: Zoran Nikolic&Andrei Rotaru**

**11.25 – 11.40 OR5 FTIR/DRIFT Contactless Measurement of Salt Crystallization Phenomena**
D. Čjepa[1], S. Vučetić[1], O. Rudić[1], S. Pašalić[2], S. Vujović[3], J. Ranogajec[1]
*[1]Faculty of Technology, University of Novi Sad, 21000, Novi Sad, Serbia*
*[2]Serbian Ministry of Education, Science and Technological Development, Nemanjina 22-24, 11000 Belgrade, Serbia*
*[3]Provincial Institute for the Protection of Cultural Monuments, 21000, Novi Sad, Serbia*

**11.40 – 11.55 OR6 Magnetic Characterization of PIM MnZn Ferrite for Power Electronic Application**
Nebojša Mitrović, Elvis Gašanin,Aleksandra Kalezić -Glišović, Borivoje Nedeljković, Maja Kićanović
*Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems*
*Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia*

**11.55 – 12.10 OR7 Selection of the Most Suitable Non-conventional Machining Processes for Ceramic Processing by Using MCDMs**
Dušan Petković, Miloš Madić, Goran Radenković
*University of Niš, Faculty of Mechanical Engineering, Aleksandra Medvedeva 14, Niš, Serbia*

**12.10 – 12.25 OR8 The Fractal Nature Grains Shape Reconstruction on the Way to Microstructure Prognosis**
Filip Bastić[1], Danijel Sirmić[1], Miloš Cvetanović[1],V.V. Mitić[1,2], V. Lj.Kocić[1], V. Paunović[1]
*[1]University of Niš, Faculty of Electronic Engineering, Niš, Serbia*
*[2]Institute of Technical Sciences of SASA, Belgrade, Serbia*

**12.25 – 12.40 JEOL Electron Microscopes-news**
S. Zizek
*SCAN d.o.o. Predvor, Nazorjeva 3, Kranj, Slovenia*

## 13.00 – 14.00 Buffet Lunch

## Club SASA, Mezzanine Hall, 1st floor

## 14.00 – 16.00 4th Session – Traditional & Bio&Heritage

**Chairpersons: Maria Eugenia Rabanal & Ljubica Pavlovic**

## Red Hall 1, 1st floor

**14.00 – 14.25 KN10 Ni-Al Layered Double Hydroxides as Precursors of Ceramic Pigments**
Margarita Gabrovska[1], Dorel Crişan[2], Nicolae Stănică[2], Dimitrinka Nikolova[1], Maya Shopska[1], Lyubima Bilyarska[1], Maria Crişan[2], Rumeana Edreva-Kardjieva[1]
*[1]Institute of Catalysis, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. Bl. 11, 1113 Sofia, Bulgaria*
*[2]"Ilie Murgulescu" Institute of Physical Chemistry, Romanian Academy, 202 Splaiul Independentei Str., 060021 Bucharest-12, Romania*

**14.25 – 14.50 KN11 What we Know and what we would like to Know – New Developments in Characterisation of Pharmaceutical Materials**
Milan D. Antonijević
*School of Science, Faculty of Engineering and Science, University of Greenwich (Medway Campus), Chatham Maritime, Kent ME4 4TB, UK*

**14.50 – 15.15 KN12 Objective Measurement Method to Detect Hip Bone affected by Osteoarthritis**
Francesco Lamonaca[1], Monica Vasile[2], Alfonso Nastro[3]
*[1]Dept. of Informatics, Models, Electronic and Systems, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy*
*[2]Medical School, Ovidius University of Costanta, Bd.Mamaia 124, 900527, Costanta, Romania*
*[3]Department of Chemistry and Chemical Technology, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy*

**15.15 – 15.35 INV7 Biodegradable Composite Materials**
Dumitru Nedelcu
*"Gheorghe Asachi" Technical University of Iasi, Romania, Blvd. Mangeron, No. 59A, 700050 Iasi, Romania*

**15.35 – 15.50 INV8 Where is Archaeology Without Physical and Chemical Analysis in the Ceramic Technology Studies?**
Biljana Djordjević
*National Museum in Belgrade, Serbia*

**15.50 – 16.00 OR9 Sculptural Concretes: Use in Restoration**
Rajko Blažić
*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

## 16.00 – 17.00 Coffee Break and Poster Session 2

## 17.30 Sightseeing or Commercial Visit

## Wednesday, October, 1st, 2014

## Blue Hall 2, 1st floor

**09.00 – 09.30** **Round Table 1:** ***The Establishment of ModTech Branch in Belgrade***

**Moderator: Olivera Milošević**

*By invitation only*

**09.30 – 10.00** **Round Table 2:** ***Enhancing Scientific Cooperation between Serbia and Italy***

**Moderator: Radomir Žikić**

**10.00 – 10.30** **Coffee Break**

## Blue Hall 2, 1st floor

**10.30 – 11.45** **5th Session: Advanced Materials, Ceramics & Processing**

**Chairpersons: Vladimir Pavlovic & Dumitru Nedelcu**

**10.30 – 11.00** **PL14 A Novel, Highly Efficient Material for Photovoltaic Conversion: the $CH_3NH_3PbI_3$ Perovskite**

László Forró

*Laboratory of Physics of Complex Matter, EcolePolytechniqueFédérale de Lausanne, Switzerland*

**11.00 – 11.30** **PL15 The Bavarian Porcelain Industry Facing Global Competition - Changes, Chances and Challenges 1989 to 2014**

Wilhelm Siemen

*Deutsches Porzellanmuseum, Hohenberg, Germany*

**11.30 – 11.45** **The application of PRIZMA's Ultrasound Atomizers and Electrostatical Precipitators in the Advanced Materials Processing**

Miroslav Ravlić

*Prizma, Kragujevac*

**11.45 – 12.15** **Closing Ceremony**

## Poster Session 1: PS1 Art & Traditional & Heritage

**Hall, 2st floor**
**Monday, 29, 09, 2014.**
**17.30-18.30 h**

**PS1-1 Characterization of Material as a Supply Source for Heritage Aqueduct Construction in FYR Macedonia**
Zagorka Radojević[1], Ivana Delić Nikolić[1], Anja Terzić[1]
[1]*Institute for Materials Testing, Belgrade, Serbia*

**PS1-2 Corundum and Bauxite Refractory Shotcretes Based on Activated Waste Coal Ash: Investigation of Thermally Induced Properties Change**
Anja Terzić[1], Zagorka Radojević[1], Ljiljana Miličić[1], Nina Obradović[2], Ljubiša Andrić[3]
[1]*Institute for Materials Testing, Belgrade, Serbia*
[2]*Institute of Technical Sciences of Serbian Academy of Sciences and Arts, Belgrade, Serbia*
[3]*Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia*

**PS1-3 Self Sensing Concrete**
Gordana Topličić-Ćurćić, Dušan Grdić, Nenad Ristić, Zoran Grdić
*University of Nis, The Faculty of Civil Engineering and Architecture, Serbia*

**PS1-4 The Use of Different Analytical Techniques in the Proces of Investigated Ceramic Materials**
A.Radosavljević-Mihajlović,
*ITNMS, Bulevar Franshe d Eperea 86, Belgrade, Serbia*

**PS1-5 The Use of X-ray Powder Analysis for Investigation of Ceramic Materials**
Ana S. Radosavljevic-Mihajlovic[1], Jovica Stojanovic[1], Anja M. Dosen[2]
[1]
*ITNMS Bulevar Franche dEper , 11000 Belgrade, Serbia*
[2]*Faculty of Mining and Geology, Department of Crystallography, University of Belgrade, Đušina 7, 11000 Belgrade, Serbia*

**PS1-6 The Synthesis and Crystal Structures of Diphylloaluminosilicates Phase Doped with $Ca^{2+}$ and $Gd^{3+}$**
Ana S. Radosavljevic-Mihajlovic[1], Jovica Stojanovic[1], Anja M. Dosen[2]
[1] *University of Belgrade - Vinca Institute of Nuclear Sciences, P.O. Box 522, 11001 Belgrade, Serbia*
[2]*Faculty of Mining and Geology, Department of Crystallography, University of Belgrade, Đušina 7, 11000 Belgrade, Serbia*

**PS1-7 Combining Fresh and Ripe Sculptural Concretes**
Rajko Blažić
*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

**PS1-8 Gold and Silver Plating Concretes**
Rajko Blažić
*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

**PS1-9 Sculptural Concretes: Unusual Montages**
Rajko Blažić
*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

**PS1-10 Sculptural Concretes: Stone Immitation**
Rajko Blažić
*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

**PS1-11The Mirrors**
Zvonko Petković
*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

**PS1-12 Natural Carbonate Fillers**
Ljubiša Andrić[1], Anja Terzić[2], Marko Pavlović[3], Milan Petrov[1], Ljubica Pavlović[1], Zagorka Aćimović[3]
[1]*Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia,*
[2]*Institute for Materials Testing, Belgrade, Serbia*
[3]*University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*

**PS1-13 Calcium Carbonate Fillers Prepared by Means of Micronized Milling with Application in Coatings**
Marko Pavlović[1], Anja Terzić[2], Ljubiša Andrić[3], Milan Petrov[3], Ljubica Pavlović[3], Zagorka Aćimović[1]
[1]*University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*
[2]*Institute for Materials Testing, Belgrade, Serbia*
[3]*Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia*

**PS1-14 Advanced Optimization of Heavy Clay Products Quality by Using Artificial Neural Network Model**
Milica Arsenović[1], Lato Pezo[2], Lidija Mančić[3], Zagorka Radojević [1]
[1]*Institute for testing of materials IMS, Belgrade, Serbia*
[2]*University of Belgrade, Institute of general and physical chemistry, Belgrade, Serbia,*
[3]*Institute of Technical Sciences of SASA, Belgrade, Serbia*

## Poster Session 2: PS2 Nanostructures & Amorphous & Functional & Sintering

**Hall, 1st floor**
**Tuesday, 30, 09, 2014.**
**16-17h**

**PS2-1 Properties of Zig-zag Nickel Nanostructures Obtained by GLAD Technique**
J. Potočnik[1], M. Nenadović[1], M. Popović[1], B. Jokić[2] and Z. Rakočević[1]
[1]*University of Belgrade, INS Vinča, Laboratory of Atomic Physics, Mike Alasa 12-14, 11001 Belgrade, Serbia*
[2]*University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11000 Belgrade, Serbia*

**PS2-2 Argon Irradiation Effects on the Structural and Optical Properties of Reactively Sputtered CrN Films**
M. Novaković, M. Popović and N. Bibić
*VINČA Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

**PS2-3 Annealing Effects on the Properties of TiN Thin Films**
M. Popović, M. Novaković and N. Bibić
*VINČA Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

**PS2-4 Raman Spectroscopy of Optical Properties in CdS Thin Films**
J. Trajić[1], M. Gilić[1], N. Romčević[1], M Romčević[1], G. Stanišić[1], B. Hadžić[1], Y.S. Yahia[2]
[1]*Institute of Physics, P.O. Box 68, University of Belgrade, 11080 Belgrade, Serbia*
[2]*Nano–Science& Semiconductor Labs., Department of Physics, Faculty of Education, Ain Shams University, Roxy, Cairo, Egypt*

**PS2-5 Raman and IR Spectroscopic Study of Nanostructured $Ni_{0.5}Zn_{0.5}Fe_2O_4$ Prepared by Soft Mechanochemical Synthesis**
Z. Ž. Lazarević[1], Č. Jovalekić[2], A. Milutinović[1], M. Romčević[1], G. Stanišić[1], M. Gilić[1], N. Ž. Romčević[1]
[1]*Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia,* [2]*The Institute for Multidisciplinary Research, University of Belgrade, Serbia*

**PS2-6 Surfactants Assisted Hydrothermal Synthesis of $NaYF_4$ Co-doped $Yb^{3+}/Er^{3+}$ Up-conversion Nanoparticles**
Ivana Z. Dinic[1], Ivan M. Dugandzic[1], Lidija T. Mandcic[1], Maria Eugenia Rabanal[2], Olivera B. Milosevic[1]
[1]*Institute of Technical Sciences of SASA, 11000 Belgrade, Serbia*
[2]*Materials Science and Engineering Department and IAAB, Universidad Carlos III de Madrid, Avda de la Universidad 30, 28911 Leganes, Spain*

**PS2-7 Growth, Structural and Optical Studies of Neodymium Doped Yttrium Aluminum Garnet**

S. Kostić[1], Z. Ž. Lazarević[1], M. Romčević[1], A. Milutinović[1], V. Radojević[2], M. Petrović-Damjanović[1], N. Ž. Romčević[1]
[1]*Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia*
[2]*The Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia*

**PS2-8 Influence of $Er^{3+}/Yb^{3+}$ Concentration Ratio on the Down-conversion and Up-conversion Luminescence and Lifetime in $GdVO_4$: $Er^{3+}/Yb^{3+}$ Microcrystals**

Tamara V. Gavrilović,[1] Dragana J. Jovanović,[1] Vesna Lojpur,[1] Aleksandar Nikolić[2] and Miroslav D. Dramićanin[1]
[1]*Laboratory for Radiation Chemistry and Physics, Vinča Institute of Nuclear Sciences,University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia,* [2]*Faculty of Chemistry, University of Belgrade, Studentski trg 12-16, Belgrade*

**PS2-9 Annealing Effects on Luminescent Properties of $Eu^{3+}$ Doped $Gd_2Zr_2O_7$ Nanopowders**

M. S. Rabasovic[1], D. Sevic[1], J. Krizan [2], M. D. Rabasovic[1] and N. Romcevic[1]
[1] *Institute of Physics, University of Belgrade, Serbia,* [2]*AMI d.o.o, Trstenjakova 5, 2250 Ptuj, Slovenia*

**PS2-10 The Morphological Characterization of Mechanically Activated ZnO Powder**

A. Peleš[1], S. Filipović[1], N. Obradović[1], J. Krstić[2], V. Pavlović[1]
[1]*Institute of Technical Sciences of SASA, Knez Mihailova 35/IV 11000 Belgrade, Serbia,* [2]*Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Njegoševa 12, 11000 Belgrade, Serbia*

**PS2-11 Strontium Containing Polyphosphate Glass for Fabrication of 3D-scafold for Biomedical Application**

V. D. Živanović [1], S. D. Matijašević[1], J. D. Nikolić [1], Grujić [2], S. V. Smiljanić[2,] S. N. Zilđović[1], V.S. Topalović[1]
[1]*Institute for the Technology of Nuclear and other Mineral Raw Materials, 86 Franchet d'Esperey St., 11000 Belgrade, Serbia,* [b] *Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia.*

**PS2-12 Reduction of Doubtful Detection of Micro-nucleus in Human Lymphocyte**

Francesco Lamonaca[1], Domenico Grimaldi[2], Alfonso Nastro[3]
[1]*Dept. of Informatics, Models, Electronic and Systems, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy.(e-mail: flamonaca@deis.unical.it)*
[2]*Dept. of Informatics, Models, Electronic and Systems, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy.*
[3]*Department of Chemistry and Chemical Technology, , University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy*

**PS2-13 Nanometric Oxide Films Obtained by Applying Pulsed Electric Discharges**

Topala Pavel, Thighineanu Ion
*Academy of Science of Moldova, Moldova*

**PS2-14 Thermally Induced Structural Transformations of $Fe_{73.5}Cu_1Nb_3Si_{15.5}B_7$ Amorphous Alloy**

Dragica M. Minić[1], Milica Vasić[1], Dušan M. Minić[2], Bohumil David[3], Vladimir A. Blagojević[1], Tomáš Žák[3]

*[1]Faculty of Physical Chemistry, University of Belgrade, Serbia, [2]Military Technical Institute, Belgrade, Serbia, [3]CEITEC IPM, Institute of Physics of Materials AS CR, Brno, Czech Republic*

**PS2-15 The Correlation of the Electric Resistance Change and Density of the Fermi Level Electron States of the Amorphous Alloy NiFeWCu**

[1]Z. Vukovic, [1]M. Plazinic, [1]J. Zivanic, [2]M. Spasojevic, [1]A. Maricic

*[1] Faculty of Technical Sciences, Cacak, Serbia, [2] Faculty of Agriculture, Cacak, Serbia*

**PS2-16 Development of Cu-C Composite Microstructure**

Rebeka Rudolf[1,2], Nebojša Romčević[3]

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

**PS2-17 The Influence of the Mechanochemical Activation and Heat Effect on the Magnetic Properties of the Powder System $BaTiO_3$ - $Fe_xO_y$**

[1]Z. Ristanovic, [2]S. Djukic, [2]A. Plazinic, [1]D. Sretenovic, [2]A. Maricic

*[1] Higher Education School of Technical Specialized Studies, Cacak, Serbia, [2] Faculty of Technical Sciences, Cacak, Serbia*

**PS2-18 Problems of Thermodynamically Equilibrium and Integral Characteristics of Entropy**

Stanislav Veljković[1], Ivan Stefanović[1] , Časlav Stefanović[2]

*[1]Faculty of Electronic Engineering 18000 Niš, Serbia,[2]Faculty of Mathematics and Natural Science, Kosovska Mitrovica, Serbia*

**PS2-19 The $Ho_2O_3$ Concentration Influence on $BaTiO_3$ – ceramics Fractal Structures**

D. Sirmić[1], M.Cvetanović[1], F. Bastić[1], V. Mitić[1,2], Lj. Kocić[1], S. Janković[3], V. Paunović[1], M. Miljković[4]

*[1]University of Niš, Faculty of Electronic Engineering, Niš, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Mathematical Institute of SASA, Belgrade, Serbia, [4]University of Nis, Center for Electron Microscopy, Nis, Serbia*

**PS2-20 The Sintering Temperature Influence on $BaTiO_3$ – ceramics Microstructure Fractal Nature**

F. Bastić[1], D. Sirmić[1], M.Cvetanović[1], S. Janković[2], V. Mitić[1,3], Lj. Kocić[1], V. Paunović[1], B. Jordović[4]

*[1]University of Niš, Faculty of Electronic Engineering, Niš, Serbia, [2]Mathematical Institute of SASA, Belgrade, Serbia, [3]Institute of Technical Sciences of SASA, Belgrade, Serbia, [4]University of Kragujevac, Faculty of Technical Sciences, Kragujevac, Serbia*

**PS2-21 Statistical Analysis of the Influence of Temperature on Microstructure Contact Surfaces on BaTiO3 -ceramics Doped with $Ho_2O_3$**

S. Janković[1] , V. V. Mitić[2, 3], Lj. Kocić[2] , V. Paunović[2], M. Miljković[4]
*[1]Mathematical Institute, SASA, Knez Mihailova 35, 11000 Belgrade, Serbia, [2]University of Niš, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, 18000 Niš, Serbia, [3]Institute of Technical Sciences, SASA, Knez Mihailova 35, 11000 Belgrade, Serbia, [4]University of Niš, SEM Laboratory, 18000 Niš, Serbia*

**PS2-22 $BaTiO_3$ – ceramics and Fractal Microstructure Analyses**

M. Cvetanović[1], F. Bastić[1], D. Sirmić[1], V. Mitić[1,2], Lj. Kocić[1], V. Paunović[1], M. Miljković[3]
*[1]University of Niš, Faculty of Electronic Engineering, Niš, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]University of Nis, Center for Electron Microscopy, Nis, Serbia*

**PS2-23 The Electrical Characteristics of Nb doped $BaTiO_3$ Ceramics**

Miloš Marjanović[1], Miloš Đorđević[1], Vesna Paunović[1], Vojislav Mitić[1,2]
*[1] University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia*

**PS2-24 The Influence of Temperature on Microstructure Contact Surfaces on $BaTiO_3$ – ceramics doped with $Ho_2O_3$**

S. Janković[1] , V. V. Mitić[2,3*], Lj. Kocić[2,] V. Paunović[2], M. Miljković[4]
*[1]Mathematical Institute, SASA, Knez Mihailova 35, 11000 Belgrade, [2]University of Niš, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, 18000 Niš, Serbia, [3]Institute of Technical Sciences, SASA, Knez Mihailova 35, 11000 Belgrade, Serbia, [4]University of Niš, SEM Laboratory, 18000 Niš, Serbia*

**PS2-25 Microstructure Samples Preparation and Analysis on the Way for Statistical and Fractals Applications**

Miroslav Miljkovic[1], Vesna Paunovic[1], Ljubisa Kocic[1], Slobodanka Jankovic[3], Vojislav Mitic[1,2]
*[1] University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia, [3]Mathematical institute, SASA, Belgrade, Serbia*

**PS2-26 Integral Characteristics of Distribution of Gas Molecules Velocity**

Janja Nedović [1] , Dimitrije Stefanović[1] , Dejan Blagojević[2]
*[1]Faculty of Electronic Engineering 18000 Niš, Serbia, [2]High Tehnical School 18000 Niš, Serbia*

**PS2-27 The Influence of Calcination Temperature on the Internal Morphology of a $Fe_2O_3$-$Cr_2O_3$ Porous Catalyst Used in the Water-gas Shift Reaction**

Andrei Rotaru[1,2] and Petre Rotaru[1]
*[1]University of Craiova, Faculty of Mathematics and Natural Sciences, Department of Chemistry, A.I. Cuza 13, Craiova, Romania, [2]INFLPR-National Institute for Laser, Plasma and Radiation Physics, Laser Department, Bvd. Atomistilor, Nr. 409, Magurele (Ilfov), Bucharest, Romania*

**PS2-28 The Effect of Calcination Condition on the Structural and Textural Properties of Mg(II) Doped Mesoporous Alumina**

Zorica Vuković, Tatjana Novaković, Ljiljana Rožić, Srđan Petrović
*University of Belgrade, IChTM-Department of Catalysis and Chemical Engineering, Njegoševa 12, Belgrade, Republic of Serbia*

**PS2-29 Hydrogen Retention in Glassy Carbon**

Zoran Jovanović, Ana Kalijadis, Zoran Laušević
*Vinča Institute of Nuclear Sciences (010), University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*

**PS2-30 Influence of Mortmorillonite/Beidelite Ratio on Electrochemical Response of *p*-Nitrophenol at Smectite Modified Glassy Carbon Electrode**

M. Žunić[1], A. Milutinović-Nikolić[1], D. Stanković [2], D. Manojlović[2], N. Jović-Jovičić[1], P. Banković[1], Z. Mojović[1], D. Jovanović[1]
*[1]University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia, [2]University of Belgrade, Faculty of Chemistry, Studentski trg 12-16, Belgrade, Serbia*

**PS2-31 Oxygen Reduction Reaction on Palladium Modified Zeolite 13X**

Zorica Mojović, Tihana Mudrinić, Predrag Banković, Nataša Jović-Jovičić, Ana Ivanović-Šašić, Aleksandra Milutinović-Nikolić, Dušan Jovanović,
*University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Department of Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Republic of Serbia*

**PS2-32 General Factorial Design in Adsorption Process of Acid Yellow 99 on Hexadecyl Trimethyl Ammonium Modified Smectite**

N. Jović-Jovičić, A. Ivanović-Šašić, A. Milutinović-Nikolić, P. Banković,
Z. Mojović, M. Žunić, T. Mudrinić and D. Jovanović
*University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia.*

**PS2-33 The Influence of the Nickel Incorporation Method on the Performance of Bentonite Based Electrodes in Electrooxidation of Phenol**

T. Mudrinić[1], Z. Mojović[1] A. Milutinović-Nikolić[1], P. Banković[1], M. Žunić[1], N. Jović-Jovičić[1] N. Vukelić[2], D. Jovanović[1]
*[1]University of Belgrade - Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia, [2]University of Belgrade, Faculty of Physical Chemistry, Studenski trg 12-16, 11000 Belgrade, Serbia*

**PS2-34 Use of the Complex Salt for the Charge Obtaining with the Aim of Reactionary SPS - Sintering of TiN - $TiB_2$ – Ni Composite**

Petukhov O., Ragulya A.
*Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine. 03680, Kiev -142, 3, Krzhyzhanovsky St., Ukraine*

**PS2-35 Research of the Thermodynamic Laws of Reactionary SPS-sintering of $TiB_2$ – TiN Composition**

Petukhov O.
*Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine. 03680, Kiev -142, 3, Krzhyzhanovsky St., Ukraine*

**PS2-36 Properties of Magnesium Titanate Ceramic Obtained by Two Stage Sintering**

S. Filipovic[1], N. Obradovic[1], V. B. Pavlovic[1], D. Kosanovic[1], M. Mitric[2], V. Paunovic[3], V. Pouchly[4], M. Kachlik[4], K. Maca[4]
*[1] Institute of Technical Science of SASA, 11000 Belgrade, Serbia,[2] "Vinča" Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia,[3] Faculty for Electronics, University of Nis, 18000 Nis, Serbia,[4] CEITEC BUT, Brno University of Technology, Technicka 10, 61600 Brno, Czech Republic*

**PS2-37 Influence of Mechanical Activation on the Constituents of the $MgO$-$Al_2O_3$-$SiO_2$-$MoO_3$ System**

N. Đorđević[1], N. Obradović[2], D.Kosanović[2], S. Marković[2], M. Mitrić[3]
*[1]Institute for Technology of Nuclear and Other Mineral Raw Materials,Bulevar Franse d΄Eperea 86, 11000 Belgrade, Serbia, [2]Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000 Belgrade, Serbia,[3]Vinča Institute of Nuclear Sciences, University of Belgrade, Mike Alasa 12-14,11000 Belgrade, Serbia*

**PS2-38 Mechanism and Kinetics of Dissolution of Glass-ceramics in Simulated Body Fluid (SBF)**

Jelena. D. Nikolić[1], Vladimir. D. Živanović[1], Snežana N. Zildžović[1], Srđan D. Matijašević[1], Snežana R. Grujić[2], Sonja V. Smiljanić[2], Vladimir S. Topalović[1]
*[1]Institute for technology of nuclear and other mineral raw materials, Franchet d΄Esperey 86, Belgrade, Serbia, [2]Faculty of Technology and metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia*

**PS2-39 Equivalent Electrodes' method (EEM) and the Hybrid boundary element method (HBEM) application**

Slavoljub R. Aleksić, Nebojša B. Raičević, Saša S. Ilić, Nenad N. Cvetković
*University of Niš, Faculty of Electronic Engineerin, A. Medvedeva 14, 18000 Niš, Serbia*

**PS2-40 Determination of the Martensitic and Reverse Transformation Temperatures in Copper-based Shape Memory Alloys**

Ana Kostov, Radiša Todorović, Aleksandra Milosavljević
*Mining and Metallurgy Institute Bor, Zeleni bulevar 35, 19210 Bor, Serbia*

**PS2-41 Microstructural Investigation of the Ternary Cu-Al-Ag System**

Zdenka Stanojević Šimšić[1], Dragana Živković[2], Ana Kostov[1] Dragan Manasijević[2], Tamara Holjevac Grgurić,[3] Ivana Marković[2], Radiša Todorović [1]
*[1]Mining and Metallurgy Institute, Bor, Serbia, [2]University of Belgrade, Techincal faculty in Bor, Bor, Serbia, [3]University of Zagreb, Faculty of Metallurgy in Sisak, Sisak, Croatia*

**PS2-42 Investigation of Thermodynamic Properties of Cu-Al-Zn Alloys**

Lidija Gomidželović[1,*], Ana Kostov[1], Dragana Živković[2]
[1]*Mining and Metallurgy Institute, Zeleni bulevar 35, 19210 Bor, Serbia,* [2]*University of Belgrade, Technical Faculty in Bor, VJ 12, 19210 Bor, Serbia*

**PS2-43 Targeted Synthesis of Ceramic-Polymer Nanocomposites**

V. B. Pavlovic[1,2], M. Wu[3], V. Djokovic[4], M. Dukic[3], V. P. Pavlovic[5], B. Vlahovic[3,6]
[1] *FoA,Dpt.of Physics and Mathematics, University of Belgrade, Serbia,*[2]*Institute of Technical Sciences, Serbian Academy of Sciences and Arts, Belgrade, Serbia,*[3]*North Carolina Central University, Durham, NC, USA,*[4]*Vinca Institute of Nuclear Science, University of Belgrade, Serbia,* [5] *Faculty of Mechanical Engineering, University of Belgrade, Serbia,* [6] *NASA University Research Center for Aerospace Device Research and Education and NSF Center of Research Excellence in Science and Technology Computational Center for Fundamental and Applied Science and Education, North Carolina, USA*

**PS2-44 Phase Transformation in Si3N4 Ceramic Particles in Corundum Matrix Ceramic Shields**

László A. GÖMZE[1], Ludmila N. GÖMZE[2] and Norken L. GÖMZE[2]
[1]*Department of Ceramics and Silikate Engineering at University of Miskolc, (Hungary),* [2]*IGREX Engineering Service Ltd, Igrici, Hungary*

**PS2-45 Analysis of the Surface of Bio-OSS® Particles after Incubation in Cell Culture Medium using Scanning Electron Microscopy**

Sanja Stojanović[1], Stevo Najman[1], Miroslav Miljković[2], Žarko Mitić[3], Jelena Rajković[4], Miroslav Trajanović[5]
[1]*University of Niš, Faculty of Medicine, Department for Cell and Tissue Engineering; Institute of Biology and Human Genetics, Niš, Serbia,* [2]*University of Niš, Faculty of Medicine, Laboratory for Scanning Electron Microscopy, Niš, Serbia,* [3]*University of Niš, Faculty of Medicine, Department for Pharmacy, Niš, Serbia,* [4]*University of Niš, Faculty of Sciences and Mathematics, Department for Biology and Ecology, Niš, Serbia,* [5]*University of Niš, Faculty of Mechanical Engineering, Laboratory for Intelligent Production Systems, Niš, Serbia*

**PS2-46 Osteogenic Potential of Adipose-derived Mesenchymal STEM cells applied with Bio-OSS® as Carrier**

Stevo Najman[1], Ivica Vučković[2], Dragan Petrović[2], Slađana Petrović[3], Jelena Živković[1], Sanja Stojanović[1]
[1]*University of Niš, Faculty of Medicine, Institute of Biology and Human Genetics, Niš, Serbia,* [2]*University of Niš, Faculty of Medicine, Clinic of Stomatology, Department of Maxillofacial Surgery, Niš, Serbia,*[3]*University of Niš, Faculty of Medicine, Center for Radiology, Clinical Centre Niš,*

**PS2-47 Structural Features Amorphous-like Coatings AlN-$TiB_2$-$TiSi_2$ After Annealing (900, 1300)ºC and Their Impact on Physical and Mechanical Properties Changes**

A.D. Pogrebnjak, A.A. Demianenko
*Sumy State University, 2, Rimsky-Korsakov Str., Sumy, 40007 UK*

## PL1

# Structural Ceramics for Extreme Environments

William Bill Lee

*Dept. of Materials and Centre for Advanced Structural Ceramics (CASC), Imperial College London*

This lecture will examine, using examples from the authors own work, current development of structural ceramics for use in the extreme environments of future refractory, aerospace and nuclear applications. It will include consideration of high temperature, corrosive atmosphere and intense radiation flux (and sometimes all three).

## PL2

# 2D Atomic Layers from Layered Ceramics

Minoru Osada

*International Center for Materials Nanoarchitectonics (WPI-MANA), National Institute for Materials Science (NIMS), Tsukuba, Japan*
*E-mail.* osada.minoru@nims.go.jp

The enormous success of graphene has sparked the research and development of atomically thin, 2D materials from a broad range of other layered compounds. Here we review the progress made in 2D oxide nanosheets, highlighting emerging functionalities in electronic applications. A variety of oxide nanosheets (such as $Ti_{1-x}O_2$, $Ti_{1-x}Co_xO_2$, $MnO_2$, and perovskites) were synthesized by delaminating appropriate layered precursors into their molecular single sheets *via* soft-chemical process. These oxide nanosheets have distinct differences and advantages compared with graphene because of their potential to be used as insulators, semiconductors, and even conductors, depending on their composition and structures. Another attractive aspect is that oxide nanosheets can be organized into various nanoarchitectures by applying solution-based layer-by-layer assembly. Sophisticated functionalities or nanodevices can be designed through the selection of nanosheets and combining materials, and precise control over their arrangement at the molecular scale. We utilized oxide nanosheets as building blocks in the LEGO-like assembly, and successfully developed various functional nanodevices such as all nanosheet FETs, artificial Pb-free ferroelectrics, spinelectronic devices, magneto-plasmonic materials, Li-ion batteries, etc. Our work is a proof-of-concept, showing that new functionalities and nanodevices can be made from nanosheet-architectures.

## PL3

# Nonclassical Materials: Single Crystalline $BaTiO_3$ Nanocube, Supra Crystal and Their Properties

K. Kato[1], K. Mimura[1], Q. Ma[1], F. Dang[1], H. Imai[2], S. Wada[3], M. Osada[4], H. Hajime[4], M. Kuwabara[5]

[1]*National Institute of Advanced Industrial Science and Technology, 2266-98 Anagahora, Shimoshidami, Moriyama, Nagoya, Japan*
[2]*Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, Japan*
[3]*University of Yamanashi, 4-3-11, Takeda, Kofu, Japan*
[4]*National Institute for Materials Science, 1-1 Namiki, Tsukuba, Japan*
[5]*Kyushu University, 6-1 Kasuga-kouen Kasuga, Fukuoka, Japan*

Single crystalline {100} dominant $BaTiO_3$ nanocubes were synthesized by the hydrothermal method. The size was stepwise tunable in the range of 15 nm to 30 nm. During the growth, step and terrace structures were clearly observed on the {100} surfaces and the height of the each step and terrace was found to be identical to one unit cell. The nanocubes with a small size distribution were able to develop orderly structures on various kinds of substrates according to the capillary force assisted self-assembly mechanism during the evaporation of solvents from the dispersion. By post heat treatment at 1123 K, the assemblies have got relatively higher density and abnormal microstructure where the original cubes remained and a number of sharp interfaces run parallel in three dimensions. The local piezoresponse behaviors identified by PFM indicated the existence of ferroelectricity. Recently, the dielectric properties were characterized. The high dielectric constant of about 3000 and the relatively low loss of 0.07 were considered to be due to the high quality of $BaTiO_3$ nanocube and a number of interfaces. The $BaTiO_3$ nanocube and supra crystal are considered to be a kind of nonclassical materials for development of innovative functional devices and advanced processing.

## PL4

# Advanced Ceramics from Preceramic Polymers and Fillers

Paolo Colombo[1,2,3], Enrico Bernardo[4]

[1]*Department of Industrial Engineering, University of Padova, Italy*
[2]*Adjunct Professor of Materials Science and Engineering, Department of Materials Science and Engineering, The Pennsylvania State University, USA*
[3]*Visiting Professor, Department of Mechanical Engineering, University College London, UK*
[4]*Department of Industrial Engineering, University of Padova, Italy*

This talk will illustrate how it is possible, via the addition to a preceramic polymer (siloxane, carbosilane or silazane) of nano-sized powder fillers, such as γ-alumina, calcium carbonate, silicon nitride, magnesium hydroxide, and others, to obtain advanced ceramic materials such as mullite, cordierite, forsterite, yttrium silicate and SiAlON. The nano-sized fillers react very readily and with low activation energy with the ceramic matrix deriving from the decomposition of the preceramic polymer, leading to a fast crystallization kinetics and a high amount of crystalline phase present. Additionally, a high phase purity is achievable at low temperatures.

Besides advanced technical ceramics, this approach is also suitable for the production of silicate ceramics of interest for biomedical applications. In particular, we have produced bioceramic components by adding calcium carbonate (micro- or nano-sized powders) to silicone resins giving wollastonite ceramics after heating. Addition of HAp powders led to the fabrication of W/HA ceramics, while Mg- or Zn-containing bioceramics can be produced by adding suitable powder precursors to silicone resins.

Components can be produced in the shape of bulk parts, highly porous foams or thick coatings and can find several applications, such as wollastonite-apatite scaffolds for bone tissue replacement, mullite or yttrium silicate-based anti-oxidation coatings for SiC-based ceramics, pastes for joining of ceramic parts, or (when doped with rare earths) active materials for LEDs.

## PL5

# The Birth of Fracture Mechanics: A Perspective on Toughness

Sheldon M. Wiederhorn

*National Institute of Standards and Technology*
*Gaithersburg, MD, 20899-8500*

In this talk, we project backwards to a time before materials science, fracture mechanics and a way to characterize or modify the microstructure of materials in a controlled fashion. Universal mechanical test machines did not exist and standard means of establishing how a material would perform under a given load regime were still to be developed. Yet the needs for mechanical reliability were there, just as they are today. In this talk we review some of the problems encountered at the beginning of the 20$^{th}$ century that are still problems today. We shall show how the development of fracture mechanics and modern techniques of microstructural analysis enabled the solution of mechanical problems associated with the use of ceramics in modern applications. In the course of the lecture we will trace the development of fracture mechanics from the early 20$^{th}$ century to the present day and the replacement of performance tests with design criteria based on fracture mechanics analysis.

## PL6

# One-step Mechanical Method to Create Nanocomposite Structure and its Applications for Advanced Materials

Makio Naito, Akira Kondo, Takahiro Kozawa

*JWRI, Osaka University, 11-1, Mihogaoka, Ibaraki city, Osaka 567-0047, Japan*

One-step mechanical method stands for green and sustainable powder processing that creates advanced materials with minimal energy consumption and environmental impacts. So far, we have developed particle bonding method which is a typical one to make advanced composites. The technology has two main unique features. Firstly, it creates direct bonding between particles without any heat support or binders in the dry phase. The bonding is achieved through the enhanced particle surface activation induced by mechanical energy, in addition to the intrinsic high surface reactivity of nanoparticles. In this presentation, particle bonding method and its applications will be explained. Furthermore, by making use of the particle bonding principle, we have developed several unique one-pot methods to make nanocomposite structure. For example, a method to synthesize nanocomposite granules for LIB electrodes without extra heat was developed. Furthermore, the synthesis of nanoparticles and their bonding with another kind of particles was also achieved to make nanocomposite structure. It was applied for designing fuel cell electrodes. The disassembling of particle bonding structure was also achieved by using bonding method. It is effective for recycling composite materials to develop advanced materials. In this presentation, these methods and their applications will be also explained.

**PL7**

## Tailoring Ceramic Nanostructures for Nanodevice Applications

Branislav Vlahovic, Igor Filikhin, and Serge Matinian

*Department of Physics, North Carolina Central University, 1801 Fayetteville Street, Durham, NC 27707, USA*

Nanostructured ceramic materials are due to their unique properties of potential interest for development of novel nanodevice. Presented will be an accurate computational approach in modelling of their optoelectrical properties, which takes into account nanostructure composition, size, shape, and through an effective potential external fields, stress, and piezoelectrical potentials. Considered will be also collective effects of nanostructures on energy level spectra and charge transfer process between them. The effect of violation of symmetry of nanostructure geometry on the tunneling is studied in details. We show that small violation of geometry drastically affects localization of electron and leads to relaxation of delocalized state of the system. External electrical and magnetic fields applied to nanosystem are considered as another factor that violates the symmetry and has significant effect on "delocalized" electron wave function and charge transfer between nanostructures, which may impact nanodevice performance.

As a specific examples considered will be a novel biochemical sensor based on charge transfer between detector’s nanostructures and analyte molecules. The sensor is based on an original concept that relies on tunneling between an analyte molecule and the discrete energy levels of the nanostructures. As another example considered are ceramic nanostructures as active elements of photovoltaic devices.

## PL8

# FAMA – facility for Modification and Analysis of Materials with Ion Beams

N. Nešković

*Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia*

FAMA is the low energy part of the TESLA Accelerator Installation, in the Vinča Institute of Nuclear Sciences, Belgrade, Serbia. It is a user facility for basic and applied research in the field of modification and analysis of materials with ion beams, which was commissioned in May 1998. Currently, FAMA comprises three machines and four experimental channels. The machines are a plasma source of multiply charged heavy ions (M1), producing heavy ion beams of the energies up to about 500 keV, a plasma source of positive or negative light ions (M2), producing light ion beams of the energies up to 30 keV, and a proton cyclotron complex (M3), delivering proton beams of the energies between 1 and 3 MeV. The experimental channels are a channel for irradiation of materials (C1), a channel for surface modification of materials (M2), a channel for analysis of materials in vacuum (C5), and a channel for analysis of materials in air (C6). The C1 channel is connected to the M1 machine, the C2 channel to the M1 and M2 machines, and the C5 and C6 channels to the M3 machine. The program of FAMA is focused on new materials and directed to nanotechnologies. So far, 14 user groups have participated in its realization. Additional five user groups are expected to begin using FAMA in the forthcoming period.

**PL9**

# Electrical Discharge Machining (EDM) of High Performance Ceramics – Materials and Process Development for Wear Resistant Precision Tools with High Geometrical Complexity

Rainer Gadow, Richard Landfried and Frank Kern

*Institute for manufacturing technologies of ceramic components and composites, IMTCCC*
*University of Stuttgart, Allmandring 7b, D-70569 Stuttgart, Germany*
*rainer.gadow@ifkb.uni-stuttgart.de*

Important high value adding applications of modern structural ceramics are in the field of tools and dies in manufacturing engineering. I. e. processing of highly abrasive materials in powder injection molding or extrusion requires mold materials with high wear resistance to increase the durability of the tools and to sustain a high quality of the manufactured products. High performance ceramics which exhibit high hardness, bending strength and toughness feature the perfect combination of properties for these applications. Their drawback is, that they cannot be economically customized in complex shapes and small lot sizes, as they are required in tool and mold design. Recent development of electrically conductive oxide ceramics enabled the use of EDM, the most used process for machining of hard materials, as alternative to conventional ceramic manufacturing technologies. By combining the shaping and final machining of ceramics by EDM in one process step, complex shaped assemblies with fine structures, small tolerances and the benefits of ceramic material properties can produced.

The focus is on ZTA based ceramics with addition of titanium carbide that can be machined by wire EDM and die sinking. Mechanical and electrical properties of the materials as well as the characteristics of the machining process and its influence on the workpiece material are analyzed. Additionally the feasibility of the ceramic material for tool inserts is shown by real wear tests in extrusion dies.

## PL10

# Development of Zircon by Powder Injection Moulding

José M. Torralba [1,2], Carolina Abajo[1], Javier Hidalgo[1], Antonia Jiménez-Morales[1]

[1]*Department of Materials Science and Engineering, Universidad Carlos III Madrid, Spain*
[2]*IMDEA Materials Institute, Madrid, Spain*
*Corresponding author: José M. Torralba, josemanuel.torralba@imdea.org*

Powder Injection Moulding is a technology that allows obtaining high precision components of metals and ceramics. For PIM technology a powder with suitable characteristics must be used and usually ceramic powders not always can assure it. In the case of Zircon, the available powders are far from the optimal characteristics for a PIM feedstock. On the other hand, in recent years, many efforts have been made to obtain more environmentally acceptable powder injection molding processes. Therefore, this study has two different objectives. The first one is to develop a versatile eco-binder composition for metal and/or ceramic powders, based on polyethylene glycol (PEG) as a water soluble component and cellulose acetate butyrate (CAB) as a backbone natural polymer derived from cellulose. That means, to develop an eco-friendly feedstock system. The second one is to develop the above mentioned feedstock for a material (Zircon) with an extremely irregular powder, far from the optimal conditions of PIM technology. The character innovative of this investigation lies in the optimization of environmentally acceptable powder injection molding process. In particular, versatile binder system design by natural polymers and water solvent debinding stage for ceramics (the particular case of Zircon).

**PL11**

# Aqueous Processing of Water Sensitive Powders. How to Overcome the Hurdles?

José M.F. Ferreira

*Department of Materials and Ceramics Engineering (DEMaC), CICECO, University of Aveiro, 3810-193, Aveiro-Portugal*
Tel.: +351–234–370242; Fax: +351–234–370204; E–mail address: jmf@ua.pt

Aqueous processing is healthier, safer and more economic and environmental friendly in comparison to systems involving organic solvents as dispersion media. The term “solvent” derives from the ability of the dispersing liquid to dissolve different kinds of processing additives (dispersants, binders, plasticizers, etc.) to potentiate their specific roles along the successive processing steps. Water has a less dissolving power towards a number of polymeric additives, has a high surface tension and a relatively low vapour pressure at room temperature, making drying step more difficult and risky. Meanwhile, the development of high concentrated emulsion binders and of other complementary consolidation approaches encouraged several successful attempts at lab/pilot plant scales to replace organic solvents by water especially for ‘water insensitive’ powders. Moreover, recent developments on aqueous processing of water sensitivity ceramic powders were made by applying them a suitable surface treatment to hinder hydrolysis and non-stoichiometric dissolution events that would otherwise degrade the materials. Illustrative examples of successful aqueous processing water sensitive powders, including aluminium nitride, magnesium alumina spinel, barium titanate, barium strontium titanate solid solutions and other ferroelectric lead-free alkaline earth titanates / zirconates will be given by adopting different consolidation methods.

**PL12**

## Ozone Decay on the Metal Oxides Ceramics

S. Rakovsky, T. Batakliev, V. Georgiev, M. Anachkov, G. Zaikov[1]

*Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria*
*[1]Institute of Biochemical Physics – Russian Academy of Sciences, Moscow, Russia*

Investigations over different ceramics containing manganese, copper and nickel oxide of the ozone decay were made. By X-ray, ESCA, IR, UV and thermal methods the oxides were characterized. The decomposition coefficient "γ" is used to evaluate the catalytic activity of the ceramics. Coefficient "γ" is proportional to ozone decomposition rate and it has been already used in other studies f or catalytic activity estimation. The reaction carried out in the presence of thermally modified catalytic samples operating at different temperatures and ozone flow rates. By kinetic methods, surface measurements, temperature programmed reduction and IR-spectroscopy the reaction was followed. The phase composition of the metal oxide catalyst was determined by X-ray diffraction. The catalyst mixture has shown high activity in ozone decomposition at wet and dry $O_3/O_2$ gas mixtures. The mechanism of catalytic ozone degradation was suggested.

**PL13**

# Chemical Nanotechnologies: From Molecules to Functional Nanostructures for Energy and Health Applications

Sanjay Mathur
*Inorganic and Materials Chemistry, University of Cologne, Greinstrasse 6, D-50939 Cologne, Germany*
*E-mail: sanjay.mathur@uni-koeln.de*

Chemical nanotechnologies have played, in the past few decades a major role in the convergence of life, physical and engineering sciences leading not only to simple collaboration among the disciplines but to a paradigm shift based on true disciplinary integration. The successful synthesis, modification and assembly of nanobuilding units such as nanocrystals and wires of different materials have demonstrated the importance of chemical influence in materials synthesis, and have generated great expectations for the future. Implications of chemistry as an innovation motor are now visible for knowledge leap forward in various sectors such as materials engineering for energy, health and security.

Inorganic nanostructures inherit promises for substantial improvements in materials engineering mainly due to improved physical and mechanical properties resulting from the reduction of microstructural features by two to three orders of magnitude, when compared to current engineering materials. This talk will present how chemically grown nanoparticles, nanowires and nanocomposites of different metal oxides open up new vistas of material properties, which can be transformed into advanced material technologies. The examples will include application of super-paramagnetic iron oxide nanoparticles for magnetic resonance imaging (MRI) and drug delivery applications, vapour phase synthesis and electrospinning of nanowires for application as electrode materials and in water splitting reactions (for solar hydrogen production). A novel sensing concept based on the integration and correlation of complementary functionalities originating from multiple junctions in a singular nanostructure to palliate the current issues in gas sensor technologies such as low power consumption, low operating temperature and cost effective production will be elaborated. Finally, the current challenges of integration of nanomaterials in existing device concepts will be discussed.

## PL14

# A Novel, Highly Efficient Material for Photovoltaic Conversion: the $CH_3NH_3PbI_3$ Perovskite

László Forró

*Laboratory of Physics of Complex Matter, EcolePolytechniqueFédérale de Lausanne*

The lead-halide octahedra in organic-inorganic hybrid compounds can form 0, 2 and 3D structures. Recently, a 3D member of this family, the methylammonium lead iodide ($CH_3NH_3PbI_3$) perovskite turned out to be extremely efficient material in photovoltaic cells, with light conversion efficiency up to 19%. The investigation of the basic physical properties of this material is primordial for improving its performance in solar cells. In this talk few key measurements performed onlarge single crystals and on hybrid structures will be reported.

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## PL15

# The Bavarian Porcelain Industry Facing Global Competition - Changes, Chances and Challenges 1989 to 2014

Wilhelm Siemen

*Porzellanikon – Staatliches Museum für PorzellanSelb/Hohenberg an der Eger, Werner-Schürer-Platz 1D 95100 Selb, Germany*

During the last 25 years the Bavarian porcelain industry has changed in many ways. Facing global competition, first from the factories in the former GDR, then from the eastern European countries and until today by Asian producers the number of workers engaged dropped from 27.000 in 1992 to about 5.000 in 2014. Some of the well-known Bavarian companies –like f. e. Winterling, Eschenbach, Bareuther - do not exist anymore. Sometimes only the brands are still existing on the market. Their goods are produced from other European but also from Asian factories. Whilst this happened also 75% of the porcelain sales shops in Germany vanished. People decided to buy their goods at cheaper places. And at least society moved from the way of live: single living instead of the married couple with two children, mobility instead of staying at one certain place for lifetime, dining at restaurants instead of serving homemade food at home. After a long time of struggling the Bavarian porcelain producers today are almost in a good shape: a modernized production almost automatic and energy saving, products that respond to the new forms of lifestyle, high quality product from international designers for the world markets. In 2014 there is a sign of positive progress for those which remained. Innovation lead to better turnovers and improved earnings. The speech is focusing on these developments and names the changes in the 25years period, today's challenges and tomorrows chances."

## PL16

# Friction and Wear Behavior of Electrodeposited Cu-Si3N4 Composite Coatings

Maryam Eslami[1], Farhad Golestani-fard[1], Hassan Saghafian[1], Alain Robin[2]

[1]*School of Metallurgy and Materials Engineering, Iran University of Science and Technology, Tehran, Iran*
[2]*Engineering School of Lorena, Department of Materials Engineering, University of São Paulo, Brazil*

$Cu–Si_3N_4$ composite coatings were obtained by electrolysis from a copper sulphate solution containing dispersed $Si_3N_4$ particles of 0.4 or 1μm. The effect of electrodeposition parameters such as surfactant concentration, particle concentration and current density on the incorporation percentage of $Si_3N_4$, the preferred orientation of copper crystallites, the microstructure, the microhardness and the wear resistance of the coatings were investigated. The incorporation of $Si_3N_4$ particles into the copper matrix resulted in the production of composite deposits with finer structure and led to change the preferred orientation growth of copper grains. The presence of $Si_3N_4$ particles decreases the wear loss and the friction coefficient of the coating dramatically. Fluctuation of friction coefficient values for $Cu–Si_3N_4$ composite coating was lower compared with the pure copper coating. The wear properties of $Cu–Si_3N_4$ composite coatings were found to depend on the weight fraction, the size and the distribution of co-deposited particles.

## KN1

# Multifunctional Self-organized Nanowires and Nanowire Arrays

Srdjan Milenkovic[1], Achim Walter Hassel[2]

*[1]IMDEA Materials Institute, Eric Kandel 2, 28906, Getafe, Spain*
*[2]Institute for Chemical Technology of Inorganic Materials, Johannes Kepler University Linz, Altenberger Str. 69, A-4040 Linz, Austria*

Metallic nanowires have been promising materials for many novel applications, ranging from chemical and biological sensors to optical and electronic devices. Self-organized nanoarrays are usually produced using template-directed or lithographic methods. Here, a novel combined method is presented for producing self-organized metallic nanostructures. It combines directional solidification of eutectic alloys with electrochemical processing. In the first step directional solidification of a eutectic alloy with fibrous morphology yields self-organized arrays of nanowires of a minor phase embedded in a matrix of the other phase. The process is based on simultaneous crystallization and aligned growth of two phases parallel to the direction of heat extraction. In the next step either metallic nanowires or nanowire arrays are produced by selective matrix dissolution. This method has several advantages: i) it allows large scale synthesis; ii) both wires and matrix are single crystalline; iii) the obtained nanostructures exhibit extremely high aspect ratios (>1000), unreachable by most of the techniques, and iv) wire diameter and spacing can be controlled by the processing parameters such as growth rate and temperature gradient. The obtained nanostructures can be employed either as a model system for studying material properties, or high temperature STM tips, or as pH sensors.

**KN2**

# Magnetic and Structural Properties of $ZrO_2$(Fe, Mn) and CdO(Fe) Nanoparticles

I. Kuryliszyn-Kudelska[1], M. Arciszewska[1], A. Małolepszy[2], M. Mazurkiewicz[2], L. Stobinski[3], R. Minikayev[1], W. Paszkowicz[1], N. Nedelko [1], A. Grabias[4], M. Kopcewicz[4], W. Dobrowolski[1]

[1]*Institute of Physics, Polish Academy of Sciences, Al. Lotników 32/46, 02-668 Warsaw, Poland*
[2]*Warsaw University of Technology, Faculty of Materials Science and Engineering, 02-507 Warsaw, Wołoska 141, Poland*
[3]*Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 44/52, 01-224 Warsaw, Poland*
[4]*Institute of Electronic Materials Technology, Wolczynska 133, 01-919 Warsaw, Poland*

Nanosized magnetic oxides are of particular interest due to the potential commercial applications. The aim of the present work was to study the structural and magnetic properties of nanosized $ZrO_2$(Fe, Mn) and CdO(Fe) prepared by the hydrothermal method. The microwave assisted synthesis was conducted during 20 min in the reactor under a pressure of 55 bar. The detailed characterization was performed by means of X-ray diffraction (XRD) and high resolution transmission electron microscopy (HR-TEM) measurements. The systematic measurements of AC magnetic susceptibility up to 300K and magnetization as a function of magnetic field (up to 9T) and temperature were performed. We observed different types of magnetic behavior. The superparamagnetic like behavior and the Curie-Weiss behavior at high temperatures were observed. The observed disparity in magnetic behavior for different conditions of chemical synthesis will be discussed. In addition Mössbauer measurements allowed us to study both structural and magnetic properties of the samples doped with Fe.

**KN3**

## NanoTools for Ultrafast DNA Sequencing

Radomir Žikić

*Institute of Physics, Pregrevica 118 Belgrade, Serbia*
*radomir.zikic@ncs.rs*

In this talk, it will be presented main results of the project "NanoTools for ultrafast DNA sequencing" funded by EC FP7 framework programme. The goal of this project was to investigate a novel single-molecule DNA sequencing nanotechnology protocol (gene sequencer) that has potential to sequence a molecule of genomic dimensions in hours without expensive and fault sensitive DNA copying steps and chemical reactions. The gene sequencer is based on the electrical characterization of individual nucleobases, while DNA passes through a nanopore with integrated nanotube side-electrodes. In particular, unique combination of state of the art capabilities for cutting and usage of single wall carbon nanotubes as electrodes forming a lithographically fabricated "nanogap" with nanometer precision will be presented. Also, the IV characteristics of four nucleotides (including the sugar-phosphate group) between two carbon nanotubes at finite bias were studied using density functional theory in a finite electric field. The results show that the application of bias of about a few Volts can induce currents, depending on the base, of up to 10 nA.

**KN4**

# Transport Properties of Electron-doped $Sr_{1-x}La_xCu_2O_\delta$ Superconducting Thin Films

V. P. Jovanović [1], Z. Z. Li [2] and H. Raffy [2]

[1]*Institute of Physics, University of Belgrade, Pregrevica 118, 11000 Belgrade, Serbia*
[2]*Laboratoire de Physique des Solides, UMR 8502-CNRS, Université Paris-Sud, 91405 Orsay, France*

An important, still open question in solid state physics is the mechanism of high-temperature superconductivity observed in cuprate compounds, discovered 28 years ago. They are characterized by a layered structure – superconducting $CuO_2$ planes separated by doping layers. Superconductivity emerges from an insulating antiferromagnetic state by doping the $CuO_2$ planes with holes or electrons. Structurally, the simplest cuprate family is only composed of $CuO_2$ planes separated by Sr planes and it might be considered as a model cuprate. However, it appeared that such compound is difficult to prepare: no single crystals were produced to date. Ceramic samples are prepared under high pressure. Epitaxial films are also difficult to synthesize. We have studied $Sr_{1-x}La_xCuO_\delta$ (SLCO) compound which is electron-doped by partial substitution $Sr^{2+}/La^{3+}$. As most of research is focused on hole-doped cuprates, our goal was to make stable superconducting SLCO thin films to perform the first measurements of magnetic and electrical transport properties of this "model" cuprate family. C-axis oriented films were deposited by rf magnetron sputtering technique on heated substrates suitable for epitaxial growth. We determined basic superconducting properties of these films, namely the critical temperature and upper critical fields, and the temperature and field dependence of the critical currents. Normal state transport properties were also investigated. In particular a strong temperature dependence of the Hall number was observed, with a change of sign, indicating that two types of carriers are present. Negative in-plane magnetoresistance was also detected, indicative of some remaining antiferromagnetism. Any theory that concerns the mechanism of superconductivity of cuprates must be able to explain these properties.

**KN5**

# Magnetic Interactions and Magnetotransport in $Ge_{1-x}TM_xTe$ Diluted Magnetic Semiconductors

L.Kilanski[1], R.Szymczak[1], E.Dynowska[1], M.Gorska[1], A.Podgorni[1], W.Dobrowolski[1], M.Romcevic[2], V.E.Slynko[3] and E.I.Slynko[3]

[1]*Institute of Physics, Polish Academy of Sciences, al. Lotnikow 32/46, 02-668 Warsaw, Poland*
[2]*Institute of physics, University of Belgrade, 11080 Belgrade, Republic of Serbia*
[3]*Institute of Materials Science Problems, Ukrainan Academy of sciences, Chernovtsy, Ukraine*

Diluted magnetic semiconductors (DMS) allows an independent control of electrical and magnetic properties by many orders of magnitude via changes in the technological parameters of the growth or post growth treatment of the compound. DMS compounds are usually developed on the basis of a III-V or II-VI semiconductor matrix into which transition metal (TM) or rare earth ions are introduced on a level of several atomic percent. IV-VI based DMS, in particular $Ge_{1-x}TM_xTe$ alloys, possess many advantages over widely studied $Ga_{1-x}Mn_xAs$. The carrier concentration and the amount of TM ions can be controlled independently. Moreover, the solubility of TM ions in GeTe is very high allowing growth of homogeneous $Ge_{1-x}TM_xTe$ solid solutions over a wide range of chemical composition. Itinerant ferromagnetism can be controlled in a wide range of values reaching the Curie temperatures with a maximum of about 200 K for bulk $Ge_{1-x}TM_xTe$ with $x = 0.5$.

In this lecture, I will discuss the most important aspects of the current progress in understanding the structural, electrical, and magnetic properties of the selected representatives of Mn- and Cr- alloyed GeTe based DMS systems. I will start by presenting the present state of the studies of the physical mechanisms of the ferromagnetism and spin-glass-like states in $Ge_{1-x}TM_xTe$. I will present the most up-to-date results of the experimental work carried out at the Institute of Physics PAS in Warsaw. I will present the explanation of the nature of the magnetotransport effects such as negative magnetoresistance and anomalous Hall effect in $Ge_{1-x}TM_xTe$ solid solutions.

**KN6**

# Towards Electronic Materials Fractal Theory

Ljubiša M. Kocić[1] and Vojislav V. Mitić[2]

[1]*University of Niš, Faculty of Electronic Engineering, Niš, Serbia*
*ljubisa.kocic@elfak.ni.ac.rs*
[2] *Institute of Technical Sciences of SASA, Belgrade, Serbia*
*vmitic.d2480@gmail.com*

We are witnesses of blowing-up of new technologies and materials that nowadays are being introduced by the increasing rate. With huge diversity of electrophysical properties as well as difference between dimensions of 12 orders of magnitude, from nano tubes to boulders of ore which makes the length scale $10^{-9}$ to $10^{3}$ m yields a demand of introducing an universal analytic tool that will independent from both dimension and phenomenology. Next remark is that these materials are usually of amorphous, amorphous-crystals and crystals solid state ceramics, and thou of very irregular geometry, with characteristic example of powder metallurgy. There are also evidences of self-similar phenomena upon different magnitude of magnification of materials' grains or intergranular pores. Besides, the grains themselves possesses very irregular contours which makes difficult calculating their surface area or probability of intergranular contacts. All of these arguments makes reasonable to treat such materials as fractal objects and apply fractal analysis to extract new information about their inner properties regardless dimension range or underlying phenomena. The existing literature as well as our experiments and results show that materials like different ceramics, especially electronics ceramics materials, semiconductors, electromagnetics, ferroelectrics, multiferroics, thin films, diamond films etc., already have fractal nature. As practical outcome we propose introducing suitable correction quantities that would take care of fractal reality as well as involvement of important physical laws. Especially, these fractal nature analysis approaches do open a new perspective for deeper and higher level electronics integrations within the new fractal electronics ideas.

**KN7**

# Characterizing Griffith Cracks in Glass: a Measurement Problem

Sheldon M. Wiederhorn

*National Institute of Standards and Technology Gaithersburg, MD, 20899-8500*

When Griffith presented his famous theory of crack stability in elastic materials in the early twentieth century, he was unable to provide much detail on the structure of cracks at the nanometer level of resolution. Now, almost 100 years later, techniques such as Transmission Electron Microscopy, Atomic Probe Microscopy, Nuclear Reaction Analysis and Nuclear Reflection are available to achieve this level of resolution. Here we review the kind of data obtained by using these techniques and the implications of the data vis-á-vis cracks in silicate glasses. Measurements by atomic force microscopy provide information on the size of the nonlinear zone at crack tips in glass, on environmental conditions at crack tips and the possibility of cavity formation as a mechanism of crack growth. Examination by nuclear reaction analysis and neutron reflection of fresh fracture surfaces formed in water has yielded information on water penetration through the glass surrounding the crack tip, to a resolution of 3 nm to 5 nm. Improvement of measurement techniques in the coming years should enable us to study crack tips in glasses to higher levels of resolution and to answer more detailed questions concerning the level of stress and the size of the non-linear zone at the crack tip.

**KN8**

# Computer Simulation of Grain Coarsening Due to Diffusion and Deformation in Liquid Bridge

Zoran S. Nikolic[1] and Kazunari Shinagawa[2]

[1]*University of Niš, Faculty of Electronic Engineering, Serbia*
[2]*Kagawa University, Faculty of Engineering, Japan*

From many experiments with mixtures of small and large grains, it can be concluded that during liquid phase sintering (LPS), smaller grains partially dissolve and a solid phase precipitates on the larger grains and grain coarsening occurs. The growth rate can be controlled either by the solid-liquid phase boundary reaction or by diffusion through the liquid phase. When a liquid phase is dispersed between solid grains, there are three possible states of liquid bridges between contacting grains, which can be observed for increasing degrees of saturation in a system of two, three or more solid grains with interstitial liquid phase. For low saturation of the void space (< 25%), small quantity of liquid is distributed as individual liquid bridges between grains forming the cluster of connected grains. This state is called a *pendular* state in which the liquid phase is present under the form of a catenoid meniscus. By increasing the amount of the liquid, the *funicular* state is obtained where both liquid bridges as well as some of the pores filled with liquid are present. The *capillary* state is reached when all voids are completely filled. As a matter of fact, the funicular state characterized by the co-existence of liquid bridges and liquid-filled pores can be treated as the transition state to the capillary state. Note that at least three grains are necessary for the presence of funicular or capillary liquid bridges. Computer simulation of LPS can be realized applying viscoplastic finite element (FE) analysis and microscopic modeling. Taking into account the surface tension acting on the pore surface, and assuming that the grains during sintering are viscoplastic and the flow stress is proportional to the viscosity, one can calculate deformation behaviors of the grains for slightly compressible materials. Such approach can be specially applied for computer simulation of Ostwald ripening characterized by small amount of liquid located within liquid bridges only.Numerous researchers have studied LPS trying to determine the morphological evolution of a small number of particles during Ostwald ripening. The approach allows the bodies to change shape consistent with interparticle diffusional interactions and the interfacial concentrations as given by the Gibbs-Thomson equation. In this study, two-dimensional mathematical approach for simulation of grain coarsening by grain boundary migration based on a physical and corresponding numerical modeling of LPS will be considered. A combined mathematical method of analyzing viscous deformation and solute diffusion in pendular liquid bridge between two grains will be proposed. The viscous FE method will be used for calculating meniscus of the liquid bridge, with the interfacial tensions taken into consideration. The FE method for diffusion will be also implemented by using the same mesh as the deformation analysis. The similar approach will be applied for simulation of grain coarsening within capillary liquid bridge. To the best of our knowledge, there was no computer study of grain coarsening within pendular and capillary liquid bridges before. Simulation of the grain coarsening of W-Ni alloy will be demonstrated as a first step.

**KN9**

## Recycling of the Advanced Ceramic Materials

Srecko Stopic, Bernd Friedrich

*IME Process Metallurgy and Metal Recycling, RWTH Aachen University, Germany*

Recycling in the metallurgical processes plays a critical role in supporting the green economy in terms of recovering materials for reuse. Yttrium oxide found interesting applications in many industrial fields (superconductors, catalysis, crucible, oxygen sensor). The feasibility of using yttrium oxide as a crucible material or coating respectively for induction melting of titanium is widely used in metallurgy. During the production of crucibles based on yttrium oxide as well as through the melting/casting operations significant waste materials were formed. The ceramic material remaining from knock-off of the cast parts contains a high amount (up to 15%) of yttrium oxide from the front layers of the shells. In this study the recovery of yttrium oxide from various waste crucible materials by leaching, a subsequent precipitation and final thermal decomposition was studied. The solubility of available yttrium oxide in waste materials is a function of concentration, type of the leaching reagent as well as other process parameters. Selective dissolution of yttrium was investigated in some acidic solutions under atmospheric and high pressure conditions aiming the process efficiency and the feasibility for an industrial application. Regarding the high commercial value of yttrium oxide the scale up of recycling strategy was considered.

## KN10

# Ni-Al Layered Double Hydroxides as Precursors of Ceramic Pigments

Margarita Gabrovska[1*], Dorel Crişan[2], Nicolae Stănică[2], Dimitrinka Nikolova[1], Maya Shopska[1], Lyubima Bilyarska[1], Maria Crişan[2], Rumeana Edreva-Kardjieva[1]

[1]*Institute of Catalysis, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. Bl. 11, 1113 Sofia, Bulgaria*
[2] *"Ilie Murgulescu" Institute of Physical Chemistry, Romanian Academy, 202 Splaiul Independentei Str., 060021 Bucharest-12, Romania*

The controlled thermal treatment of Ni-Al layered double hydroxides (LDHs) results in formation of nano-sized Ni-Al mixed metal oxides and nickel aluminate spinel ($NiAl_2O_4$) with homogeneous distribution of $Ni^{2+}$ and $Al^{3+}$ ions.

Ni-Al LDHs with a ratio of $Ni^{2+}/Al^{3+}$ = 0.5, 1.5 and 3.0 were prepared by co-precipitation followed by stepwise heating in the range 200–1000$^{o}$C in an air. The aim of this study is to establish the effect of Ni content on the phase composition, morphology, thermal behavior, coordination of $Ni^{2+}$ ions and magnetic properties of Ni-Al layered compounds as basic materials for obtaining of ceramic pigments by varying the $Ni^{2+}/Al^{3+}$ molar ratio and the temperature of the thermal treatment. The solids were investigated using specific surface area measurements, powder X-ray diffraction, scanning electron microscopy, thermal analysis, infrared and diffuse reflectance spectroscopy, and magnetic susceptibility.

It was found that the color of the obtained oxide derivatives, varying from pale green to pale cyan, is determined by the coordination state of the $Ni^{2+}$ ions depending on the Ni content and the calcination temperature of the layered precursors. It may be concluded that Ni-Al LDHs represent promising materials for the preparation of ceramic pigments with different properties and applications.

## KN11

# What we Know and What we would Like to Know – New Developments in Characterisation of Pharmaceutical Materials

Milan D. Antonijević

*School of Science, Faculty of Engineering and Science, University of Greenwich (Medway Campus), Chatham Maritime, Kent ME4 4TB, UK*

Aims of current study are: to investigate how variations in molecular structure influence solid-state molecular mobility, as measured by TSDC, and secondly to assess if and how such mobility/relaxation properties relate to the thermal stability of the materials under investigations. Furthermore, alongside with assessing molecular mobility at sub ambient temperatures, solubility of particles in complex mixtures using combination of thermal/microscopic and separation methods is under investigation/development.

Thermally Stimulated Current spectrometer was used to investigate molecular mobility of small and large organic molecules in temperature range from -170°C to 250°C using heating rate of 10°C/min.

Thermally Stimulated Current Spectroscopy demonstrated usefulness in detecting and characterising previously unreported mobilities in samples. Almost all amorphous and crystalline samples under investigation revealed dipolar reorientation at temperatures significantly lower than their existing first and/or second order transitions. Those processes were easily classified as cooperative or non-cooperative suggesting type of interaction between neighbouring molecules or behaviour of backbone in high molecular weight molecules. Amino acids, peptides and proteins all demonstrated mobility that could not be easily inter-correlated implying that detected mobilities are not structural features that molecules can carry and transfer to new structure. Finally, TSC can be extremely useful technique for studying batch-to-batch variations due to enormous sensitivity to even spatially small mobility.

**KN12**

# Objective Measurement Method to Detect Hip Bone affected by Osteoarthritis

Francesco Lamonaca[1], Monica Vasile[2], Alfonso Nastro[3]

*[1]Dept. of Informatics, Models, Electronic and Systems, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy.(e-mail: flamonaca@deis.unical.it)*
*[2]Medical School, Ovidius University of Costanta, Bd.Mamaia 124, 900527, Costanta, Romania*
*[3]Department of Chemistry and Chemical Technology, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy*

Common disease in aging population is the Osteoarthritis (OA). It represents a major cause of disability and social isolation, especially where the hip is involved. The diagnosis of OA is problematic. Up today it is based on the observation of symptom during physical exercise: activity limitation associated with patient's hip pain. Obviously this approach is strongly influenced by the level of pain tolerance of the patient.

In the paper objective measurement method to detect hip bone affected by OA is presented. It is based on the application of the Thermo gravimetric (TG), Differential Thermo gravimetric (DTG) and Differential Scanning Calorimetry (DSC) analysis to some milligram of hip bone. These analysis are well known and deeply applied for engineering materials. The main advantages are: the use of well-known techniques permits to assess the traceability and the objectivity of the measurements; the use of reduced quantity of bone permits to be executed in ambulatory room.
Experimental tests are executed on bone samples with weight in the range 22-30mg extracted by healthy hip and hip affected by OA. The measurement system pointed out is composed by: NETZSCH STA 409 controlled by PC by using serial connection. The experimental conditions are the follows: (i) reference: 20mg of Coalino Calcinato , (ii) flow speed: 15ml/min, (iii) environment: air, (iv) temperature step: 10°C/min, (v) initial temperature 20°C, (vi) final temperature 800°C. NETZSCH STA 409 permits to evaluate at the same time both TG DTG and DSC. The advantage is the possibility to easily compare the three curves by assuming same environmental conditions. The experimental results confirm the effectiveness of the proposed measurement method by highlighting different trend of the experimental curves in the case of samples extracted by healthy or pathology hip bones.

## INV1

# Synthesis and Characterization of Magnesium Hydroxide Nanoparticles *via* Hydrothermal Method

A. Sierra-Fernandez[1,2], G. Flores-Carrasco[3], L.S.Gomez-Villalba[1], O.Milosevic[4], R. Fort[1], M.E.Rabanal[2]

[1]*Instituto de Geociencias (CSIC, UCM), C/ José Antonio Novais 2, 28040 Madrid, Spain*
[2]*University Carlos III of Madrid and IAAB, Department of Materials Science and Engineering and Chemical Engineering, Avda.Universidad 30, 28911 Leganes, Madrid, Spain*
[3]*CIDS-ICUAP Benemérita Universidad Autónoma de Puebla, Av. San Claudio y 14 sur, Edif. 103C C.U., Col. San Manuel, Puebla 72570, México*
[4]*Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, 11000 Belgrade, Serbia*

The interest in the nanostructured magnesium hydroxide ($Mg(OH)_2$) is rapidly growing due to the fact that its physical and chemical properties makes it appropriate for multiple applications. So far, it has been used in medicine, industry, or more recently, in the conservation of cultural heritage. The current research is based on the synthesis and the characterization of functional and nanocrystalline $Mg(OH)_2$ with different particle sizes, morphologies and high purity. The synthesis was carried out via the hydrothermal method using hydrazine hydrate as a precipitator. Moreover, due to it is essential to study the behaviour of this type of nanoparticles under factors as the time of exposition, the relative humidity and $CO_2$ concentration, they were exposed to controlled atmosphere at high relative humidity (75%RH). The carbonation process was also studied, identifying the different magnesium carbonate polymorphs.The physical and chemical property of synthesized $Mg(OH)_2$ nanoparticles have been characterized by X Ray diffraction (XRD), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), High resolution Transmission electron Microscopy (HR-TEM), thermogravimetry (TG) and differential scanning calorimetry (DSC). The results showed the successful use of this synthesis route to obtain $Mg(OH)_2$ nanostructured with important properties for the preservation of the stone heritage and promising $CO_2$ adsorption properties.

## INV2

# Electrical and Dielectric Characterization of Nanostructural Ceramic Materials by Complex Impedance Spectroscopy

D. L. Sekulić[1], Z. Ž. Lazarević[2], N. Ž. Romčević[2]

[1]*Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia*
[2]*Institute of Physics, University of Belgrade, Belgrade, Serbia*

A complex impedance spectroscopy is a powerful technique to understand the electrical and dielectric behavior of ceramic materials, especially of ferroelectric materials such as ferrites. The concept microstructure is fundamental to ceramics and the link between microstructure and electrical properties is not always obvious or straightforward. The ability of this useful method to differentiate the transport characteristics of grains and the grain boundaries, two main components that comprise the microstructure, is very important in understanding the overall properties of ceramics. The measurement data can be analyzed in terms of electrical impedance, dielectric permittivity and electric modulus, which represent the same information expressed in various ways. Specifically, our results are discussed for four different nanostructured ferrite materials, $M\mathrm{Fe_2O_4}$ ($M$ = Mn, Ni, Zn, Mg), obtained by soft mechanochemical synthesis. The experimental data equivalents to the real and imaginary parts of complex electrical quantities were measured as a function of the frequency of the applied electric field from 100 Hz to 40 MHz at several temperatures. The importance of choosing the correct and appropriate equivalent electrical circuit to represent the data is presented in the case of nanocrystalline ferrites, with their characteristic temperature-dependent capacitance.

## INV3

# A- and B-site Substitutions Effect on the Dynamic Relaxation Processes in Tetragonal Tungsten Bronzes

Andrei Rotaru[1,2,3] and Finlay D. Morrison[3]

*[1]University of Craiova, Faculty of Mathematics and Natural Sciences, Department of Chemistry, A.I. Cuza 13, Craiova, Romania*
*[2]INFLPR-National Institute for Laser, Plasma and Radiation Physics, Laser Department, Bvd. Atomistilor, Nr. 409, Magurele (Ilfov), Bucharest, Romania*
*[3]University of St Andrews, EaStCHEM, School of Chemistry, North Haugh, KY169ST, St Andrews, Fife, Scotland, United Kingdom*

The tetragonal tungsten bronze (TTB) structure $(A1)_2(A2)_4C_4(B1)_2(B2)_8O_{30}$ gives an extra degree of freedom to the flexibility if compared to the perovskite structure, enhancing the separation of magnetic and ferroelectric ordering to distinct sublattices and makes possible various compositional substitutions. Of particular interest are niobium based TTBs due to their enhanced ferroelectric properties over other analogues such as tantalum or tungsten; however, the majority of the tetragonal tungsten bronzes reported in the literature exhibit relaxor properties. Despite the extensive past and recent work on TTBs our understanding of how to manipulate this structure is poor compared to other systems.

The family of tetragonal tungsten bronze relaxors of composition $Ba_{6-x-y}Sr_xCa_yGaNb_9O_{30}$ and $Ba_6M^{3+}Nb_9O_{30}$ ($M^{3+}$ = $Ga^{3+}$, $Sc^{3+}$ and $In^{3+}$, and their solid solutions) were studied in an attempt to understand their dielectric properties to enable design of novel polar TTB materials. A combination of electrical measurements (dielectric and impedance spectroscopy) and powder diffraction (X-ray and neutron) studies as a function of temperature was employed for characterising the dynamic dipole response in these materials. Electrical measurements indicate frequency dependence of both permittivity and dielectric loss characteristic of relaxor behaviour in all compositions [1]. For A-site substitutions, the dipole stability appears to show correlation with the degree of local strain as quantified by the statistical A-site size variance. For B-site substitutions the dipole freezing temperature, increased with increasing M cation size; dipole freezing was directly correlated to the structural anisotropy (maximal crystallographic strain).

## INV4

# Electronics Ceramics Materials Fractal Nature and Entrophy

Vojislav V.Mitić[1,2], Ljubiša Kocić[1], Vesna Paunović[1], S. Jankovic[3], Vlada Pavlović[2,4]

[1]*University of Niš, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*
[3]*Mathematical Institute of SASA, Belgrade, Serbia*
[4]*University of Belgrade, Faculty of Agriculture, Belgrade, Serbia*
*vmitic.d2480@gmail.com*

$BaTiO_3$ based ceramics has attracted a considerable attention during the years due to its excellent physical and electrical properties and numerous practical application such as multilayer capacitors (MLCCs), PTC thermistors, varistors etc.

There is also evidence of growing need and interest for energy storing increasing capacities in all cases, new and alternative energy sources.

From all these points of view, there is a very important question of regarding contact surfaces between two grains from the aspect that surface, in spite of being a structure defect, could be very useful and important to have such structure prognosis in the light of increasing the contact surface for the energy fluctuations and storages aspect within the controllability of electronics properties based on intergranular impedance model.

So, it is very important to establish the mathematical-physical approach to the model of such type of fractal grains' contact surfaces.

It is a fundamental question to put in correlation fractal nature which is practically recognize the order in every disorder in the structures and systems from the second point of view.
Regarding the entropy nature of structures and motions in the ceramics materials nature, within the energy-fundamental temperature relation, we are are now attacking the very base of electro-physical phenomena in the sense of broader frontiers, of higher levels electronics integrations and miniaturizations.

## INV5

# The Sintering Activation Energy of Various Advanced Ceramics and Composites

Karel Maca

*Dept. of Ceramics and Polymers, Brno University of Technology, Technicka 2, 616 69 Brno, Czech Republic*
*CEITEC BUT, Brno University of Technology, Technicka 10, 616 00 Brno, Czech Republic*

The sintering kinetics of alumina, tetragonal zirconia and cubic zirconia as well as their layered composites was evaluated with the help of two theoretical models, namely Master Sintering Curve and Wang & Raj model. The samples were sintered particularly by conventional pressure-less sintering (either by single step sintering or by two step sintering), but also by microwave sintering and pressure-assisted Spark Plasma Sintering. The calculated sintering activation energies show that the sintering is governed at least by two different mechanisms, one acting at low densities and second one at high densities.

## INV6

# Application of Integral Characteristics in Thermodynamics and Quantum Mechanics

Dimitrije Stefanović[1], Janja Nedović[1] , Časlav Stefanović[2]

[1]*Faculty of Electronic Engineering 18000 Niš, SERBIA, janja89@yahoo.com and vule@elfak.ni.ac.rs*
[2]*Faculty of Mathematics and Natural Science, Kosovska Mitrovica, SERBIA, caslav.stefanovic@gmail.com*

In our previous papers from mathematics, regarding more specific field of mathematics-combinatory, and electronic theory of the sintering processes we have shown, that the sets of curves which represents multinomial coefficients have characteristically behavior. When considering its extremums, with necessary conditions which are in relation with degree of freedom of the particles, i.e. partition and composition of distribution functions. Moreover, in the papers of the field of telecommunications we have shown that almost all distribution functions own integral characteristics also.

In this paper, we need to make concept, which enables application of integral characteristics in two very different fields of science – thermodynamics and quantum mechanics. This concept is based on analysis of the laws of statistical thermodynamics and qauntum mechanics with curves of entropy and solution of Schroedinger equation for atoms. We consider in parallel integral curves of fundamental entropy, which is analog with fine graining, with usually used functions of distribution functions: for example in one of the papers on this conference we considered Maxwell-Boltzmann distribution. Also, we considered in parallel curves of fundamental entropy, which is similar to coarse graining, and Planck's and Bose – Einstein distributions. In the last case we used Bohr's and Bohr-Sommerfield's planetary models of athoms.

**INV7**

# Biodegradable Composite Materials

Dumitru Nedelcu

"*Gheorghe Asachi" Technical University of Iasi, Romania, Blvd. Mangeron, No. 59A, 700050 Iasi, Romania, nedelcu1967@yahoo.com*

Large-scale use of non-renewable resources has led to a significant increase of both the fossil raw materials pricing - a threat to the global economy and the last two decades atmospheric concentration of carbon dioxide – known to affect the global climate. Estimates on the following decades indicate these resources are to be exhausted. Therefore a considerable lowering of the finite resources consumption would prevent the needs of the present from compromising the ability of future generations to meet their own needs. It is known the most of the energy resources, the polymers, and the synthetic organic polymers are derived from fossil fuels such as oil and natural gas. Resources can be maintained if a sustainable future is to be provided by using bio-based materials comprising maximum possible quantity of biomass renewable derivatives. Bioplastics, biofibers, biocomposites and related biomaterials will serve as substitutes for materials and products traditionally made from petroleum resources. To anticipate this need, the German Fraunhofer Institute for Chemical Technologytogether with Tecnaro GmbH Company (founded byJurgenPfitzer and Helmut Nagele) have made studies and developed - based on wood components - a new material which can be processed in the same way as thermoplastics. Arboform is the output of natural fibres, lignin, and additives mixing. It can be obtained by using different types of lignin (30%) extracted out of processes and sources (10 types at least), natural fibres 60% (flax, hemp, sisal, wood) and10% natural additives (softeners, pigments, processing agents, etc.). Arboform is the trade name for a fully biodegradable bioplastic composite also known as "liquid wood". The material properties – biodegradability and reusability up to ten times without modifications of its features - recommended it to be the near future alternative to all plastic materials. Depending on the quantity of the mixed components, Arboform can be provided in three different variants: LV3 Nature, F45Nature and LV5 Nature. The component elements are mixed and tamped without heating so that to obtain compound granules. This composite material can be injected into moulds by the same injection technology applied to plastics. Arboform is used in the manufacture of a wide range of products, for example: automotive parts, modular circuit boards, watch cases, computer and television set components, etc. In terms of biodegradation, Arboform behaves like wood as it decomposes into water, humus and carbon dioxide proving it to be more eco-friendly than plastics emitting fumes when incinerated. Moreover, Arboform production does not involve supplementary cutting down of trees as lignin is a pulp and paper industry product. Arboform is a high-quality thermoplastic engineering material and is involved in applications requiring state-of-art technology standards. Natural wood positive properties joining the processing features of thermal plastic materials make Arboform the "liquid wood" capable to replace in future times any regular plastic within all activity fields.

The hereby study describes the lignin production process, biodegradability against international standard ISO 1485: 2004, Arboform processing, mechanical, electrical and thermal properties of samples, and the microstructural analysis.

## INV8

# Where is Archaeology without Physical and Chemical Analysis in the Ceramic Technology Studies?

Biljana Djordjević

*National Museum in Belgrade, Belgrade, Serbia*

Archaeology can not achieve all goals without relying on Natural Sciences. Thus, geomagnetic research has become essential part of every field survey and C14 analysis are the most reliable confirmation of the age of an archaeological unit so far. Archaeobotany and archaeozoology are reliable clue to the knowledge of flora and fauna in the past. Stone analysis provide information on the sources of raw materials in one area but also about the cultural contacts of the communities in the past. All these analysis have become an indispensable part of archaeological research and a data from different locations are often easily comparable. This is not the case with ceramics. The great variety of clays at the local level and usual addition of tempers make the identification of the clay source extremely complex. Therefore, the analysis of the chemical composition of ceramic vessels, as well as local clays are of great importance for the further development of archeology in this field. What archaeologists expect from these analysis and what thay can really get are the questions that this paper aims just to open.

## OR1

# Synthesis and Characterization of Nanostructured Hybrid Systems of Ag&ZnO Obtained by Solvothermal Method for Photocatalytic Applications

L. Muñoz[1], A. Sierra-Fernandez[1,2], L.S.Gomez-Villalba[2], O.Milosevic[3], M.E.Rabanal[1]

*[1]University Carlos III of Madrid and IAAB, Department of Materials Science and Engineering and Chemical Engineering, Avda.Universidad 30, 28911 Leganes, Madrid, Spain*
*[2]Instituto de Geociencias (CSIC, UCM), C/ José Antonio Novais 2, 28040 Madrid, Spain*
*[3]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, 11000 Belgrade, Serbia*

In this work is reported the solvothermal synthesis of hybrid nanostructured ZnO&Ag systems starting from zinc nitrate hexahydrate ($Zn(NO_3)_2 \cdot 6H_2O$) and silver nitrate ($Ag(NO_3)_2$) as precursors. The structural and morphological properties of the obtained hybrid materials were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Subsequently, the photocatalytic behavior of prepared systems was evaluated. The results verify the viability of as-synthesized ZnO&Ag nanocomposites for its application in the removal of contaminants in water. The best results (percentage of pollutant removal > 99 %) are obtained for samples synthesized at low temperature, intermediate times, higher ratios $Ag^{+}/Zn^{2+}$ and in the presence of CTAB, which controls the final morphology of nanostructures and the dispersion thereof. These results prove that the system morphology is critical to the properties of the obtained material.

## OR2

# Ultrasonic Processing of Hierarchically Organized $TiO_2$ Functional Nanomaterials

Ivan M. Dugandzic[1], Dragana J. Jovanovic[2], Lidija T. Mancic[1], Zoran V. Saponjic[2], Jovan M. Nedeljkovic[2], Olivera B. Milosevic[1]

[1]*Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000, Belgrade, Serbia*
[2]*Vinča Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

Hierarchically organized functional nanomaterials are of interest for potential use in electrochemical, catalytic and gas-sensing applications due to their unique structural organization defined on different length scales. Here we present the application of the aerosol processing route in generation of hierarchically organized nanostructured $TiO_2$ particles. Particles are obtained by the thermal decomposition of aerosol generated by atomization of colloidal $TiO_2$ solution with a low-intensity ultrasound generator operating at the high frequency of 1.7 MHz. By a proper choice of the precursors type and concentration, as well as processing parameters (temperature of aerosol decomposition and the residence time of droplet/particle), fine control over both the submicron- and nanometer-length scales of spherically structured $TiO_2$ was achieved. The median diameter and the crystallite size of titania particles were found to be tunable from 350 to 450 nm and from 2.5 to 50 nm, respectively. Moreover, it was shown that the structural complexity of the particles synthesized at the lower processing temperatures might be further extended by their surface sensitization with several bidentate ligands. The results obtained demonstrate advantages of ultrasonic spray pyrolysis route in synthesis of hierarchically organized functional nanomaterials.

## OR3

# Influence of $Sm_2O_3$ on the Microstructure and Dielectric Characteristics of Codoped $BaTiO_3$ Ceramics

Vesna Paunović[1], Vojislav Mitić[1,2], Ljiljana Živković[1], Ljubiša Kocić[1]

[1]*University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*

The samples of Sm/Mn codoped $BaTiO_3$ ceramics, prepared by conventional solid state procedure with dopant concentrations ranged from 0.1 up to 5.0 at%, were investigated in this paper. The specimens were sintered at 1290°C and 1350°C in an air atmosphere for two hours.

The low doped samples demonstrated the mainly uniform and homogeneous microstructure with average grain sizes ranged from 0.3 μm to 5.0 μm. The appearances of secondary abnormal grains in fine grain matrix and core-shell structure were observed in highly doped $Sm/BaTiO_3$ sintered at 1350°C.

Dielectric measurements were carried out as a function of temperature up to 200°C. The low doped samples, sintered at 1350°C, display the high value of dielectric permittivity ($\varepsilon_r$=6800 ) at room temperature. A nearly flat permittivity-response was obtained in specimens with 5.0 at% additive content. Using a modified Curie-Weiss low the Curie-like constant $C^{\checkmark}$ and a critical exponent $\gamma$ were calculated. The obtained values of $\gamma$ pointed out the diffuse phase transformation in heavily doped $BaTiO_3$ samples.

## OR4

# The Research of the Physical and Chemical Mechanism and Kinetics of Reactionary SPS-sintering of $TiB_2$ – TiN Composition

Petukhov O.[1], Khobta I.[1], Herrmann M.[2], Rathel J.[2],
Ragulya A.[1]

*[1]Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine. 03680, Kiev -142, 3, Krzhyzhanovsky St., Ukraine*
*[2]Fraunhofer IKTS, Winterbergstrasse 28, 01277, Dresden, Germany*

The aim of the present study was the research of physical and chemical mechanism and kinetics of reaction of $TiB_2$-TiN composition synthesis at reactionary (R) SPS-sintering. The thermogravimetric analysis (TA), differential thermal analysis (DTA) of the thermal treatment process of the $TiH_2$-B-hBN powder mixture and mass-spectroscopic analysis (MSA) of this thermal treatment products at 20-1300$^o$C were conducted. The components ratio corresponded to final content of $TiB_2$ 50 wt.% in $TiB_2$ - TiN composition. The powder mixture was sintered by RSPS method at 1100 and 1700$^o$C and the soaking of 0,5 min. The sintered samples were subjected to the X-ray analysis (XRA).

The release of physically bound water (~0,2 wt.%) occured at 80-150$^o$C. The mass basic loss ($H_2$ release) occured at 375-700 $^o$C. 4 peaks were presented on the DTA curve: 1 - 320, 2 - 450, 3 - 540, 4 - 660 $^o$C. The 1$^{th}$ peak was related to the transition of the part of hydrogen atoms from tetrahedron to octahedral $TiH_2$ positions. The 2$^{th}$ peak (450$^o$C) was the result of hydrogen moving away from the tetrahedron pores. Hydrogen moving away from the octahedral pores occurred at more high temperature ( the 3$^{th}$ peak - 540$^o$C), as this process was most laboured in terms of energy at $TiH_2$ thermal decomposition. The 4$^{th}$ peak was related to the release of remaining hydrogen from the octahedral pores and by the reduction by the atomic hydrogen of $B_2O_3$ oxide.

The hBN, TiN, $TiN_{0.3}$, $TiB_2$, TiB phases appeared after the sintering at 1100$^o$C according to X-ray phase analysis data. $TiB_2$-TiN composition appeared with hBN tracks after the sintering at 1700$^o$C.

## OR5

# FTIR/DRIFT Contactless Measurement of Salt Crystallization Phenomena

D. Čjepa[1], S. Vučetić[1], O. Rudić[1], S. Pašalić[2], S. Vujović[3], J. Ranogajec[1]

[1]*Faculty of Technology, University of Novi Sad, 21000, Novi Sad, Serbia,*
*damir.cjepa@tf.uns.ac.rs*
[2]*Serbian Ministry of Education, Science and Technological Development, Nemanjina 22-24, 11000 Belgrade, Serbia*
[3]*Provincial Institute for the Protection of Cultural Monuments, 21000, Novi Sad, Serbia*

Understanding of the mechanisms of building material degradation is essential in the terms of materials durability assessment and repairing. One of the most frequent problems related to materials durability is decomposition due to crystallization of soluble salts. Investigations of these problems mainly involve destructive analysis based on material sampling. Usage of non-destructive techniques without sampling of the material is valuable especially in the area of culture heritage.

The aim of this work is the implementation of FTIR spectroscopy (DRIFT contactless measurement), method which is preferably non-destructive, and could be very useful in the assessment of qualitative and quantitative analysis of salt crystallization. Also, in this work comparison of the results obtained by FTIR spectroscopy and other standard methods for the salt mechanisms monitoring (X-ray diffraction, Ion chromatography and Electrical conductivity measurements) is presented. Combination of afore mentioned techniques presents a significant step toward solving problems related to understanding salt crystallization phenomena in the real environment such are cultural heritage objects.

## OR6

# Magnetic Characterization of PIM MnZn Ferrite for Power Electronic Application

Nebojša Mitrović, Elvis Gašanin,
Aleksandra Kalezić -Glišović, Borivoje Nedeljković, Maja Kićanović

*Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems,*
*Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia,*
*nebojsa.mitrovic@ftn.kg.ac.rs*

One of the most common applications of soft magnetic ferrites is for cores in modern electronic components such as switching power supply transformers and amplifiers.

In this study, magnetic characterization of soft-magnetic manganese zinc ferrite manufactured by powder injection moulding – PIM technology were presented. A powder consisting of $Mn_{1-x}Zn_xFe_2O_4$ and a small amount of hematite $\alpha$-$Fe_2O_3$ was mixed with an organic binder (wax and thermoplastic) to form ferrite feedstock. Then, injection moulded toroidal samples were solvent, thermally debinded prior to sintering in air atmosphere (1340 $^{O}$C, 3.5 hours). Magnetic properties were investigated on toroidal core samples by a hysteresis graph (B-H curve at different frequencies up to 10 kHz at high level of magnetic excitation up to 6 kA/m). Magnetic power losses were analyzed as frequency dependent by evidence of apparent power, i.e. the magnitude of complex power S and active (real) power P. As the hysteresis losses are proportionally to the frequency (~ f) and eddy-current losses are proportionally to the square of frequency (~ $f^2$) it was performed separation between these two components of active power. Numerical fitting of these functionality on frequency were performed and analysed.

The results obtained were compared with the catalogue data for other MnZn ferrite samples prepared by conventional methods.

## OR7

# Selection of the Most Suitable Non-conventional Machining Processes for Ceramic Processing by Using MCDMs

Dušan Petković[1], Miloš Madić[1], Goran Radenković[1]

[1]*University of Niš, Faculty of Mechanical Engineering, Aleksandra Medvedeva 14, Niš, Serbia*

Selection of the most suitable nonconventional machining process (NCMP) for a ceramic material machining represents a multi-criteria decision making (MCDM) problem with conflicting and diverse objectives. Many different MCDM methods have been developed, and new ones are being developed.

This paper describes the use of a new MCDM, i.e. weighted aggregated sum product assessment (WASPAS) method for selecting the best or optimal NCMP for the given application. By applying WASPAS, ten NCMPs (alternatives) were ranked based on the ten beneficial and non-beneficial criteria, where the best alternative was ranked as 1 and the worst one as 10. Comparison of obtained ranking performance with other MCDM methods used by previous researchers was carried out in order to demonstrate WASPAS applicability and capability.

## OR8

# The Fractal Nature Grains Shape Reconstruction on the Way to Microstructure Prognosis

Filip Bastić[1], Danijel Sirmić[1], Miloš Cvetanović[1],
V.V. Mitić[1,2], V. Lj.Kocić[1], V. Paunović[1]

[1]*University of Niš, Faculty of Electronic Engineering, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*
*filip.bastic@gmail.com*

The structure of $BaTiO_3$ based ceramics materials, can be controlled by using different pressing pressures, sintering temperatures and different additive concentrations. In this paper, microstructure properties of $Ho_2O_3$ doped $BaTiO_3$-ceramics have been investigated. Different concentrations have been used, as well as different sintering temperatures. The ratio of dopant concentration ranges from 0.05% to 1%. Also, three different sintering temperatures are applied (1320°C, 1350°C and 1380°C). For selected contacted grains, the SEM (Scanning Electron Microscope), equipped with EDS (energy dispersive spectrometer) microphotographs are taken providing suitable configuration for structural and electrical model study. Analysis of SEM are twofold. The first one is based on conversion of 2D digital gray photos into numerical data, which represent 3D surface defined over dimensions of the microphotograph. The second analysis of fractal (box-counting) dimension direct calculation by using gray microphotographs graphical analyzing program is done. From above analysis, the important conclusions, are taken concerning the considered materials, from the frontiers view points, the ceramics structures prognosis within the electronic properties designing.

Keywords: $BaTiO_3$-ceramics; fractals; microstructure; microphotograph

**OR9**

## Sculptural Concretes: Use in Restoration

Rajko Blažić

*High School-Academy for Art and Conservation, Serbian Ortodox Church*

It is especially necessary to mention the use of Sculptural Concretes in smaller artefacts, through the use of techniques of impression and casting, in demanding artistic work, copying, multiplication, production of missing parts, or in the cheaper full reconstruction of parts or replicas of entire parts or objects.

**PS1-1**

# Characterization of Material as a Supply Source for Heritage Aqueduct Construction in FYR Macedonia

Zagorka Radojević[1], Ivana Delić Nikolić[1], Anja Terzić[1]

[1]*Institute for Materials Testing, Vojvode Mišića Boulevard 43, Belgrade, Serbia,*
*e-mail: zagorka.radojevic@institutims.rs, ivana.delic@institutims.rs,*
*anja.terzic@institutims.rs*

Aqueduct which is situated in Skoplje, FYR of Macedonia represents an important archeological emplacement. Judging from the aspect of cultural heritage, but also from the aspect of material science, this historical site provides plenty of investigation material. It is not possible to determine the exact date of building of the aqueduct, due to the changes and reparation work performed on some parts of the structural elements. The condition of the aqueduct is adversely, namely, level of deterioration of some parts of the construction is high. This investigation was conducted as the initial stage of the restoration and renovation of the object. In this light, the first step was to mark sampling locations on the object and to sample characteristic brick specimens. Special attention was paid on avoiding of the additional damage of the monument. After sampling procedure, specimens were carefully preserved and prepared for further laboratory testing; by such making the investigation results as accurate as possible. Namely, precise results of the physical, mechanical, chemical and mineralogical properties give a closer insight to the structure of "old" brick material and enable to design "new material" with similar properties which would be applied in restoration process. Applied investigation is mostly engaged with textural characteristics because newly designed material that ought to replace original material built in the monument should aesthetically fit in the building conception and satisfy durability of this renovated heritage monument.

Keywords: ceramic, brick, stone, textural properties, cultural heritage.

Acknowledgements: This investigation was supported by Serbian Ministry of Education, Science and Technological Development and it was conducted under projecs III 45008.

## PS1-2

# Corundum and Bauxite Refractory Shotcretes based on Activated Waste Coal Ash: Investigation of Thermally Induced Properties Change

Anja Terzić[1], Zagorka Radojević[1], Ljiljana Miličić[1], Nina Obradović[2], Ljubiša Andrić[3]

[1]*Institute for Materials Testing, Belgrade, Serbia*
[2]*Institute of Technical Sciences of Serbian Academy of Sciences and Arts, Belgrade, Serbia*
[3]*Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia*
*anja.terzic@institutims.rs*

The necessity for application of activated secondary raw materials in refractory industry is caused by a growing demand for refractory castables with advanced properties and continuous technological evolution of high-temperature materials. In this investigation, refractory shotcretes with the same matrix composition were prepared from 15 wt.% of high aluminate cement and 45 wt.% of bauxite aggregate + 30 wt.% of chamotte filler, i.e. 75% of corundum aggregate. The request for obtaining a low-cement castable is fulfilled by application of 10 wt.% of mechanically activated coal ash as the cement substitution in the shotcretes. The ash was activated by means of various high energy mechano-activators. Results were compared in order to choose the most efficient activation procedure. The properties have been studied at temperatures ranging from room temperature to adopted maximal temperature 1400°C. Mechanisms of hydration and sintering were investigated by means of differential thermal analysis at three different heating rates. The measurements showed different activation energies for ordinary shotcretes and shotcretes with activated ash. The evolution of the refractory shotcretes properties was investigated and correlated to microstructural changes induced by temperature and microfiller addition. The combination of advantages in investigated refractory shotcretes makes them suitable for use in severe conditions at high temperature applications especially in refractory industries.

Keywords: waste ash, ceramics, composites, refractories, ceramics, sintering, ecology.

Acknowlegements This investigation was supported by Serbian Ministry of Education, Science and Technological Development and it was conducted under following projects: 172057 and 45008.

**PS1-3**

# Self Sensing Concrete

Gordana Topličić-Ćurćić, Dušan Grdić, Nenad Ristić, Zoran Grdić

*University of Nis, The Faculty of Civil Engineering and Architecture, Serbia*
*gordana.toplicic.curcic@gaf.ni.ac.rs, dusan.grdic@hotmailc.rs, nenad.ristic@gaf.ni.ac.rs, zoran.grdic@gaf.ni.ac.rs*

Most of infrastructural structures around the world is built of concrete. Conventional concrete serves as a structural material, but it does not have the so called sensory abilities. It is necessary that the conventional concrete should increase its ability to "sense" cracking or damage in itself, and also to sustain, or even improve its mechanical properties. The reason for the mentioned fact is because great effort must be made in order to restore the damaged infrastructural buildings into serviceable and safe condition.
Self-sensing concrete is the new direction in the field of material research in the last several years: it is been called: self-sensing concrete, self-monitoring concrete, intrinsically smart concrete, piezoresistive or pressure-sensitive concrete.
Self-sensing concrete monitors the condition of the building structure, maintain it and helps provide necessary data for assessment of the structural integrity of the structure.
The paper shows some of the examples of the self sensing concrete, using optical fibers and smart aggregates.

Keywords: conventional concrete, self-sensing concrete, optical fibers, smart aggregate.

**PS1-4**

# The Use of Different Analytical Techniques in the Proces of Investigated Ceramic Materials

A.Radosavljević-Mihajlović

*ITNMS, Bulevar Franshe d Eperea 86, Belgrade, Serbia*
*a.radosavljevic@itnms.ac.rs*

Forensics in the broadest sense means the application of knowledge and technologies in various fields of science in criminal and civil law processes within the criminal justice. Rapid technological and scientific development leads to new physical-chemical techniques, which have become very effective to processes of detecting and resolving various criminal incidents. The physico-chemical and analytical techniques that are commonly used and applied in the identification of different materials with the criminal act of the gas chromatograph mass (gas chromatograph-mass spectrometer -GCMS), spectroscopic methods (Fourier Transform Infrared spectrophtometer FTIR, IR), various X-ray methods (X-ray diffractometers by XRD, the XRD spectroscopy), as well as a scanning electron microscope (SEM / EDAX spectra). The aim of this paper is to bring the listed instrumental and analytical methods in the field of forensic tests, as well as their application in solving various criminal incidents.

Keywords: forensic, FTIR analysis, X-ray powder diffraction, SEM/EDAX analsys

## PS1-5

# The Use of X-ray Powder Analysis for Investigation of Ceramic Materials

Ana S. Radosavljevic-Mihajlovic[1], Jovica Stojanovic[1], Anja M. Dosen[2]

[1]*ITNMS Bulevar Franche dEpere, 11000 Belgrade, Serbia*
[2]*Faculty of Mining and Geology, Department of Crystallography, University of Belgrade, Đušina 7, 11000 Belgrade, Serbia*
*a.radosavljevic@itnms.ac.rs*

The X-ray powder diffraction is very simple method for characterizing the microstructure and structure of ceramic materials. With this method we can observed the different parameters like average crystallite size and strain, the position of atoms in structure, average dislocation density, different types of internal stresses. In this work are presented the X-Ray line profile analysis based on X-Ray powder diffraction patterns for investigate the microstructure of nanocrystalline materials.

Keywords: X-ray powder diffraction, ceramic materials, microstructure

**PS1-6**

# The Synthesis and Crystal Structures of Diphylloaluminosilicates Phase Doped with $Ca^{2+}$ and $Gd^{3+}$

Ana S. Radosavljevic-Mihajlovic[1], Jovica Stojanovic[1], Anja M. Dosen[2]

[1]*University of Belgrade - Vinca Institute of Nuclear Sciences, P.O. Box 522, 11001 Belgrade, Serbia*
[2]*Faculty of Mining and Geology, Department of Crystallography, University of Belgrade, Đušina 7, 11000 Belgrade, Serbia*
*e-mail* a.radosavljevic@itnms.ac.rs

This work deals with the crystal structures of doped Ba-hexacelsian with $Ca^{2+}$ and $Gd^{3+}$ ions. The ion-exchange procedure is used for doping the Ba-hexacelsian structure with $Ca^{2+}$ and $Gd^{3+}$. The crystal structures of both doped samples are refined and described in this article. The crystal structure of Ca doped hexacelsian is refined in the space group $P\bar{3}c1$ and results indicate ordering distribution of Si and Al (unit cell parameters is $a$=5.2995, $c$=15.594 Å and agreement factors: $R_{exp}$= 15.3 $R_p$=19.9, $R_{wp}$=19.0, $R_B$=15.0 $R_F$=4.08). The results of Rietveld refinements indicate that $Ca^{2+}$ cations are incorporated into hexacelsiane structure without change structure. The thermal treatment of Gd doped hexacelsian was change the strucuture into galenite.

**PS1-7**

## Combining Fresh and Ripe Sculptural Concretes

Rajko Blažić

*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

A very good characteristic of Sculptural Concretes is that, even after many years, a new detail can be added in the same color and texture, in accordance with the customer's wishes, to the old, basic surface. It is recommended that all the realized recipes – as they are in most cases different – should be preserved so that future customers will have a larger catalog of materials to choose from, but also in order to meet the needs of old clients if they should require new work, added details or additions to the original composition. Bonds between the two masses, the old and the new, cannot be detected.

**PS1-8**

## Gold and Silver Plating Concretes

Rajko Blažić,
*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

The issue of Sculptural Concretes' surface isolation before and after gold plating was researched for about ten years and quality results were achieved, in the form of neutralized atmospheric effects both in interiors and exteriors. The final protection also secures resistance to eventual mechanical damage (scratching, touching, etc.).
In order to accentuate the fullness of gold, a single coat of red acrylic color is used as one of the bases, while acrylic indigo or dark blue is used for silver. A finely finished surface is also of great significance.

**PS1-9**

## Sculptural Concretes: Unusual Montages

Rajko Blažić

*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

In addition to friezes, monumental wall compositions composed of multiple parts of varying dimensions, shapes and sizes are the most interesting – as they offer limitless possibilities of application in color, ornamentation, texture or surface work.
Work on such compositions does not require any special conditions or machines, and can be performed in all types of weather and construction conditions, because the entire process of use of Sculptural Concretes is tied to workshop work.

**PS1-10**

## Sculptural Concretes: Stone Immitation

Rajko Blažić

*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

Taking into account that the basic aggregate is stone rubble in various granulations, immitation of natural stone in color and texture is quite successful.

A very good characteristic of Sculptural Concretes is that, even after many years, a new detail can be added in the same color and texture, in accordance with the customer's wishes, to the old, basic surface. It is recommended that all the realized recipes – as they are in most cases different – should be preserved so that future customers will have a larger catalog of materials to choose from, but also in order to meet the needs of old clients if they should require new work, added details or additions to the original composition. Bonds between the two masses, the old and the new, cannot be detected.

This technique is especially appropriate for unusual shapes, free forms, and particularly for the decoration of concrete columns, where it has unlimited advantages compared to other artistic solutions and materials.

**PS1-11**

# The Mirrors

Zvonko Petković

*High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

As far as light sources are concerned, distinction should be made between objects which radiate with their own light and those which reflect light received from another light source. When light rays hit an object, delimited by either straight or curved, regular or irregular surfaces, they are partly (if possible) absorbed by the object and partly, to a greater or lesser degree, reflected from its surface. The type of reflection depends on the nature of the surfaces hit by the light: if the surface is grainy, uneven, rough – i.e. generally speaking irregular, then the light is scattered in all directions and we call it diffuse light. The light reflected from smooth surfaces will behave quite differently: it will not be scattered but reflected in a single direction. In this case, the eye cannot perceive light from all points (as it is the case with the light reflected from rough surfaces), but only from a certain sequence of points, i.e. the path along which the light is reflected. Furthermore, while the light reflected from rough surfaces enables us to perceive the surface (e.g. paper), in the light reflected from smooth surfaces we see only the reflected light and the surface can be seen only if it is not absolutely smooth and it also reflects diffuse light. When we speak about the reflection of light, we usually imply the reflection from smooth surfaces. Such smooth surfaces which regularly reflect light are called *mirrors*.

**PS1-12**

# Natural Carbonate Fillers

Ljubiša Andrić[1], Anja Terzić[2], Marko Pavlović[3], Milan Petrov[1], Ljubica Pavlović[1], Zagorka Aćimović[3]

[1]*Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia*
[2]*Institute for Materials Testing, Belgrade, Serbia*
[3]*University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*

Natural carbonate fillers are amongst most important and most economical inorganic fillers. These fillers are being widely applied in civil engineering, road bases, and various industrial braches such as industry of colors and lacquers, polymers, paper, abrasives, pesticides, electrodes, pharmaceuticals, etc. During previous twenty years, a significant technological advancement has been performed on global level which further enabled and widened carbonate fillers application. In Serbia, the production of high quality fillers is not fully established; therefore consumers are orientated on imported raw materials which originate from the countries that produce super-fine and ultra-fine carbonate qualities. However, the production possibilities are not only modern technology related; they are based on starting raw material of adequate quality. Production and application of natural carbonate fillers are targeted by manufacturers of modern micronizing milling equipment, which can be seen in their constant attempts to obtain higher quality of carbonate fillers that are applied in various industrial branches. Micronized non-metallic mineral raw materials are already replaced variety of other mineral fillers which are found in insufficient quantities in nature and whose manufacturing technology is by far more complex and therefore much more expensive. The most important advantage of carbonates is in their prevalence in superficial parts of Earth crust, quantity of rock masses, easy processing and micronizing. Natural carbonate fillers, due to new processing techniques such is micronizing milling, represent good and inexpensive aternative for the other micronized natural inorganica materials. With its fineness and whiteness some of the products that belong to the natural calcium carbonates ($CaCO_3$) group can compete with chemically precipitated calcium carbonates. Micronized natural carbonate fillers represent an important addition in technological processing and their final goal is to shape the properties of the final product. In many cases, regarding the carbonate filler quantity in a final product, they might as well be treated as a basic component.

Key words: fillers; powders; micronization; particle size; fineness; ceramic raw materials.

Acknowledgements: This investigation was supported by Serbian Ministry of Education, Science and Technological Development and it was conducted under following projects:

**PS1-13**

# Calcium Carbonate Fillers Prepared by Means of Micronized Milling with Application in Coatings

Marko Pavlović[1], Anja Terzić[2], Ljubiša Andrić[3], Milan Petrov[3], Ljubica Pavlović[3], Zagorka Aćimović[1]

[1]*University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*
[2]*Institute for Materials Testing, Belgrade, Serbia*
[3]*Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia*

Rapid technological development in past few decades led to formation of a certain group of ceramic materials which are often referred to as "coating agents". This term is rather descriptive because materials that belong to this group show varieties in its shape and appearance. Coatings are disperse systems, and their mutual component is a binding agent or binder which can be organic or inorganic. Treatment of the filler particles surfaces by means of micronizing milling is conducted with an aim to improve the filler properties which are employed during their application in coatings. This technology was applied on the carbonates first and later on other types of materials. Basic criteria which carbonate fillers have to fulfill in order to give a quality coating are: particle size, shape of micronized particle, hardness, density, color, abrasiveness, breaking index, chemical composition, whiteness level, consistency (chemical and time-relevant), etc. A certain type of filler can not have all criteria fulfilled, therefore its application is being chosen after knowing the filler properties. The grain size composition plays an important role in choosing of a fillers application. Regarding granulometry, i.e. mean particle diameter fillers can be categorized as: 1) micronized fillers (<10 μm); 2) fine powder (10 – 50 μm); 3) average fine powder (50 – 250 μm); 4) coarse powder (>250 μm). Calcium carbonate fillers applied in coating systems can contain particles sizing from extremely fine (parts of μm) to coarse (above 250 μm). However, this is not the only criterion, since the covering ability in the thin layer depends of the light refractive index, binder, etc. The researching in area of application, development and manufacturing of carbonate fillers is disclosed. The development of devices and procedures for micrionizing milling and mecheno-chemical activation is an actual theme; therefore the collaboration between manufacturers of coatings and carbonate fillers is of utter importance. Mutual collaboration will contribute to the development of new technical and technological procedures and reaching of the global standards of quality in production of the carbonate fillers for application in coatings.

Keywords: fillers; powders; coatings; micronization; particle size.

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**PS1-14**

# Advanced Optimization of Heavy Clay Products Quality by Using Artificial Neural Network Model

Milica Arsenović[1], Lato Pezo[2], Lidija Mančić[3], Zagorka Radojević[1]

[1]*Institute for testing of materials IMS, Belgrade, Serbia*
[2]*University of Belgrade, Institute of general and physical chemistry, Belgrade, Serbia*
[3]*Institute of Technical Sciences of SASA, Belgrade, Serbia*

The effects of firing temperature (800–1100°C), chemical composition (expressed in terms of the content of major oxides - $SiO_2$, $Al_2O_3$, $Fe_2O_3$, CaO, MgO, $Na_2O$, $K_2O$, MnO and $TiO_2$), as well as several shape formats of laboratory brick samples on the final product quality were investigated. Prediction of the final laboratory products parameters was evaluated by second order polynomial regression models (SOPs) and artificial neural networks (ANNs), and afterwards both models were compared to one another and to experimental results. . Observed parameters of fired products that were determined in this study were: compressive strength (*CS*), water absorption (*WA*), firing shrinkage (*FS*), weight loss during firing (*WLF*) and volume mass of cubes (*VMC*). SOPs showed high $r^2$ values (0.897 - 0.913 for compressive strength models, 0.942-0.962 for water absorption, 0.928 for firing shrinkage, 0.988-0.991 for water loss during firing and 0.941 for volume mass of cubes models). ANN model, coupled with sensitivity analysis, was obtained with high prediction accuracy: 0.866–0.939 for compressive strength models, 0.954–0.974 for water absorption, 0.882 for firing shrinkage, 0.982-0.988 for water loss during firing and 0.920 for volume mass of cubes models. The optimal samples chemical composition and firing temperature were chosen depending on a final usage of the raw material in heavy clay brick industry.

Keywords: Heavy clay products; Prediction; Optimization

**PS2-1**

## Properties of Zig-zag Nickel Nanostructures Obtained by GLAD Technique

J. Potočnik[1], M. Nenadović[1], M. Popović[1], B. Jokić[2] and Z. Rakočević[1]

[1]*University of Belgrade, INS Vinča, Laboratory of Atomic Physics, Mike Alasa 12-14, 11001 Belgrade, Serbia*
[1]*University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11000 Belgrade, Serbia*

In this study, zig-zag structure of the nickel thin film has been obtained using Glancing Angle Deposition (GLAD) technique. Glass substrate was positioned 75 degrees with respect to the substrate normal. Thickness of the deposited thin film was 440 nm, which was achieved for the deposition time of 3 hours. The obtained nickel thin film was characterized by X-ray Photoelectron Spectroscopy, Scanning Electron Microscopy and Atomic Force Microscopy. Surface energy of the deposited thin film was determined by measuring the contact angle using the static sessile drop method. It was found that the deposited thin film consists of 78.2 at.% of nickel. The diameter of the columns was 22 nm and the surface roughness value was 1.60 nm. According to contact angle measurements, it was found that the value of the surface energy was 29 $mJ/m^2$.

**PS2-2**

# Argon Irradiation Effects on the Structural and Optical Properties of Reactively Sputtered CrN Films

M. Novaković, M. Popović and N. Bibić

*VINČA Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

The present study deals with CrN films irradiated at room temperature (RT) with 200 keV $Ar^+$ ions. The CrN layers were deposited by d.c. reactive sputtering on Si (100) wafers, at nitrogen partial pressure of $5\times10^{-4}$ mbar, to a total thickness of 280 nm. The substrates were held at 150ºC during deposition. After deposition the CrN layers were irradiated with 200 keV $Ar^+$ ions to the fluences of $5\times10^{15}$ – $2\times10^{16}$ ions/cm$^2$. Structural characterization was performed with Rutherford backscattering spectroscopy (RBS), cross-sectional transmission electron microscopy (XTEM) and X-ray diffraction (XRD). Spectroscopic ellipsometry measurements were carried out in order to study optical properties of the samples. The irradiations caused the microstructrual changes in CrN layers, but no amorphization even at the highest argon fluence of $2\times10^{16}$ ions/cm$^2$. Observed changes in microstructure were correlated with the variation in optical parameters. It was found that both refractive index and extinction coefficient are strongly dependent on the defect concentration in CrN layers.

**PS2-3**

## Annealing Effects on the Properties of TiN Thin Films

M. Popović, M. Novaković and N. Bibić

*VINČA Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

The structure, optical properties and electrical resistivity studies on TiN thin films is presented. The film of thickness 240 nm was grown on Si (100) substrate by dc reactive sputtering at an average deposition rate of ~ 8 nm/min. After deposition the samples were annealed for 1h at 600 and 2h at 700$^{o}$C in nitrogen ambient and vacuum furnace, respectively. Structural characterizations were performed by Rutherford backscattering spectrometry (RBS), X-ray diffraction (XRD) and transmission electron microscopy (TEM). The optical properties were investigated by spectroscopic ellipsometry while a four point probe was used for electrical characterization. It was found that the post-deposition annealing of the films did not cause any variation in stoichiometry, but strongly affects the structural parameters such as lattice constant, micro-strain and grain size. The observed increase in the grain size after annealing leads to significantly lower value of the coefficient of absorption. These changes could be directly correlated with variation of electrical properties of TiN thin films.

**PS2-4**

## Raman Spectroscopy of Optical Properties in CdS Thin Films

J. Trajić[1], M. Gilić[1], N. Romčević[1], M Romčević[1],
G. Stanišić[1], B. Hadžić[1], Y.S. Yahia[2]

[1]*Institute of Physics, P.O. Box 68, University of Belgrade, 11080 Belgrade, Serbia*

[2]*Nano–Science& Semiconductor Labs., Department of Physics, Faculty of Education, Ain Shams University, Roxy, Cairo, Egypt*

Properties of CdS thin films were investigated applying atomic force microscopy (AFM) and Raman spectroscopy. CdS thin films were prepared using technique of thermal evaporation under base pressure 2 x $10^{-5}$ torr. The quality of these films was investigated by AFM spectroscopy. We determined that all samples surfaces are relatively smooth and uniform, having well defined nanosized grains with relatively small values of roughness. Raman spectra measurements reveal, besides characteristic CdS modes and their multiphonon combinations, existence of surface optical phonon (SOP) mode at 297 $cm^{-1}$. We treated the CdS thin film as a mixture of homogenous spherical inclusion in air and modeled it by Maxwell – Garnet formula.

## PS2-5

# Raman and IR Spectroscopic Study of Nanostructured $Ni_{0.5}Zn_{0.5}Fe_2O_4$ Prepared by Soft Mechanochemical Synthesis

Z. Ž. Lazarević[1], Č. Jovalekić[2], A. Milutinović[1], M. Romčević[1],
G. Stanišić[1], M. Gilić[1], N. Ž. Romčević[1]

[1]*Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia*
[2]*The Institute for Multidisciplinary Research, University of Belgrade, Serbia*

Ferrites have been extensively investigated in recent years for their useful electrical and magnetic properties and applications in information storage systems, magnetic bulk cores, magnetic fluids, microwave absorbers and high frequency devices. Among the spinel ferrites, Ni-Zn ferrite is a magnetic material that is much used by the modern electronics industry due to its high electrical resistivity, high values of magnetic permeability, low dielectric loss, together with high mechanical strength, good chemical stability, and low coercivity.

Spinel Ni-Zn ferrite was obtained by soft mechanochemical synthesis in a planetary ball mill starting from two mixtures of the appropriate quantities of the powders: (1) oxide powders: $NiO/ZnO/Fe_2O_3$ in one case, and in the second case (2) hydroxide powders: $Ni(OH)_2/Zn(OH)_2/Fe(OH)_3$. The powder samples obtained after 5h and 10h of milling were characterized by X-ray diffraction, transmission electron microscopy, Raman, IR and Mössbauer spectroscopy. The synthesized ferrites have a nanocrystalline structure with a crystallite size of about 13nm and 16nm, respectively. In the far-IR reflectivity spectra are seen four active modes. Raman spectrum suggests an existence of mixed spinel structure in the obtained nano-powder samples. Mössbauer spectroscopy studies implied on the possible cation distribution between the tetrahedral and octahedral sites in formed ferrite.

## PS2-6

# Surfactants Assisted Hydrothermal Synthesis of $NaYF_4$ co-doped $Yb^{3+}/Er^{3+}$ Up-conversion Nanoparticles

Ivana Z. Dinic[1], Ivan M. Dugandzic[1], Lidija T. Mandcic[1], Maria Eugenia Rabanal[2], Olivera B. Milosevic[1]

*[1]Institute of Technical Sciences of SASA, 11000 Belgrade, Serbia*
*[2]Materials Science and Engineering Department and IAAB,*
*Universidad Carlos III de Madrid, Avda de la Universidad 30, 28911 Leganes, Spain*

In the past few years there is a great interest for synthesis of the surface modified up-conversion nanoparticles that can be used for biomedical application such as bio-detection, fluorescene imaging and drug delivery. Thanks to their enhanced tissue penetration depth, improved stability against photo-bleaching and low cytotoxicity Ln-doped fluorides have been recognized as novel near-infrared fluorophores. Among them, $NaYF_4$ is considered to be one of the most efficient low phonon energy host for Ln-ions doping, particularly its hexagonal form which poses multisite character of the crystal lattice. In this work $NaYF_4$ nanoparticles co-doped with $Yb^{3+}$ and $Er^{3+}$ were synthesized using the hydrothermal method at 200 ºC (3h) in the presence of polyvinylpyrrolidone (PVP) and polyethylene glycol (PEG), used as surfactants and structure directing agents also. Obtained particles were analyzed by X-ray powder diffractometry (XRPD), Furrier transform infrared spectroscopy (FTIR) and scanning/transmission electron microscopy (SEM/TEM). It was shown that addition of PVP enhance the crystallization of hexagonal $NaYF_4$:$Yb^{3+}$, $Er^{3+}$ phase which provide more intense green emission CIE (0.31, 0.66), assigned to the $Er^{3+}$ ($^2H_{11/2}$, $^4S_{3/2}$) → $^4I_{15/2}$ electronic transitions, after been excited with infrared light (λ=978 nm).

**PS2-7**

# Growth, Structural and Optical Studies of Neodymium Doped Yttrium Aluminum Garnet

S. Kostić[1], Z. Ž. Lazarević[1], M. Romčević[1], A. Milutinović[1],
V. Radojević[2], M. Petrović-Damjanović[1], N. Ž. Romčević[1]

[1]*Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia*
[2]*The Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia*

In this paper, we used the Czochralski method to obtain good quality yttrium aluminium garnet ($Y_3Al_5O_{12}$) – YAG and yttrium aluminium garnet doped with neodymium – Nd:YAG crystals. The investigations were based on the growth mechanisms and the shape of the liquid/solid interface on the crystal properties and incorporation of $Nd^{3+}$ ions. The obtained single YAG and Nd:YAG crystals were studied by use of X-ray diffraction, Raman and IR spectroscopy. There are strong metal oxygen vibrations in region 650–800 $cm^{-1}$ which are characteristics of Al–O bond: peaks at 784/854, 719/763 and 691/707 $cm^{-1}$ correspond to asymmetric stretching vibrations in tetrahedral arrangement. Peaks at 566/582, 510/547 and 477/505 $cm^{-1}$ are asymmetric stretching vibrations and 453/483 $cm^{-1}$ is symmetric vibration of Al–O bond in octahedral arrangement of garnet structure. Lower energy peaks correspond to translation and libration of cations in different coordinations – tetrahedral, octahedral and dodecahedral in the case of the lowest modes.

**PS2-8**

# Influence of $Er^{3+}/Yb^{3+}$ Concentration Ratio on the Down-conversion and Up-conversion Luminescence and Lifetime in $GdVO_4$: $Er^{3+}/Yb^{3+}$ Microcrystals

Tamara V. Gavrilović,[1] Dragana J. Jovanović,[1] Vesna Lojpur,[1] Aleksandar Nikolić[2] and Miroslav D. Dramićanin[1]

[1]*Laboratory for Radiation Chemistry and Physics, Vinča Institute of Nuclear Sciences, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*
[2]*Faculty of Chemistry, University of Belgrade, Studentski trg 12-16, Belgrade*

Here we studied the effects of $Er^{3+}/Yb^{3+}$ concentration ratio on structural, morphological and luminescence properties of $GdVO_4$:$Er^{3+}/Yb^{3+}$ green phosphors prepared by a high-temperature solid-state method. The samples with different concentrations (between 0.5 to 2 mol%) of dopant $Er^{3+}$ emitting ion and different concentrations (between 5 to 20 mol%) of sensitizer ion ($Yb^{3+}$) were studied. The phosphors were characterized by the X-ray diffraction (XRD), scanning electron microscopy (SEM) with semi-quantitative EDX analysis and photoluminescent spectroscopy. For all samples, XRD diffraction patterns confirmed a formation of a pure $GdVO_4$ phase.

Both, downconversion (under 330 nm excitation) and upconversion (under 980 nm excitation) emission spectra show two strong emissions in the green region near 525 and 550 nm corresponding to the $^2H_{11/2} \rightarrow {}^4I_{15/2}$ and $^4S_{3/2} \rightarrow {}^4I_{15/2}$ transitions of $Er^{3+}$ ions, respectively. Additionally, two relatively weak peaks are appearing at 660 nm ($^4F_{9/2} \rightarrow {}^4I_{15/2}$ transition) and around 410 nm ($^4H_{9/2} \rightarrow {}^4I_{15/2}$ transition). The intensity of the green emission was changed by changing $Er^{3+}/Yb^{3+}$ concentration ratio. Obtained results indicate that the molar ratio 1.5:20 ($Er^{3+}$:$Yb^{3+}$) could be an optimum for production of material with high upconversion green emission intensity. The values of a lifetime at wavelengths of 552 nm are about 100 μs.

**PS2-9**

# Annealing Effects on Luminescent Properties of $Eu^{3+}$ Doped $Gd_2Zr_2O_7$ Nanopowders

M. S. Rabasovic[1], D. Sevic[1], J. Krizan [2], M. D. Rabasovic[1] and N. Romcevic[1]

[1]*Institute of Physics, University of Belgrade, Serbia*
[2]*AMI d.o.o, Trstenjakova 5, 2250 Ptuj, Slovenia*

In this report presented are structure, morphology and luminescence properties of nanopowders based on gadolinium zirconium oxide ($Gd_2Zr_2O_7$) doped by europium ions ($Eu^{3+}$). The nanopowders were prepared using a flame combustion method, the most frequently used process due to the simplicity and low cost of the synthesis procedures and also due to the possibility of tailoring the size and morphology of particles. The produced material is suitable for various optical devices. The structure of prepared materials has been confirmed and characterized using X-ray powder diffraction (XRD), scanning electron microscope (SEM) and photoluminescence (PL) techniques. The luminescence properties of synthesized nanopowders were characterized by emission spectra and luminescence lifetimes obtained by using the streak camera system. Moreover, emission spectra were obtained and compared for powders as-obtained and after additional annealing at 1200 $^{o}$ C. Luminescence emission spectra clearly show peaks characteristic for the strong emission lines at 611 nm and 630 nm corresponding to the $^5D_0 \rightarrow {}^7F_2$ long lived transition.

**PS2-10**

# The Morphological Characterization of Mechanically Activated ZnO Powder

A. Peleš[1], S. Filipović[1], N. Obradović[1], J. Krstić[2], V. Pavlović[1]

[1]*Institute of Technical Sciences of SASA, Knez Mihailova 35/IV 11000 Belgrade, Serbia*
[2]*Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Njegoševa 12, 11000 Belgrade, Serbia*

The authors investigated the morphological characteristics of mechanically activated ZnO powder. ZnO powder was mechanically activated for 2, 5, 10 and 30 minutes in a planetary ball mill. Mechanical activation introduces lattice disorder and defects into ZnO hexagonal wurtzite structure. In order to determine specific surface area and pore volume, we performed $N_2$ porosimetry and SEM in order to investigate the microstructure of non-activated and mechanically activated ZnO powders. Using Kubelka-Munk function, UV-Vis spectra showed the reducing in band gap with activation time. ZnO powder activated for 5 minutes has the narrowest band gap.

**PS2-11**

# Strontium Containing Polyphosphate Glass for Fabrication of 3D-scafold for Biomedical Application

V. D. Živanović [1], S. D. Matijašević[1], J. D. Nikolić [1], Grujić [2], S. V. Smiljanić[2,] S. N. Zilđović[1], V.S. Topalović[1]

[1]*Institute for the Technology of Nuclear and other Mineral Raw Materials, 86 Franchet d'Esperey St., 11000 Belgrade, Serbia.*
[2]*Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia*

Due to the dissolution behaviour and biocompatibility, multicomponent phosphate glasses are good candidates for different biomedical application including the bone implants. For successful application in bone repair, the porous 3D-scaffolds can be fabricated by sintering/crystallization of the powdered glass. Therefore, the aim of this study is to determine the thermal characteristics of parent phosphate glass $42P_2O_5$ •40CaO•5SrO •10 $Na_2O$•3$TiO_2$ (mol %) obtained by standard melt-quenching technique. Non-isothermal (DTA) and isothermal heating experiments were performed on the powdered and bulk glass samples. Using the DTA temperature data ( $T_g$, $T_x$, $T_c$, $T_m$), the glass stability on heating and the dominant crystallization mechanism of glass were determined. The phase composition and microstructure of isothermally heated bulk glass samples at $T_c$ = 620- 680 $^0$C for t = 1-3 h were examined by XRD and SEM methods. The polyphosphate glass studied showed a high stability on heating ($K_H$ = 1.30). The dominant surface crystallization mechanism of this glass determined by DTA method was confirmed on SEM micrograph of the crystallized samples. The primary crystalline phase $NaCa(PO_3)_3$ is formed during surface nucleation and crystallization of this glass.

**PS2-12**

## Reduction of Doubtful Detection of Micro-nucleus in Human Lymphocyte

Francesco Lamonaca[1], Domenico Grimaldi[2], Alfonso Nastro[3]

*[1]Dept. of Informatics, Models, Electronic and Systems, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy.(e-mail: flamonaca@deis.unical.it)*
*[2]Dept. of Informatics, Models, Electronic and Systems, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy*
*[3]Department of Chemistry and Chemical Technology, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy*

The image flow cytometer permits the analysis of human lymphocyte for the early detection of exposure to carcinogenic agents. Image alterations can misstate the diagnosis. Pre-processing procedure is pointed out to detect altered image and establish if it can be corrected or must be rejected. Correction procedure based on the Wiener's deconvolution, is proposed to correct the*motion blur alteration* in order to reduce the number of rejected images. The proposed correction operates in conjunction with (i) the spatial filters, pointed out to correct the *bad exposure*, the *Gaussian out of focus* and the *Gaussian noise*, and (ii) the Wiener's deconvolution with Point-Spread Function (PSF) particularized for *Gaussian out of focus alteration* with high intensity. The heavy computation burden of correction based on each one of Wiener's deconvolution, compared with that based on spatial filters suggests to use each one of the Wiener's deconvolution to process the rejected images from the spatial filters only, and not all acquired images. According to this consideration and to speed up the complete pre-processing correction procedure, the implementation is based on the computing distributed service implemented by using the LabVIEW Shared Variables. The criteria to establish the number of PCs to be used to perform the image correction, based on the Wiener's deconvolution, is experimentally evaluated.

**PS2-13**

# Nanometric Oxide Films Obtained by Applying Pulsed Electric Discharges

Topala Pavel, Thighineanu Ion

*Academy of Science of Moldova, Moldova*

The paper presents the results of theoretical and experimental investigations of phenomena that accompany the formation of nanometer oxide and hydroxide pellicles by applying electrical discharges in impulse (EDI). The chemical content of processed surface analysis (EDX – Energy Dispersive X-ray analysis) attests the presence of oxigen that reaches up to 60% at. for steel surfaces, 30-35% at. for those made of titanium alloys, up to 20% at. for those made of aluminum alloys, and up to 50% at. for those made of copper alloys. The presence of considerable amounts of nitrogen is found only in titanium and iron alloys (and constitutes about 15% at), while in aluminum and copper alloys its presence is not significant. The superficial phase analysis (XPS - X-ray Photoelectron Spectroscopy) of the oxigen allowed us to state that the oxigen in pellicle forms three base structures: $-O^{-2}$ (oxide), - $OH^{-}$ (hydroxide), and structures of the type O-C and O-C=O. The chemical analysis showed that the concentration of each of the three components is 0.89:1.00:0.50.

Keywords: electrical discharges in pulse, oxide pellicle, "cold" electrode spot, micro-hardness, surface roughness.

**PS2-14**

# Thermally Induced Structural Transformations of $Fe_{73.5}Cu_1Nb_3Si_{15.5}B_7$ Amorphous Alloy

Dragica M. Minić[1], Milica Vasić[1], Dušan M. Minić[2], Bohumil David[3], Vladimir A. Blagojević[1], Tomáš Žák[3]

[1]*Faculty of Physical Chemistry, University of Belgrade, Serbia*
[2]*Military Technical Institute, Belgrade, Serbia*
[3]*CEITEC IPM, Institute of Physics of Materials AS CR, Brno, Czech Republic*

$Fe_{73.5}Cu_1Nb_3Si_{15.5}B_7$ amorphous alloy undergoes a series of thermally induced structural transformations in temperature region between 25-800$^o$C, including structural relaxation, two Curie temperatures and crystallization. Thermally induced crystallization occurs in two well-separated stages: the first, around 475$^o$C, corresponds to formation of α-Fe(Si)/$Fe_3Si$ and $Fe_2B$ phases, while the second, around 625$^o$C, corresponds to formation of $Fe_{16}Nb_6Si_7$ and $Fe_2Si$ phases out of the already formed α-Fe(Si)/$Fe_3Si$ phase. Changes in microstructure caused by these transformations were characterized in detail using XRD, TEM and Mössbauer spectroscopy. Mössbauer spectroscopy reveals a very small degree of crystallinity in the as-prepared alloy, which is lost during structural relaxation after annealing at temperatures below 400$^o$C. In addition, it suggests that crystallization of the alloy is much more complex process than suggested by XRD data, with several metastable intermediate phases serving as precursors to crystallization of stable crystalline phases. Magnetic, electrical and mechanical properties of the alloys are heavily influenced by the observed structural changes, most notably during crystallization of the alloy.

## PS2-15

# The Correlation of the Electric Resistance Change and Density of the Fermi Level Electron States of the Amorphous Alloy NiFeWCu

[1]Z. Vukovic, [1]M. Plazinic, [1]J. Zivanic, [2]M. Spasojevic, [1]A. Maricic

*[1]Faculty of Technical Sciences, Cacak, Serbia, [2] Faculty of Agriculture, Cacak, Serbia*

The electric resistance of the pressed amorphous alloy FeNiWCu has been measured in the temperature range from 20ºC to 600ºC. It has been shown that an intense structural relaxation takes place in the temperature range from 160ºC to 420ºC, under the influence of thermal influence. The process of structural relaxation gets finalized in the temperature range from 420ºC to 470ºC, while the temperature range from 470ºC to 560ºC marks the period of undercooled liquid. The abrupt decrease of electric resistance between 560ºC to 600ºC is caused by the process of crystallization of amorphous powder phase.

The method of measuring thermoelectromotive force (TEMS) has been used to demonstrate that each level of the structural changes is followed by the corresponding change in the electron density of states at Fermi level. The increase in the electron density of states, following the process of structural relaxation is $\Delta n_1/n_0$ = 8%. In the temperature range corresponding to the state of undercooled liquid no change in the electron density of states has been detected. The crystallization process of the amorphous powder causes 14% change in the density of electron states.

**PS2-16**

# Development of Cu-C Composite Microstructure

Rebeka Rudolf[1,2], Nebojša Romčević[3]

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

The microstructure development of the sintered composite Cu-C will be described by quantitative microstructure analysis, with the objective of defining the influence of process parameters on microstructure development and material properties. Special attention is focused on the size, shape and volume fraction of each influential microstructure element.

The fabrication of the discontinuous Cu-C composite with the use of mechanical alloying and sintering was applied for the achievement of submicron dispersion of graphite particles. During the mechanical mixing of powder an intensive agglomeration of C-particles occurred. The tendency was inversely proportional to the initial size of graphite particles. The degree of agglomeration determines a distribution of graphite on the volume of the matrix. The greater initial size of the C-particles (lower degree of agglomeration) increases the fraction of the uniform distribution of the C-particles while, at a higher degree of agglomeration, the priority of C-particles distributed along the boundary increases. During the cold pressing the microstructural evolution depends on two mechanisms which, consequently, influence the bimodal distribution of graphite in the cold pressed samples. Graphite agglomerates are spread along the boundary, while in the dispersed C-particles imprinted in the surface of Cu-particles the sliding of C-layers took place. Consequently, the spherical morphology of graphite changes to bar morphology.

Key words: microstructure analysis, composite Cu-C

**PS2-17**

# The Influence of the Mechanochemical Activation and Heat Effect on the Magnetic Properties of the Powder System $BaTiO_3$ - $Fe_xO_y$

[1]Z. Ristanovic, [2]S. Djukic, [2]A. Plazinic, [1]D. Sretenovic, [2]A. Maricic

*[1]Higher Education School of Technical Specialized Studies, Cacak, Serbia*
*[2]Faculty of Technical Sciences, Cacak, Serbia*

The powder mixture $(BaTiO3)_{50}$ and $Fe_{50}$ has been activated inside the specialized mill for the duration of 80 minutes, 100 minutes, 120 minutes and 150 minutes in the atmosphere of ordinary air. During the activation process, the iron powder changes into iron oxide powder. Depending on the duration of the activation process, the percentage of the iron oxide FeO, $Fe_2O_3$, $Fe_3O_4$ and the percentage of the $BaTiO_3$ changes. At the same time, as the composition of the activated system changes, its electric and magnetic properties change correspondingly. The method of XRY analysis was utilized to show that with longer activation times, oxide content increases while the $BaTiO_3$ content decreases in the mixture.

XRY analysis of the heated samples showed that the percentage of oxides and $BaTiO_3$ inside the samples changes as a function of the heating temperature. Thermomagnetic measurements, using Faraday's method, showed that the powder activated for 120 minutes has maximum magnetization prior to heating. The maximum magnetization increase in the cold samples from 10% to 22% was measured after heating the samples to to 460ºC. The percentage depends on the duration of the activation period.

Keywords: mechano-chemistry, heat effect, magnetic properties

# PS2-18

## Problems of Thermodynamically Equilibrium and Integral Characteristics of Entropy

Stanislav Veljković[1], Ivan Stefanović[1] , Časlav Stefanović[2]

[1]*Faculty of Electronic Engineering 18000 Niš, Serbia, janja89@yahoo.com and vule@elfak.ni.ac.rs*
[2]*Faculty of Mathematics and Natural Science, Kosovska Mitrovica, Serbia, caslav.stefanovic@gmail.com*

Starting from mathematics, more precisely from combinatory and electronic theory of the sintering process, we have shown that the sets of curves, which represents multinomial coefficients, have characteristically behavior, when considering its extremes, with necessary conditions which are in relation to partition and composition of integer number n.
In this paper, we have applied obtained results for analyzing the oldest laws of radiations, Kirchhoff's law and Planck's law. After thorough introduction to the problems of radiation theory, we have shown that the envelope theory can be applied to analyze classical radiation laws, which are, as already known, subject to quantum mechanics, regarding corresponding quantum statistical distributions. Using obtained results in the succeeding paper, it will be shown that the theory of envelopes gives significant results, which enable simple explanations in accordance with classical, as well as quantum mechanics of practical's.

Keywords: integral characteristics, thermodynamics, quantum mechanics, Kirchhoff's, Plank's, envelope

**PS2-19**

# The $Ho_2O_3$ Concentration Influence on $BaTiO_3$ – ceramics Fractal Structures

D. Sirmić[1], M.Cvetanović[1], F. Bastić[1], V. Mitić[1,2], Lj. Kocić[1], S. Janković[3], V. Paunović[1], M. Miljković[4]

[1]*University of Niš, Faculty of Electronic Engineering, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*
[3]*Mathematical Institute of SASA, Belgrade, Serbia*
[4]*University of Nis, Center for Electron Microscopy, Nis, Serbia*
*sirmicdaniel@yahoo.co.uk*

An influence of dopant concentration on microstructure and dielectric properties of doped $BaTiO_3$-ceramics is developed based on fractal geometry. Using different technological parameters and different additives the structure of $BaTiO_3$ based ceramics materials can be controlled.

In this research, $BaTiO_3$ samples with different concentration of $Ho_2O_3$ are used. The ratio of dopant concentration ranges from 0.05% to 1%. The sintering temperature of 1350°C is chosen. Selected specimens of $BaTiO_3$ were documented using SEM (Scanning Electron Microscope) equipped with EDS analysis. As it is expected, the influence of impurities on intergranular capacity and other electrical properties is significant which is demonstrated and confirmed in this paper. Using the method of fractal modeling, a reconstruction of microstructure configurations, like grains shapes or intergranular contacts is performed.

Such interdisciplinary research is important for opening new frontiers in electronics, and give us a fine perspective in dielectric materials. A merit of such perspective is definition of a bond between microelectronics and materials and components made for sensors and actuators.

Keywords: BaTiO3-ceramics, doped ceramics, fractal structure.

**PS2-20**

# The Sintering Temperature Influence on $BaTiO_3$ – ceramics Microstructure Fractal Nature

F. Bastić[1], D. Sirmić[1], M.Cvetanović[1], S. Janković[2], V. Mitić[1,3], Lj. Kocić[1], V. Paunović[1], B. Jordović[4]

[1]*University of Niš, Faculty of Electronic Engineering, Niš, Serbia*
[2]*Mathematical Institute of SASA, Belgrade, Serbia*
[3]*Institute of Technical Sciences of SASA, Belgrade, Serbia*
[4]*University of Kragujevac, Faculty of Technical Sciences, Kragujevac, Serbia*
filip.bastic@gmail.com

A new correlation between microstructure and dielectric properties of doped $BaTiO_3$-ceramics is developed based on fractal geometry. Using different technological parameters and different additives concentrations the structure of $BaTiO_3$ based ceramics can be controlled.

In this paper, the influence of different temperatures on $BaTiO_3$ – ceramics doped with $Ho_2O_3$ characteristics are observed and discussed. Among the set of samples containing dopant concentration in the range from 0.05% to 1%, the one with concentration of 0.1% is selected. The microstructure and compositional studies of $BaTiO_3$ were investigated by SEM (Scanning Electron Microscope) equipped with EDS analysis. Three different sintering temperatures: 1320°C, 1350°C and 1380°C are applied. By rising the temperature, the ceramics grain size decreases nonlinearly. Using theory of fractal objects and underlying statistics of the grain contact surfaces, a reconstruction of microstructure configurations, as grains shapes or intergranular contacts, has been successfully done.

The $BaTiO_3$ - ceramics microstructure viewed as a fractal is of great significance for future technology of components and materials miniaturization. The complemental statistical approach contribute to investigation of $BaTiO_3$-ceramic grains distribution and nature of intergrain contacts, which brings a major shift in the field of electronic components and alternative energy sources**.**

Keywords: BaTiO3-ceramics, doped ceramics, fractals, statistical morphology, sintering temperature.

**PS2-21**

# Statistical Analysis of the Influence of Temperature on Microstructure Contact Surfaces on $BaTiO_3$ -ceramics Doped with $Ho_2O_3$

S. Janković[1] , V. V. Mitić[2, 3], Lj. Kocić[2] , V. Paunović[2], M. Miljković[4]

[1]*Mathematical Institute, SASA, Knez Mihailova 35, 11000 Belgrade*
[2]*University of Niš, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, 18000 Niš, Serbia*
[3]*Institute of Technical Sciences, SASA, Knez Mihailova 35, 11000 Belgrade, Serbia*
[4]*University of Niš, SEM Laboratory, 18000 Niš, Serbia*

The materials based on $BaTiO_3$ can be controlled using different technological parameters and different additives. We investigate the influence of different temperature levels of sintering (1320°C, 1350°C and 1380°C) on the size of contact area for 0.1% $Ho_2O_3$ doped BaTiO3 ceramic. Microstructural investigations were carried out using scanning electron microscopy (JEOL-JSM 5300) equipped with EDS (QX 2000S) system. Grain size distribution was determined by quantitative metallography method.

The new correlation between microstructure and dielectric properties of doped $BaTiO_3$-ceramics based on fractal geometry and contact surface probability is recently developed. The presented results indicate that statistical model of contact surfaces is very important for the prognosis of $BaTiO_3$-ceramics microstructure and dielectric properties.

## PS2-22

# $BaTiO_3$ – ceramics and Fractal Microstructure Analyses

M. Cvetanović[1], F. Bastić[1], D. Sirmić[1], V. Mitić[1,2], Lj. Kocić[1], V. Paunović[1], M. Miljković[3]

[1]*University of Niš, Faculty of Electronic Engineering, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*
[3]*University of Nis, Center for Electron Microscopy, Nis, Serbia*
*milos_cvetanovic@yahoo.com*

Ceramics grain structure is difficult to describe by using traditional analytical methods based on Euclidean geometry. Using the fractal geometric/analytic methods instead, the new approach is offered in this paper.

There are a many materials that can be doped to $BaTiO_3$, in order to gain different characteristics and in this study we are using $Ho_2O_3$. Different concentrations has been used, as well as different sintering temperatures. For selected contacted grains, the SEM (Scanning Electron Microscope) pictures are taken providing suitable configuration for an electrical model study. It is shown that ferroelectric, optoelectric and piezoelectric properties, are influenced by fractal structure of grains and intergrains contacts, distribution of pores and inner dynamics during sintering process.

Nowadays the material science is aware of importance of taking fractal properties of different ceramics and a new analytic and numerical models are suggested. The similar behavior is discovered in thin films and nano technologies as well.

**PS2-23**

# The Electrical Characteristics of Nb doped $BaTiO_3$ Ceramics

Miloš Marjanović[1], Miloš Đorđević[1], Vesna Paunović[1], Vojislav Mitić[1,2]

[1]*University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*

The Nb doped $BaTiO_3$ ceramics, with different $Nb_2O_5$ content, ranging from 0.5 to 2.0 at% Nb, were investigated regarding their electrical characteristics in this paper. Nb/$BaTiO_3$ ceramics using in this investigation were prepared by the conventional solid state reaction and sintered at 1320°C in an air atmosphere for 2 hours.

The dielectric characteristic of doped $BaTiO_3$ ceramics like as dielectric constant, dissipation factor, impedance (resistance, reactance) have been done by using LCR-Meter Agilent 4284A in the frequency range 20 Hz-1 MHz and Agilent E4991A RF Impedance/Material Analyzer for high frequency measurements (1 MHz – 3 GHz).

Dielectric constant and tangent losses after initial large values remains nearly independent of frequency greater than 3 kHz. Dielectric measurements were carried out as a function of temperature up to 180°C. The low doped samples sintered at 1320°C, display the high value of dielectric permittivity at room temperature, 2600 for 0.5Nb/$BaTiO_3$. A nearly flat permittivity-temperature response was obtained in specimens with 2.0 at% additive content. The Curie-Weiss and modified Curie-Weiss law is used to clarify the influence of dopant on the dielectric properties and $BaTiO_3$ phase transformation. All investigated samples have an electrical resistivity $\rho > 10^5$ Ωcm at room temperature.

**PS2-24**

# The Influence of Temperature on Microstructure Contact Surfaces on $BaTiO_3$ –ceramics Doped with $Ho_2O_3$

S. Janković[1] , V. V. Mitić[2,3], Lj. Kocić[2,] V. Paunović[2], M. Miljković[4]

[1]*Mathematical Institute, SASA, Knez Mihailova 35, 11000 Belgrade*
[2]*University of Niš, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, 18000 Niš, Serbia*
[3]*Institute of Technical Sciences, SASA, Knez Mihailova 35, 11000 Belgrade, Serbia*
[4]*University of Niš, SEM Laboratory, 18000 Niš, Serbia*

The materials based on $BaTiO_3$ can be controlled using different technological parameters and different additives. We investigate the influence of different temperature levels of sintering (1320°C, 1350°C and 1380°C) on the size of contact area for 0.1% $Ho_2O_3$ doped $BaTiO_3$ ceramic. Microstructural investigations were carried out using scanning electron microscopy (JEOL-JSM 5300) equipped with EDS (QX 2000S) system. Grain size distribution was determined by quantitative metallography method.

The new correlation between microstructure and dielectric properties of doped $BaTiO_3$-ceramics based on fractal geometry and contact surface probability is recently developed. The presented results indicate that statistical model of contact surfaces is very important for the prognosis of $BaTiO_3$-ceramics microstructure and dielectric properties.

Keywords: $BaTiO_3$-ceramics, microstructure, grain contact surface

**PS2-25**

# Microstructure Samples Preparation and Analysis on the Way for Statistical and Fractals Applications

Miroslav Miljkovic[1], Vesna Paunovic[1], Ljubisa Kocic[1], Slobodanka Jankovic[3], Vojislav Mitic[1,2]

[1]*University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia*
[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*
[3]*Mathematical institute, SASA, Belgrade, Serbia*

The new correlation between microstructure and dielectric properties of doped $BaTiO_3$-ceramics based on fractal geometry and contact surface probability has been developed.

The doped $BaTiO_3$-ceramics using in this investigation has been prepared by a conventional solid state reaction. The content of additive oxides, $Ho_2O_3$, are ranged from 0.05 to 1.0 at%. The samples were sintered at 1320° and 1350°C for two hours with heating rate of 300°C/h in the air atmosphere. The microstructures of the as sintered or chemically etched samples were observed by using scanning electronic microscope JEOL-JSM 5300 equipped with energy dispersive spectrometry EDS (QX 2000S) system.

By using the fractal analysis and statistics methods of the grains contact surface, a reconstruction of microstructure configurations, like grains shapes, or intergranular contacts has been successfully done. The presented results indicate that fractals analysis and statistics model of different shapes of contact surfaces are very important for prognosis of $BaTiO_3$-ceramics microstructure and dielectric properties. The morphology of sintered $BaTiO_3$-ceramics grains points out the validity of developing new structure analytical methods based on different geometries of grains' model systems. The grains contact models based on ellipsoidal geometry is presented as a new modeling tool for structure research of $BaTiO_3$-ceramics materials. The directions of possible materials properties prognosis are determined according to the correlations synthesis-structure-property.

Keywords: microstructure, fractals, stat analysis, correlation: synthesis-structure properties

**PS2-26**

# Integral Characteristics of Distribution of Gas Molecules Velocity

Janja Nedović[1] , Dimitrije Stefanović[1], Dejan Blagojević[2]

[1]*Faculty of Electronic Engineering 18000 Niš, Serbia,*
*janja89@yahoo.com and vule@elfak.ni.ac.rs*
[2]*High Tehnical School 18000 Niš, Serbia, kleyntruck@eunet.rs*

The analysis of all mentioned distribution functions is performed by mathematical methods applicable for all continual distribution functions. The Maxwell- Boltzmann distribution,i.e. distribution of gass molecules velocity, can be analysed in the same way, thus obtaining mean gas molecule velocity for certain temperatures in the usual manner.

Our work has shown that this distribution has integral characteristics, i.e. characteristics related to family of curves obtained on the basis of family considerations. Systems feature a certain number of gas molecules stored in a reservoir at a certain temperature, as it is known, have distribution implicitly determines the probability that the instantaneously gas molecule velocity has certain value depending on the temperature.

Usually is to observe and analyse one of the distribution function, and its changeability with certain parameters. In our paper we have analysed entirely families of distributionals functions of the form

$$f(v;T) = 4\pi N\left(\frac{M}{2\pi k_B T}\right)^{3/2} v^2 \exp\left(-\frac{Mv^2}{2k_B T}\right)$$

where v-instanteneous molecule velocity, T-temperature, $k_B$-Bolzmann constant, M-molecular mass, and N-number of molecules, for T=const., and v=const.

We have shown in our paper, that maximums of one family of curves determine the anvelope of another family, and that maximums of the second family of curves determine the anvelope of the first. Analyses are based on a relatively simple mathematical methods, described in our other papers. Our results contain integral characteristics of the gas molecule system and express new methods of representation of Maxwell-Boltzman distribution, nondescript in the literature that is known to us.

Keywords: Maxwell-Boltzmann distribution, groups, curve families, anvelope

**PS2-27**

# The Influence of Calcination Temperature on the Internal Morphology of a $Fe_2O_3$-$Cr_2O_3$ Porous Catalyst Used in the Water-gas Shift Reaction

Andrei Rotaru[1,2] and Petre Rotaru[1]

[1]*University of Craiova, Faculty of Mathematics and Natural Sciences, Department of Chemistry, A.I. Cuza 13, Craiova, Romania*
[2]*INFLPR-National Institute for Laser, Plasma and Radiation Physics, Laser Department, Bvd. Atomistilor, Nr. 409, Magurele (Ilfov), Bucharest, Romania*

The study of the calcination temperature and time effects on the internal morphology of a porous catalyst $Fe_2O_3$-$Cr_2O_3$ was performed. The study has been carried out by conducting various wisely-chosen preparative conditions and by means of multiple physical-chemical analytical techniques for characterising the materials, but also relied on monitoring and correlating the textural, diffusional and catalytic properties. The textural properties indicate intermediate calcination times and calcination temperatures (723-773 K); the best catalytic activity is obtained for the samples calcined at 773 K for 1 to 8 hours, but the crystallographic results limit to maximum 4 hours of calcination. Diffusion takes place by Knudsen mechanism which influences the catalytic activity that increases with decreasing diffusional velocity through a highly porous material characterised by a large surface area and dominated by small pores with radii dimensions below 200 Å. The mechanical properties advocate for using a slightly lower calcination temperature than 773 K, while experimental results for BET surface area found the highest value at 746 K.

**PS2-28**

# The Effect of Calcination Condition on the Structural and Textural Properties of Mg(II) Doped Mesoporous Alumina

Zorica Vuković, Tatjana Novaković, Ljiljana Rožić, Srđan Petrović

*University of Belgrade, IChTM-Department of Catalysis and Chemical Engineering, Njegoševa 12, Belgrade, Republic of Serbia*

Mesoporous alumina is widely used as catalyst supports, because their high specific surface areas, surface property and crystalline structure are important in the field of various catalysis. Influence of annealed temperature on the pore structure and phase transformation of Mg(II) doped alumina prepared by sol-gel method was investigated. The pore structure is evaluated by BET method based on nitrogen adsorption isotherms. The phase structure of the samples after the thermal treatments was studied by X-ray diffraction method. The results of sorption analysis show that the samples annealed at 500 °C and 700 °C exhibited a typical type - IV isotherms with hysteresis loops of the H2 type, which were typical of mesoporous materials and slit shaped pores. After annealing at 1000 °C samples are poses type - II isoterms, a representative of mesoporous material with narrow pores. The mesoporosity values of annealed samples show a slight decrease before 700 °C. At higher temperatures the formation larger pores due to the collapse of the pores with shrinkage of the material structure resulted in a strong increase in crystallite size and decrease of surface area and pore volume. Magnesia, also affect on the surface stability of alumina even at temperatures exceeding 1000 °C and produces different accelerating effect depending on the initial surface area.

**PS2-29**

# Hydrogen Retention in Glassy Carbon

Zoran Jovanović, Ana Kalijadis, Zoran Laušević

*Vinča Institute of Nuclear Sciences (010), University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*

Hydrogen isotope retention is a critical issue in fusion devices with carbon plasma facing components. In order to better understand the basic mechanism of hydrogen interaction with carbon materials glassy carbon was irradiated at room temperature with 15 keV $H^+$ ion beam at the Facility for Modification and Analysis of Materials (FAMA). Our results have shown that keV-energy protons implanted in glassy carbon evolved as $H_2$, H-atoms and $H_2O$. Based on the activation energies of molecular hydrogen desorption it can be concluded that the low temperature desorption of molecular hydrogen is the result of H-atoms clustering and their subsequent recombination to $H_2$ from (mostly) para- and ortho positions. Hydrogen atoms that have diffused to the edge of the basal plane can interact with oxygen complexes created on the edge-carbon atoms thus forming water or diffuse out of the material as atomic hydrogen. Finally, our experiments have shown that the theory of the molecular hydrogen formation developed for low-energy H-atoms and ideal graphite structure is also valid for the disordered structure of glassy carbon and the implantation of high energy $H^+$ ions deep below the surface of the material.

## PS2-30

# Influence of Mortmorillonite/Beidelite Ratio on Electrochemical Response of *p*- Nitrophenol at Smectite Modified Glassy Carbon Electrode

M. Žunić[1], A. Milutinović-Nikolić[1], D. Stanković [2], D. Manojlović[2], N. Jović-Jovičić[1], P. Banković[1], Z. Mojović[1], D. Jovanović[1]

[1]*University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia*
[2]*University of Belgrade, Faculty of Chemistry, Studentski trg 12-16, Belgrade, Serbia*

Bentonite clays from different localities: Bogovina and Mečji Do were organomodified. The organomodification was performed with different amounts of benzyltrimethylammonium (BTMA) bromide. The characterization of clay-based samples was performed, including XRD, FTIR and chemical and textural analysis. Each clay sample (either Na-enriched clay or one of the organoclays) was deposited as a thin film on a glassy carbon electrode (GCE) and tested toward electrooxidation of *p*-NP. The results indicated that the incorporation of BTMA into smectite enhanced the electrode stability toward the electrooxidation of *p*-NP in comparison with bare GCE and modified GCE containing Na-enriched clay. On the other hand, there was a difference between the electrochemical behavior of the electrodes based on BTMA-modified clay from different localities (Bogovina or Mečji Do). The electrodes based on the latter one were more stable. The difference in the mortmorillonite:beidelite ratio (the main phyllosilicate constituents of these clays) can be the cause of different adsorptive and therefore electrochemical behavior of the investigated materials.

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**PS2-31**

## Oxygen Reduction Reaction on Palladium Modified Zeolite 13X

Zorica Mojović, Tihana Mudrinić, Predrag Banković, Nataša Jović-Jovičić, Ana Ivanović-Šašić, Aleksandra Milutinović-Nikolić, Dušan Jovanović

*University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Department of Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Republic of Serbia*

Palladium was dispersed over zeolite NaX by procedure of impregnation/thermal degradation of palladium acetylacetonate salt.

Samples characterization was performed by X-ray diffraction and SEM analysis. XRD analysis results showed that decomposition of palladium acetyacetonate in air produced palladium oxide. According to the EDX analysis Pd content in palladium modified zeolite was 3.7 – 4.0 wt.

Electrochemical behavior of synthesized material was investigated in 0.1 M NaOH. The influence of addition of carbon black to composite electrode on its electrocatalytic performance was also investigated. Composite electrodes with and without carbon black were tested for oxygen reduction reaction. According to Koutecky-Levich slope the oxygen reduction reaction followed $4e^-$ mechanism on both electrodes. The onset of ORR on the electrode with added carbon black was shifted toward more positive potentials for about 40 mV in comparison to the electrode without carbon black. The addition of carbon black to 13XPd enhanced the activity of electrode without changing the ORR overall mechanism.

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**PS2-32**

# General Factorial Design in Adsorption Process of Acid Yellow 99 on Hexadecyl Trimethyl Ammonium Modified Smectite

N. Jović-Jovičić, A. Ivanović-Šašić, A. Milutinović-Nikolić, P. Banković,
Z. Mojović, M. Žunić, T. Mudrinić and D. Jovanović

*University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia*

In this paper organobentonites obtained by the substitution of interlayer cations of smectite by hexadecyl trimethylammonium ions (HDTMA) were used as adsorbents for Acid Yellow 99 (AY 99). The adsorbents were prepared using different molar ratios of HDTMA, corresponding to 0.2, 0.5, 1.0 and 2.0 times of cation exchange capacity of used clay (locality Serbia, Bogovina). The amount of adsorbed dye at time $t$ ($q_t$) was obtained for different adsorption times (0 - 180 min) and different temperatures (25, 30, 40 and 50°C), while starting concentration of AY 99 was constant (50 mg $dm^{-3}$) for all adsorption processes. The results were analyzed using the general factorial design in order to determine the regression coefficients for different regression models. For statistical analysis, the amount of HDTMA intercalated in smectite structure (A), time (B) and temperature (C) were chosen to be independent factors, while $q_t$ was chosen to be dependent factor. The ANOVA was performed in order to evaluate the significance of individual factors and their interaction effects based on their F- and p- values. Different regression models were tested. The modified third order polynomial model was shown to be the most appropriate model according to F- and p- values.

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## PS2-33

# The Influence of the Nickel Incorporation Method on the Performance of Bentonite Based Electrodes in Electrooxidation of Phenol

T. Mudrinić[1], Z. Mojović[1] A. Milutinović-Nikolić[1], P. Banković[1], M. Žunić[1], N. Jović-Jovičić[1] N. Vukelić[2], D. Jovanović[1]

*[1]University of Belgrade - Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia*
*[2]University of Belgrade, Faculty of Physical Chemistry, Studenski trg 12-16, 11000 Belgrade, Serbia*

The beneficial interrelationship between Ni and Fe as active site for electrooxidation of phenol was investigated. Four Ni,Fe–bentonite samples were synthesized by different methods. First two samples were obtained by impregnation of acid treated betonite with different nickel precursors, $Ni(NO_3)_2 \times 6H_2O$ and nickel acetylacetonate $[Ni(acac)_2]$. The third sample was obtained by pillaring of bentonte with Al,Fe solution and then impregnated by $[Ni(acac)_2]$. Pillaring of bentonite with Al,Fe,Ni solution was performed to obtain the fourth sample. The change in phase composition was monitored by XRD. Each modified bentonite was tested as electrode material in the electrooxidation of phenol in acidic solution. Working electrode was obtained by coating carbon glassy electrode (CGE) with mixture of each modified bentonite and carbon black dispersed in Nafion® solution. The aim of this study was to examine stability of nickel modified bentonite-based CGE regarding electrode fouling during electrooxidation of phenol. The GCE modified with bentonite pillared with Al,Fe,Ni solution proved to be the most stable electrode during electrooxidation of phenol.

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**PS2-34**

# Use of the Complex Salt for the Charge Obtaining with the Aim of Reactionary SPS - sintering of TiN - $TiB_2$ – Ni Composite

Petukhov O., Ragulya A.

*Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine. 03680, Kiev -142, 3, Krzhyzhanovsky St., Ukraine*

The aim of the present study was the research of possibility of the nickel complex salt use for the charge obtaining with the purpose of reactionary SPS - sintering of TiN-$TiB_2$-Ni composite with 1-3 wt. % nickel additions.

The $TiH_2$, BN powders and the complex nickel salt were initial materials. The salt have been prepared as a result of nickel acetate mixing with the diethanolamine in the ethanol medium. The powder mixtures have been obtained by mixing-milling in the ethanol in the planetary-type mill. SPS - sintering were conducted in the direct current at $1700^0$C with the curing time of 30 sec. The heat rate were 5,5 and 11,0 $^0$C/ sec.

The diethanolamine use as a modifier of the nickel acetate solution in the ethanol allowed to the increase of the acetate solubility, and to achieve a low light sensitivity and, therefore, increasing the long-term stability of the solution. Nickel adding in the form of the complex salt solution on the basis of the ethanol led to the coarsening of the milled mixture, and also to the growth of oxygen, carbon, hydrogen weight content. The concentration increasing of complex salt led to the decreasing of total weight content of nitrogen, due to the growth of nickel weight content and other components of the complex salt. However, the content of nitrogen associated with boron atoms, increased in connection with the decomposition products recovery of the complex salt.

When the heating rate of 11.0 $^0$C/sec nickel additive led to the density decrease. The microhardness and fracture toughness changed slightly. The negative impact of nickel additive associated with the presence of residual nickel oxide. The heating rate reducing to 5.5 $^0$C/sec led to the density increasing, microhardness and some crack resistance increasing of the samples containing 3 wt % Ni because of nickel oxide reduction.

## PS2-35

# Research of the Thermodynamic Laws of Reactionary SPS-sintering of $TiB_2$ – TiN Composition

Petukhov O.

*Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine. 03680, Kiev -142, 3, Krzhyzhanovsky St., Ukraine*

The aim of the present study was the establishment of the thermodynamic laws of chemical reactions and thermal effects at reactionary (R) SPS-sintering of TiN-$TiB_2$ composition. The calculation of temperature dependence of isobar-isothermal potential change was conducted by means of Gibbs equation, the thermo-chemical calculations of the thermal effects were conducted for the determination of passing probability of the most characteristic reactions in the $TiH_2$ - BN - Ti - B components system.

One of basic motive forces of the sintering was the self-propagating high-temperature synthesis (SHS - process). The combined chemical reaction: $TiH_2 + 2/3\ BN = 2/3\ TiN + 1/3\ TiB_2 + H_2\uparrow$ was realized at RSPS of TiN - $TiB_2$ composition. High enough formation probability of TiN - $TiB_2$ composition in the system Ti - H - B - N - O at the temperatures of RSPS (1000-2000 K) was ascertained. The reaction of titanium oxidization by $B_2O_3$ impurity had high probability. The reaction could result in the formation of titanium oxide and elementary boron. The equilibrium was displaced toward CO formation and $CH_4$ decompositions, except for the water gas reaction in the C-H-O system at temperatures higher 873-1073 K.

The thermal effect of TiN - $TiB_2$ synthesis reaction at using as a component of metallic titanium considerably exceeded the thermal effect of the reaction at the initial $TiH_2$ use. In last case the thermal effect rose considerably due to recombination of hydrogen atoms. It could promote the SHS - process efficiency, could promote the synthesis reaction rate and intensify the consolidation. Thermal effect of TiN - $TiB_2$ synthesis reaction at the use of initial $TiH_x$ decreased at the increase of hydrogen content in initial $TiH_x$ at the simultaneous increase of thermal effect of hydrogen atoms recombination.

**PS2-36**

# Properties of Magnesium Titanate Ceramic Obtained by Two Stage Sintering

S. Filipovic[1], N. Obradovic[1], V. B. Pavlovic[1], D. Kosanovic[1], M. Mitric[2], V. Paunovic[3], V. Pouchly[4], M. Kachlik[4], K. Maca[4]

[1]*Institute of Technical Science of SASA, 11000 Belgrade, Serbia*
[2]*"Vinča" Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*
[3]*Faculty for Electronics, University of Nis, 18000 Nis, Serbia*
[4] *CEITEC BUT, Brno University of Technology, Technicka 10, 61600 Brno, Czech Republic*

The aim of this paper was investigation of structural and electrical properties of magnesium titanate ceramic obtained mechanochemically and subjected to two stage sintering process. Mixtures of MgO and $TiO_2$ were treated in a planetary ball mill for several time intervals ranging from 0 to 160 minutes. Powders prepared in this way were two stage sintered, at 1400 $^oC$ in air in the first stage, and then post-sintered by pressure assisted technique Hot Isostatic Pressing (HIP) at 1280 $^oC$ in argon atmosphere with a pressure of 200 MPa. X-ray diffraction was performed in order to established phase composition of obtained ceramics. Densities of sintered samples were measured by Archimedes method. The values of density were over 96 % of theoretical one and pure MgTiO3 phase was observed. Morphology of sintered bodies was investigated by SEM, and micrographs indicate the final sintering stage and very dense ceramics. Electrical measurements were performed in the microwave field of frequency.

**PS2-37**

# Influence of Mechanical Activation on the Constituents of the $MgO-Al_2O_3-SiO_2-MoO_3$ System

N. Đorđević[1], N. Obradović[2], D.Kosanović[2], S. Marković[2], M. Mitrić[3]

[1]*Institute for Technology of Nuclear and Other Mineral Raw Materials,Bulevar Franse d'Eperea 86, 11000 Belgrade, Serbia*
[2]*Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000 Belgrade, Serbia*
[3]*Vinča Institute of Nuclear Sciences, University of Belgrade, Mike Alasa 12-14,11000 Belgrade, Serbia*

Cordierite, $2MgO{\cdot}2Al_2O_3{\cdot}5SiO_2$ (MAS), is high-temperature ceramic material. Cordierite is commonly used material because of outstanding electrical properties, low temperature expansion coefficient and low dielectric constant. In order to accelerate the process of sintering, 5.00 mass% $MoO_3$ has been added to the starting mixtures. The mechanical activation of the starting mixtures was performed in a high energy ball mill during 0-160 minutes. All starting mixtures were sintered at 1100$^o$C, 1200$^o$C and 1300$^o$C for 2h. The particle size analysis (PSA) was employed in order to determine the changes in the particle size of the mechanically treated powders. The phase composition of the starting powders was analyzed by the X-ray diffraction method. Differential thermal (DTA) and thermogravimetric (TG) analysis were used in order to determine characteristic temperatures within the system during heating. Based on the obtained DTA results, it was established that mechanical activation with additive $MoO_3$, has influence on decreasing sintering temperatures for about 150$^o$C.

Keywords: Mechanical activation, XRD, DTA/TG, Cordierite.

**PS2-38**

# Mechanism and Kinetics of Dissolution of Glass-ceramics in Simulated Body Fluid (SBF)

Jelena. D. Nikolić[1], Vladimir. D. Živanović[1], Snežana N. Zildžović[1], Srđan D. Matijašević[1], Snežana R. Grujić[2], Sonja V. Smiljanić[2], Vladimir S. Topalović[1]

[1]*Institute for technology of nuclear and other mineral raw materials, Franchet d´Esperey 86, Belgrade, Serbia*
[2]*Faculty of Technology and metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia*

Phosphate glass and glass-ceramics have great potential for usage as a hard tissue implants and drug carriers due to the their similar chemistry to bones, good solubility and bioactivity. The properties of these materials can be tailored by adjusting the glass composition and controlled crystallization procces of parent glass. The precipitation of crystaline phase/phases in glass affects on bioactivity and it is possible to tune this property by crystallisation. In this work, the dissolution of phosphate glass-ceramics prepared from $55.4P_2O_5$•26.87 $K_2O$•3.31CaO•4MgO•$5.52SiO_2$•1.19ZnO•1.30CuO•$1.24Fe_2O_3$·1.11MnO (wt%) glass immersed in simulated body fluid (SBF) was studied. The dissolution experiments were performed under static conditions with powder samples grain size 0.1-0.3 and 0.3-0.65 mm at temperatures T=20 and 37 °C for different times. The dependence of normallized mass loss (*f*m) on time was determined and the initial dissolution rates $r_o$ = 0,00694 and 0,01079 g/m$^2$h and the dissolution rate constants $k$ = 0,00606 and 0,02661 h$^{-1}$ for T = 20 and 30 $^0$C were calculated. During dissolution of samples the electrolytic dissociation followed by hydrolytic decomposition of polyanionic glass network occurred.

**PS2-39**

# Equivalent Electrodes' Method (EEM) and the Hybrid Boundary Element Method (HBEM) Application

Slavoljub R. Aleksić, Nebojša B. Raičević, Saša S. Ilić, Nenad N. Cvetković

*University of Niš, Faculty of Electronic Engineerin, A. Medvedeva 14, 18000 Niš, Serbia*

The Equivalent electrodes method (EEM) and on EEM based Hybrid boundary elements method (HBEM) application are presented in the paper. The basic idea of EEM is that an arbitrary shaped electrode can be replaced by finite system of equivalent electrodes (EE). The EE are placed on the electrode surface. Depending on problem geometry, for EE can be used flat or oval strips, spherical bodies and toroidal electrode. Using boundary condition that the electrode surface is equipotential, it is possible to form system of linear equations, with EE charges as unknowns. All the necessary calculations can be realized determining EE charges. If the system is composed of several electrodes, or multilayer medium exists in it, EEM application can be simplified by using Green's functions for some electrode or for stratified medium. The HBEM is based on the idea to substitute boundary segments with total charges placed in free space at the centers of boundary segments. This approach includes using of corresponding Green's function for electric scalar potential and point matching method for matching values of potential and boundary condition for normal components of the electric field. It has been applied for electrostatic as well as magnetostatic problems.

**PS2-40**

# Determination of the Martensitic and Reverse Transformation Temperatures in Copper-based Shape Memory Alloys

Ana Kostov, Radiša Todorović, Aleksandra Milosavljević

*Mining and Metallurgy Institute Bor, Zeleni bulevar 35, 19210 Bor, Serbia*

Simultaneous TD-DTD method is used for determination of the start, finish and maximum transformation of martensite into parent phase at various heating rates (reverse transformation) and temperatures of the start, finish and maximum transformation parent phase into martensite at various cooling rates (martensitic transformation) in the investigated copper-based shape memory alloys Cu-Zn-Al.

According to obtained results, the transformation in the investigated shape memory alloys is characterized by temperature hysteresis because there is a difference between temperature of the finish martensitic transformation into parent phase and temperature of the start of parent phase transformation into martensite.

The value of temperature hysteresis of transformation is related to the activation energy for transformation. That is a specific quantity of non-chemical free energy for the investigated shape memory alloy i.e. surface energy and plastic deformation energy.

The temperature at which the parent (high-temperature) phase starts to transform into the martensite temperature for the reverse transformation is lower than the temperature at which martensite starts to transform into the parent (high-temperature) phase, and it could be concluded that the martensitic transformation is transformation of the second order for the investigated alloys.

**PS2-41**

# Microstructural Investigation of the Ternary Cu-Al-Ag System

Zdenka Stanojević Šimšić[1], Dragana Živković[2], Ana Kostov[1] Dragan Manasijević[2], Tamara Holjevac Grgurić,[3] Ivana Marković[2], Radiša Todorović [1]

[1]*Mining and Metallurgy Institute, Bor, Serbia*
[2]*University of Belgrade, Techincal faculty in Bor, Bor, Serbia*
[3]*University of Zagreb, Faculty of Metallurgy in Sisak, Sisak, Croatia*

The results of microstructural characterisation of some as-cast alloys in Cu-Al-Ag system are presented in this paper. Investigation was carried out on alloy samples in the section with constant Al:Ag molar ratio equal to 1:1. The samples were examined according to metallographic procedure using optical microscopy (LOM) and scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM-EDS).

Keywords: Cu-Al-Ag system, ternary alloys, LOM, SEM-EDS

## PS2-42

# Investigation of Thermodynamic Properties of Cu-Al-Zn Alloys

Lidija Gomidželović[1,*], Ana Kostov[1], Dragana Živković[2]

[1]*Mining and Metallurgy Institute, Zeleni bulevar 35, 19210 Bor, Serbia*
[2]*University of Belgrade, Technical Faculty in Bor, VJ 12, 19210 Bor, Serbia*

The results of calculation of thermodynamic properties using Muggianu model in two cross sections from copper corner (section Al:Zn = 1:5 and Al:Zn = 1:2) belonging to ternary Cu-Al-Zn system are presented in this paper. The calculation was conducted at 1400 K, because at this temperature all metals are in liquid state (copper is metal with highest melting point in investigated ternary Cu-Al-Zn system, equal to 1357 K). Alloys belonging to ternary Cu-Al-Zn system are multifunctional materials mostly used like Cu-based shape memory materials, but also have application in catalysis, electronics and production of metal matrix composites. Additionally, isothermal section of phase diagram at 293 K is calculated using Thermo-Calc software. Calculated copper activities show negative deviation from Rault's law, for both investigated section. Thermodynamic properties obtained by calculations, indicate that copper shows good miscibility with aluminum and zinc in all investigated alloys. According to calculated isothermal section of ternary Cu-Al-Zn phase diagram, thirteen different phases can be identified in isothermal section of ternary Cu-Al-Zn system and most of them can be connected to phases found in constitutive binary systems: Cu-Al, Cu-Zn and Al-Zn, but there are also ternary phases which are characteristic for this ternary system.

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## PS2-43

# Targeted Synthesis of Ceramic-Polymer Nanocomposites

V. B. Pavlovic[1,2], M. Wu[3], V. Djokovic[4], M. Dukic[3], V. P. Pavlovic[5], B. Vlahovic[3,6]

[1]*FoA, Department of Physics and Mathematics, University of Belgrade, Serbia*
[2]*Institute of Technical Sciences, Serbian Academy of Sciences and Arts, Belgrade, Serbia*
[3]*North Carolina Central University, Durham, NC, USA*
[4]*Vinca Institute of Nuclear Science, University of Belgrade, Serbia*
[5]*Faculty of Mechanical Engineering, University of Belgrade, Serbia*
[6]*NASA University Research Center for Aerospace Device Research and Education and NSF Center of Research Excellence in Science and Technology Computational Center for Fundamental and Applied Science and Education, North Carolina, USA*

It is well known that materials used in nano-electro-mechanical systems (NEMS) must simultaneously satisfy numerous requirements for chemical, structural, mechanical and electrical properties. Taking into account that the application of targeted synthesis principles is fundamental for development of these materials, in this article the results of the investigation of the nano-scale grain size effects, grain/particle size induced structural transformations, the evolution of the particle structure during targeted synthesis process and microstructure modeling of ceramic-polymer nanocomposites, has been presented. The nanocomposite BT,ST/PVDF films were prepared by pulsed laser deposition (PLD) method and investigated by X-ray diffraction (XRD) method and Raman spectroscopy, while the microstructure morphology has been analyzed by scanning electron microscope (SEM). It was found that PLD of BT,ST on PVDF substrate offers a new set of opportunities for development of advanced flexible piezo-films for the next generation of NEMS, which applications span the aero-space industry, communications, defense systems, national security, health care, information technology and environmental monitoring.

## PS2-44

# Phase Transformation in $Si_3N_4$ Ceramic Particles in Corundum Matrix Ceramic Shields

Prof. Dr. László A. GÖMZE[1], Ludmila N. GÖMZE[2] and Norken L. GÖMZE[2]

*1Department of Ceramics and Silikate Engineering at University of Miskolc, (Hungary)*
*[2]IGREX Engineering Service Ltd, Igrici, (Hungary)*
*femgomze@uni-miskolc.hu and igrex2009@yandex.ru*

Examining the material structures and behavior of different ceramic materials and ceramic matrix composites under high speed collisions in several years, the authors successfully developed a new family of hetero-modulus and hetero-viscous alumina matrix composite materials with extreme high mechanical properties including fatigue, hardness and dynamic strength. Studying the high speed collision ( v > 1000 m/sec ) process between high density metallic bodies and reinforced with Si3N4, SiAlON and AlN submicron and nanoparticles corundum matrix composites the authors have found that the dynamic strength of these materials had increased, because of the transformation of alpha and beta silicon-nitride diamond like cubic c-Si3N4 crystals in oxygen-depleted environment. In spite of these diamond like c-Si3N4 crystals did not increased the average density of the alumina matrix ceramic composite they could gave these CMCs excellent mechanical and thermo-mechanical properties and increased dynamic strength.

Analytical methods applied in this research were scanning electron microscopy, X-ray diffractions and energy dispersive spectrometry. Digital image analysis was applied to microscopy results to enhance the results of transformations.

Keywords: alumina, collision, composite, diamond, dynamic, silicon-nitride, strength

## PS2-45

# Analysis of the Surface of Bio-OSS® Particles after Incubation in Cell Culture Medium using Scanning Electron Microscopy

Sanja Stojanović[1], Stevo Najman[1], Miroslav Miljković[2], Žarko Mitić[3], Jelena Rajković[4], Miroslav Trajanović[5]

[1]*University of Niš, Faculty of Medicine, Department for Cell and Tissue Engineering; Institute of Biology and Human Genetics, Niš, Serbia*
[2]*University of Niš, Faculty of Medicine, Laboratory for Scanning Electron Microscopy, Niš, Serbia*
[3]*University of Niš, Faculty of Medicine, Department for Pharmacy, Niš, Serbia*
[4]*University of Niš, Faculty of Sciences and Mathematics, Department for Biology and Ecology, Niš, Serbia*
[5]*University of Niš, Faculty of Mechanical Engineering, Laboratory for Intelligent Production Systems, Niš, Serbia*

The aim of this study was to analyze changes in the surface of Bio-Oss® particles after incubation in cell culture medium. Appropriate amount of Bio-Oss® material was incubated in Dulbecco's Modified Eagle's Medium (DMEM) at 37°C in water bath for 3 days. After that, material was dried, coated with gold and analyzed using scanning electron microscope (JEOL, JSM 5300). After incubation surface of Bio-Oss® particles looks less grainy. Very small grains, that are visible on the surface of material before incubation, cannot be seen after incubation. Ridged shapes that are visible on the surface of some granules are larger and flatter after incubation. The impression is that an incubation made erosion of cam bumps or that larger and wider reefs compared to the material before incubation are made by depositing of new material. Also, the edges of the pores of similar input surfaces are smaller after incubation which is probably due to the alignment of sharp curves.

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**PS2-46**

# Osteogenic Potential of Adipose-derived Mesenchymal STEM cells applied with Bio-OSS® as Carrier

Stevo Najman[1], Ivica Vučković[2], Dragan Petrović[2], Slađana Petrović[3], Jelena Živković[1], Sanja Stojanović[1]

[1]*University of Niš, Faculty of Medicine, Institute of Biology and Human Genetics, Niš, Serbia*
[2]*University of Niš, Faculty of Medicine, Clinic of Stomatology, Department of Maxillofacial Surgery, Niš, Serbia*
[3]*University of Niš, Faculty of Medicine, Center for Radiology, Clinical Centre Niš, Niš, Serbia*

The aim of this study was to examine the osteogenic potential of freshly isolated adipose-derived mesenchymal stromal/stem cells (ASCs) applied with biomaterial Bio-Oss® as carrier in regeneration of rabbit calvaria defects. Defects of rabbit calvaria were filled with the mixture of freshly isolated adipose-derived mesenchymal stem cells (ASCs), Bio-Oss® particles and blood, with Bio-Oss® particles mixed with blood or only with Bio-Oss® particles. Bone density in defects was measured after one, three and six weeks using MSCT and histological examination was performed four and eight weeks after filling defects. The use of Bio-Oss® particles in combination with freshly isolated ASCs in bone tissue regeneration resulted in increased and preserved bone density which is in significantly greater extent than in the other groups. Application of freshly isolated ASCs in combination with biomaterials such as Bio-Oss® is a promising tool for assisted regeneration of the bone tissue.

Acknowledgement: This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Grant III 41017.

**PS2-47**

# Structural Features Amorphous-like Coatings AlN-$TiB_2$-$TiSi_2$ After Annealing (900, 1300)ºC and Their Impact on Physical and Mechanical Properties Changes

A.D. Pogrebnjak, A.A. Demianenko

*Sumy State University, 2, Rimsky-Korsakov Str., Sumy, 40007 Ukraine*

The main aim of this work is to carry out comprehensive analysis of structure, phase composition, surface morphology of coatings which are obtained by magnetron sputtering of multicomponent target AlN-$TiB_2$-$TiSi_2$ after their annealing at 900ºC, 1300ºC. The element composition, structural-phase composition, morphology were investigated before and after annealing of coatings with $900^0$C, $1300^0$C using SEM/EDS, AFM, SIMS, XRD, 3D Laser, Nanoindenter. At high temperature the impact on the coating observed crystallization with the crystallite formation sized of 11-25 nm. Annealing at the highest temperature 1300°C leads to a fundamental change in the pattern of the diffraction spectrum. The main component of the coating becomes aluminum oxide $Al_2O_3$ and 30 vol.% remains $AlB_2$. It is provided high damping properties of AlN-$TiB_2$-$TiSi_2$ coatings due to the obtained values of the viscoplastic index =0.07 with hardness H = 15.3 GP which decrease after annealing of 1300ºC. As conclusion, the amorphous structure and high damping properties of the AlN-$TiB_2$($TiSi_2$) coating makes promising the use of these coatings as diffusion barriers in the form of independent elements and as a contacting layer in multilayer wear resistant coatings.

## List of Participants

**A**

Aleksić, Slavoljub, *University of Niš, Faculty of Electronic Engineerin, A. Medvedeva 14, 18000 Niš, Serbia*

Andrić, Ljubiša, *Institute for Technology of Nuclear and Other Raw Mineral Materials, Belgrade, Serbia*

Antonijevic, Milan, *School of Science, Faculty of Engineering and Science, University of Greenwich (Medway Campus), Chatham Maritime, Kent ME4 4TB, UK*

Arsenović, Milica, *Institute for testing of materials IMS, Belgrade, Serbia*

**B**

Bastić, Filip, *University of Niš, Faculty of Electronic Engineering, Niš, Serbia*

Blažić, Rajko, *High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

**C**

Carausu, Constantin, *"Gheorghe Asachi" Technical University of Iasi, Romania, Blvd. Mangeron, No. 59A, 700050 Iasi, Romania*

Colombo, Paolo, *Department of Industrial Engineering, University of Padova, Italy, Adjunct Professor of Materials Science and Engineering, Department of Materials Science and Engineering, The Pennsylvania State University, USA, Visiting Professor, Department of Mechanical Engineering, University College London, UK*

Cvetanović, Miloš, *University of Niš, Faculty of Electronic Engineering, Niš, Serbia*

**D**

Dinic Ivana, *Institute of Technical Sciences of Serbian Academy of Sciences and Arts,, 11000 Belgrade, Serbia*

Dugandzic Ivan, *Institute of Technical Sciences of Institute of Serbian Academy of Sciences and Arts,A, 11000 Belgrade, Serbia*

**Dj**

Djordjevic, Biljana, *National Museum in Belgrade, Serbia*

Đorđević, Nataša, *Institute for Technology of Nuclear and Other Mineral Raw Materials,Bulevar Franse d'Eperea 86, 11000 Belgrade, Serbia*

**F**

Ferreira, José M.F., *Department of Materials and Ceramics Engineering (DEMaC), CICECO, University of Aveiro, 3810-193, Aveiro, Portugal*

Filipović, Suzana, *Institute of Technical Sciences of Serbian Academy of Sciences and Arts, 11000 Belgrade, Serbia*

Forro, Laszlo, *Laboratory of Physics of Complex Matter, EcolePolytechniqueFédérale de Lausanne, Switzerland*

**G**

Gabrovska, Margarita, *Institute of Catalysis, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. Bl. 11, 1113 Sofia, Bulgaria*

Gadow, Rainer, *Institute for manufacturing technologies of ceramic components and composites, IMTCCC, University of Stuttgart, Allmandring 7b, D-70569 Stuttgart, Germany*

Gavrilović, Tamara, *Laboratory for Radiation Chemistry and Physics, Vinča Institute of Nuclear Sciences,University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*

Golestanifard, Fahrad, *School of Metallurgy and Materials Enginering, Iran University of Science and Technology, Tehran, Iran*

Gomidzelović, Lidija, *Mining and Metallurgy Institute, Zeleni bulevar 35, 19210 Bor, Serbia*

Gömze, László A. , *Department of Ceramics and Silikate Engineering at University of Miskolc, Hungary*

**J**

Janković**,** Slobodanka, *Mathematical Institute, SASA, Knez Mihailova 35, 11000 Belgrade, Serbia*

Jovanović, Vladimir, *Institute of Physics, University of Belgrade, Pregrevica 118, 11000 Belgrade, Serbia*

Jović Jovičić, Nataša *University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia*

**K**

Kato, Kazumi, *National Institute of Advanced Industrial Science and Technology, 2266-98 Anagahora, Shimoshidami, Moriyama, Nagoya, Japan*

Kilanski, Lukasz, *Institute of Physics, Polish Academy of Sciences, al. Lotnikow 32/46, 02-668 Warsaw, Poland*

Kocic, Ljubisa, *University of Niš, Faculty of Electronic Engineering, Niš, Serbia;*[2]*Institute of Technical Sciences of SASA, Belgrade, Serbia*

Kostić, Slobodanka, *Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia*

Kostov, Ana, *Mining and Metallurgy Institute Bor, Zeleni bulevar 35, 19210 Bor, Serbia*

Kudelska, Izabela, *Institute of Physics, Polish Academy of Sciences, Al. Lotników 32/46, 02-668 Warsaw, Poland*

**L**

Lamonaca, Francesco, *Dept. of Informatics, Models, Electronic and Systems, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy*

Laušević, Zoran, *Vinča Institute of Nuclear Sciences (010), University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*

Lazarević, Zorica *Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia*

Lee, William Bill, *Dept. of Materials and Centre for Advanced Structural Ceramics (CASC), Imperial College London*

**M**

Maca, Karel, *Dept. of Ceramics and Polymers, Brno University of Technology, Technicka 2, 616 69 Brno,Czech Republic, CEITEC BUT, Brno University of Technology, Technicka 10, 616 00 Brno, Czech Republic*

Marjanović, Miloš, *University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia*

Mathur, Sanjay, *Inorganic and Materials Chemistry Dpt.,University of Cologne, Germany*

Milenkovic, Srdjan, *IMDEA Materials Institute, Eric Kandel 2, 28906, Getafe, Spain*

Milošević, Olivera, *Institute of Technical Sciences of Serbian Academy of Sciences and Arts,11000 Belgrade, Serbia*

Miljković, Miroslav, *University of Niš, Faculty of Medicine, Laboratory for Scanning Electron Microscopy, Niš, Serbia*

Minić, Dragica, *Faculty of Physical Chemistry, University of Belgrade, Serbia*

Mitić, Vojislav *University of Niš, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia ,Institute of Technical Sciences of SASA, Belgrade, Serbia,*

Mitrović, Nebojša, *Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems,Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia*

Mojović, Zorica *University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Department of Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Republic of Serbia*

Mudrinić, Tihana *University of Belgrade - Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia*

Muñoz, Lidia *University Carlos III of Madrid and IAAB, Department of Materials Science and Engineering & Chemical Engineering, Avda.Universidad 30, 28911 Leganes, Madrid, Spain*

**N**

Naito, Makio, *Osaka University, 11-1, Mihogaoka, Ibaraki city, Osaka 567-0047, Japan*

Najman, Stevo, *University of Niš, Faculty of Medicine, Institute of Biology and Human Genetics, Niš, Serbia*

Nastro, Alfonso, *Dept. of Informatics, Models, Electronic and Systems, University of Calabria, Ponte Pietro Bucci, 87040 Rende (CS), Italy*

Nedelcu, Dumitru, *"Gheorghe Asachi" Technical University of Iasi, Romania, Blvd. Mangeron, No. 59A, 700050 Iasi, Romania*

Nedović, Janja, *Faculty of Electronic Engineering 18000 Niš, Serbia*

Nešković, Nebojša,*Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia*

Nikolić, Jelena *Institute for technology of nuclear and other mineral raw materials, Franchet d'Esperey 86, Belgrade, Serbia*,

Nikolic, Zoran, *University of Niš, Faculty of Electronic Engineering, Serbia*

Novaković, Mirjana, *VINČA Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

**O**

Osada, Minoru, *International Center for Materials Nanoarchitectonics (WPI-MANA); National Institute for Materials Science (NIMS), Tsukuba, Japan*

**P**

Paunović, Vesna, *University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia*

Pavlović, Vladimir, *Institute of Technical Sciences, Serbian Academy of Sciences and Arts, Belgrade, Serbia*

Pavlović, Marko, *University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*

Peleš, Adriana, *Institute of Technical Sciences of SASA, Knez Mihailova 35/IV 11000 Belgrade, Serbia*

Petković, Dušan *University of Niš, Faculty of Mechanical Engineering, Aleksandra Medvedeva 14, Niš, Serbia*

Petković, Zvonko *High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia*

Petukhov, O., *Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine. 03680, Kiev -142, 3, Krzhyzhanovsky St., Ukraine*

Popović, Maja, *VINČA Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

Popović, Dušan, Analysis, Laboratory Equipment, Gandijeva 76 A, 11070 Belgrade, Serbia

Potočnik, Jelena, *University of Belgrade, INS Vinča, Laboratory of Atomic Physics, Mike Alasa 12-14, 11001 Belgrade, Serbia*

Pruteanu, Octavian, *"Gheorghe Asachi" Technical University of Iasi, Romania, Blvd. Mangeron, No. 59A, 700050 Iasi, Romania*

**R**

Rabanal, Maria Eugenia, *University Carlos III of Madrid and IAAB, Department of Materials Science and Engineering and Chemical Engineering, Avda.Universidad 30, 28911 Leganes, Madrid, Spain*

Rabasović, Maja, *Institute of Physics, University of Belgrade, Serbia*

Radojević, Zagorka *Institute for Materials Testing, Belgrade, Serbia*

Radosavljević Mihajlović, Ana *ITNMS, Bulevar Franshe d Eperea 86, Belgrade, Serbia*

Rakovsky, Slavcho, *Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria*

Ravlić, Miroslav, *Prizma, Kragujevac, Serbia*

Ristanović, Z., *Higher Education School of Technical Specialized Studies, Cacak, Serbia*

Rotaru, Andrei, *University of Craiova, Faculty of Mathematics and Natural Sciences, Department of Chemistry,A.I. Cuza 13, Craiova, Romania, INFLPR-National Institute for Laser, Plasma and Radiation Physics, Laser Department, Bvd. Atomistilor, Nr. 409, Magurele (Ilfov), Bucharest, Romania*

Rudić, Ognjen, *Faculty of Technology, University of Novi Sad, 21000, Novi Sad, Serbia*

Rudolf, Rebeka, *University of Maribor, Faculty of Mechanical Engineering, Slovenia,* [2] *Zlatarna Celje d.d. Slovenia*

**S**

Sekulić, Dalibor, *Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia*

Siemen, Wilhelm, *Deutsches Porzellanmuseum, Hohenberg, Germany*

Sirmić, Danijel *University of Niš, Faculty of Electronic Engineering, Niš, Serbia*

Stanojević Šimšić, Zdenka, *Mining and Metallurgy Institute, Bor, Serbia*

Stefanovic, Dimitrije, *Faculty of Electronic Engineering 18000 Niš, Serbia*

Stefanović, Časlav, *Faculty of Mathematics and Natural Science, Kosovska Mitrovica, Serbia*

Stojanović, Sanja *University of Niš, Faculty of Medicine, Department for Cell and Tissue Engineering; Institute of Biology and Human Genetics, Niš, Serbia*

Stopić, Srećko, *IME Process Metallurgy and Metal Recycling, RWTH Aachen University, Germany*

**T**

Terzić, Anja, *Institute for Materials Testing, Belgrade, Serbia*

Topala Pavel *Academy of Science of Moldova, Moldova*

Topličić Ćurčić, Gordana, *University of Nis, The Faculty of Civil Engineering and Architecture, Serbia*

Torralba, Jose Manuel, *Department of Materials Science and Engineering, Universidad Carlos III Madrid, Spain;IMDEA Materials Institute, Madrid, Spain*

Trajić, Jelena, *Institute of Physics, P.O. Box 68, University of Belgrade, 11080 Belgrade, Serbia*

**U**

Unger, Felix, *President of the European Academy of Sciences & Arts*

**V**

Van de Voorde, Marcel, *Delft University of Technology, Delft, The Nederlands*

Vasic, Milica, *Faculty of Physical Chemistry, University of Belgrade, Serbia*

Veljković, Stanislav, *Faculty of Electronic Engineering 18000 Niš, Serbia*

Vlahovic, Branislav, *Department of Physics, North Carolina Central University, 1801 Fayetteville Street, Durham, NC 27707, USA*

Vuković, Zorica, *University of Belgrade, IChTM-Department of Catalysis and Chemical Engineering, Njegoševa 12, Belgrade, Serbia*

Vuković, Z., *Faculty of Technical Sciences, Cacak, Serbia*

**W**

Wiederhorn, Sheldon, *National Institute of Standards and Technology, Gaithersburg, MD, 20899-8500, USA*

**Ž**

Žikić , Radomir, *Institute of Physics, Pregrevica 118 Belgrade, Serbia*

Živanović, Vladimir, *Institute for the Technology of Nuclear and other Mineral Raw Materials, 86 Franchet d'Esperey St., 11000 Belgrade, Serbia*

Žižek, Slavko, *SCAN d.o.o. Predvor, Nazorjeva 3, Kranj, Slovenia*

Žunić, Marija, *University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia*


СВ
НИКОЛА