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

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

PROGRAM AND THE BOOK OF ABSTRACTS

Serbian Academy of Sciences and Arts, Knez Mihailova 35
Serbia, Belgrade, 17-19. September 2018.

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Dear Colleagues,

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

Advanced Ceramics today include many old-known ceramic materials produced through newly available processing techniques as well as broad range of the innovative compounds and composites, particularly with plastics and metals. Such developed new materials with improved performances already bring a new quality in the everyday life. The chosen Conference topics cover contributions from a fundamental theoretical research in advanced ceramics, computer-aided design and modeling of a new ceramics products, manufacturing of nanoceramic devices, developing of multifunctional ceramic processing routes, etc. Traditionally, ACA Conferences gather leading researchers, engineers, specialist, professors and PhD students trying to emphasizes the key achievements which will enable the wide speared use of the advanced ceramics products in High-Tech industry, renewable energy utilization, environmental efficiency, security, space technology, cultural heritage, etc.

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, it has 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.

This year, the conference is dedicated to the memory of Academician Momčilo M. Ristić (1929-2018), Honorary President of the Serbian Ceramic Society and founder of Material Science in our country.

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

Conference Topics

Basic Ceramic Science & Sintering – *in memoriam Momčilo M.Ristić, academician*
Optical, Glass & Electro Ceramics
Nano & Bio Ceramics
Modeling & Simulation
Advanced Ceramics
Heritage, Arts & Design
Guide on Science Writing

Conference Co-chairmens:

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

Conference Programme Chairs:

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Dr. Nina Obradović SRB

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American Ceramics Society,
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Archeological Institute of SASA,
Institute of Physics UB,
Vinča Institute of Nuclear Sciences - Laboratory of Physics (010),
Electrical Engineering Institute Nikola Tesla
High School-Academy for Arts and Conservation.

Conference Program and Abstracts

Program and Abstract's Contents

Conference Information:

Conference venue: Serbian Academy of Sciences and Arts, Great Hall (second floor) and Halls 1, 2 (first floor), Knez Mihailova 35, Belgrade, Serbia
Conference dinner (with invitation): Hotel Palace, Topličin Venac 23, Belgrade
Conference fee: Standard fee for foreign participants: 200 EUR; Standard fee for domestic participants: 10000 RSD, Members of SCS, Keynote lecturers and PhD Students: 50% Discount; Invited lecturers have 40% Discount; Plenary lecturers & the last year winners for oral and poster presentations: Free of charge.
Invoice and bank details for Conference fee payment: Banka Intesa ad Beograd, Account No. 160-380150-55, notification: Conference fee – participant name.
Paying of the conference fee at site will be available only in cash.
Currency: The official currency in Serbia is dinar, abbreviated RSD. Money may be exchanged in all banks and authorized exchange offices. Exchange rate for 1 EUR is around 118 RSD. Cash may be taken from ATMs 24 hours a day. Credit cards are accepted in shops, hotels and restaurants.

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 either in ***Science of Sintering***. (nina.obradovic@itn.sanu.ac.rs) or in Journal of Ceramic Science and Technology.

Serbian Ceramic Society *is delighted to announce that several publication series will draw on the research and innovation of ACA Conferences: the annual* ***Selection of Papers*** *– a compilation of selected research from the most recent conference (in two forms: research papers (6-10 pages) and review papers (more than 16 pages), and new* ***Scientific Status Reports*** *– a series of topical books of review chapters (20-30 pages each) aimed at bringing the latest developments in the different fields of ceramic science to a broader audience. This new series will aim to gather research and innovation of Advanced Ceramic and Application Conferences over the past years and present it to a completely new audience. More details will be presented at the Round table: Guide on Scinece Writing (September 19th afternoon session).*

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

Additional Conference information president@serbianceramicsociety.rs
http://www.serbianceramicsociety.rs/about.htm
Recommended places near the Conference venue:
Hotel: Hotel Palas, Topličin venac 23; http://www.palacehotel.co.rs/
Restaurant: Kafana Đura, Đure Jakšića 1, Belgrade (street beside conference venue)
Exchange office: „Hulk“, Vuka Karadžića 4
Tourist Information Centre: Knez Mihailova 5

Water: Tap water in Belgrade is safe to drink.

Program Overview

Date	Time	Programme		Floor, Room
September, 17, Monday	**08.00-09.00**	**Registration**		2nd Floor, Hall
	09.00-09.30	**Opening Ceremony**		2nd Floor, Great Hall
	09.30-10.00	**Memorial speech in honour of M.M. Ristić**		2nd Floor, Great Hall
	10.00-10.10	**Short Break**		
	10.10-11.40	**Plenary Session 1**		2nd Floor, Great Hall
	11.40-12.00	**Coffee Break & Photo Session**		2nd Floor, Hal
	12.00-14.00	**Plenary Session 2**		2nd Floor, Great Hall
	14.00-15.00	**Buffet Lunch**		Club SASA
	15.00-18.15	**Plenary Session 3**		2nd Floor, Great Hall
	20.00	**Conference dinner (with invitations)**		Hotel Palace
September, 18, Tuesday	**08.00-09.00**	**Registration** **Posters Installation**		1st Floor, Hall
	09.00-10.45	**Session: Basic Ceramic Science & Sintering 1** **In memoriam of Academician Momčilo Ristić** Blue Hall		1st Floor
	10.45-11.00	**Coffee Break**		1st Floor, Hall
	11.00-13.00	**Session: Basic Ceramic Science & Sintering 2** **In memoriam of Academician Momčilo Ristić** Blue Hall		1st Floor
	13.00-14.00	**Buffet Lunch**		Club SASA
	14.00-16.00	**Session: Optical, Glass & Electro Ceramics 1** Blue Hall		1st Floor
	15.55-16.20	**Coffee Break**		
	16.20-18.00	**Session: Optical, Glass & Electro Ceramics 2** Blue Hall		
	18.00-19.00	**Poster Session**		1st Floor, Hall
September, 19, Wednesday	**09.30-11.45**	**Session: Nano & Bio Ceramics 1** **Blue Hall**	**Session: Nano &Bio Ceramics 2** **Red Hall**	1st Floor
	11.45-12.10	**Coffee Break**		
	12.10-13.40	**Session: Modeling & Simulation** **Blue Hall**	**Session: Advanced Ceramics** **Red Hall**	
	13.40-14.45	**Buffet Lunch in restaurant**		Kafana Đura
	14.45-15.45	**Session: Heritage, Art & Design** **Blue Hall**		1st Floor
	15.45-16.00	**Coffee Break**		
	16.00-17.00	**Round table: Guide on Science Writing**		
		Closing Ceremony		

Monday, September 17th, 2018

	Hall, 2nd Floor
08.00 – 09.00	**Registration**
	Great Hall, 2nd Floor
09.00 – 09.30	**Opening Ceremony of the Seventh Serbian Ceramic Society Conference: Advanced Ceramics and Application** Prof. dr Vojislav Mitić, Dr. Olivera Milošević, Branislav Brindić, President of SASA Academician Vladimir Kostić, Representatives of MNTR, High Representatives of the Government RS
09.30 - 10.00	**Memorial speech in honour of M.M. Ristić**
10.00 - 10.10	**Short break**

	Great Hall, 2nd Floor
10.10 – 11.40	**Plenary Session 1** *Chairpersons: Rainer Gadow, Olivera Milošević*
10.10 – 10.40	**PL 1** **Current Research on Bioinspired Materials in State Key Lab of Metal Matrix Composite in SJTU** Di Zhang, Jiajun Gu, Zhiqiang Li, Wang Zhang, Qinglei Liu, Dingbang Xiong,Yao Li State key lab of metal matrix composites, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai, 200240 China
10.40 – 11.10	**PL 2** **Ultra-High Temperature Mechanical and Thermal Properties of ZrB_2 Ceramics** William G. Fahrenholtz Materials Science and Engineering Missouri University of Science and Technology
11.10 - 11.40	**PL 3** **'Dual use' of science and technology- the ethical concerns** Wolfgang Bill Price
11.40 - 12.00	**Coffee Break and Photo Session** — **Hall, 2nd Floor**

	Great Hall, 2nd Floor
12.00 - 14.00	**Plenary Session 2** *Chairpersons: Vladimir Pavlović, Danilo Suvorov*
12.00 - 12.30	**PL 4** **Design and Syntheses of New Nanotubes as Gene Carrier Materials** Susan Shwu-Chen Tsay, Uttam Patil, and Reuben Jih-Ru Hwu Department of Chemistry, National Tsing Hua University, Hsinchu 30013, Taiwan, R.O.C.
12.30 - 13.00	**PL 5** **Grain growth control during sintering of BaTiO3 particles with semi-defined shape** Danilo Suvorov Advanced Materials Department, Jožef Stefan Institute, Jamova 39, 1001 Ljubljana, Slovenia
13.00 - 13.30	**PL 6** **Ceramics Application in Electrochemical and Thermoelectrical Energy Converters** Mihails Kusnezoff, Jochen Schilm, Axel Rost, Stefan Megel, Alexander Michaelis Fraunhofer IKTS, Winterbergstr. 28, 01277 Dresden, Germany
13.30 - 14.00	**PL 7** **How a fundamental understanding of the properties of microwave ceramics can be used to enhance their performance & develop magnetically-controlled microwave devices** Nathan Newman, Justin Gonzales, and Ahmad Sayyadishahraki Materials Program, Arizona State University, Tempe, AZ
14.00 - 15.00	**Buffet Lunch - Club SASA Mezzanine**

	Great Hall, 2nd Floor
15.00 - 18.00	**Plenary Session 3** *Chairpersons: Nathan Newman, William Farenholtz*
15.00 - 15.30	**PL 8** **Materials and System Development for Near Infrared Biophotonics with Transparency** Kohei Soga Department of Materials Science and Technology, Tokyo University of Science 6-3-1 Niijuku, Katsushika, Tokyo 125-8585, Japan

15.30 - 16.00	**PL 9** **Glass and glass ceramic layer composites with functional coatings- materials and process engineering, product development and applications** Rainer Gadow, Andreas Killinger and Venancio Martinez Institut für Fertigungstechnologie keramischer Bauteile, Universität Stuttgart, Allmandring 7b, D-70569 Stuttgart, Germany	
16.00 - 16.30	**PL 10** **Facing Global Challenges with Materials Innovation** Fernando Rizzo Department of Chemical and Materials Engineering, PUC-Rio, Rio de Janeiro, Brazil	
16.30 - 16.45	**Coffee Break**	**1st Floor, Hall**
16.45 - 17.15	**PL 11** **Powder to Process** Gregory S. Patience, Federico Galli, Paul A. Patience, Daria C. Boffito Polytechnique Montréal, Department of Chemical Engineering, Montréal, Canada	
17.15 - 17.45	**PL12** **Ideas and challenges of ceramic complex shape parts manufacturing by Spark Plasma Sintering and 3D printing** A.V. Ragulya, S.E Ivanchenko, S.A. Umerova, V.G. Kolesnichenko, O.V. Mikhailov Frantsevich Institute for Problems in Materials Science NAS of Ukraine, 3 Krzhizhanovsky str., 03142 Kyiv-142, Ukraine	
17.45 - 18.15	**PL 13** **Structural Health Monitoring of Glass Fiber Composite Materials by piezoelectric Nanosensors using Cyclic Loading** Khan, Zaffar Institute of Space Technology, Department of Aeronautics & Astronautics	
20.00	**Conference dinner (with invitation) Hotel Palace**	

Tuesday, September 18th, 2018

	Hall, 1st Floor
08.00 - 09.00	**Registration** **Posters and Exibition Installation**

	Blue Hall, 1st Floor
09.00 - 10.45	**Session: Basic Ceramic Science and Sintering 1** **In memoriam of Academician Momčilo Ristić** *Chairpersons: Nina Obradović, Suzana Filipović*
09.00 - 09.30	**PL 14** **Development of porous and dense Si3N4 bodies for different applications** Farhad Golestanifard School of Metallurgy & Materials Engineering, Iran University of Science and Technology (IUST), Narmak, Tehran, Iran
09.30 – 09.55	**KN-BCS 1** **Structural and magnetic ordering in polycrystalline $Sm_{0.5}Ca_{0.2}Sr_{0.3}MnO_3$ perovskite** F.A.Khan[1] , M. A. A. Bally[1], P. Svedlindh[2], S.A. Ivanov[2], P.Nordblad[2], M.S. Andersson[2] [1] Bangladesh university of Engineering and Technology (BUET), Dhaka-1000 Bangladesh [2] Department of Engineering Sciences, Solid State Physics Division, Uppsala University, Sweden
09.55 - 10.15	**INV-BCS 1** **Mathematical modeling in the process of sintering MgO from seawater** J. Jakić, M. Labor, V. Martinac Faculty of Chemistry and Technology, Ruđera Boškovića 35, 21000 Split, Croatia
10.15 - 10.30	**Sponsors- B.Brindić** **(Optoelectronic Group Harder Digital)**
10.30-10.45	**Sponsors- S. Žižek** **(Scan)**
10.45 - 11.00	**Coffee Break** Hall, 1st Floor

	Blue Hall, 1st Floor
11.00 – 13.00	**Session: Basic Ceramic Science and Sintering 2** **In memoriam of Academician Momčilo Ristić** *Chairpersons: Feroz Alam Khan, Zaffar Khan*
11.00 - 11.30	**PL 15** **Electroceramics for High Frequency Applications with Low Temperature Fabrication Methods** Heli Jantunen Microelectronics Research Unit, University of Oulu, Faculty of Information Technology and Electrical Engineering, Oulu, Finland
11.30 - 11.55	**KN-BCS 2** **Rapid microwave sintering of ceramic materials and powder metals** Kiril Rybakov Institute of Applied Physics, Russian Academy of Sciences 46 Ulyanov St., Nizhny Novgorod, 603950 Russia
11.55 - 12.15	**INV-BCS 2** **Behavior of ceramic material at the micro meteorites impact** Tudor Chereches[1], Paul Lixandru[2], Dumitru Nedelcu[3], Daniel Dragnea[4], Dragos Mihai Chereches[5] [1,2,4]SC UPS-PILOT ARM SRL, Bucharest [3]Gheorghe Asachi Technical University of Iasi, Romania [5]Politehnica University of Bucharest, Romania
12.15 - 12.30	**ORL-BCS 1** **Pressure-less rapid sintering of nanoparticle yttria stabilized zirconia** Vladimír Prajzler[1], David Salamon[1,2], Karel Maca[1,2] [1] CEITEC BUT, Brno University of Technology, Purkyňova 123, 612 00 Brno, Czech Republic [2] Faculty of Mechanical Engineering, Brno University of Technology, Technická 2896/2, 616 69 Brno, Czech Republic
12.30 - 12.45	**ORL-BCS 2** **Synthesis of Wollastonite powder and manufacturing of porous scaffolds for multiple applications** Mariano Casas-Luna[1], Miroslava Horynová[1], Edgar B. Montúfar[1], Jorge Alberto Torres-Rodríguez[1], Ladislav Celko[1], Nina Obradovic[2] [1] Central European Institute of Technology - Brno University of Technology, Brno, Czech Republic. [2] Institute of Technical Sciences of the Serbian Academy of Science and Arts, Belgrade, Serbia

12.45 - 13.00 **ORL-BCS 3**

Interaction of oxide ceramics with metal hydrudes

Nikola Novaković, Sanja Milošević Govedarović, Bojana Paskaš Mamula, Sandra Kurko, Tijana Pantić, Mirjana Medić Ilić, Jasmina Grbović Novaković

Vinča Institute of Nuclear Sciences, CONVINCE Centre of Excellence for Hydrogen and Renewable Energy, POB 522, 11000 Belgrade, Serbia

13.00 - 14.00 **Buffet Lunch - Club SASA, Mezzanine**

Blue Hall, 1st Floor

14.00 - 16.00 **Session: Optical, Glass & Electro Ceramics 1**

Chairpearsons: Lidija Mančić, Heli Jantunen

14.00 - 14.30 **PL 16**

Functionalization of graphene + transition metal oxide composites

L. Kilanski[1], A. Jedrzejewska[2], D. Sibera[2], and R. Jedrzejewski[3]

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Aleja Lotnikow 32/46, PL-02668 Warsaw, Poland
[2] Institute of Chemical and Environment Engineering, West Pomeranian University of Technology, Szczecin, Poland
[3] Institute of Materials Science and Engineering, Faculty of Mechanical Engineering and Mechatronics, West Pomeranian University of Technology, Szczecin, Poland

14.30 - 14.55 **KN-OGE 1**

Photocatalysts based on hybrid nanostructures of metal oxides

L. González[1,2], L. Muñoz[1], G. Flores-Carrasco[1,3], G. Salas[2], M.E. Rabanal[1]

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[2] Instituto Madrileño de Estudios Avanzados en Nanociencia,
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[3] CIDS-ICUAP Benemérita Universidad Autónoma de Puebla,
Av. San Claudio y 14 sur, Edif. 103C C.U., Col. San Manuel, Puebla 72570, México

14.55 – 15.15 **INV-OGE 1**

Multifunctional nanomaterials base on inorganic hydroxides: a look from the atomic scale

L.S. Gomez-Villalba[1], A. Sierra-Fernandez [1], R. Fort1, M.E. Rabanal[2,3]

[1]Instituto de Geociencias, CSIC, UCM. (Madrid, Spain), Calle Severo Ochoa 7, planta 4. Madrid, 28040

[2] Department of Materials Science and Engineering and Chemical Engineering. University Carlos III of Madrid (Madrid, Spain),Avenida de la Universidad 30, CP 28911 Leganés, Madrid

[3] Instituto Tecnológico de Química y Materiales Alvaro Alonso Barba (IAAB), (Madrid, Spain)

15.15- 15.35 **INV-OGE 2**

Development and application of highly efficient undoped, doped and composite nanostructured photocatalysts based on titanium dioxide

Veljko R. Đokić

Faculty of Technology and Metallurgy, University of Belgrade, 11120 Belgrade, Serbia

15.35 - 15.55 **INV-OGE 3**

Detection of high pressure phase transitions in RE^{3+} doped Y_2O_3 and Y_2MoO_6 through luminescence measurements

Marko G. Nikolić[1], Ana Vlašić[1], Mihailo Rabasović[1], Branka Murić[1], Vladan Čelebonović[1], Nadežda Stanković[2], Branko Matović[2] and Branislav Jelenković[1]

[1]Institute of Physics, Belgrade University, Belgrade, Serbia

[2]Institute of Nuclear Sciences "Vinča", Belgrade University, Belgrade, Serbia

15.55 - 16.20 **Coffee Break** **Hall, 1st Floor**

Blue Hall, 1st Floor

16.20 - 17.35 **Session: Optical, Glass & Electro Ceramics 2**

Chairpearsons: Maria Eugenia Rabanal, Zorica Lazarević

16.20 - 16.45 **KN-OGE 2**

Tailoring of nanoporous structures and carbon nanotextures of bio-carbon electrode materials for energy storage

Qinglei Liu, Ni Wang, Danmiao Kang, Fengyu zhou, Di Zhang

State key lab of metal matrix composites, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai, 200240 China

16.45 - 17.05 **INV-OGE 4**

Optical and stryctural properties of nanostructured semiconductors

Martina Gilić and Milica Ćurčić

Institute of Physics Belgrade, University of Belgrade,
11080 Belgrade, Serbia

17.05 - 17.25 **INV-OGE 5**

Forensic science and fractal nature analysis

Goran Lazović[1], Vojislav V. Mitić [2,3], Ana S. Radosavljević-Mihajlović[4], Dragan Simeunović[5]

[1] University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
[2] University of Nis, Faculty of Electronic Engineering, Nis, Serbia;
[3] Institute of Technical Sciences of SASA, Belgrade, Serbia;
[4] Institute for technology nuclear and other raw materials. Franshe D Epere 86, 1100 Belgrade, Serbia
[5] Academy of Nacional Security Republic of Serbia

17.25 - 17.45 **INV-OGE 6**

Application of impedance spectroscopy in analysis of electrical properties of chalcogenide glasses

M.V. Šiljegović[1], K.O.Čajko[1], D. L. Sekulić[2], Petr Kostka[3], Stanislav Minárik[4], S.R. Lukić Petrović[1]

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[2] University of Novi Sad, Faculty of Technical Sciences, Trg D. Obradovića 6, 21 000 Novi Sad, Serbia
[3] Laboratory of Inorganic Materials, joint workplace of the University of Chemistry and Technology Prague, and the Institute of Rock Structure and Mechanics of the Czech Academy of Sciences, V Holešovičkách 41, 182 09 Prague 8, Czech Republic
[4] Faculty of Materials Science and Technology, Slovak University of Technology, Bottova 25, 917 24 Trnava, Slovakia

17.45 - 18.00 **OR-OGE 1**

Dissolution properties of bioactive glasses containing strontium

Vladimir S. Topalović[1], Srđan D. Matijašević[1], Jelena D. Nikolić[1], Marija S. Đošić[1], Veljko V. Savić[1], Sonja V. Smiljanić[2], Snežana R. Grujić[2]

[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

18.00-19.00 **Poster Session** **Hall, 1st Floor**

Wednesday, September, 19th, 2018

	Blue Hall, 1st Floor
09.30 - 11.45	**Session: Nano & Bio Ceramics 1** *Chairpearsons: Vojislav Mitić, Veena Tikare*
09.30 – 09.55	**KN-NB 1** **Motion Control of nano/micro sized ceramics by Nano second pulse field** Tadachika Nakayama Nagaoka Univ. of Tech., Japan
09.55 - 10.20	**KN- NB 2** **Biomedical-grade ceramics: innovations in design and development** Paola Palmero, Clémence Petit and Laura Montanaro Politecnico di Torino, Department of Applied Science and Technology, Corso Duca degli Abruzzi 24, 10129 Torino, Italy
10.20-10.40	**INV-NB 1** **Synthesis, Properties and Application of Nanocrystalline Diamond Layers** Markus Mohr, Hans-Jörg Fecht Ulm University, Albert-Einstein-Allee 47 89081 Ulm, Germany
10.40 - 11.00	**INV-NB 2** **Characterization of SiO_2 and SiC ceramics obtained through incorporation of a pore generator into the structure of activated carbon derived from carbonization of Plane tree fruit** Bojan Janković[1], Vladimir Dodevski[2], Maja C. Pagnacco[1], Ivana Radović[2] [1] Faculty of Physical Chemistry, University of Belgrade, Studentski trg 12-16, P. O. Box 137, 11001 Belgrade, Serbia [2] Institute of Nuclear Sciences "Vinča", University of Belgrade, Laboratory for Materials Sciences, Mike Petrovića Alasa 12-14, P.O. Box 522, 11001 Belgrade, Serbia
11.00 – 11.15	**ORL-NB 1** **Electrical characterization and humidity sensing potential of NiZn ferrite nanoparticles** Dalibor L. Sekulić[1], Zorica Ž. Lazarević[2], Nebojša Ž. Romčević[2] [1]University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia [2]University of Belgrade, Institute of Physics, Belgrade, Serbia

11.15 – 11.30 **ORL-NB 2**

Silica – polyurethane nanocomposites: Composition – property relationship

Milena Špírková, Jiří Hodan and Jana Kredatusová

Institute of Macromolecular Chemistry CAS,
Heyrovského nám. 2, 16206 Prague 6, Czech Republic

11.30 – 11.45 **ORL-NB 3**

TO_2-GO Effect Over PVDF Piezoelectricity: Light and Flexible Presure Sensors

Olga Martín, Viviana Jehová González, Ester Jalón, Marjan E. Shabestari, Juan Baselga

Universidad Carlos III de Madrid,
Avda. De la Universidad, 30. Leganes (Madrid), Spain

11.45 - 12.10 **Coffee Break Hall, 1st Floor**

Blue Hall, 1st Floor

12.10 - 13.40 **Session: Modeling &Simulation**

Chairpersons: Paola Palmero, Srđan Petrović

12.10 - 12.35 **KN-MS 1**

Time-dependent Intergranular Capacitance Induced by Solid Skeletal Structure Evolution

Zoran S. Nikolić[1] and Vojislav V. Mitić[2]

[1] University of Niš, 18000 Niš,
Univerzitetski trg 2, Serbia
[2] Faculty of Electronic Engineering, 18000 Niš,
Aleksandra Medvedeva 14, Serbia

12.35 - 13.00 **KN-MS 2**

Numerical Simulation of Microstructural Evolution during Fabrication and Service

Veena Tikare

Center for Computing Research, Sandia National Laboratories,
Albuquerque, NM

13.00 - 13.20 **INV-MS 1**

Thermal and electrical conductivity relation phenomena within fractal nature synthesized diamonds frontiers

Vojislav V. Mitic[1,2], Sandra Veljkovic[1], Goran Lazovic[3], Markus Mohr[4], Peter Gluche[5], Vesna Paunovic[1], Hans Fecht[6]

[1]University of Nis, Faculty of Electronic Engineering, Nis, Serbia;
[2]Institute of Technical Sciences of SASA, Belgrade, Serbia;
[3]University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
[4]Institute of Micro and Nanomaterials, Ulm University
[5]GFD, Gesellschaft fur Diamantprodukte mbH, Lise-Meitner-StraBe 13, Ulm, Germany
[6]Institute of Functional Nanosystems FNS, Ulm University

13.20 - 13.40 **INV-MS 2**

Separation process of granular materials – mathematical modeling and numerical simulations

Milada Pezo

University of Belgrade, Institute of Nuclear Sciences Vinča, Laboratory for Thermal Engineering and Energy

13.40 - 14.30 **Buffet Lunch** **Restaurant Đura**

Red Hall, 1st Floor

09.30 - 11.45 **Session: Nano & Bio Ceramics 2**

Chairpearsons: Sonja Jovanović, Ana Radosavljević

09.30 – 09.55 **KN-NB 3**

An intelligent automotive catalyst applied to hydrogen recombination

Hirohisa Tanaka

Kwansei Gakuin University 2-1, Gakuen, Sanda, Hyogo 669-1337 Japan

09.55 - 10.20 **KN-NB 4**

Ion channeling and nuclear resonant elastic reaction in analysis of materials

S. Petrović and M. Erić

Laboratory of Physics, Vinča Institute of Nuclear Sciences, University of Belgrade, PO Box 552, Belgrade, Serbia

10.20-10.45 **KN-NB 5**

Bioinspired optical related materials from Lepidoptera wings

Wang Zhang, Jiajun Gu, Qinglei Liu and Di Zhang

State key lab of metal matrix composites, Shanghai Jiao Tong University, 800 Dong Chuan Road, Shanghai, 200240 China

10.45 - 11.05 **INV-NB 3**

The consequences of extending the Heisenberg principle to a complementary description

Anna Backerra

Gualtherus Sylvanusstraat 2, 7412 DM Deventer, The Netherlands

11.05 – 11.25 **INV-NB 4**

Effects of micelles on surfactant self-assembly

Jelena Manojlović

Faculty of Mechanical Engineering, University of Nis, Aleksandra Medvedeva 14, Nis, Serbia

11.25 – 11.40 **ORL-NB 4**

Natural Innovative Clay Materials for Moisture Control and Heating

Milena Stojiljković[1], Staniša Stojiljković[1], Bratislav Todorović[1], Gordana Jović[2], Ljubiša Vasić[2]

[1] Tehnološki fakultet Leskovac
[2] IGM „Mladost" Leskovac

11.45 - 12.10 **Coffee Break** **Hall, 1st Floor**

Red Hall, 1st Floor

12.10 - 13.20 **Session: Advanced Ceramics**

Chairpersons: Hirohisa Tanaka, Qinglei Liu

12.10 - 12.30 **INV-AC 1**

Hydro-/Solvothermal synthesis: The influence of synthesis parameters on physicochemical properties of ferrite nanoparticles

Sonja Jovanović[1,2], Marija Vukomanović[2], Matjaž Spreitzer[2]

[1] Advanced Materials Department, Jožef Stefan Institute, Ljubljana, Slovenia
[2] Laboratory of Physics, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

12.30 - 12.50 **INV-AC 2**

The synthesized nano photonic material for eye protection of UV and high energy blue radiation with optimal eye sensitivity

Lidija Matija[1], Ivana Mileusnić[1], Đuro Koruga[2]

[1]Nano Lab, Biomedical Engineering, Faculty of Mechanical Engineering ,University of Belgrade, Serbia
[2]TFT Nano Center, Belgrade, Serbia

12.50-13.10 **INV-AC 3**

Processing and characterization of polymer nanocomposites with embedded ceramic quantum dots

Rouaida M. Abozaid[1], Ivana M. Radović[2], Zorica Lazarević[3], Dragutin Šević[3], Maja Rabasović[3] and Vesna Radojević[1]

[1]University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia
[2]University of Belgrade, Vinca Institute of Nuclear Sciences, Laboratory for Materials Sciences, Mike Petrovića Alasa 12-14, P.O. Box 522, Belgrade 11000, Serbia
[3]University of Belgrade, Institute of Physics, Pregrevica 118, 11080, Zemun, Serbia

13.10 - 13.25 **ORL-AC 1**

Optimal Linear Regression and Sample Size for Characterization of Strength Distributions of Advanced Ceramics

Serkan Nohut

İstanbul Gedik University, Faculty of Engineering, Mechatronics Engineering, 34876, Kartal İstanbul, Turkey

13.25 - 13.40 **ORL-AC 2**

Natural Zeolites as surfaces for adhezion of acidophilic iron oxidizing bacteria

S. Stanković, A. Radosavljević-Mihajlović, N. Petronijević, M. Bugarčić, G. Jovanović, B. Marković, M. Sokić

Institute for technology of nuclear and other raw materials, Bulevar Franshe d Eperea 86, Belgrade, Serbia
Institute of Nuclear Science Vinca,, Belgrade, Serbia

13.40 - 14.45 **Buffet Lunch** **Restaurant Đura**

Red Hall, 1st Floor

14.45 - 15.45 **Session: Heritage, Art & Design**

Chairpearsons: Luz Gomez, Zoran Lević

14.45 - 15.00 **ORL-HAD 1**

Spinning bowls in the central Balkans: the innovation in the late neolithic textile industry

Marija Svilar

University of Belgrade, Faculty of Philosphy

15.00 - 15.15 **ORL-HAD 2**

Miniature Ceramic Objects as Archaeological Findings

Lidija Balj

Museum of Vojvodina, Dunavska 35, Novi Sad, Serbia

15.15 - 15.30	**ORL-HAD 3** **Historical development of the ceramics industry in Serbia with regard to some of the most significant producers** Zoran Lević Museum of Science and Technology, 51 Skender begova street, Belgrade	
15.30-15.45	**ORL-HAD 4** **Discussing acoustic function of the ceramic vessels inbuilt in the medieval church in village Trg** Zorana Đorđević[1], Dragan Novković[2], Filip Pantelić[2] [1] Institute for Multidisciplinary Research, University of Belgrade [2] The School of Electrical and Computer Engineering, Dpt for Audio and Video Technologies, Belgrade	
15.45 - 16.00	**Coffee Break**	**Hall, 1st Floor**
16.00-17.00	**Round table: Guide on Science Writing** G. Patience (Web of Science); W. Farenholtz (J.Am.Cer.Soc.); Springer Nature; De Gruyter	
17.00	**Closing Ceremony**	

Book of Abstracts

PL 1

Current Research on Bioinspired Materials in State Key Lab of Metal Matrix Composite in SJTU

Di Zhang, Jiajun Gu, Zhiqiang Li, Wang Zhang, Qinglei Liu, Dingbang Xiong, Yao Li

State key lab of metal matrix composites, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai, 200240 China

Biological materials naturally display an astonishing variety of sophisticated nanostructures that are difficult to obtain even with the most technologically advanced synthetic methodologies. Inspired from nature materials with hierarchical structures, many structural and functional materials are developed based on the model or templating synthesis method. We focused on creating bioinspired structure materials and replicating the morphological characteristics and the functionality of a biological species. One hand, the structure and toughened mechanisms of nacreous layer were introduced to design the Al composites. Biomimetic laminated CNT(carbon nanotube)/Al composite were design and fabricated, which obtain both strength and toughness. The other hand, we change original components of nature structure into our desired materials with original morphologies faithfully kept. Properties of the obtained materials are studied in details. Based on these results, we discuss the possibility of using these materials in photonic control, solar energy harvest, electromagnetic shielding, energy harvesting, and gas sensitive devices, et al. Related research will show by some speakers from our research group. These bioinspired structure and functional materials with improved performance characteristics are becoming increasing important, which will have great values on the development on structural function materials in the near future.

PL 2

Ultra-High Temperature Mechanical and Thermal Properties of ZrB_2 Ceramics

William G. Fahrenholtz

Materials Science and Engineering
Missouri University of Science and Technology

Zirconium diboride and other carbides, nitrides, and borides of early transition metals belong to a family of materials known as ultra-high temperature ceramics. Because of melting points in excess of 3000°C, these ceramics have been proposed for use in the extreme environments associated with hypersonic flight, atmospheric re-entry, rocket engines, and scramjet propulsion. Research at Missouri S&T has examined processing, densification, properties, and oxidation of these materials with recent research focused on characterizing thermal and mechanical behavior at temperatures up to at least 2000°C. For example, thermal conductivity of ZrB2 ceramics has been characterized up to 2000°C. At room temperature, reported values of thermal conductivity range from as low as about 30 W/m•K up to as high as 130 W/m•K with no explanation for the differences. Our research has focused on the effect that impurities and processing ad-

ditives have on thermal properties. Transition metals such as W and Cr reduce thermal conductivity due to decreases in electrical conductivity. In contrast, eliminating trace impurities such as Hf can increase thermal conductivity by increasing both the phonon and electron contributions to thermal transport. Reaction processing of high purity precursors has been utilized to produce ceramics with room temperature thermal conductivities in excess of 130 W/m•K. Mechanical properties of ZrB_2-based ceramics have been measured at temperatures in excess of 2000°C. Nominally pure ZrB_2 that had a room temperature strength of ~400 MPa maintained a strength of at least ~220 MPa up to 2300°C. The strength of ZrB_2-SiC was measured up to 2200°C. In air, elevated temperature strength was limited by oxidation damage to the ceramics. In inert environments, a strength of 130 MPa was maintained at 2200°C. Below 1800°C, strength was limited by the size of SiC clusters while above 1800°C strength was controlled by changes to the microstructure including growth of second phases and formation of liquids.

PL 3

‚Dual use' of science and technology - the ethical concerns

Wolfgang Bill Price

The presentation will examine the ‚dual use' of science and technology and the ethics from their applications for mass impact of the human condition. Through the ages impact and consequences from development of science and its application have shaped economies, societies, and the geo-political realms of states. The ‚dual use' from modern-day science has posed increasingly acute concerns for the welfare from transformative human conditions. The lecture will briefly cite the timeline for progression of major science and technology events and the ‚dual use' scale of their destructive and/or disruptive impact on society and the nature of the human condition. Particular attention will be on the ethical concerns from development of two recent ‚dual use' technologies with which the lecturer is familiar—nuclear and digital science.

PL 4

Design and Syntheses of New Nanotubes as Gene Carrier Materials

Susan Shwu-Chen Tsay, Uttam Patil, and Reuben Jih-Ru Hwu

Department of Chemistry, National Tsing Hua University, Hsinchu 30013, Taiwan, R.O.C.

The ability to deliver nucleic acids by plasmid DNA, antisense oligonucleotides, siRNA, etc. is under vigorous studies in scientific fields. It offers the potential to develop potent vaccines and novel therapeutics to cure diseases that cannot be remedied by traditional therapies, such as hereditary diseases, cancers, etc. Moreover, formation of triple helical DNA to deliver a triplex-forming oligonucleotide (TFO) as a sequence-specific gene targeting agent possesses very attractive application potential. Certain chemical modifications of natural nucleobases on the third strand may offer a good chance to enhance the stability of the Hoogsteen base pair. Thus

some DNA binders capable of forming hydrogen bondings with nucleobases were utilized to be onto carbon nanotubes. The hybridization between the interaction of DNA and ligands on the carbon nanotubes deviates from the reported π–π stacking between the nucleobases of DNA and nanotubes. In this talk, the design, syntheses and structural properties of these novel nanotubes investigated by physical and analytical methods will be discussed.

PL 5

Grain growth control during sintering of $BaTiO_3$ particles with semi-defined shape

Danilo Suvorov

Advanced Materials Department, Jožef Stefan Institute,
Jamova 39, 1001 Ljubljana, Slovenia

$BaTiO_3$ has been intensively investigated for a wide range of applications in the field of electroceramics due to its outstanding dielectric, ferroelectric and piezoelectric characteristics. All these properties are closely linked to the microstructural features such as the grain size and porosity. Grain growth that occurs during sintering of powders leads to various types of microstructures (fine, course, bimodal). Uniform grain size has been found to be essential to ensure good electrical and mechanical properties. Since the grain growth is determined by the diffusion and interface reactions the shape of initial particles, presence of liquid phase, dopants and atmosphere play an important role in the development of the microstructure [1].

In this study we explore the possibilities for controlling the grain growth during sintering of semi-defined shaped 100-200 nm $BaTiO_3$ particles, prepared by hydrothermal synthesis method. Due to the partially faceted interfaces different types of grain growth in terms of relative grain size are expected to occur in this system. These include normal grain growth, pseudo-normal grain growth, abnormal grain growth and stagnant grain growth. The variation of the relative contribution of the particular grain type will be examined for different sintering regimes and atmospheres. The control of the grain growth during sintering will include isothermal and two-step sintering. The last approach suppresses the rapid grain growth in the final-stage of the sintering [2]. The focus of this study will be on the preparation of the $BaTiO_3$ ceramics with uniform grain size distribution using the particular semi-defined shaped BaTiO3 particles. The recent reports about high d33 values of $BaTiO_3$ ceramics, prepared from hydrothermally synthesized nano-powders, raise expectations that high-performance $BaTiO_3$ ceramics could be obtained by controlling the density, grain-size and domain structure [3]. The microstructural development at different annealing conditions will be investigated in details. The dielectric and ferroelectric properties will be discussed in terms of grain size and domain structure.

[1] S-J. Kang, M-G. Lee and S.-M.An, J. Am. Ceram. Soc. 92 (2009)1464-1471.
[2] I.-Wei Chen and X.-H. Wang, Nature 404 (2000) 168-171.
[3]Y. Huan, X. Wang, J. fang and L. Li, J. Am. Ceram. Soc. 96 (2013) 3369-3371.

PL 6

Ceramics Application in Electrochemical and Thermoelectrical Energy Converters

Mihails Kusnezoff, Jochen Schilm, Axel Rost,
Stefan Megel, Alexander Michaelis

Fraunhofer IKTS, Winterbergstr. 28, 01277 Dresden, Germany

Functional ceramics are widely used in different fields of energy applications. The modern electrochemical energy converters and storage devices, such as solid oxide cells and solid state batteries, contain ceramics as electrode and electrolyte. Even in thermoelectric modules ceramics is used not only for packaging and connecting of single TEG elements but also for thermoelectric energy conversion.

The solid oxide cells have great potential within energy conversion field and can been used for highly efficient power generation as fuel cells or in converting of steam/CO_2 mixtures to the syngas for following Fischer-Tropsch conversion by excessive electricity at high temperatures above 750°C. The latter presents an opportunity for recycling of CO_2 into a useful liquid fuel.

All solid state batteries with Li^+ and Na^+ conducting electrolytes are of high interest due to their high electrochemical stability, safety and good ionic conductivity.

NASICON type materials based on the parent composition $LiTi_2(PO_4)_3$ as well as LLZO represent a favourable material classes for lithium batteries.

Common sodium sulphur batteries with ion conducting ceramic separators operate at temperatures of 300°C in order to reach acceptable cell efficiencies. Furthermore, an intensive research on new sodium sulphur battery systems for decreased operating temperatures below 100°C leads to new opportunities.

In thermoelectric devices the ceramic/metal brazing is a key enabling technology for reliable module manufacturing. Despite low efficiency of ceramic thermoelectric material high performance modules which were able to work even at temperature differences up to 500 K can be manufactured.

PL 7

How a fundamental understanding of the properties of microwave ceramics can be used to enhance their performance & develop magnetically-controlled microwave devices

Nathan Newman, Justin Gonzales, and Ahmad Sayyadishahraki

Materials Program, Arizona State University, Tempe, AZ

Future satellite communication and cellular systems requires low-loss temperature-compensated microwave ceramics with enhanced dielectric constants. Despite the practical importance of achieving a small loss tangent and near-zero temperature coefficient of resonant frequency (τ_F) in these materials, a fundamental understanding of which physical mechanisms are responsible for determine these important parameters has not been firmly established. I will describe my group's efforts using modern experimental and theoretical condensed matter meth-

ods to identify the responsible mechanisms in practical materials. We show that the dominant loss mechanism in commercial microwave materials comes from spin excitations of unpaired transition-metal d electrons in exchange coupled clusters at reduced temperature. At room temperature, we correlate the dominant loss mechanism with polaron transport. We also show that the properties of commercial cell-phone base station filters, are optimized by adding dopants or alloying agents, such as Ni or Co, to $Ba(Zn_{1/3}Ta_{2/3})O_3$ and $Ba(Zn_{1/3}Nb_{2/3})O_3$ to adjust τ_F to zero. This occurs as a result of the temperature dependence of $\varepsilon_\rho \mu_r$ offsetting the thermal expansion.

PL 8

Materials and System Development for Near Infrared Biophotonics with Transparency

Kohei Soga

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The wavelength range between 1000 and 1700 nm is known as one of the most transparent range for light to propagate biological tissues. As for fluorescence bioimaging, it is known that the observation depth is limited to be in several millimeters. On the other hand, in the above range, it can reach several centimeters. The range has been called with various names, such as second biological window, NIR II or OTN-NIR (over-1000-nm near infrared) and attracted attentions of the developer and users of biophotonics during the decade. The author and the coworkers have developed both materials and imaging systems for the OTN-NIR biophotonics. It is known that some sort of dyes, quantum dots, carbon nanotubes and rare-earth doped ceramic nanoparticles (RED-CNPs) are emissive in the OTN-NIR range. Namely, the RED-CNPs can be applied for various photonic applications since they can emit not only the OTN-NIR fluorescence but visible fluorescence with a near infrared excitation through a process called upconversion. The presentation will review the OTN-NIR biophotonics together with the application of the RED-CNP for various scenes of biophotonics as small animal bioimaging, photodynamic therapy and nanothermometry.

PL 9

Glass and glass ceramic layer composites with functional coatings - materials and process engineering, product development and applications

Rainer Gadow, Andreas. Killinger and Venancio Martinez

Institut für Fertigungstechnologie keramischer Bauteile,
Universität Stuttgart, Allmandring 7b

Functional coating deposition by thermal spraying is a sophisticated and versatile solution to improve superficial properties of machine components and parts in various technical systems, with high flexibility, easy integration and reduced production cost. The manufacturing by thermal spray technology of functional coatings with insulating and electrically conductive proper-

ties on glass or glass ceramic substrates is of outstanding interest for new application fields in environmental engineering, techncal physics and advanced consumer industries, such as ozonizer tubes, solar absorbers, new energy efficient cooking plates or packaging technology in this study. Due to the specific thermophysical properties of the substrate materials glass and glass ceramic, i. e. low or even negative CTE, low heat conductivity and inability of plastic deformation, modified or new production processes in comparison to the established coating operations on metal substrates are required. It is of hghest imprtance to prevent coating failure or the layer composite component collapse, due to the distribution of residual stresses in the composite induced during and after the deposition process, as well as by operational load stresses. In the described product development approach, the three coatings systems, metal oxide layer-composites, ceramic-metal mixed layers and ceramic mono-layers as conductive coatings on glass ceramics were thermally sprayed by APS with a predefined geometry. The influence of different process parameters on coating electrical and mechanical properties and residual stress distribution through the coating and substrate is analyzed. Finally a concept to maange the mismatch of thermophysical properties by optimzed heat and mass transfer as well as sophisticated robot trajectories during coating operation is introduced and elaborated.

PL 10

Facing Global Challenges with Materials Innovation

Fernando Rizzo

Department of Chemical and Materials Engineering, PUC-Rio, Rio de Janeiro, Brazil

The path of society evolution has long been associated with growing demand for natural resources and continuous environmental degradation. During the last decades, this pace has accelerated considerably, despite the general concern with the legacy being left for the next generations. Looking ahead, the predicted growth of the world population, and the improvement of life conditions in most regions, point to an increasing demand of energy generation, resulting in additional pressure on the Earth sustainability. Materials have had a key role in decreasing the use of natural resources, by either improving efficiency of existing technologies or enabling the development of radical new ones. Greenhouse effect (CO_2 emission) and energy crisis are global challenges that can benefit from the development of new materials for the successful implementation of promising technologies and for the imperative replacement of fossil fuels by renewable sources. The talk will present some examples and highlight cases of technological developments that are dependent on materials innovation.

PL 11

Powder to Process

Gregory S. Patience

Polytechnique Montréal, Department of Chemical Engineering, Montréal, Canada

Modern society flourishes because of advances in powder technology that spans fields from food (flour, sugar, cheerios), cement, ceramics, chemicals pharmaceuticals, and batteries. The emerging challenges for humanity will be to recycle the products of these advances rather than

allowing them to accumulate in the environment. The feedstocks of the future will be biomass and waste. However, to compete with petroleum and existing infrastructure, emerging processes must be economic as consumers continue to favour low prices and convenience over conscience.

Micronization is one of the first steps to decrease the heterogeneity of waste and biomass, to make to make catalyst, and also to produce nano-particles for Li-ion battery materials. Slurrying these particles with substrates – enzymes, carbon, and colloidal silica – follows in many processes. Our laboratory fabricates C-$LiFePO_4$ nanoparticles and powders for cathode materials, synthesizes catalyst for processes that convert glycerol (from biodiesel) to acrolein, fructose to furan dicarboxylic acid, and wasted natural gas to Fischer-Tropsch fuels, and powders to depolymerize end of life polymers to monomers like polymethylmethacrylate to metahcacrylic acid. We spray dry the slurries in the next manufacturing step for catalysts to produce spherical microspheres from 20 μm to 200 μm. Finally, high temperature furnaces calcine these powder to activate them and to improve their attrition resistance to survive the mechanical stresses during transport or in reactors.

Our laboratry has integrated mechano-chemical techniques to decrease the processing times to produce particles. We introduced ultrasonic probes into a media mill with 2 mm zirconia media. With this innovation, we were able to micronize $LiFePO_4$ powders at a 60 weight percent and reduce the particle size to less than 200 nm. We spray dried these powders to form microspheres and developed a recipe

To convert fructose solutions to value added chemicals, we developed technology in which we atomize a liquid solution into a catalytic fluidized bed operating at between 200 ^oC and 500 ^oC. Since the heat and mass transfer rates are faster than the caramelization rates, the hexoses react HMF and DFF. Reaction rates are orders of magnitude higher than liquid phase processes and deactivation rates due to furanic polymers are lower.

Challenges facing these technologies include (1) densifying nanparticles for batteries; (2) reducing Ostwald ripening (precious metal sintering) and coke in reactors operating at high pressure; (3) atomizing sugars in large scale spargers; and (4) identifying reactor technology and catalyst to recycle end of use polymers.

PL 12

Ideas and challenges of ceramic complex shape parts manufacturing by Spark Plasma Sintering and 3D printing

A.V. Ragulya, S.E Ivanchenko, S.A. Umerova, V.G. Kolesnichenko, O.V. Mikhailov

Frantsevich Institute for Problems in Materials Science NAS of Ukraine, 3 Krzhizhanovsky str., 03142 Kyiv-142, Ukraine

Present research is addressed to complex shape parts manufacturing problems. One of the attractive approaches to achieve fully dense ceramic pieces is SPS in the mode of sinterforging provided high strain rates at temperatures of superplastic deformation. Preliminary sintered ceramic workpiece with residual porosity below 5% and grain size smaller than 100 nm is considered valid for high temperature creep at the strain rate of $10^{-3} \div 10^{-4}$ 1/s under moderate pressures and external electric field. The experimental evidences are shown for nanostructured Si_3N_4 and $MgAl_2O_4$ using HP-D25 SPS machine of the FCT System GmbH.

FEM results of modeling the SPS sinterforging are presented for dome-shape ceramic parts. Another approach considered here includes 3D printing technology exploating CJP360 printer for spinel nanopowders. Details of printing, bleed compensation, density and porosity dis-

tribution are presented. Different accuracy of printing by X,Y and Z axes is a feature of 3D printing technology should be taken into account and therefore several practical results are presented.

PL 13

Structural Health Monitoring of Glass Fiber Composite Materials by piezoelectric Nanosensors using Cyclic Loading

Khan, Zaffar

Institute of Space Technology, Department of Aeronautics & Astronautics

This research aims to investigate the in situ structural response of glass fibre composites under cyclic loading using piezoelectric effects. This involved deposition of smart sensing layer on glass fiber reinforced composite substrate. The substrate chosen was developed from 8 layers of woven glass fiber laminated using VARTM technique. The smart sensing layer is composed of carbon nano-particles dispersed in high density polystyrene. The smart sensing layer was deposited on the composite specimens using doctor blade and a slot die as part of ongoing research about structural health monitoring.

Cyclic tests were performed to demonstrate the repeatability of the sensor as well as various characteristics such as, linearity, saturation and general response characteristics in UTM. The dynamic response of the smart layer reveals that the nanosensors are able to follow loading and unloading cycles almost linearly without any delay. The response of the sensor is frequency dependent with saturation / noise observed at high frequency cyclic testing. The smart layer also demonstrated repeatability when cyclic loads are applied. The hysteresis response has been correlated to damping function. This information may be effectively used to predict the failure modes, pattern and sequence of composites in wind turbine blades under cyclic loading.

PL 14

Development of porous and dense Si_3N_4 bodies for different applications

F. Golestanifard

Emeritus professor

This report discusses the research results of synthesis, microstructural and property development of silicon nitride (Si_3N_4) bodies, with emphasis on potential applications. Si_3N_4 is of interest due to its low density, and high thermal and chemical resistances. Being researched for the last 30 years, better processing roots are still in demand.

Dense and porous Si_3N_4 bodies were developed via different roots, including direct nitridation, powder sintering and aqueous gel casting processes. Both, pressure-less and hot pressings were employed to consolidate the synthesised powders. X-ray diffraction and Scanning Electro-Microscopy were used to study the phase and microstructural evolution. Bending strength and toughness measurements were taken to evaluate the property improvements. Si_3N_4 bodies were also evaluated for Electrically Discharge Machining (EDM), where titanium nitride (TiN) was used as the conductive additive.

It has been found that the amount and distribution of β-Si_3N_4 plays a vital role in improving mechanical properties. It was possible to develop bodies with 40% porosity and a bending strength above 200mPa. Addition of 35% of evenly distributed TiN furnished a microstructure which could be EDM-ed successfully. It has also been found that the temperature, nitrogen pressure and soaking regime were the most influential factors in the sintering behaviour. Si_3N_4 bodies developed in this research can be used for biomedical and aerospace applications, due to their low density, low dielectric constant, high strength and suitable microstructure.

PL 15

Electroceramics for High Frequency Applications with Low Temperature Fabrication Methods

Heli Jantunen

Microelectronics Research Unit, University of Oulu, Faculty of Information Technology and Electrical Engineering, Oulu, Finland

Low Temperature Co-fired Ceramics (LTCC) technology is used very widely for high frequency applications. In the recent five years, Ultra Low Temperature Co-fired Ceramic (ULTCC) materials have been developed utilizing the same LTCC fabrication procedure having the main difference only in the decreased firing temperatures (700-200 ºC). Both of these technologies are even more valid when we are utilizing even higher frequencies in the near future. In addition, feasible materials with room temperature fabrication has been recently introduced. The aim here is to survey the advantages and readiness levels of these technologies through practical examples, and discuss the future chances especially from the microwave/millimeter wave electronics and their packages point of view.

PL 16

Functionalization of graphene + transition metal oxide composites

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Low-dimensional structures made of carbon, such as nanotubes, fullerenes, graphene and others have been the subject of great interest for since two decades [1]. In the recent years graphene, allotropic form of carbon having a quasi-two dimensional lattice structure has been the subject of considerable interest due to remarkable properties it possesses i.e. high electron mobility due to Dirac-like band structure, high breaking strength which is 200 times greater than the value for steel, high thermal conductivity, very high specific surface area and many others.

High specific surface area of graphene was the reason for the increasing interest in the recent years towards the decoration of graphene with magnetic nanoparticles [2]. Nanocomposite materials consisting of graphene with magnetic nanoparticles are considered to be of major interest in the recent years since they are capable of significantly improving functional properties of base materials. Transition metal oxides, and in particular iron oxides such as Fe_2O_3 and Fe_3O_4 are considered to be very important from the applicability point of view due to their biocompatibility in physiological environments and low toxicity. Graphene decorated with magnetic iron oxide will have a significant impact on magnetic properties of the resulting composite, making it very promising for a variety of fields of applications such as magnetic energy storage, biomedicine, catalysis, magnetic fluids, and environmental remediation.

In this lecture, I will discuss the most important aspects of the current progress in understanding the structural and magnetic properties of the selected representatives of graphene + Fe_2O_3 , $CoFe_2O_4$ and $NiFe_2O_4$ composite systems. I will start by presenting the present state of the studies of the physical mechanisms of the magnetic properties of graphene composites. 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 magnetic impurities in these systems as well as the leading magnetic interactions present at different temperature regions. In particular we focus on finding limits at which the magnetic properties of the composite, such as parameters of the magnetization hysteresis loop, can be varied via changes in Fe_2O_3 content and the type of solvent used for sample synthesis.

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KN-BCS 1

Structural and magnetic ordering in polycrystalline $Sm_{0.5}Ca_{0.2}Sr_{0.3}MnO_3$ perovskite

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The $Sm_{0.5}Ca_{0.2}Sr_{0.3}MnO_3$ perovskite samples are prepared by conventional solid-state reaction technique and sintered at different temperatures (750 ,800 ,850 ,900 ,1000 ,1050 C). The XRD investigation confirms that $Sm_{0.5}Ca_{0.2}Sr_{0.3}MnO_3$ crystallizes in single phase orthorhombic structure with space group Pnma. From the SEM images, it is observed that the grains have well defined perovskite structure and the grains are homogeneously distributed throughout the sample. Field cooled (FC) and zero-field cooled (ZFC) dc magnetization measurements show a divergence at low temperature (around 100K) which indicates a frozen state. Some salient features of this curve are as follows : (i) $Sm_{0.5}Ca_{0.2}Sr_{0.3}MnO_3$ displays the spin freezing temperature, T_f = 27 K. (2) There is a second peak which may be ascribed to some ferromagnetic clusters having well defined T_c = 59K. (3) A broad hump is seen around 250K signifying the charge ordering

temperature (T_{CO}). The temperature derivative of M(T) curve taken with an applied field of 100 Oe indicates the spin freezing temperature, Tf = 27 K, the Curie temperature T_c=59K and the charge ordering temperature (T_{CO}) = 265K. The M-H curve at temperature T=100K shows a linear dependence of M on H which is attributed to the anti-ferromagnetic state. Frequency dependence of AC susceptibility measurement shows a peak around T_f. The temperature dependent ac susceptibility curves peaks at different frequencies decreases with increasing frequency, indicating a spin-glass-like transition.

KN-BCS 2

Rapid microwave sintering of ceramic materials and powder metals

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Recently it has been demonstrated experimentally that microwave heating can be used to achieve ultra-rapid sintering of ceramics. Using a gyrotron system operating at a frequency of 24 GHz, compacted samples based on oxide ceramics were sintered to full density within a time not exceeding several minutes. The ultra-rapid sintering regime requires that the absorbed microwave power be above a certain threshold value, typically on the order of 10...30 W/cm^3. Similar to the dc electric field-assisted flash sintering, at this power level the volumetric heating results in an overheating instability (thermal runaway), which is accompanied with a drastic enhancement of the mass transport in grain boundaries. As opposed to ceramics, in powder metals the thermal instability usually does not develop because their conductivity decreases with temperature. However, rapid sintering of powder metals can be accomplished by purposely using the resonant nature of microwave heating. The implementation of these rapid sintering processes is contingent upon fast and efficient control over the temperature and the microwave power supplied to the materials.

KN-OGE1

Photocatalysts based on hybrid nanostructures of metal oxides

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In this research work, the preparation of γ-Fe_2O_3-ZnO hybrid nanostructures was carried out through a solvothermal process evaluating the influence two experimental parameters such as the reaction temperature and time. The shape, structure, chemical composition, puri-

ty, crystalline phase and the spectroscopic and photocatalytic properties of prepared nanocomposites were characterized by X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (HR-TEM), Vibrating Sample Magnetometer (VSM), Coupled Plasma Optical Emission Spectroscopy (ICP-OES), Dynamic Light Scattering (DLS), Thermogravimetric Analysis (TGA) and UV-Vis Spectroscopy. Based on the observations obtained for the degradation of methylene blue (MB, used as a model of cationic dye), under irradiation of UV-Vis light, the nanocomposites of γ-Fe_2O_3-ZnO synthesised both at 6 h, and 12 h at 120 °C demonstrate a high photocatalytic activity compared to γ-Fe_2O_3 and pure ZnO. The percentage of degradation obtained for both nanostructures was much higher than that obtained for the pure compounds of γ-Fe_2O_3 and ZnO (85% and 81% versus 51% and 46%, respectively). Also, the study of stability and recyclability in the degradation of the MB dye was carried out. For this purpose, photocatalytic tests were carried out by reusing these nanocomposites after magnetic recovery. It has been verified that the photocatalytic properties of these nanocomposites are maintained, demonstrating the high photocatalytic stability of the prepared nanocomposites. In summary, γ-Fe_2O_3-ZnO hybrid nanostructures are suitable candidates for its use in environmental applications and to solve problems of removal of organic contaminants in the wastewater treatments.

KN-OGE2

Tailoring of nanoporous structures and carbon nanotextures of bio-carbon electrode materials for energy storage

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Plant biomass has evolved intriguing and complex structures with biopolymers (lignocellulosic, etc.) made of carbon, hydrogen, and oxygen as major chemical constitutive elements. Many structural characteristics of plant biomass, such as the structural hierarchy of cell-wall constituents and the arrangement of the vascular bundles, are believed to be highly responsible for their structural and functional properties including the capability of adapting to their environment, resisting assault from enemy, and energy capture, conversion and transport for their survival. These optimized structures make plant biomass to attract much attention being as a sustainable resource for mass production of renewable functional carbon materials. In the talk, we will introduce our recent progress of nanoporous carbon-based electrode materials from biomass for supercapacitors and lithium-ion battery. Using appropriate approaches, hierarchical porous structures and carbon nanotextures have been formed throughout the carbon matrix and tuned over the nanoscale range to provide improved functional performance. Benefited from the diversity in functionality, low cost, short growth cycle, abundance, and renewability, plant biomass is promising for the development of advanced nanostructured functional carbon materials.

KN-NB 1

Motion Control of nano/micro sized ceramics by Nano second pulse field

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This study aims to elucidate the mechanism of driving nano/micro dielectric ceramics particles under the nano second pulse or DC electric field. The microstructure driving is affected by various electrical phenomena occurring at the same time such as surface potential, polarization, and electrostatic force. It makes the challenge to clarify the driving mechanism. A simple experimental system was used to observe the behavior of the ceramics nano particles and spherical micro ZrO_2 particles in a nonaqueous solution under the electric field. The results suggested that the driving mechanism of the ceramics nano particles and ZrO_2 particles under electric field was created by the combination of the electric image force, the gradient force, and the contact charging phenomenon. It is propose a method to control the micro/nano structure by using this motion control mechanism in the further studying and application.

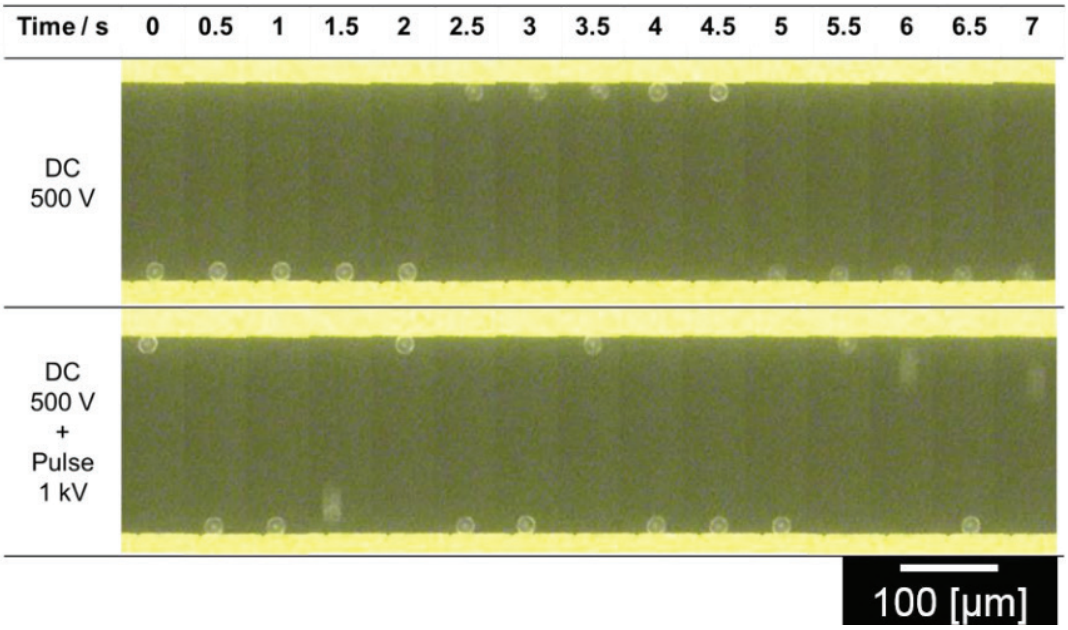

Fig. Comparison of the driving ZrO_2 particles under the DC electric field, or pulse and DC superposition electric field. DC 500 V and pulse 1000 V were applied as the superposition voltage.

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KN-NB2

Biomedical-grade ceramics: innovations in design and development

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Aim: The benefits of advanced bioceramics have been universally recognized, specifically in terms of strength, wear resistance and biocompatibility. However, next-generation devices require increasingly higher performance and durability. To this aim, we have developed innovative designs and controlled processing routes for advanced bioceramics. Two cases studies are presented here: the former dealing with structural ceramics for dental applications, the latter with bioactive composites for bone replacement.

Method: A complex zirconia-based triphasic composite was designed and developed, with the aim of fabricating dental implants characterized by high strength and toughness, a perfect reliability and a lifetime longer than 60 years. On the other hand, we have developed a new graded scaffold, combining a gradation of composition and porosity, based on calcium phosphates (CPs) and polycaprolactone (PCL), the former to supply rigidity and strength, the latter to provide an active environment with the living tissue.

Conclusion: Zirconia-based ceramics fully satisfied the design requirements, since materials having flexural strength > 1 GPa, fracture toughness > 10 MPa√m and no degradation behavior were developed. The graded scaffold showed a proper porosity gradient as well as a modulation of biodegradation activity moving from the dense ceramic core to the external macroporous CPL/CPs composite, demonstrating the potential of this innovative scaffold to fit the target multi-functionality.

KN-NB3

An intelligent automotive catalyst applied to hydrogen recombination

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Ceramics are applied in the automotive catalyst, and heat-resistant alumina and ceria-zirconia have been used as support materials for dispersing precious metals to suppress grain growth under high temperatures.

“An intelligent catalyst” is utilized the ceramic crystal more dynamically. Catalytically active precious metal is dissolved in a host perovskite lattice forming solid solutions, and released on the surface as metallic nano-particles according to the inherent redox fluctuation of exhaust. The intelligent catalyst is characterized by realizing the rejuvenating function instead of preventing aging. The function was actually applied to Pd, Rh and Pt, and put to practical use in 2002 and has been adopted for super-ultra-low-emission-vehicles (SULEV) exceeding 6.5 million.

March 2011, by the Tohoku-Pacific Ocean Earthquake and subsequent Tsunami, hydrogen explosions has occurred in Fukushima Daiichi Nuclear Power Plant. A huge amount of highly radioactive waste has been gathered and kept in the container. During the long-term sequestration storage, strong radiation decomposes water and generates hydrogen and oxygen in the container. Thus, highly active catalysts for recombining hydrogen into water have been strongly desired. The intelligent catalyst demonstrates the ability to oxidize hydrogen from cryogenic temperatures and is expected to contribute to safe storage of radioactive debris and waste.

KN-NB4

Ion channeling and nuclear resonant elastic reaction in analysis of materials

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This work is devoted to the application of the ion channeling and nuclear resonant elastic reactions in the analysis of materials. It will be illustrated in the case of nuclear resonant elastic reaction $^{12}C(p,p_0)^{12}C$, at 1.737 MeV, and the implantation of 4 MeV carbon atoms in the <100> diamond crystal. The spectra from the virgin samples were recorded for 1.2, 1.5, 1.75 and 1.9 MeV protons for determination of the channeling parameters and the energy calibration. Our newly developed computer code CSIM, which is based on the phenomenological approach, has been used for fitting of the spectra including the ones with the protons of the same energy and the implanted sampled. As a result, we were able to determine the ion beam induced diamond crystal amorphization.

KN-NB5

Bioinspired optical related materials from Lepidoptera wings

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Recently, an increasing number of researchers have directed their attention to the wings of *lepidopterans* (butterflies and moths) because of their dazzling colors. According to one previous study, these iridescent colors are caused by periodic structures on the scales that make up the surfaces of these wings. These materials have recently become a focus of multidiscipline research because of their promising applications in the display of structural colors, advanced sensors, and solar cells. This work will provide a broad overview of the research into these wings. Specifically, the review focuses on characterization and simulation of bioinspired optical materials templated from lepidopteran wings scales.

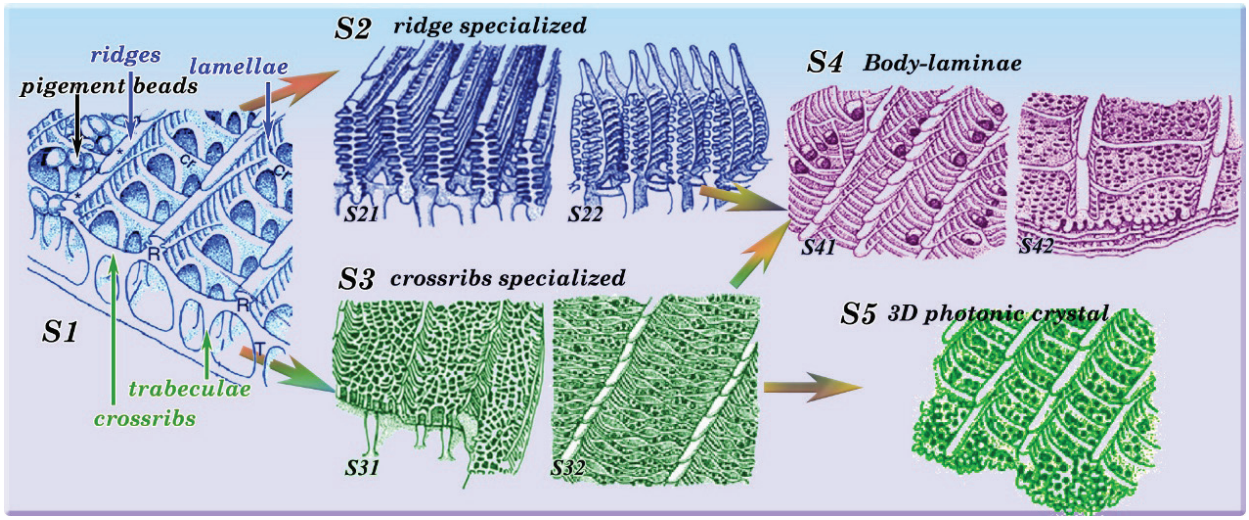

Figure 1. Five microstructure groups of butterfly wing scales. Ridges, crossribs (or horizontal struts), lamellae (or subribs), trabeculae (or vertical struts), and pigment beads are all marked in S1

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KN-MS1

Time-dependent Intergranular Capacitance Induced by Solid Skeletal Structure Evolution

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It is the fact that for many different sintered ceramic materials a number of common basic (diffusion) sintering mechanisms exist, which determine their microstructural development and final properties, including electrical properties. Therefore it is particularly interesting to gain better understanding of these mechanisms and how they affect the production of ceramics with optimal properties. One way is by simulation. Process modeling by simulation enables the evolution of parameters to be followed throughout the processing time and offers a framework within which experimental observations can be assessed.

In modeling intergranular capacitance we will focus on the behavior of intergranular regions of ceramic samples. It is convenient to assume that if loose powder grains are brought into contact, inter-atomic forces cause small circles-of-contact (necks) to form between them. Thus, we will assume that the contact regions can be approximately treated as micro-capacitances which dielectric thicknesses change as their necks grow and the grains approaching each other, by diffusion.

Our approach will be based on rigorous topological characterization of skeletal structure that requires reducing the solid-phase space into a node network and emphasizes connectivity.

The skeleton network, will be given as a system of functions of some topological parameters, which changes monotonically with time by adding new solid-phase domains during solid skeleton evolution due to neck growth.

The simulation of neck growth will be based on the concept that sintering neck growth law $f(D)$ and the sintering transformation of special type, $D^{t+\Delta t} \mapsto D^t - f(D^t) \cdot \Delta t$, can be applied to each pair of contacting grains within the multi-grain model. The update of the state will be defined by the new topology of the skeletal structure, which will be accomplished by updating the position of each grain.

We will only investigate the phenomena occurring in the grain-boundary regions, i.e. the case where the grain boundary impedance is the dominant impedance in the sample. We will define the method for analyzing intergranular capacitance by separating the contributions of grain boundaries and grains and by introducing mathematical formalisms.

Note that the developed model for intergranular capacitance can be applied to real systems with spherical grain distributions. The model can be used to assist in the creation, modification, analysis and optimization of new high-performance electronic ceramics materials. Even more, the paper presents an attempt to model and to establish an equivalent electrical model of time-temperature dependent intergranular impedance.

KN-MS 2

Numerical Simulation of Microstructural Evolution during Fabrication and Service

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Controlling the engineering properties of ceramics is highly dependent on controlling their microstructure, thus models that predict the evolution of microstructure during fabrication and during engineering service life are important to designing ceramics for their respective applications. In this talk, the two major models used to simulate microstructure evolution, phase-field, kinetic Monte Carlo and their variants, will be reviewed with emphasis on their capabilities and limitations. Several cases of microstructural evolution namely grain growth, sintering, diffusion-limited phase transformations, precipitate nucleation and growth, recrystallization and others will be presented. The application of models to each phenomenon will be described and the insights gained from simulating the processes will be also be described. Lastly, the future trends in modeling microstructural evolution will be discussed.

Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525

INV-BCS 1

Mathematical Modeling in the Process of Sintering MgO from Seawater

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Magnesium oxide obtained from seawater by substoichiometric precipitation, with the addition of 80% of dolomite lime as the precipitation agent was used in the present study. The sintering process was conducted at temperatures of 1400, 1500 and 1700 ºC for the duration of 1, 2 and 4 h and the addition of 1, 2 and 5 wt % TiO_2 with the purpose of establishing a mathematical model between the B_2O_3 mass fraction as the dependent variable and independent variables of the temperature of isothermal sintering, the isothermal sintering time and the mass fraction of the added TiO_2. The B_2O_3 mass fraction in sintered MgO samples changes with the change in the parameters of activated sintering. Compared to the B_2O_3 mass fraction in calcined MgO sample, the percent of B_2O_3 evaporated from the sintered samples increases both with the increase of the duration of isothermal sintering and with the increase of the sintering temperature and the mass percent of TiO_2 added. Different techniques have been used for characterization of the sintered MgO samples. The addition of TiO_2 leads to formation of $CaTiO_3$ and $MgTiO_4$ which has been detected by the XRD analysis. The SEM/EDS analysis of MgO samples detected the presence of CaO and confirmed the results obtained by the XRD analysis. The chemical analysis detected the presence of CaO and B_2O_3 as impurities. The TiO_2 reaction with CaO reduces the amount of CaO available to react with B_2O_3, therefore a higher amount of B_2O_3 can evaporate during the sintering process. The correlation and regression analysis was performed on the experimental data using the Statistica 7 mathematical package. Multiple regression models were examined in order to obtained the best regression equation (higher determination coefficient R^2, lower standard estimate errors and it met the conditions imposed by the residual analysis). This relationship among all the factors of sintering makes it possible to predict the B_2O_3 content in the final product of MgO.

INV-BCS 2

Behavior of ceramic material at the micro meteorites impact

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The micrometeorites and cosmic dust play an important role in reducing the life span of space objects. Hypercinetic particles, with masses and energies distributed in a very wide range of scales, probable bombard the spatial objects, producing damage with less or greater, sometimes catastrophic, functional effects. The magnitude of the operational lifetime of spatial structures, in particular of satellites of any nature, is currently done by various methods. One of them, widely used, is to protect vital surfaces with materials able to withstand, to some extent, the im-

pact of the hypercinetic. Ceramic materials are used as protective layers for exposed components. In the design of super-protective structures there are difficulties in establishing the conditions of impact, the problem having many unknowns, including the distribution of masses and velocities of the microparticles, the trajectories, the frequency of impact, etc.

In this paper on the modelled heterostructure with finite elements were analysed the behaviour in the shock regime, the spectral response and the dynamic response to the harmonic excitation in the base with acceleration intensity of 20 g.

Thus, the first part of the paper analyzes and interprets the existing data regarding the field of the microparticles in the vicinity of the Earth, then an analysis of the ceramic materials protection is made, in order to establish the defining mechanical properties and the material models used in the quantitative approaches. During the second part a methodology is developed to analyze the effects of the impact of the hypercinetic on the protective layers. The third part is intended for the numerical analysis of the impact of the hypercinetic and the probabilistic probability of the lifetime, correlated with the impact risk, for several constructive variants and conjuncture situations as well. The results obtained in this paper are useful before to make some experimental research.

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INV-OGE 1

Multifunctional nanomaterials base on inorganic hydroxides: a look from the atomic scale

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Nanomaterials with brucite structure have aroused interest in a wide range of applications due to its structure in layers which allows capturing inorganic and organic ions. Among them, $Ca(OH)_2$ and $Mg(OH)_2$ stand out for their alkalinity which can be used for controlling acidi-

fication processes, in wall paintings or paper surfaces, in a wide field within cultural heritage conservation. The capability of capturing CO_2 in the structure causes its carbonation, allowing the application in consolidation and restoration of building materials, including lime mortars and carbonate stones.

Environmentally, Ca/Mg hydroxides can be used as CO_2 gas and nuclear waste collectors and also for elimination of liquid contaminants. Also, they are used as flame retardants and antibacterial agents. A comprehensive control of the structure is important to determine the stability and phase transformation processes. TEM-HRTEM results of diverse nanoparticles obtained from different synthesis routes are discussed in terms of morpho-structural properties, performing a detailed atomic-scale analysis of the defects and their role in dehydration processes, optical properties and crystal shape variations using TEM-EELS, SEM-EDS, Electron diffraction, image analysis, XRD and ESEM-Cathodoluminescence spectroscopy. Results show how depending on the synthesis conditions, besides of environmental parameters such as relative humidity, time or in-situ radiation effects, give rise to microstructural variations which modify their properties.

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INV-OGE 2

Development and application of highly efficient undoped, doped and composite nanostructured photocatalysts based on titanium dioxide

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Titanium dioxide, due to its photocatalytic activity, chemical/biological inertness, resistance to chemical-/photo-corrosion, non-toxicity, and relatively low cost, is one of the most studied semiconductors for applications in environmental protection, self-cleaning, deodorizing, sterilizing and renewable energy sources. However, owing to its wide band gap and fast electron/hole recombination, the efficiency of photocatalysts based on TiO_2 is typically low for potential practical applications. In order to improve the photocatalytic efficiency of TiO_2, research efforts have been dedicated to: (1) reducing the band gap energy by doping (N-, C-, etc.), (2) improving the separation (reducing the recombination rate) of photogenerated charge carriers (TiO_2/modified carbon nanotubes (CNT) nanocomposites, etc.) and (3) increasing the specific surface area and the quality of the active sites (nanoparticles, nanorods, nanocomposites, nanostructured thin films, etc.). The phase composition, crystallite size, and the structural and surface properties of the obtained nanostructured photocatalysts were analyzed by XRD, FEG-SEM, TEM/HRTEM, XPS and FTIR spectroscopy, as well as by low temperature N_2 adsorption. The results of C.I. Reactive Orange 16 photodegradation/Cr(VI) photoreduction in the presence of most of the synthesized catalysts showed their high photocatalytic activity.

INV-OGE 3

Detection of high pressure phase transitions in RE^{3+} doped Y_2O_3 and Y_2MoO_6 through luminescence measurements

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Rare earth ions (RE^{3+}) are highly sensitive to local symmetry so changing the symmetry is reflected in their luminescence spectra. In this work we investigated the high pressure photoluminescence properties of cubic and monoclinic Y_2O_3, as well as, monoclinic Y_2MoO_6, doped either with Eu^{3+} or Sm^{3+} ions.

Photoluminescence emission of cubic Y_2O_3:Sm^{3+} and Y_2O_3:Eu^{3+} phases were recorded up to the pressure of 20 GPa and 15 GPa, respectively. With varying pressure, the intensity ratio of $^4G_{5/2} \rightarrow {}^6H_{7/2}$ and $^4F_{3/2} \rightarrow {}^6H_{7/2}$ Sm^{3+} emission shows three distinct regions. Furthermore, the intensity ratio of $^5D_0 \rightarrow {}^7F_1$ and $^5D_0 \rightarrow {}^7F_2$ Eu^{3+} emission of the cubic matrix has similar pressure dependence as Sm^{3+} doped phase. A steep pressure dependence evident in the range of 9.2-13.1 GPa could be used for detecting a pressure induced cubic to monoclinic phase transition of Y_2O_3 matrix. It matches well the behavior of the pressure sensitive Sm^{3+} spectra in the range of 9.1-11.6 GPa, which is proven to appear due to a phase transition at ~ 11 GPa.

The monoclinic Y_2O_3:Eu^{3+} also has a pressure-sensitive intensity ratio of $^5D_0 \rightarrow {}^7F_1$ and $^5D_0 \rightarrow {}^7F_2$ emission lines. Measurements for the monoclinic Y_2O_3:Eu^{3+} matrix were recorded up to 8 GPa. The dependence is unambiguous, without any phase transitions in the measured region. The nature and high sensitivity suggests that this dependence can be used as an efficient high pressure sensor.

Photoluminescence emission measurements of Y_2MoO_6:Sm^{3+} and Y_2MoO_6:Eu^{3+} phases were recorded up to 12 and 11.5 GPa, respectivelly. Intensity ratio variation of $^4G_{5/2} \rightarrow {}^6H_{5/2}$ and $^4G_{5/2} \rightarrow {}^6H_{7/2}$ Sm^{3+} emission lines, as well as of $^5D_0 \rightarrow {}^7F_1$ and $^5D_0 \rightarrow {}^7F_2$ Eu^{3+} emission lines as a function of pressure can be also used for detection of the Y_2MoO_6 phase transition. The accomplished results demonstrate the properties of Y_2MoO_6:Sm^{3+} and Y_2MoO_6:Eu^{3+} inorganic phosphors, with emmision linear dependance of the intensity ratio on the pressure up to 8 GPa, could be used as an efficient high pressure sensor.

INV-OGE 4

Optical and stryctural properties of nanostructured semiconductors

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Science and technologyof nanostructures is a broad and interdisciplinary area of research and development activity that has been growing explosively worldwide in the past decade. Ongoing studies cover not only basic research but also the broad applications range.

The properties of materials at the nano scale differ from the ones at corresponding bulk materials. These differences depend on particle sizes, shape and surface characteristics. Nanomaterials have a much greater surface area to volume ratio than their conventional forms, which can lead to greater chemical reactivity and affect their strength. The enhanced surface area increases surface states, which change the activity of electrons and holes, and affects the chemical reaction dynamics. Also at the nano scale, quantum effects can become much more important in determining the materials properties and characteristics, leading to novel optical, electrical and magnetic behaviours.

We discuss recent advances in understanding the nanostructure and optical properties of semiconductor nanocrystals. Spectroscopic methods can provide a great deal of information about the electronic and spatial structure of the nanocrystals. As consequence of miniaturization, we expect bulk modes to be shifted and broadening. Linking these characteristics with the synthesis methods will play key roles in the further development of these particles for optoelectronic and biomedical applications.

INV-OGE 5

Forensic Science and Fractal Nature Analysis

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The forensic photography**,** also referred to as crime scene photography, is an activity that records the initial appearance of the crime scene and physical evidence, in order to provide a permanent record for the court. Now a day, we can imagine the crime scene investigation without photography evidence. Crime or accident scene photographs can often be re-analysed in cold cases or when the images need to be enlarged to show critical details. Fractals are rough or fragmented geometric shape that can be subdivided in parts, each of which is a reduced copy of the whole Fractal dimension (FD) is an important fractal geometry feature. There are many applications in various fields including image processing, image analysis, texture segmentation, shape classification and identifying the image features such as roughness and smoothness of an image. The damage image can be reviewed, analyzed and reconstructed by fractals.

INV-OGE 6

Application of impedance spectroscopy in analysis of electrical properties of chalcogenide glasses

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Flexible structure, significant variation in properties, and almost unlimited ability for doping make chalcogenide glasses promising materials for chemical sensors. Also, chalcogenide semiconductors are intensively studied due to their possible applications in phase change memory devices. The undoped chalcogenide glasses possess low values of electrical conductivity which could mean a serious limit to their technological application. Doping of the amorphous matrix with elements such as Ag and Cu is an effective tool for modification and improvement of the electrical properties. In order to achieve carrier-type reversal, chalcogenides are doped with Bi. The impedance spectroscopy (IS) is a techique that enables estimation of contributions of the particular structural elements to the overall impedance response in interval 10^2-10^6 Hz at different temperatures. This techique is particularly important for the analysis of the glasses with structural phase separation as well as of glass ceramics. This paper presents the results of IS application on electrical measurements of glassy systems $Cu_xAs_{50}Se_{50-x}$, $Bi_x(As_2S_3)_{100-x}$ and $Ag_x(As_{40}S_{30}Se_{30})_{100-x}$. The advantage of presenting data in the form of Cole–Cole plots and the priority of the IS application in the sense of the possibility of a simultaneous detection of different processes which contribute to the overall polarization is also discussed.

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INV-NB 1

Synthesis, Properties and Application of Nanocrystalline Diamond Layers

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Nanocrystalline diamond layers unite multiple extreme material properties. Due to the large grain boundary volume of this class of diamond films, the properties of the overall material are largely altered by the properties of the grain boundaries. Hence, the ability of systematic variation of the grain size by the used growth parameters is important for the optimization of the properties of diamond films. That way the material properties (such as electrical conductivity, thermal conductivity, hardness, stiffness, brittleness) can be adjusted to the desired applications.

The possibility to deposit nanocrystalline diamond films by means of hot-filament chemical vapor deposition on large areas enables the exploitation of the material for commercial applications.

An overview over the synthesis and the mechanical, electrical and thermal properties of nanocrystalline diamond layers will be given.

In addition, current and potential future applications of nanocrystalline diamond films will be presented.

INV-NB 2

Characterization of SiO_2 and SiC ceramics obtained through incorporation of a pore generator into the structure of activated carbon derived from carbonization of Plane tree fruit

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The main objective of this research is to obtain a carbon solid residue (by carbonization process of biomass in an inert atmosphere) which, through physical activation and chemical treatment (by TEOS - tetraethyl orthosilicate) would allow creation of highly porous and spatially distinct ordered biomorphic ceramics. Natural grown system is used as bulk template for fast high-temperature conversion into the ceramics.

Results of carbonization experiments at several highly operating temperatures, and activation of carbons with multiple-cycle actions by the TEOS, clearly showed the possibility of obtaining the SiO_2 and SiC structures. Verification of surface-active reaction groups in the identified ceramic structures was carried out through Fourier-transform infrared (FTIR) spectroscopy. Raman spectroscopy was used in order to qualitatively reproduce the existence of polytypes. Morphology of resulting porous ceramics has been investigated by scanning electron microscopy (SEM) and X-ray diffraction (XRD).

Porous ceramics can be produced applying the described technology during thermal reactions at 1400 °C for 2 h, where obtained ceramic materials retain a tubular and honeycomb pore structure of wood fruits. SiC formation is governed mainly by the reactions in vapor phase, which is testified by formation of chins in the pore cavities and SiO_2 diffusion in the pore walls.

INV-NB 3

The consequences of extending the Heisenberg principle to a complementary description

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Using the definition of complementarity as defined by Max Jammer in 1974, it is possible to express the Heisenberg principle in a complementary way. A complete complementary formalism is developed, using the concept that determinate and indeterminate aspects of a phenomenon are mutually independent, and that they occur joined in nature in such a manner that one of both dominates an observation and the other occurs as a small disturbance. Combining this starting point with relativity theory, space may be considered as a finite physical item, having an extremely low energy density entity and a potential equal to that of mass. Space and time are described separately in a mathematical similar way.

Then a basic item can be defined as a constant amount of potential energy, called the Heisenberg-unit. By using set-theory this unit can be supplied with complementary attributes of time, space and mark (a precursor of charge and electromagnetism). Only by interaction with another H-unit, these attributes can be transformed from mathematical into physical items, describing actual phenomena.

The resulting complementary language, representing a dualistic way of considering the universe, creates a bridge between large- and small-scale phenomena and so between quantum-mechanics and gravity. The laws of Maxwell emerge in an easy way. The interaction between two H-units can describe elementary particles as neutron, proton, electron, neutrino, gluon and Higgs particle. Four types of electrons can be described, two of them being characteristic for nanostructured material, providing it with features being unknown in classical physics. A spin particle is described as a separate item, existing at the surface of a particle. With more H-units the four forces of nature can be described, as well as gravitational waves, and the basic difference between gravity and electricity.

In this lecture a general overview of twin physics will be given, with a few examples of described particles. We concentrate on the consequences for the expected minimum distance and time interval in measurements.

INV-NB 4

Effects of micelles on surfactant self-assembly

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The aim of our research was to produce homogeneous monolayers of surfactants on muscovite mica, using quaternary ammonium surfactants (cetyltrimethylammonium bromide). According to some earlier studies described in the literature, well-ordered monolayers or bilayers on mica can be produced. Self-assembled monolayers were prepared using different methods already proposed in the literature as well as using newer protocols that we have established. Homogeneous hydrophobic monolayers on mica were difficult to realize. Clear seasonal variations between winter and summer called for a systematic variation of many experimental parameters. The specific conductivity of aqueous surfactant solutions as a function of temperature was measured, below and above the critical micelle concentration (cmc). At the Krafft temperature and above the cmc a significant increase of conductivity was observed, commonly ascribed to the micelle formation. In heating-cooling cycles below and above the Krafft temperature a significant and reproducible conductivity hysteresis is found. A procedure that allows the "erasure" of such structural memory effects has been identified. These significant solution structural changes as a function of the experimental conditions have a great influence to surfactant self-assembly on mica.

INV-MS1

Thermal and electrical conductivity relation phenomena within fractal nature synthesized diamonds frontiers

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Many areas, like the most known jewelry, medical-surgery, in high professional industry, as well as producing micro components, there are many possibilities for application of synthesized diamonds. These and others specific application of polycrystal diamonds, require permanently research and improvement of their properties. Such exploring could be much better with understanding fundamentals of microstructures. In such investigation, fractal nature analysis could significantly contribute to the revealing of possibilities for improvements. By the experimental procedure, it is noticed that the influence of grain size on thermal and electrical conductivity have notable impact. Considering that, these conductivities affect the possibility of application in many areas, explaining on microstructural nature is of high importance. The influence

of relation between the structures and final properties of synthetized diamonds can be achieved by explaining these phenomena based on fractal nature. The aim of the investigation is the establishing thermal and electrical conductivity relation phenomena within fractal nature synthesized diamonds frontiers.

INV-MS2

Separation process of granular materials – mathematical modeling and numerical simulations

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Separations of granular materials of different mass, size and other characteristics are frequently used in process, chemical, building construction, energy and food industry. Zigzag air classifier is cascade classifier that consists of vertical zigzag channel where several pipes with rectangular cross section are connected at a fixed angle to each other. The optimization of devices used for separation and classification can be performed with numerical simulations. The main focus in this numerical simulation is the discovery of the particle trajectory and the evaluation of the separation efficiency of the zigzag apparatus. The mathematical modeling based on CFD (Computational Fluid Dynamics) can easily obtain the satisfactory and reliable results of the separation characteristics and process parameters. The fluid phase is treated as a continuum by solving the Navier-Stokes equations, while the dispersed phase is solved by tracking a large number of particles through the calculated flow field. The dispersed phase can exchange momentum, mass, and energy with the fluid phase.

INV-AC1

Hydro-/Solvothermal synthesis: The influence of synthesis parameters on physicochemical properties of ferrite nanoparticles

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In the last few decades cobalt ferrite ($CoFe_2O_4$, CFO) has attracted considerable attention due to its potential application in data storage, catalysis, energy, environment, and in particular, biomedicine. However, for each application, the ferrite nanoparticles with specific size, shape and magnetic response are required. Therefore, fine-tuning of the particle size, shape, crystallinity and chemical composition is essential and for that purpose hydro-/solvothermal synthesis method was used.

In the present work, the CFO nanoparticles were prepared using hydrothermal and solvothermal methods in which the synthesis parameters such as pH, temperature and amount of capping agent were examined. The results show that pH influences the formation and growth of

CFO phase. Additionally, by controlling the pH magnetic properties of CFO nanoparticles can be effectively tuned. It was observed that the growth of particles, as well as their morphology, is also affected by the synthesis temperature; however, hydrothermally prepared particles were in all the cases fairly agglomerated. In order to overcome this, the synthesis media was changed and the oleic acid was used as surfactant. The addition of oleic acid decreases the size of the CFO nanoparticles and changes their morphology. At critical concentration (0.25 M) the spherical particles of about 6 nm were obtained. Magnetic measurements revealed that by controlling the oleic acid concentration magnetic behavior of the CFO nanoparticles can be changed from ferrimagnetic to superparamagnetic. Also, solvothermal method proved to be good for synthesis of Zn-substituted CFO nanoparticles ($Zn_{1-x}Co_xFe_2O_4$; x = 0; 0.05; 0.1; 0.3 and 0.5) with uniform size (5-7 nm) and shape (sphere-like) and superparamagnetic behavior suitable for bio-application.

INV-AC2

The synthesized nano photonic material for eye protection of UV and high energy blue radiation with optimal eye sensitivity

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Light sensitivity is a condition in which bright lights damage our eyes and this condition is known as photophobia. If light irradiation brake out values of eye sensitivity than problem ranging from minor irritations to serious medical emergencies. In everyday life, during the day, major light source is sun radiation. However, during the night mankind is under influence of several types of light sources: (1) different type of LEDs, (2) gas-discharge lamp, and (3) halogen lamp. Also, people are very exposed to white LEDs light with dominant blue diodes using mobile phone or laptops. A new TV screens with LEDs could be dangerous for our eyes if people spending long period in front of screens. To solve this problem of incompatibility, a spectrum that needs human eye and everyday light emission spectra, nano photonic material is used . This nano photonic material, molecules of C_{60} in PMMA, can not only block harmful radiation (UV and blue), but transform it into spectra useful for the optimal eye vision. It is known that the light affects the circadian rhythm and, consequently, the functions of the organism. For discoveries of molecular mechanisms controlling the circadian rhythm, the Nobel Prize in Physiology and Medicine in 2017, Jeffrey Hall, Michael Rosebush and Michael Young were awarded. Initial study on 28 voluntaries showed that glasses with nano photonic material stimulate secretion of serotonin, melatonin, cortisol and dopamine. However, at the same time regulate ratio between serotonin/melatonin and other hormones.

INV-AC3

Processing and characterization of polymer nanocomposites with embedded ceramic quantum dots

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This paper introduces processing and characterization of polymer nanocomposites based on poly(methyl methacrylate) (PMMA) matrix with embedded core-shell CdSe/ZnS quantum dots. Incorporation of quantum dots in the polymer is an attractive way of reducing the cost of optical devices, while retaining optical properties of the dots. Core-shell quantum dots were incorporated in the polymer via solvent casting, in order to investigate the influence of the nanocomposite's processing on the acitivity of their core. Surface modification of particles was performed to establish better compatibility between the dots and the polymer. FESEM analysis was used to investigate the morphology of the obtained nanocomposites. Time-resolved fluorescence measurements have given insight in the luminscence of unmodified and modified quantum dots in the polymer matrix, and it was confirmed that the chemical modification did not disrupt luminescence of the dots. Oxidation effects in quantum dots were removed with the use of PMMA as a host, and the core remained active.These findings showed that solvent casting is a suitable method for the processing of CdSe/ZnS- PMMA nanocomposites that could broaden the application field for the quantum dots.

ORL-BCS 1

Pressure-less rapid sintering of nanoparticle yttria stabilized zirconia

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Pressure-less rapid sintering of yttria-stabilized zirconia was performed in a specially designed resistive furnace with a vertically moving sample holder. Four commercially available powder grades (tetragonal and cubic zirconia) with similar particle size were used in the study. As received powders were compacted in a steel die, followed by cold isostatic pressing and low temperature annealing. The green bodies, prepared in two sizes – thick (⌀ 14 x 10 mm) and thin (⌀ 14 x 2 mm), were rapidly sintered with a heating rate of 100 °C/min up to 1500 °C. The thin samples attained densities > 95 % of theoretical density (TD) as soon as the sintering temperature of 1500 °C was reached with no dwell time needed. However, in case of thick samples, only

one powder grade achieved such a high final density (98.4 %TD) at 1500 °C with 10 min holding time. The three others attained significantly lower final densities of 90.3 %TD, 85.4 %TD and 85.0 %TD due to formation of gradient microstructure with nearly dense outer shell (characterized by closed porosity) and porous core of the sample (characterized by open porosity network). Possible causes of this phenomena are discussed.

ORL-BCS 2

Synthesis of wollastonite powder and manufacturing of porous scaffolds for multiple applications

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Wollastonite ($CaSiO_3$) is gaining attention due to its attractive properties, which can be used in a wide field of industries, i.e., thermal insulation; catalysis; filters and water purification; reinforcement phase in composites; and more recently, in orthopaedics. The additive manufacturing method has been used to process various materials in order to obtain diverse shaped-structures with controlled porosity. The aim of the present work is to establish an easy synthesis and processing of wollastonite powder to elaborate porous structures via robocasting technique. An injectable paste that serves as an ink was developed to build up cylindrical structures of 10 mm in diameter and 10 mm in height, using a tip of 410 μm. The cylinders were 3D-printed following two different arrangement patterns, named as honeycomb and rectilinear infills. In the same way, two pore sizes of 350 and 500 μm were produced. The final structures were evaluated in terms of their porosity, shape and size of pores by scanning electron microscopy and compression test. The purity of the wollastonite bodies was evaluated by X-ray diffraction. Moreover, preliminary studies were carried out on the final consolidated porous scaffolds showing its potential use in catalysis, water purification and/or orthopaedics.

ORL-BCS 3

Interaction of oxide ceramics with metal hydrides

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Magnesium hydride (MgH_2) is one of the most favorable hydrogen storage materials because it is directly formed from the reaction of Mg metal with gaseous hydrogen while reaching a high mass capacity (7.6 wt %). However, the sorption reaction is too slow for practical use and needs higher temperature than 300 °C for hydrogen sorption reactions. The hydrogen storage

properties can be tailored by addition of small amount of transition metal oxides (TiO_2,VO_2). In order to understand the processes that occurred during sorption reaction we have used both theoretical and experimental approach to study reaction mechanism in powder and thin films materials. Processes taking place during hydrogen desorption from Mg/MgH_2 thin films upon modification either by TiO_2 capped layer or by ion irradiation were also investigated. Irradiation was used to produce controlled point defects quantity with well-defined depth distribution. It was shown that the size, shape, and concentration of Mg nuclei formed during hydrogen desorption from MgH_2 thin films depend on the characteristics and distribution of the induced defects. Addition of VO_2 to powder milling bland dramatically improves the kinetics of sorption reaction, It is worth to notice that the full charge/discharge is achieved at relatively low temperatures.

ORL-OGE 1

Dissolution properties of bioactive glasses containing strontium

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Because of their potential application in bone tissue repair and regeneration, different types of bioactive glasses have been extensively studied. This study has been focused on examination of the dissolution process of two bioactive glass compositions, $42P_2O_5{\cdot}40CaO{\cdot}5SrO{\cdot}10Na_2O{\cdot}3TiO_2$ (GSSR5) and $46P_2O_5{\cdot}40CaO{\cdot}SrO{\cdot}10Na_2O{\cdot}3TiO_2$ (GSSR1) (mol %). Powdered glass samples were immersed in simulated body fluid (SBF) and kept in a water bath at 37 ºC for 21 days under semi-dynamic conditions. The mass loss of glass, normalized concentration of ions and pH values of solutions were determined. Dissolution rates for both glasses were increasing until the 5h mark and after that time the dissolution rates decreased. After the 48h glass dissolution rates reached the steady state. Measured dissolution rates after 168h for GSSR5 and GSSR1 were $1{,}13{\cdot}10^{-4}$ gh^{-1} and $3{,}61{\cdot}10^{-4}$ gh^{-1}, respectively.

ORL-NB 1

Electrical characterization and humidity sensing potential of NiZn ferrite nanoparticles

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In recent years, the ferrite nanoparticles are being increasingly recognized as materials for potential applications in humidity sensors. For these technological applications, it is necessary to focus mainly on their electrical properties rather than magnetic properties. The aim of this study is to investigate the electrical properties and humidity sensing potential of $Ni_{0.5}Zn_{0.5}Fe_2O_4$ nano-

particles synthesized by a soft mechanochemical processing from mixture of high–purity Ni(II), Zn(II) and Fe(III) hydroxides. Structural analysis of ultrafine NiZn ferrite nanoparticles with an average size of about 24 nm was performed by means of TEM and X–ray diffraction measurements. In the frequency range from 100 Hz to 5 MHz, the impedance response of synthesized $Ni_{0.5}Zn_{0.5}Fe_2O_4$ indicates that these nanoparticles exhibit semiconducting nature (NTCR–type behavior) and non–Debye type of relaxation phenomena. As part of a systematic study, the dependence of impedance response on the relative humidity has been also evaluated. The relative humidity was generated is in the range from 15% RH to 85% RH at room temperature. Under these conditions, the high impedance sensitivity (impedance changes by more than two orders of magnitude) and linear response in the entire relative humidity range was observed at relatively low measurement frequency (at 2 kHz). Also, hysteresis error within 3.5 % indicates a good repeatability, and slight fluctuations in the impedances with time directly confirm the good stability.

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ORL-NB 2

Silica – polyurethane nanocomposites: Composition – property relationship

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Polyurethane (PU) elastomers are very popular polymer materials used i.a. in medical and biomedical applications. Usage of waterborne polyurethane dispersions (PUDs) belongs to current environment-friendly technique of PU film and coating preparation. Biocompatible silica-PU nanocomposite films were prepared by solution blending method followed by water evaporation from mixed dispersions of PUD and nanosilica particles. The effect of the content of colloidal silica on functional properties of silica-PU films was tested by mechanical, microscopy and thermogravimetric techniques together with the study of thermal, swelling and surface properties. Different nanosilica/PUD ratios result in materials with strongly different behavior: the silica loading up to 10 wt% in nanocomposite finalizes in organic matrix filled by inorganic nanoparticles; silica content about 30 wt% results in bi-continuous system while the ceramic-like matrix filled by PU arises at 50 to 60 wt% of silica. If PUDs are made from linear chains (like in our case), only *physical* type of interface polyurethane/nanosilica via hydrogen bonds exists. This type of materials can be re-used by dissolution in acetone and PU re-dispersion in water. Prepared nanocomposite films and coatings can be practically used depending on demands, if elastomeric or ceramic-like coverage of substrates is desired.

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ORL-NB 3

To_2-Go Effect Over PVDF Piezoelectricity: Light and Flexible Presure Sensors

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We present an easy method to prepare hybrid graphene oxide sheets (GO) functionalized with TiO_2 ($GOTiO_2$) nanoparticles and homogeneously dispersion in a suitable PVDF thermoplastic polymer. These nanocomposites films was tested as a load sensors and compared with free polymer, GO composites and TiO_2 composite.

Charpy impact and oscilloscopy detector have been used to piezoelectric load test Graphene oxide or TiO_2 addition increased piezoelectric efficiency of PVDF but only GO-TiO_2 nanocomposite change piezoelectricity as function of impact energy. Therefor load sense was produced by graphene oxide-TiO_2 nanoparticle. Possibly electronic charge separation produced between the semiconductor(TiO2) and the conductor(GO) generate a dipole able to affect polymer piezoelectricity.

ORL-NB 4

Natural Innovative Clay Materials for Moisture Control and Heating

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The development of modern construction is increasingly pushing out natural materials with polymers, aluminum and long synthetic materials. In order to bring the interior of the space in modern buildings closer to the microclimate conditions, it is necessary to incorporate innovative natural materials that will balance energy consumption, temperature and extreme temperature differences during the day and night without energy consumption. In this work were analyzed unripened brick tiles with the addition of non-organic salts, chicken feathers and straw. The aim of this paper is to examine Bigot curve of the material, as well as the moisture absorption of the appropriate combination of brick clay and additives. Chicken feathers are a hydrophobic material that allows better bonding, while straw in addition to binding affects the porosity of the material. From inorganic salts, we distinguished the klacium chloride by balancing the absorption of moisture from the room when it is high and desorption is the same in the room when it is missing. Brick clays are not standardized materials, so it is necessary to correct their properties with the addition of non-organic salts or some organic substances in order to achieve how energy savings can contribute to human health. Mixture of clay brick are given different kinetics during drying. Cracks and shrinkage may occur due to the water evaporation during material bonding. Linear shrinkage is usually between 3% and 12% with wet mixtures and between 0.4% and 2% with dry pressurized mixtures. By using natural salts and organic materials, it is possible to reduce the

collection of materials, reduce the density, increase the sorption characteristics of the water vapor from the air. At the same time, microbiology should be taken into account within the natural material itself. The best combination in terms of shrinkage and absorption of moisture was obtained with 5% calcium chloride and 5% chicken feathers. Unripened clay brick tiles are natural, biodegradable, recyclable materials.

ORL-AC 1

Optimal Linear Regression and Sample Size for Characterization of Strength Distributions of Advanced Ceramics

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Strength distribution of advanced ceramics is mostly characterized by Weibull distribution function because of pre-existing cracks that occur during the manufacturing and machining processes. A linear regression method is generally applied in the estimation of Weibull parameters for its simplicity and low overestimation. Furthermore, the sample size affects the reliable decision of discrimination of different distribution functions.

In the first part of this study, 5100 experimental alumina strength data and virtual strength data generated by Monte Carlo simulations are used in order to investigate the effect of sample size on strength distribution of advanced ceramics. It is suggested that, at least 150–200 samples should be used for determination of best fitting distribution function with a statistical fallibility of 10%. Extreme Value Analysis.

In the second part, an optimal probability estimator for different sample sizes is obtained by using alumina strength data. In comparison with other commonly used estimators, the optimal probability estimator shows less bias and higher safety. The performance of the optimal probability estimator is also verified by experimental strength data. In conclusion, an optimal probability estimator constant of 0.25 is suggested in practical applications.

ORL-AC 2

Natural Zeolites as surfaces for adhezion of acidophilic iron oxidizing bacteria

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Acidophilic iron oxidizing bacteria are applied in biotechnological processes for extraction of copper and other metals from mineral raw materials (bioleaching). Time required to produce sufficient bacterial biomass and acitvity of acidophilic bacteria in the oxidation of ferrous iron are of crucial importance for the efficiency of the bioleaching. Acidophilic bacteria tend to adhere on the surface of the minerals and excrete exopolysaccharides creating microenvironment

(biofilm) that favors oxidation of ferrous iron and growth of the bacterial population. Recent research has showed that zeolites can be used as carriers for bacterial adhesion. Adhesion of bacteria to the surface of the zeolite significantly increases bacterial biomass and oxidation rate of ferrous iron in comparison to planktonic cells. Therefore, the use of zeolites as carriers of acidophilic bacteria is a promising approach for the rapid generation of bacterial biomass required for efficient ferrous iron oxidation during bioleaching. We have examined the use of two zeolites and tested iron oxidizing activity of several species of iron-oxidizing bacteria. The aim of this study was to evaluate the optimal combination of zeolites and bacteria in order to achieve maximal oxidation rate of ferrous iron.

ORL-HAD 1

Spinning bowls in the central Balkans: the innovation in the late neolithic textile industry

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Being an extremely unusual and rare find, textile has always been an attractive topic in archaeological literature. Nowdays, the identification of textile tools made of various materials has become a major issue in archaeology worldwide. However, when it comes to textiles in the Central Balkans, our knowledge is unfortunately very limited mainly because tools used in the production process were only superficially examined. This paper focuses on the use of ceramic vessels in the process of spinning and further examines the nature of a very long relationship between textile and pottery. Although only a few, highly fragmented spinning bowls have been discovered so far on the territory of Central Balkans, the given finds offer valuable information that enable us to improve our understanding on processing of plant fibres at the end of the Neolithic, as well as the role ceramic vessels had in the given process. As a matter of fact, spinning bowls from the Central Balkans appear to be the earliest finds in question which is an issue that undoubtedly requires more attention.

ORL-HAD 2

Miniature Ceramic Objects as Archaeological Findings

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Miniature ceramic objects are very common archaeological findings on prehistoric settlements on Central Balkans. The largest number of them are small pots which are differently shaped and resemble the dishes that were used at that time. In addition to them, there are miniature figurines of animals and people, ritual objects, rattles, different types of tools and various tokens, small ceramic pellets and balls. A small number of these items were made with high-quality workmanship, but the majority of them showing the average if not the very poor craftsmanship skills. They originated from different period of prehistory – from Neolithic to Iron Age, and it is estimated that they are between 2.000 and 7.000 years old.

In the attempts of the interpretation of these objects there are several different points of view. Some scholars see them as ritual objects–mostly offerings, others see in them objects for some special purpose and some interpret them as children's toys, but most of them just mark them as objects of unknown purpose. In this paper I will try to show that miniature ceramic objects are very important for our understanding of the past and that they have just enough characteristics which allow us to interpret their use. With careful observation of their shape and traces of making and use, which can be seen on their surface, as well as by analysis of their context of the findings on the archaeological site, we can comprehend their role in the past. If we find the right way to approach them, they will provide us glimpse into the daily life in the prehistory and give us precious information about ancient societies.

ORL-HAD 3

Historical development of the ceramics industry in Serbia with regard to some of the most significant producers

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The main aim and the subject is historical development of the industrial manufacturers of ceramics in Serbia with regard to some of the most significant producers. It's purpose is to provide a brief overview of the industrial production of ceramics from the 19th century to present days, and its technological and technical evolution and improvement of domestic producers of ceramics in the region.

This presentation is a part of the archival and field research, carried out during the preparation of the exhibition "Ceramics - the material of the past, present and the future" held at the Museum of Science and Technology in in Belgrade in the period from March to May 2018. Manufacturers that will be mentioned are *Toza Marković, Potisje Kanjža, Keramika Kanjiža, Keramika Mladenovac, Zorka Keramika, Zorka Opeka, Polet-Novi Bečej, Elektroporcelan Novi Sad, Mognohrom* and *Porcelan Zaječar.*

Through this and all the future researches the majority of the ceramics manufacturers should be a part of the Cultural and/or Industrial Heritage of the Republic of Serbia.

ORL-HAD 4

Discussing acoustic function of the ceramic vessels inbuilt in the medieval church in village Trg

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Ceramic vessels were inbuilt in the church walls in all parts of medieval Europe. They are often referred to as „acoustic vessels", although their acoustic effect was disputed even in the time of building. This paper questions the acoustic effect of ceramic pots inbuilt in the medieval church in village Trg (end of 13th century), as one of the most numerous findings of a kind in

Serbia. Acoustic vessels in medieval Serbian churches were usually inbuilt horizontally under the central dome – in pendentives and under rebated arches. However, in the church in village Trg the pots are all the same type and dimensions, inbuilt vertically, upside down, in the height of 3.75 m from the floor. In order to examine their acoustic function, we built 3D computer model of vessels and church interior, based on the reconstruction of Milka Čanak-Medić. Using Comsol Multiphysics software for simulation of acoustic response and interaction between vessels and church interior, we experimented with the position and orientation of the ceramic pots in the walls, thus examining in what case the acoustic effect was the most noticeable. This way we questioned if the builders had empirical knowledge of the acoustic laws and comprehended the cumulative effect of acoustic vessels, as sugested in previous studies.

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Presentation of Optoelectronic Group Harder Digital

Branislav Brindic

Harder Digital Sova – Bulevar Cara Konstanina 80, 18000 Nis, Serbia

Optoelectronic Group Harder Digital belong to high tech companies in the field of optoelectronics, especially focused to night vision industry. Current status on world market is position between Top 10 companies in this field.

Main production is manufacture of different types and generations of image intensifier tubes and related components which are widely used in security night vision applications, industry, medical and scientific field. Opto Group is one of rare example in night vision industry which has in-house developed technology of key components in production (fiber optic components, miniature high voltage power supply etc) up to the system level (image intensifier tube and different types of night vision devices and cameras).

Manufacturing process of image intensifiers is very complex and belongs to hi tech products as required multi disciplinary technologies and special knowledge of specific materials. Basic is vacuum technology combined with sub technologies as deep drawing for metal parts, brazing and soldering for metal – ceramic joints with special alloy, fritting for glass-metal connections, chemical processes for cleaning, vacuum degassation of different materials, photocathode processing , screen technology with luminophore, mechanical glass optical treatment etc. This production requires special conditions of work in clean room class ISO6 and ISO7.

Special attention will be given for processes of hot vacuum sintering of fiber optic blocks with mechanical and isostatic press.

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P1

Degradation of cultural heritage

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Our cultural heritage contains almost all available natural materials.These cultural heritage objects, even though they are made of "more resistant" ceramics, stone and metal, are under the influence of environmental parameters that can change their structure and composition.

Changes in this condition are accompanied by slow changes in the properties of materials, the final results of which are processes that lead to material degradation. This degradation is a consequence of natural influences and processes and is known as the natural state of the material.

The main causes of material decomposition are: Chemical, Physical and Biological. If we investigate the process mechanisms and the change in the properties of the materials that were created under the influence of the tooth of the time and the time of civilization, we will see that moisture underlies all these processes. Namely, aggressive substances of the environment, such as: SO_2, CO_2, nitrates, aerosols, soluble crystalline salts, etc. act on building materials solely in the presence of moisture.

The causes of material decomposition could be avoided, perhaps even completely eliminated, if the object were kept in a perfectly dry condition. However, the method by which the construction material would be made waterproof, without changing its appearance, is not known so the process of gradual decomposition of materials is inevitable in its exposure to weathering.

The processes of of physical or mechanical degradation result in the transformation of solid material into a loose state. Factors that condition this type of degradation are varied or combine with other causes.

Depending on the degree of degradation, its historical and aesthetic value and future purposes, architectural objects should be conserved, and if necessary, restored By expert team to avoid new damage or selection of inadequate materials.

P2

Biodegradation of cultural monuments

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The biodegradation process has the greatest impact in warm climates where air humidity promotes the growth of most organisms.

The main type of damage comes from the metabolic activity of organisms that are linked by physical, chemical and aesthetic mechanisms, while the intensity of these damages is strictly correlated with the type and dimension of organisms that are involved

When it comes to biogenic degradation, it is usually thought of the impact of mosses or lichens that usually occur in damp places or on the north sides of buildings. The very appearance of organisms on stone surfaces does not mean automatic destructive action.

Conservation interventions use direct or indirect methods to halt or slow down the biodegradation process. Methods and products must be carefully chosen, bearing in mind the type of underlying substance and material that will not harm the cultural monument.

P3

Diagnosis of the condition

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Prior to any work on a cultural - historical monument, the condition of the object must be determined along with the type and degree of damage to each of its components: beams, arches, vaults, domes, roof and brickwork, walls… The choice of the type and characteristics of the material for conservation and restoration works depends on the accuracy of the diagnosis, the degree and type of damage of the monument, or some of its parts.

The selected material must satisfy the criteria for chemical and physical compatibility with old material, but the architecture of the cultural and historical monument given by the builders from the past must be respected.

The deterioration of materials used in the restoration of the monuments can be attributed to one of the following causes: Inexperience in restoration works, Physical phenomena**,** Chemical reactions or Inadequate choice of the components used to obtain materials and so many others.

Changing one factor disturbs the established balance, which can cause serious consequences, because although we live in an era of great advancement of science, material decay is a natural process, which can be slowed down only by knowing and understanding its mechanism.

P4

Recovery of rare earth elements from coal fly ash

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Rare earth elements (REE) are often referred to as "the secret ingredients of modern industry", as they are extensively applied in many branches of contemporary industry. These elements found their end applications as catalysts, battery alloys, magnets, and most importantly as dopants in ceramic materials. The quantity of RRE (i.e. specifically the fifteen lanthanides, as well as scandium and yttrium) is scarce, as they usually appear as companion elements of other ores in their deposits. Therefore, the unconventional REEs-containing resources have to be assessed. REE can be found in acid mine drainage, produced water, coal and most importantly coal byproducts. Fly ash, as a byproduct of coal combustion in thermal plants, often comprises REE concentrations that vary between 200 and 1500 ppm. This quantity of REEs can be isolated, even though the extraction can be challenging. In this study, the five phase extraction has been conducted on fly ash obtained from the five different landfill sites. The extraction of thirty two elements (As, Ga, Ce, Be, Ge, Nd, Cr, Zr, Eu, Cu, Nb, Gd,Co, Mo, Dy, Li, Ag, W, Mn, Cd, Au, Ni, In, Hg, Pb, Sn, Ti, V, Sb, Th, Zn, La) has been conveyed. The complexity of the obtained data was also examined by principal component analysis (PCA) and cluster analysis (CA) in the identifying chemical composition of each coal ash sample. The recovery of mentioned elements from fly ash was assessed by means of techno-economic analysis.

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P5

Adsorption study on natural clays as cement mineral additives: possibility of toxic metallic cations immobilization

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Evironmetally safe mortars in which part of the cement binder was replaced by mineral additives (i.e. zeolite, bentonite and fly ash) were designed. Fly ash, as fine powdery byproduct of coal combustion, comprises heavy metals in its composition. Bentonite and zeolite are natural adsorbents with ability to immobilize certain toxic elements and prevent their migration from the mortar structure. In this study the ability of bentonite and zeolite to adsorb toxic cations pres-

ent in fly ash leachate was investigated. Metallic cations were detected in quantities not higher than 52.6, 15.5, 52.4 and 22.7 mg/kg for Zn, Pb, Cu and Ni respectively. Adsorption kinetic was monitored using 0.1 mol/dm^3 solutions of each of investigated cations (Zn^{2+}, Pb^{2+}, Cu^{2+} and Ni^{2+}) as well as multicomponent solution of all these cations during predefined time intervals in the range from 10-1440 minutes. Adsorption isotherms were obtained in concentration range for each cation of single and multicomponent solution in the range from 0.10-0.30 mol/dm^3. The obtained results of this investigation indicate that bentonite and zeolite are efficient adsorbents and, therefore, they can be applied in combination with fly ash in environmentally-safe construction materials.

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P6

Lanthanide doped hydroxyapatite for multimodal imaging

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Lantanide dual-doped hydroxyapatite (HaP:Ln) is currently the subject of numerous studies in reconstructive medicine. Designed in form of hybrid nanoparticles which have magnetic and luminescent properties HaP:Ln (where Ln=Gd/Eu or Gd/Yb/Tm) is capable to enhance signal detection. Beside it, due biodegradable properties it is suitable for use in bone tissue engineering and target drug delivery. For such a promising approach, doping of a HAp matrix is performed with Gd/Eu and Gd/Yb/Tm during hydrothermal synthesis using EDTA as chelating agent. Morphological and structural characteristics of the particles were obtained using X-ray powder diffraction (XRPD), scanning and transmission electron microscopy (SEM/TEM), energy dispersive X-ray spectroscopy (EDX), Fourier Transform Infrared (FTIR) and photoluminescence (PL). The results show that needle-like nano- or micro- particles were obtained in all systems. Their phase composition and uniform distribution of dopants were confirmed by the structural refinement of the XRPD data and luminescence response from Eu and Tb (λ_{ex} = 370, 394 and 977 nm).

P7

Effects of Gd^{3+} co-doping on $NaYF_4$:Yb,Er nanoparticles structure

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$NaYF_4$ doped with Rare Earth elements such as Yb and Er is well known as a compound with the remarkable up-conversion photoluminesce and wide application. In this work, the influence of additional co-doping of $NaYF_4$:Yb,Er with gadolinium (0, 15 and 30 mol%) was explored. The syntheses were performed solvothermally using the mixture of water/ethanol as medium and polyvinylpyrrolidone (PVP) as capping ligand. The obtained powders were subjected to X-ray powder diffraction (XRPD), scanning electron microscopy (SEM), Fourier-transform infrared (FTIR) spectroscopy and photoluminesce (PL) analyses. Structural refinement shown that $NaYF_4$:Yb,Er particles generally crystallized in a cubic form (*Fm-3m*), while the additional presence of Gd^{3+} in the crystal lattice lead to the pure hexagonal phase crystallization (*P63/m*). Morphological analyses revealed that all powders are composed from nanodimensional particles with the size in the range of 50-70 nm, while FTIR spectra confirmed the presence of PVP functional groups on the particles surfaces. The strongest effect of Gd^{3+} doping was notices in the PL spectra, where the up-conversion response increases with the mol% of this dopant.

P8

Optomagnetic Imaging Spectroscopy for material characterization

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Optomagnetic Imaging Spectroscopy is a novel method for characterization of different types of materials. It is a nanophysical technique based on the interaction between visible light and valence electrons within the sample material. By Optomagnetic Imaging Spectroscopy it is possible to obtain magnetic properties of the sample material by convoluting the sample spectra in RGB color channels from the digital image of the sample when material is exposed to white diffuse light and white light under the Brewster's angle. The method was used for the characterization of nanophotonic filters – filters made using fullerene thin film deposition technique in vacuum from gaseous phase on the glass substrate, polymer materials for contact lenses with different concentrations of nanomaterials, and biological materials. We are presenting and discussing results and strategies for future applications of this fast and easy to use method which has already shown great performance and accuracy in previous studies.

P9

Kinetics and thermodynamics of zinc(II) ions adsorption from aqueous solution on natural Romania zeolite

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Adsorption performances of natural zeolite, originating from Mare Baia, Romania, was tested in this study. The main constituent of used adsorbent was clinoptilolite, 80 %, with molecular formula $(Na_{0.52}K_{2.44}Ca_{1.48})(Al_{6.59}Si_{29.41}O_{72})(H_2O)_{28.}64$, as obtained by the use of XRD. The adsorbent BET specific surface area was 45.7 m^2/g and particle size distribution in the range 0.4-0.8 mm. Prior to the experimental procedure, material was washed by deionized water, dried for 2 h at 105ºC and placed in desiccator. The homogenization of dry sorbent was reached using mortar and pestle. Minimal processing for material preparation was accomplished in order to simplify its production. Zeolite was tested as natural sorbent for zinc(II) ions removal from water solution. Influence of zeolite mass, temperature and contact time on adsorption capacities, kinetics and thermodynamics was investigated. Zinc(II) ion removal capacity of 65.5 mg g^{-1} at 318.15 K, obtained using of Langmuir 2 model, indicated that natural zeolite had high efficiency in processes of Zinc removal. Kinetic study fitting by Weber-Morris model predicted intra-particle diffusion as a rate-controlling step.

P10

Effect of Alkaline Activator Properties on Structure of Metakaolin-Based Geopolymer Samples

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Considering geopolymers as inorganic polymers, they are actually amorphous network of interlinked silicate and aluminate groups, so they could be prospective ceramic precursors for materials with defined dimensions obtained by casting and firing, but not from powder processing. In this research, the starting material is metakaolin, which was obtained by calcining domes-

tic kaolinite clay. Initially, four series of alkaline activators of NaOH and sodium silicate have been used. Activators present the mixtures of Na_2SiO_3 and solutions of NaOH, of different molarities 2M, 4M, 6M and 8M. The prepared geopolymer slurries were cast into the designated near shape at room temperature and after that at 60°C. In fact, the post-synthesis curing process (28 days) has an important role in the obtaining good characteristics of geopolymers. Densities, viscosities and refractive index of alkaline activators were determined over the temperature range 15-60°C of process of geopolymerizations. Based on the obtained results of investigated parameters have been selected to predict the properties of materials. All geopolymer samples were characterized by XRD, FTIR, SEM/EDS analysis and Raman spectroscopy providing complementary and valuable information of the investigated materials. This route of ceramics production has advantages associated with producing an environmental friendly, energy saving, clean new technology of geopolymer materials.

P11

Adsorption capacities of Shungite - a Russian Mineral

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Shungite, a carbon-rich rock of the Precambrian age widespread over Russia, attracts much attention due to possibilities of application in various industrial and medical fields. Carbon acts as an efficient catalyst of hydrogenation at low temperatures, as an adsorbent and filter in water purification processes, and as a multifunctional filler of polymeric and inorganic binders.

The presence of the starting components α-SiO_2, Fe_2O_3, carbon C, α-Al_2O_3, γ-Al_2O_3, and $CaCO_3$ has been determined by XRD measurement. Particle size distribution of the initial powder indicates large agglomerates with size of 10 microns and larger, confirmed by SEM also. In a batch test, the influence of shungite mass, contact time and temperature on adsorption efficiency of amlodipine, medicament used to treat high blood pressure and coronary artery disease, has been investigated. This material showed moderate adsorption capacity of 54.95 mg/g at 10 mg/l initial amlodipine concentration. The concentrations of amlodipine were determined using UV-VIS spectrometry.

P12

Effects of ball-milling on properties of sintered alumina doped with Mn_2O_3

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Recently, with the huge use of smart gadgets, developing of smart jewelry represents a very interesting segment in material science, as well as in electronic science. Alumina is widely used ceramic in many industrial fields as pigments, catalysis, microelectronics, etc., mostly because of its low cost and appropriate mechanical and electrical properties, high surface area and thermal stability. Also, modified alumina could be applied in production of smart jewelry. Thus, the main objectives of this investigation is to improve features of sintered alumina doped with Mn_2O_3 along with mechanical treatment, in order to obtain strong ceramic with low values of dielectric loss and low relative dielectric permittivity, as well as esthetic. Commercial alumina powder was doped with 1 wt % of manganese oxide and treated in planetary ball mill for an hour. Characteristic temperatures of both powders (non-activated and activated one) were investigated in detail by DTA and TG analyses. After sintering at 1200, 1300, and 1400 ^oC for 2 h, XRD patterns and SEM images were recorded. Furthermore, mechanical and electrical properties were examined for all sintered samples.

P13

Cobalt impregnated acid modified smectite in heterogeneous catalytic oxidation of azo dye using Oxone®

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The starting clay from Bogovina (Serbia) rich in smectite was submitted to acid modification in order to improve textural properties. The acid modified sample was further impregnated with cobalt using 1 mol dm^{-3} solution of $Co(NO_3)_2$ followed by calcination at 450°C during 6

hours and used as heterogeneous catalyst. It was reported that sulfate radicals have high oxidation potential and should be considered as efficient oxidants. The potassium peroxymonosulfate (Oxone® i.e. $2KHSO_5 \cdot KHSO_4 \cdot K2SO_4$) was used as radical source. Radicals were generated by presence of transition metal cation (Co^{2+}) incorporated into smectite structure of the synthesized catalyst. The obtained catalyst was investigated in decolorization of azo dye Acid Orange 10 (AO10) in the presence of Oxone® at 30 and 50 °C. Kinetic of catalytic process was studied up to 4h. The AO10 concentration monitored using UV–Vis spectrophotometry, λ_{max}=478 nm. The obtained results confirmed that cobalt impregnated acid modified smectite can be successfully applied as catalyst in heterogenous Fenton-like reaction of azo dye and corresponding aromatic amines.

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P14

Spectroscopy Study of Nd^{3+} Doped Calcium Tungstate

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Nd^{3+} doped calcium tungstate single crystals were grown from melt using the Czochralski method in air. The obtained transparent light blue single crystal and powdered sample were characterized by X-ray diffraction, Raman and FTIR spectroscopy. The XRD confirms that sample is monophasd, and that it crystallized in scheelite type of structure in 88. space group, *I* 41/*a*. A good correlation was found between the experimental and theoretical Raman and infrared active modes. FTIR confirmed the occurrence of all the functional groups and bonds in this material. From the FTIR spectrum, a strong peak of 862 cm^{-1} has been obtained due to the stretching vibration of WO_4^{2-} in scheelite structure, and a weak but sharp band at 433 cm^{-1} has been noticed due to the metal, oxygen (Ca-O) band. Micro hardness was measured with the Vickers pyramid. Anisotropy in [001] direction was not observed. The crystal showed a micro hardness of 1.5 GPa.

P15

Drug Delivery with Bioconjugated Nanomaterials

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Paclitaxel-conjugated nanoparticles (NPs) of three different types have been synthesized in our laboratory by use of Fe_3O_4 and Au as the cores. Possessing the polyethylene glycol (PEG)-SH spacer and the phosphate join unit, the new paclitaxel-P(=O)(OH)-PEG-S-Fe-NP nanomaterials functioned as a prodrug of paclitaxel, which was liberated in the presence of phosphodiesterase. A new class of targeted anti-cancer drugs is thus established by exploitation of these

conjugated nanomaterials. This strategy has great potential in biomedical applications and drug development.

P16

Alumina-Ni composites obtained by sol-gel method as adsorbents of azo dyes

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The disposal of waters contaminated with azo dyes into natural aquatic recipients can be regarded as very harmful. Since dyes have a high degree of chemical and photolytic stability adsorption can be regarded as appropriate method for dye removal. Porous alumina composites are well known as efficient and inexpensive adsorbents of different pollutants. In this paper, the alumina powders, pure and doped with 40 mass % nickel, were synthetized by sol-gel method and calcined at 500 ºC, 900 ºC and 1100 ºC in order to obtain mesoporous structures with a high specific surface area, well adaptable to adsorption application. The obtained composites were tested as adsorbents of textile azo dye Acid Yellow 99 (AY99). The adsorption was monitored with respect to contact time, using AY99 initial concentrations of 50 mg dm^{-3}, mass of adsorbent m_{ads}=50 mg and volume of dye solution V=50 cm^3. The adsorption study showed that the adsorption capacity of samples decreased with temperature of calcination and nickel content. The study confirmed the feasibility of using alumina composites as adsorbents for the azo dyes.

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P17

Preparation and optical properties of ZnS/Poly (methyl methacrylate) nanocomposite

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Nanocomposites derived from nano-scale inorganic/organic particles that are dispersed in a polymer matrix homogeneously have attracted considerable attention [1-3]. The diverse properties of numerous polymers to choose from are well documented, including both plastics and elastomers, which are the main two types of polymers. Organic/inorganic hybrid materials offer highly interesting and versatile applications when incorporated with a polymer. Among the inorganic/polymer nanocomposites, metal sulfides/polymer nanocomposites have been researched

extensively due to their interesting optical, electrical and mechanical properties. Their excellent physical and chemical properties in various fields, such as catalysis, sensors, solar cells, photo detectors, light emitting diodes and laser communication, have made them very attractive and promising materials. Semiconductor particles immobilized in a polymer matrix with nano-scale grain size show different properties relative to the same material in bulk form because of quantum size effects. Many different synthetic approaches, like thermal evaporation, chemical bath deposition, chemical vapor deposition (CVD), laser ablation, hydrothermal, homogeneous precipitation in an organic matrix, sonochemical and sol–gel methods, have been employed for the synthesis of metal sulfide nanoparticles. In this work we investigate the structural and optical properties of polymer nanocomposites prepared by the incorporation of ZnS nanoparticles into the matrices of polymer poly (methyl methacrylate) (PMMA). The structural studies of the metal sulfides/polymer nanocomposites were carried out by Scanning electron microscopy (SEM), Raman spectroscopy and Far-infrared spectroscopy. The dielectric function of ZnS nanoparticles is modeled as a mixture of homogenous spherical inclusion in air, by the Maxwell-Garnet formula. In the analysis of the far-infrared reflection spectra, appearance of combined plasmon-LO phonon modes with high phonon damping are observed, which causes decreases of coupled plasmon-phonon frequencies.

P18

Synthesis and characterization of Al pillared montmorillonite impregnated with cobalt

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Aluminum pillared clay (AP) was synthesized using ≤ 74 μm fraction of Na-exchanged clay from Wyoming, USA (Na-Wy). The process of pillaring was carried out according to a common procedure comprising the following steps: pillaring, rinsing, drying and calcination. The obtained pillared clay was impregnated with Co^{2+} using incipient wetness impregnation method. The obtained sample was calcined and denoted as CoAP. Powder X-ray diffraction (XRD) patterns of Na-Wy, AP and CoAP indicated the presence of montmorillonite, quartz and feldspar. The pillaring affected montmorillonite peak corresponding to the 001 reflection. The d_{001} value increased from 1.17 nm for Na-Wy to 1.82 nm for AP. The pillaring process also fixed the basal spacing and no swelling was registered. In the diffractogram of CoAP the 001 peak was not well defined and was shifted to higher 2θ values. Nitrogen adsorption–desorption isotherms were used to determine textural properties of the samples. Pillaring resulted in enhanced textural properties such as increased total pore volume and specific surface area in the mesoporous region, as well as increased micropore volume comparing with that of Na-Wy. On the other hand, for CoAP textural parameters' values were lower than those of AP, which could be ascribed to successful cobalt impregnation.

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P19

Oscillatory reaction as novel method in distinguishing bentonites

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In the chemical oscillatory reaction the concentrations of the reactants decrease and products increase in stepwise form, while the concentrations of intermediates oscillate with time. In this paper, the influence of different bentonites on Briggs-Rauscher (BR) oscillatory reaction was investigated. In BR the oxidation of malonic acid in the presence of hydrogen peroxide and iodate in acidic medium, catalyzed by manganese ions occurs. The same mass (0.25 g) of bentonite from different deposits: Wyoming (SWy-2), Texas (STx-1b), Bogovina (B) and Mečji Do (MD) were added to the reaction solution consisting of 7 ml [$CH_2(COOH)_2$]=0.28 M, 5 ml [$MnSO_4$]=0.04 M, 5 ml [$HClO_4$]=0.15 M, 5 ml [KIO_3] =0.38 M, and 3 ml [H_2O_2]=9.80 M. The obtained results were compared with basic BR oscillogram without bentonite. According to the obtained results the effects of bentonite on an oscillatory dynamics can be divided into three groups. The first group consisted of SWy-2 that negligibly affected the duration of the BR oscillogram. In the second group were B and MD which quenched oscillatory behavior, while STx-1b in third group extended oscillatory period. The results revealed that BR oscillatory reaction could be used as novel method for distinguishing of bentonites.

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P20

Electrochemical behavior of phenol and its derivatives on the electrodes based on inorgano/organo modified bentonite

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In this work glassy carbon electrode (GCE) was modified using previously prepared bentonites. Modification of bentonite was performed by replacing the exchangeable cations present in the natural bentonite with selected inorganic and organic cations, i.e. AlFeNi polyoxo cations and benzyltrimethylammonium (BTMA) cations, respectively. Obtained materials were denoted as AlFeNi-B and BTMA-B. GCE was modified by applying homogenous dispersion of either AlFe5Ni5-B or BTMA-B and 10 wt. % carbon black in the original Nafion® solution on the

electrode surface. The modified GCE were tested in the acidic solution of phenolic compounds (phenol-Ph, 2-nitrophenol-2-NP and 4-nitrophenol-4-NP) by cyclic voltammetry using both single and three-component solution. The modification of GCE led to significant improvement of the electrode stability. GCE modified with both AlFeNi-B and BTMA-B exhibited lower sensitivity toward 4-NP in comparison to Ph and 2-NP indicating improved selectivity of investigated electrodes. All oxidation peaks registered in each of the single solution, were obtained in the mixt solution as well. Voltammogram recorded using GCE modified with AlFeNi-B in the mixt solution exhibited more distinguished voltammetric peaks. These results suggest that AlFeNi-B could be used as a promising electrode surface modifier for simultaneous detection of the phenol and its derivatives.

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P21

The acceleration of the state I→II transition phenomenon in Briggs-Rauscher reaction with tungsten-phosphate bronzes

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The Briggs-Rauscher (BR) reaction is probably visually the most dramatic oscillating reaction, in which the oxidation of malonic acid ($CH_2(COOH)_2$) by a mixture of hydrogen peroxide (H_2O_2) and iodate (KIO_3) is catalyzed by a metal ion (usually Mn^{2+}) in acidic aqueous solution. However, it appears that oscillations are not the only interesting behavior in the BR reaction. After oscillatory regime occurred, depending on the initial concentrations the BR system may undergo a sudden transition from the state I (the state with low iodine and iodide) to the state II (the state with high iodine and iodide). Recently, it is found random behavior (5 min to more than 3 hours) of induction period for the state I→ II transition phenomenon, called crazy-clock behavior. In this paper, the influence of tungsten-phosphate bronze, obtained by thermal treatment, on BR state I→ II transition is investigated. Results obtained strongly suggest that increasing heterogeneity in the presence of tungsten phosphate bronze, enlarged nonlinear behavior and extremely shortening time for the state I to state II transition.

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P22

Aptitude of using Algerian slag for the elaboration of glass-ceramic materials

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Using wastes as starting raw material is a common method to reduce the production costs of many materials. In this experimental investigation, the preparation of glass-ceramic was by using some different types of slag.

The powdered were pressed and heated with the heating rate of 10°C /min. up to the reaction temperature of (1100°C, 1150°C, 1200°C and 1350°C) and soaked for the different time (1h,2h, and 3 hours). The specimens obtained were subjected to DTA, XRD analysis to quantify crystalline phases.

The results show that the main obtained phases glass- ceramic is "Gehlenite" and " wollastonite'' specially, for the sample heated at 1150°C for 03 hours.

P23

Analysis of the Influence of Additives on Physical and Mechanical Characteristics of Ceramic Tapes

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The paper presents the results of the use of additives protected by the European patent in order to improve the physical and mechanical characteristics of ceramic tiles. Different types of additives in different concentrations (0.15, 0.30 and 0.50%) were added to the ceramic mass, under laboratory conditions, and changes in shrinkage, cavity strength and absorption were observed. Based on the analysis of the laboratory results of the mentioned parameters, the type of additives and its concentration were selected, and a series of industrial tests were performed.

During industrial tests, the characteristics of regular ceramic mass and mass with addition of additives were monitored, without correction of process parameters. The results of the experiment indicated improvement of the characteristics of ceramic tiles using the additive. After the obtained results, the effect of shortening the baking time on the characteristics of the ceramic tile with additive was investigated. The obtained results indicated by using additives it is possible to shorten the roasting rows, and not distort the characteristics of the final product.

The use of additives in industrial conditions has indicated that with their application it is possible to obtain a product, in this case floor tiles, with improved characteristics and the possibility of increasing the capacity of the production line.

P24

The influence of structural changes on the magnetic properties of the 10% Fe and 90% $BaTiO_3$ powder

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The mechanical mixture of polycrystalline powders of 10% Fe and 90% $BaTiO_3$ was activated in the planetary ball mill for the period of 0 to 165 minutes in the air atmosphere. During the activation, the chemical composition and the structure of the mixture is changed.

XRD analysis of the activated powders showed that, depending on the activation time, the size of microcrystalline is reduced, and the density of defects and mechanical micro-stresses are increased. The starting powder and activated powders are pressurized at 500 MPa.

Thermomagnetic measurements in the applied magnetic field of 60 KA/m showed that the minimum magnetization of M = 8.4 Am^2/kg has a starting, inactivated powder, while the maximum magnetization of M = 15.61 Am^2/kg has the powder activated for 105 min.

The pressed powder sample, activated for 105 min, was successively heated and cooled in the applied magnetic field of 50 KA/m, at different temperatures.

During the annealing, under the thermal influence, the defects and micro-stresses are annihilated in the samples. This ensures greater mobility of the magnetic domain walls and their better orientation in the applied magnetic field.

The maximum magnetization of the cooled sample was achieved after annealing at the temperature of 360°C. The increase in magnetization after annealing is 8.4% compared to the magnetization prior to annealing.

The pressed powder samples were sintered at temperature of 1200°C during the period of 2 hours and possess ferroelectric properties.

P25

Phase Composition, Structure and Corrosion Resistance of Synthesized Fluoroapatite after Electron Irradiation Process

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One of the most important criteria of applicability of matrice materials for HLW immobilization is radiation and corrosion stability. At present study, the effect of electron irradiation (E up to 10 MeV) on the phase composition, structure and corrosion properties of synthesized

fluoroapatite ($Ca_{10}(PO_4)_6F_2$) was investigated. Fluoroapatite powders were produced by co-precipitation method from solution of initial components. Samples were manufactured by sintering process on air condition during 6 hours at 1200°C and possessed maximal apparent density values (90-92 %). The increase of thermal treatment process up to 9 hours was resulted in the transfer of $Ca_{10}(PO_4)_6F_2$ sample material from crystal to glass-ceramic state. Any changes in phase and structure composition of crystal fluoroapatite samples were not observed by XRD and SEM methods after the electron irradiation process. On the contrary, a lot of gas bubbles of spherical form were detected in glass-ceramic material sample after the electron irradiation process. Results of leaching tests in water conditions demonstrated any principal changes of corrosion resistance of crystal fluoroapatite material after the electron irradiation. Stability of physical-chemical properties of synthesized crystal fluorapatite after electron irradiation is challenging for further application of materials based on fluorapatite structures as promising matrices for HLW immobilization.

P26

Polyvinyl alcohol PVA with poly ethylene Glycol PEG added as a binder for the powder compaction

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During the compaction of the powder mixture of ZnO and Mn_2O_3 ($MnCO_3$) and Fe_2O_3 compacts were find fragile for further handling. Poly vinyl alcohol PVA was used as a binder in an unusual 20% PVA content. We made as well 2% PVA with 0.6% Poly ethylene glycol PEG and 20% PVA with 6 % PEG. Binder was wrapped over the powder by suspension forming in the polymer water solution and drying afterwards until all water content evaporates. On the these obtained powders employed characterization techniques were: Fourier transformed Infra red FTIR spectra with ATR attenuated total reflection technique as well as differential thermal analysis DTA on the device with low temperature sensitivity and TEM transmition electron microscopy. All binder concentrations gave compacts with good mechanical properties, that can be handled with ease but with adding, a PEG as plasticizer the operating of the anvil and piston were extremely difficult due to friction.

P27

Improvement of Silicon Carbide Ceramics Mechanical Properties by Different Additives

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Dense silicon carbide (SiC) ceramics and composites are very attractive engineering ceramics at the extreme operating parameters, in particular for high temperature and nuclear applications, such as advanced nuclear fuel forms, structural components for fission reactor systems, blankets for fusion energy systems, and matrices for nuclear waste immobilization. As alternative of the mechanical properties improvement by SiC fibers reinforcing, the different additives to the SiC matrice were investigated at present paper. The SiC matrices reinforced by additives of amorphous B, Cr, Si were fabricated using High-Speed Hot Pressing Method (HSHP). Additives content was in the range from 0,5 to 3 wt %. Microstructural characteristics of silicon carbide ceramics were analyzed by X-ray diffraction (XRD), scanning electron microscopy (SEM) and elemental distribution analyses (EDX). Results demonstrate the influence of different additions on the SiC ceramic sintering process. A fine-grained and dense ceramics with advanced mechanical properties were produced at optimal processing conditions. SiC ceramics with Cr and Si additives possess the best structural and mechanical characteristics: micro hardness 28.0 – 30 GPa and fracture toughness K_{1C} = 6.2 – 4.7 MPa·$m^{1/2}$, respectively. The sintering process by HSHP method leads to increase of the fracture toughness of ceramics. It is mean that structural and mechanical properties of SiC ceramics can be improved by effective additives content controlling.

P28

Osteoconductive and osteoinductive capacity of platelet-rich plasma

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Platelet-rich plasma (PRP). represents several times more concentrated platelets in small volume of autologous plasma. Application of platelet-rich plasma represents a new area of development and application of bone tissue engineering and the new field of scientific and clinical

research. The main hypothesis of adding PRP to bone grafts in combination with different biomaterials, is that the high concentration of platelets in the bone defects increase the local concentration of secreted growth factors and consequently boost the initial bone regeneration. A few days later, the direct effect of applied PRP will fade, and physiological mechanisms of bone reparation will proceed working on higher level. Beside the fact that PRP is intensively used in clinical practice because of its osteoconductive capacity, there are also evidences that PRP possess osteoinductive capacity. The differences in success of experimental procedures can be explained with inconsistency in used platelet concentrations, type of used biomaterials, experimental animals and experimental models. Further investigations of physiology of platelets, importance of platelet concentrations, biomaterials interactions, site of biomaterial application will bring us a bit a closer to controlled ectopic osteogenesis as a most promising approach for reconstruction of bone defects.

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P29

The biocompatibility of nanotubular oxide layer formed on the ultrafine -grained Ti-13Nb-13Zr alloy

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Primary stability of biomaterials is associated with the mechanical contact of an implant with the surrounding bone, which is governed by surface properties. The implant often needs some kind of modification to optimize and improve biological properties of the surface. In the present study, nanotubular oxide layer on Ti-13Nb-13Zr alloy (coarse-grained, CG, and ultrafine-grained, UFG, obtained by high pressure torsion) alloy was formed by means of electrochemical anodization in the 1M H_3PO_4 + NaF electrolyte, during 60 and 90 minutes. The atomic force microscopy (AFM) was studied to characterize the surface topography and it was shown that highly ordered nanotubular layers were obtained by anodization. Also, results show that increasing anodizing time increases roughness of the surface. The aim of this paper is to determine the vitro biocompatibility of the titanium alloy after electrochemical anodization. In vitro nanotubular oxide layer examinations were performed on the human fibroblast cell lines (MRC-5). The cytotoxicity of the examined materials was measured as a percent of cell growth inhibition using in vitro colorimetric methyl-thiazol-tetrazolium (MTT) test. Scanning Electron Microscope (SEM) observation of MRC-5 cell was performed using a SEM MIRA3 TESCAN which operated at an accelerating voltage of 4.5 keV. Results show that nanotubular oxide layer formed on the UFG Ti-13Nb-13Zr alloy during 90 minutes indicates better cells contact and spreading along nanotubular surface.

P30

Structural and crystallochemical characterization of thermal tretment of ion exchange natural zeolites

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There has been intense activity over the last three decades in the area of preparation of various ceramic materials using synthetic or natural zeolites as a precursors. Aqueous ion exchange can be preformed to incorporate a variety of other metals, typically alkali and alkaline earth for the Rn^+ cation. For this investigation was used the two naturale HEU type zeolite from different deposit. Thermally induced phase transformation of Pb, Ca and K-exchange is followed in the range from room temperature to 1300 ºC. The frameworks collapse into amorphous intermediate products after heating between 600 and 650 °C. Prolonged heating of the intermediate product over 900 °C results directly in formation of alumosilicate phases anorthite or structure of celsian. The crystale phases of alumosilicate in temperature range between 700 and 1300 °C was investigated by X-ray powder analyses.

P31

Optomagnetic Imaging Spectroscopy for material characterization

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Optomagnetic Imaging Spectroscopy is a novel method for characterization of different types of materials. It is a nanophysical technique based on the interaction between visible light and valence electrons within the sample material. By Optomagnetic Imaging Spectroscopy it is possible to obtain magnetic properties of the sample material by convoluting the sample spectra in RGB color channels from the digital image of the sample when material is exposed to white diffuse light and white light under the Brewster's angle. The method was used for the characterization of nanophotonic filters – filters made using fullerene thin film deposition technique in vacuum from gaseous phase on the glass substrate, polymer materials for contact lenses with different concentrations of nanomaterials, and biological materials. We are presenting and discussing results and strategies for future applications of this fast and easy to use method which has already shown great performance and accuracy in previous studies.

P32

Influence of mechanical activation time on dielectric and magnetic properties of the sintered powder mixture Fe (70%) – $BaTiO_3$ (30%)

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The starting polycrystalline powder mixture containing Fe (70 %) and $BaTiO_3$ (30 %) was activated in a planetary mill for different time intervals - 30, 60, 120, 210, 240, 300 and 360 min. XRD analysis was performed to get values of average crystalline size and microstrain for the activated powders. This analysis also yielded the percentage of barium ferrite ($Fe_{12}O_{19}BaTiO_3$) in the sintered samples, activated for different times. The highest percentage of barium ferrite after sintering was observed for the pressed sample activated for 240 min and amounts to 97.2 %. It was shown that, after sintering, this sample has the highest magnetization of 1,86 Am^2/kg, under the applied magnetic field of 16 kA/m. After heating of this sample up to Curie temperature (T_c=420ºC) and cooling, in the applied magnetic field, magnetization of this sample is increased by 237.6 % and has value M'=6.28 Am^2/kg.

Dielectric characteristics of the sintered samples were studied in the frequency range 100Hz-1MHz. It was shown that real and imaginary components of permittivity decrease when frequency grows. The maximal permittivity value of Er'=10^7 and E''=$1.5 \cdot 10^5$ was observed for the sample activated for 240 min. Temperature dependence of relative permittivity was measured at frequency of 10 kHz in the temperature range 20-200 ºC. It was shown that imaginary component of permittivity grows with temperature increase, while the value of real component falls.

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Influence of the mass ratio of Fe and $BaTiO_3$ and of the period of activation on magnetic and dielectric properties of sintered samples

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Mixtures of polycrystalline powders of Fe and $BaTiO_3$, with mass ratios of 10% Fe, 20% Fe, 30% Fe, 50% Fe, 60% Fe and 70% Fe were activated in the planetary mill in period of time ranging from 20 to 360 minutes. The sizes of micro-crystallites and micro-tensions were determined by the XRD analysis.

It was shown that, in all samples, the size of micro-crystallites decreases with longer activation times ranging from 30.8 to 11.2 nm for $BaTiO_3$ and from 92.1 to 25.3 nm for iron oxides. The value of microstrains grows with longer activation times and changes from 0.006% to 0.19% for $BaTiO_3$ and from 0.09% to 0.172% for iron oxides.

The activated powders were pressed under pressure of 500 MPa, into disc-shaped samples with the diameter of 8 mm and thickness of 1.5 mm. The pressed samples of activated powders were sintered at the temperature of T=1200°C in the atmosphere of air for two hours. It was shown that magnetization as well as dielectric permittivity of sintered samples grews with the increase in the percentage of iron in the starting powder. The most prominent ferroelectric transformation at the temperature of 120°C was observed in the sintered sample obtained by the pressing of the powder containing 50% of Fe and 50% of $BaTiO_3$, activated for 120 minutes.

The maximum real as well as imaginary component of dielectric permittivity at the frequency of 1 kHz shows the sintered sample of the starting activated powder consisting of 70% of Fe and 30% of $BaTiO_3$, and is E'=10^7 E''=1,5*10^5.

P34

Investigation of the early phase of carbon nanowall formation process in a newly developed three-plasma experiment

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Carbon nanowalls (CNWs) are two-dimensional, vertically aligned carbon sheets with an average thickness of several nanometers. Here we study of the influence of different process parameters and kinds of species on the initial phase of growth process and the structure of CNWs.

For that purpose a new triple-plasma experiment is developed. In it two plasmas are used as radical sources (precursor growth radicals from C_2F_6/CH_4 and H-atom radicals) and one as a source of ions (Ar gas). CNWs were grown on Si-wafer without catalyst. The ion energy is controlled by applying an external negative voltage.

Increasing of acceleration voltage enhances the growth speed of CNWs via increasing the number of created dangling bonds. In Raman spectra the increase of I_D/I_G indicates the increase of induced disorder with increasing ion energy. The upshift in D-peak position indicates the shortening of C–C bonds due to progressive graphitisation with increase of temperature. High value of FWHM of D-band in the case of 600° C applied temperature is due to the film formation and absence of CNWs. C–F bonds were detected in the thin film. After the nucleus formation is finished, F atoms were not detected by XPS in CNWs.

P 35

The synthesized diamonds microstructure consolidation review

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Excellent mechanical, optical and thermal properties of diamonds are the advantages for which they are used in many areas and thus in the industrial as well. Considering that natural diamonds are rare and expensive, in order to overcome that, production of synthesized diamonds is a good solution. Hence, investigation of alternative producing methods led to discovery of commercially available chemical vapor deposition – CVD method. Using this method led to creation of microcrystalline diamond (MCD) with grain size larger than 100 nm. Because of some disadvantages of this synthesized diamond, new nanocrystalline (NCD) and ultra-nanocrystalline (UNCD) diamond materials were developed, with average size of grains ranging 5-100 nm and 3-5 nm, respectively. Reactor geometry, filament setup and gas phase conditions are also very important parameters for diamonds growth on silicon wafers, in addition to the mixture composition and pressure of applied gases. The goal of the paper is to present the relation of microstructure and diverse consolidation methods.

P 36

Electrical conductivity and fractal nature analysis synthesized diamonds phenomena

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Chemical Vapor Deposition – CVD can be used for creation of synthesized diamonds. The result of the process is the microstructure which is composed of numerous small grains. Such structure can be applied in various areas, like medicine, electronics, micromechanical systems, microelectromechanical systems – MEMS and many others. For these and many other applications, one of the most important feature is the electrical conductivity. Although the natural diamond is an excellent insulator, synthesized diamonds show different behavior. The exploring of this feature is a complex area with a strong convolution between grain size and sp^2 bond-

ing effect. The optimization of the synthesized diamond properties requires the revealing of the size and the shape of the created crystallites. Due to the size of grains being significantly reduced, the fractal theory can help in analysis of the grain morphology and especially of electrical conductivity.

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The synthesized diamonds thermal conductivity and fractal nature

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It is well known that diamonds are almost the best thermal conductors. This property as well as other convenient features, leaded to intensive research of synthesized diamonds production. Also, the investigation of the most valuable characteristics is the aim of permanently exploring. The thermal conductivity of synthesized diamonds research is very important, and because of that, the knowledge of the thermal conductivity properties is a basic point for completely understanding the synthesized diamonds phenomena. The experimental procedure confirmed interesting results regarding thermal conductivity. Investigation of the influence of different inputs on the synthesized diamonds process is of high importance. Due to the fact that the dimensions of the grain size have an impact on thermal conductivity, and that they are very small in deposited films of synthesized diamonds, the investigation of their fractal nature could lead to the further explanation of phenomena. The goal of this paper is basic analysis of what is the influence on thermal conductivity in the light of fractal nature materials properties.

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The influence of Sintering Temperature on Electrical Resistivity of Modified $BaTiO_3$ Ceramics

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In this paper, the influence of sintering temperature on electrical resistivity (ρ) of modified $BaTiO_3$ ceramics was investigated. The $BaTiO_3$ doped samples were sintered at 1350 ° for 4 hours. The concentration of the additives were from 0.01 to 1.0 at% Er or Yb. The density was ranged from 83% of theoretical density (TD) for samples doped with low content of dopant (0.01 at%) to 95% for samples doped with 1.0 at% of dopant. SEM analysis for samples doped with concentration of 0.01 at% shows abnormal grain growth with the average size range between 10

μm - 40 μm. An increase in dopant concentration and sintering temperature causes a decrease in the average grain size in the investigated samples. So it is for samples doped with 1.0 at% Er/Yb, grain size range between 5 μm - 30 μm. The electrical resistivity were measured in temperature range from 25°C to 180°C at different frequencies. The value of the electrical resistivity decreases with increasing concentration of dopant, to a concentration of 0.5 at% Er/Yb, and then resistivity increases with dopant content in high doping level. Also, the electrical resistivity decreasing with increasing frequency, and for high frequencies it is lower by few order of magnitude.

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Microstructure and EDS Characterization of Doped $BaTiO_3$ Ceramics

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The purpose of this paper is an investigation of the effects of various dopants (La, Nb, Sb) on the microstructure properties, phase composition and contact surface of $BaTiO_3$ based ceramics. The doped $BaTiO_3$-ceramics were prepared by conventional solid state procedure and sintered up to 1350°C for four hours. The concentration of additive were range from 0.1 to 5.0 at% of La, Nb or Sb.

The grain size and microstructure characteristics for various samples and their phase composition was carried out using a scanning electron microscope SEM (JEOL-JSM 5300) equipped with EDS (QX 2000S) system.

The homogeneous and completely fine-grained was observed in samples doped with low concentration of dopant (0.1 and 0.5 at %). EDS analysis of this samples did not reveal any dopant-rich regions, which indicated a uniform incorporation of dopants within the samples. In high doped samples, apart from the fine grained matrix, the appearance of local area with secondary abnormal grains was observed. The increase of dopant concentration leads to the appearance of dopant-rich regions between grains.

P 40

The Alternative energy sources review

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Renewable energy sources are energy sources that are derived from nature and can be renewed. Today, they are increasingly being used because of their harmlessness to the environment. Most renewable energy technologies are powered directly or indirectly from the Sun. The composition of the Earth's atmosphere is balanced, so that the radiation into space is equal to the

incoming solar radiation, which results in a certain energy degree within the Earth's atmospheric composition, and we can roughly describe it as the Earth's climate.

Renewable energy is obtained from natural processes that are constantly renewed. In its various forms, it derives directly from the sun, or from heat generated deep within the Earth. It also includes electricity and heat generated from sources such as sunlight, wind, oceans, hydropower, biomass and geothermal energy, biofuels and hydrogen from renewable sources. Each of these sources has unique characteristics that influence how and where they can be used. Renewable energy sources include: solar energy, wind energy, biomass, biofuel, biogas, geothermal sources, energy of small watercourses, tidal energy, energy of the waves, internal energy of the sea and the ocean.

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Structural characterization of Kalsilite

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Thermally induced phase transformation of K-exchange LTA zeolite is followed in the range from room temperature to 1500 ºC. The frameworks collapse into amorphous intermediate products after heating between 600 and 650 °C. Prolonged heating of the intermediate product over 1100 °C results directly in formation a kalsilite [$\boldsymbol{a}$= 8.1095 (4) Å, $\boldsymbol{b}$ =12.824 (4) Å, $\boldsymbol{c}$ =7.0674 (4) Å, $\boldsymbol{\beta}$ =115.89 °(3)]. The crystale phases of kalsilite in temperature range between 700 and 1500 °C was investigated by X-ray powder analyses.

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Fractal nature Heywang model contribution and $BaTiO_3$-ceramics semiconducting phenomena

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Well known material with ferroelectric properties, $BaTiO_3$-ceramics, have many advanced applications. Fractal approach in analyzing of these structures can be one of the solution for investigation of morphology. It is known that a wide range of disordered systems can be characterized by the fractal nature over a microscopic correlation length, and on a small scale the energy transformations are permitted. Due to the lack of energy, priorities of the future frontiers in ce-

ramics science is to expand the knowledge even down to nano and towards new and alternative energy sources. Fractal configuration nature of $BaTiO_3$ and other ceramics is based on phenomena that ceramic grains have fractal shape; there are pores and inter-granular space and there is particles Brownian fractal motion inside the material, during and after sintering, in the form of micro-particles flow, which is the most important. These important facts are in function of further developing of knowledge of energy harvesting and storage.

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Forensic Fractal Nature Applications

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Fractals are fragmented geometric shapes based on each or parts self-similarity. Fractal dimension (FD) is the most important characteristics in fractal nature analysis. There are many fractals applications including the forensic photography. The fractals image reconstruction is very important for modern forensic science. Here we demonstrate the very new original fractal applications in forensic sciences. This is a quite new application in crime investigations specifically in latent fingerprinting within biometric analysis. All of these open a new frontier in falsificates, financial and generally economic crime scene areas.

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One Review on Solid Oxide Fuel Cell Applications

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The fuel cell is a highly efficient electrochemical clean energy conversion device that converts chemical energy into electrical energy by reacting gaseous fuel (H^+) with oxidizing gas (O_2^-) though a solid ion conducting electrolyte with reduced greenhouse gas emission and reduced oil consumption. FC generates high alteration efficiencies as compared to the other available conventional combustion engine mechanical approaches. The working principle of batteries and fuel cell are analogues to each other for the production of electricity. Oxygen pass through the cathode and hydrogen or hydrocarbon fuels supply through the anode, and then the electrochemical reaction takes place at the electrode/electrolyte interface due to the active charge carrier passing

through the electrolyte, thereby releasing the electrons into external circuit to generate electricity without pollution. There is no need to store energy as it is a continuous reforming process as long as both fuel and oxidant are provided in the fuel cell continuously. Thus, the main characteristic of a fuel cell is the production of highly efficient energy with negligible pollution. Thus, in the 21st century, energy technology such as fuel cell becomes a key determinant factor of economic development and is essential to raising the living standards in the form of the most influencing and challenging alternating source of generation of electricity.

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Fractals applications on fractured archeological samples reconstruction

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The civil engineering materials in the whole existing civilization have many characteristics which do not depend of past historical period, but, there is forever and everywhere fractal characteristic of structures morphology. Many archeological sources which are very reach with samples from prehistorical periods, ancient Greece, Roman and Vestian period, Slovenes and later, are existing in Balkan and South-East Europe. These sources and samples are very important for our civilization evaluation. Sometimes or even often, we fined archeological samples which are fractured and damaged. In such situation, it is very important to reconstruct some of these parts. We developed quite new method based on fractals analysis and characterization which is an excellent tool for reconstruction the archeological and heritage samples. In these paper, we successfully presented this application and opened new perspectives for research in this area.

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Fractal analysis in modern national security analysis

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This study observes the implementation of fractal tools on complex infrastructures critical for national security. We focus on the actual effectiveness of digital decentralisation and complex system operations, in providing reliability of critical resources related with socio-political stability of the state. We find that the process relies on devised value which functions as a mean to characterise the intolerable level of disturbance. This makes fractal analysis useful for operational contemplation of functional and structural components of critical systems. Since the index is computed and the measurements expressed, these tools also provide an estimate of the flows. The findings provide for two principle conclusions. Firstly, the value of fractal tools in national secu-

rity analysis is that they are suitable to detect indicators of irregularity, coincident, composition and structure of a current processes, which would otherwise require complex intelligence. From the aspect of national security system, this possibility extends to the tactical edge and enables remote management. Secondly, fractal tools rely on expectation, and are therefore practically behavioural. They should, therefore, not be a sole base for tactical operational development, due to unreliability of set parameters and consequently the precision of all segments within the model.

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Diamond mining in Ghana

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Like most other countries in West Africa, Ghana have several deposits of diamonds as well. However, the country has yet to feature in the global list of major diamond producers. Ghana produced a little more than 370,000 carats of rough diamonds in 2009, and this was seen as a major reduction in the production of diamonds in terms of volume. However, now with things falling in place, Ghana diamonds are becoming popular, albeit gradually. Diamond mining in the country is concentrated in the Birim Valley, near Akwatia In the Eastern Region of the Country. Usually, these diamonds are mined by small scale miners from alluvial as well as in-situ deposits. Under the British, Ghana had one of the biggest state-owned diamond miners in the world, but once the British left, diamond mining operations have gone down and it is now confined to the small scale sector. Unfortunately, diamond mining in the country has not taken off as the government would have liked it to, with the country producing around 400,000 carats a month. The production and mining of diamonds have to be streamlined. The country produces and exports mostly rough diamonds and the government has finally realized the importance of polished diamonds. The Precious Minerals Marketing Company has set up a plant for diamond cutting and polishing. This will help Ghana stop exporting rough diamonds. Furthermore, it will also generate employment, as workers will be required to polish and cut the diamonds.

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Diamond lndustry in Ghana

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In Ghana, there is a three-tier system in place for diamond mining and selling. The country has miners, who are usually small scale miners, sellers and then there are exporters. Till 2007, the Ghana Minerals Commissioned supervised the miners. However, once the Kimberley Process Certification Scheme was launched, the Precious Minerals Marketing Company Ltd. supervises not just the miners, but also the trading activities. The PMMC collects all the required information about the miners and forwards it to the Kimberley Process authorities. In 2006, the UN had banned Ghana from exporting diamonds, as there was a doubt that Ghana was dealing with

conflict diamonds. However, once the Kimberley Process authorities visited the country to check for compliance, the country was allowed to export diamonds again. The small scale miners, who sell their diamonds to exporters, have often complained about the ban on excavators. The government decided to ban excavators for diamond mining due to environmental issues. However, miners often claim that they have to dig deep to reach the rocks containing the diamond and using manual labour is making it unprofitable and difficult for them.

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Gold and precious 'metals meet' science and life

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Gold is one of the most precious metals in the world. It is present in the rivers, seas, and the earth's crust and trace amounts are present in plants and animals. It is, however, difficult and expensive to extract. In modern mining operations approximately 3 tons of ore are needed to extract one ounce of gold. The many desirable qualities found in gold, along with its scarcity, have made it the most popular metal for use in jewellery today. Gold is very important in very specific analysis and applications, within semiconductor technologies, and in all electronic materials sciences and most of her application. Purity of gold has been defined by the term karat, which is 1/24 part of pure gold by weight. Pure gold is equivalent to 24K. Gold purity may also be described by its fineness. Dunkwa Offin : 22.65 karat, Kenyasi:23.65 karat, Ayensu:22.50 karat, Bogoso:23.65 karat

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The gold mining in Ghana

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Alluvial mining techniques, which are popularly called "dig and wash" of gravels in deep and shallow. The land for mining has to be cleared and prepared for with an Excavator, trammel washing plant and mercury for the start up Process. The excavator will then gather the gravel as you set up the pumping machine to supply water to the washing plant called Trammel. The Excavator then is used to supply the gravels into the washing plant to be washed. A trammel is composed of a slightly-inclined rotating metal tube (the 'scrubber section ') with a screen at its discharge end for the process of water pumping and washing. The Pumping machine then supply water into the plant, the excavator then transport the gravels into the washing plant. Every four hours, mercury is then catches the gold, the gold is burnt and smelt. This Process is called Alluvia Mining when the gravel is shallow.

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Frequency dependence of the coercivity of of FeCoV alloy prepared by PIM/MIM technology

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Ferromagnetic parts with complex geometries for high temperature applications can be produced as iron-cobalt based alloys by Powder/Metal Injection Molding PIM/MIM route. Devices prepared from FeCo-2V alloy are usually exploited under extreme conditions In this paper were characterized Fe49Co49V2 alloy samples produced by MIM followed by sintering process during 3.5 hours at 1370 ^{O}C and 1400 ^{O}C in hydrogen atmosphere.

The hysteresis loops of different toroidal samples were measured as a function of the frequency in the range from 5 Hz to 60 Hz and exhibits semi-hard magnetic properties. Optimum magnetic properties (relative magnetic permeability of about 210 @ 3 kA/m and 5 Hz) were observed with the sample sintered at 1370 ^{O}C. The frequency dependence of the coercivity was analyzed by model based on normal eddy currents and added anomalous eddy currents.

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Nanotechnology in Dentistry

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Nanotechnology is matter at nanometer level and the application of the same to medicine is called nanomedicine. Nanotechnology holds promise for advanced diagnostics, targeted drug delivery, and biosensors.

This technology, which deals with matter in nanodimensions, has widened our views of poorly understood health issues and provided novel means of diagnosis and treatment. Researchers in the field of dentistry have explored the potential of nanoparticles in existing therapeutic modalities with moderate success. Nanotechnology in dental material sciences started with the introduction of microfills. In regards to biomaterials, nanotechnology has gained an increasing interest by researchers, particularly in case of dental implants. This is mainly due to the impact of nanoparticles on host responses at both cellular and tissue levels. The growing interest in the dental applications of nanotechnology is leading to the emergence of a new field called nanodentistry.

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Cavitation erosion resistance of glass-ceramic based on basalt

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The paper examines the resistance to the effect of cavitation of raw basalt samples from the Vrelo-Kopaonik deposit and basalt-based glass-ceramics obtained by melting and casting of the basalt aggregate. A change in the sample mass in function of the cavitation time was monitored for the evaluation of cavitation resistance. The level of degradation of the surface of the sample was quantified using the image analysis. The change in the morphology of the sample surface with the test time was followed by scanning electron microscopy. In the case of raw basalt samples it is evident that the incubation period in the early phase of cavitation damage is short, because the period without mass loss is almost negligible. According to the selected test conditions in the first 15 min, the mass loss of these samples is up to 15 mg, for 120 min exposure is 88,5mg, with a cavitation rate of 0,738 mg/min and total surface area damage of 35%. Analyzing the progression of erosion samples of glass-ceramics, it can be concluded that the loss of mass is small, in the first 15 min the mass loss is 1.29 mg, for 120 min exposure is 3.53 mg, with a cavitation rate of 0.0294 mg/min and total surface damage of the sample surface of 12%. The higher erosion rate of the raw basalt samples compared to glass-ceramic samples based on basalt can be interpreted by the rough structure of the olivine-pyrroxene basalt from Vrelo-Kopaonik deposit, compared to the compact structure of the obtained glass-ceramic samples, with glass and fluid texture, very great hardness.

Research has shown that the process of obtaining samples of glass-ceramic greatly influences cavitation resistance, especially relaxation cooling processes that eliminate internal stresses and reduce brittleness of samples. It has been shown that glass-ceramic samples based on olivine-pyrroxene basalt from the test deposit can be applied in conditions in which high cavitation loads are expected.

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Structural and magnetic properties of $Y_{1-x}Yb_xF_3$ solid solution

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In this work, the polycrystalline samples $Y_{1-x}Yb_xF_3$ (x = 0.01, 0.05, 0.1, 0.25, 0.5, 0.75 and 1) were synthesized and characterized by X-ray powder diffraction and magnetic measurements. In the first stage of synthesis, mixed sesquioxides $(Y_{1-x}Yb_x)_2O_3$ were obtained by ceramic technology. In the second stage, obtained mixed sesquioxides were treated with an excess of ammonium hydrogen fluoride in air at 170 °C for 20 h. In the third and last stage, $Y_{1-x}Yb_xF_3$ samples were obtained by heating the product from the second stage of synthesis at 500 °C for 3 h in an inert atmosphere. The X-ray diffraction revealed that the crystal structure of the $Y_{1-x}Yb_xF_3$ solid solution is orthorhombic (YF_3 structural type). The structure refinements were done by the Rietveld full-profile method within *Pnma* space group. Magnetic susceptibility measurements of all samples were done in a temperature range 2-300 K by SQUID magnetometer. The relation between magnetic and structural properties was discussed.

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