Serbian Ceramic Society Conference

ADVANCED CERAMICS AND APPLICATION IX

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, 20-21. September 2021.

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Dear colleagues and friends,

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

It is nice to host you here in Belgrade in person. As you probably know, Serbia launched a vaccination campaign at the beginning of this year, so up to date more than 50 percent of the adult population has been vaccinated. Since there is no one statistic to compare the COVID19 outbreaks and fears for loved ones in different countries, we believe that we all suffer similarly during this pandemic. That is why we appreciate even more your positive attitude and readiness to travel in this uncertain time. We understand that some of you had to cancel your lectures in the last minute due to the travel limitation in your countries, but we hope that you will come next year. We deeply hope that the ACA IX Conference will be worth remembering, that you will respect all COVID-19 safety measures at SASA building, that you will have a nice time here and that ultimately you will return to your home safely. We are very proud that we succeeded in bringing the scientific community together again and fostering the networking and social interactions around an interesting program on emerging advanced ceramic topics. The chosen topics cover contributions from fundamental theoretical research in advanced ceramics, computer-aided design and modeling of new ceramics products, manufacturing of nanoceramic devices, developing of multifunctional ceramic processing routes, etc.

Traditionally, ACA Conferences gather leading researchers, engineers, specialists, professors and PhD students trying to emphasize the key achievements which will enable the widespread use of the advanced ceramics products in the High-Tech industry, renewable energy utilization, environmental efficiency, security, space technology, cultural heritage, etc.

Serbian Ceramic Society was 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 the Serbian Ceramic Society in accordance with Serbian law procedure. Serbian Ceramic Society is almost the only one Ceramic Society in South-East Europe, with members from more than 20 Institutes and Universities, active in 16 sessions. Part of our members are also members of the Serbian Chapter of ACerS since 2019. Their activities in the organization of this conference is highly recognized. To them and all of you thanks for being with us here at ACA IX.

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
- Nano-, Opto- & Bio-ceramics
- Modeling & Simulation
- Glass and Electro Ceramics
- Electrochemistry & Catalysis
- Refractory, Cements & Clays
- Renewable Energy & Composites
- Amorphous & Magnetic Ceramics
- Heritage, Art & Design

Conference Programme Chairs:
Dr. Lidija Mančić SRB
Dr. Nina Obradović SRB

Conference Co-chairs:
Prof. Dr. Vojislav Mitić SRB
Prof. Dr. Rainer Gadow GER

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Analysis - Lab equipment, Belgrade (Serbia)

Telekom (Serbia), Netico (Serbia), TOB (Serbia), Genal (Serbia), Gradska Toplana Niš (Serbia), JKP Tržnica Niš (Serbia)

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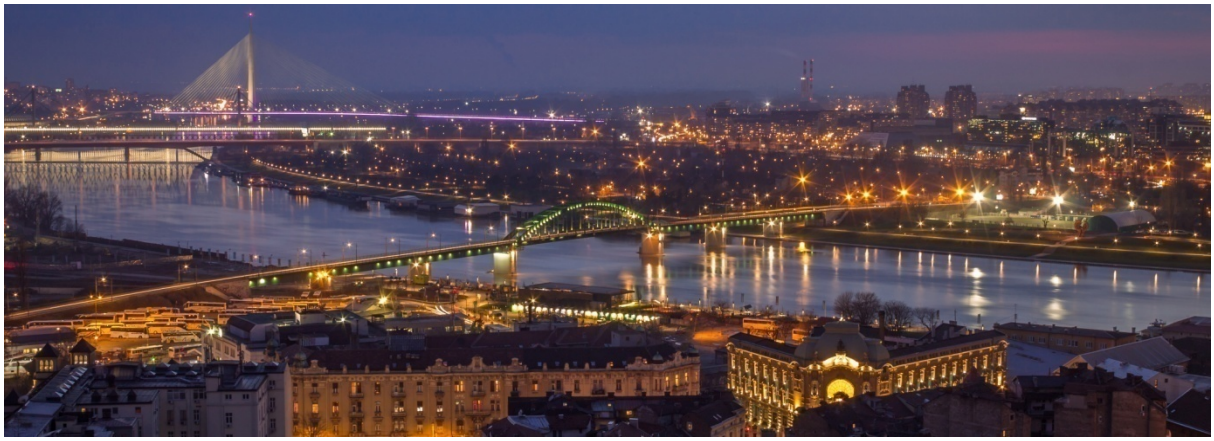
Serbian Academy of Sciences and Arts, Institute of Technical Sciences of SASA, Institute of Physics BU, Vinča Institute of Nuclear Sciences BU, American Ceramics Society – Serbian Chapter

Hotel Palas, Zadužbina Andrejević, Pink Taxi, Beotravel, Agencija Format, Shenemil Serbia

Conference Program and Abstracts

Program and Abstract's Contents

The Ninth Serbian Ceramic Conference Advanced ceramics and Application



Conference Information:

Conference location: Belgrade (Beograd) – the capital of Serbia, Serbian culture, education, science and economy, having about 2 million habitants. Belgrade is situated in South-Eastern Europe, on the Balkan Peninsula, at the confluence of the Sava and Danube Rivers in north central Serbia. The official language is Serbian, while foreigners can use English.
Conference venue: Serbian Academy of Sciences and Arts - SASA, Great Hall (2nd floor) and Halls 1, 2 (1st floor), Knez Mihailova 35, Belgrade, Serbia
Dress code: Serbian Academy of Science and Arts is a distinguished institution of supreme national importance. We kindly ask you to respect a dress code and not to wear short skirts and pants (above the knee); tank top and sleeveless shirts; flip-flops and open-toed sandals.

Covid-19 outbreak - information for conference participants:
Prevention and general precautions:

- avoid close contact (within 1 m) with people who are ill with fever, cough or respiratory symptoms;
- wear a face covering in enclosed environments;
- wash or sanitize your hands frequently – after coughing, before preparing food or eating, after toilet use, after contact with ill persons, and during exposure to high traffic public areas;
- cover your mouth and nose with a disposable tissue when coughing or sneezing and use the nearest waste receptacle to dispose of it after use. If you do not have a disposable tissue, cough or sneeze in your elbow;
- strictly do not attend the conference if you are unwell. Stay at home or your accommodation if you become unwell, develop a fever or respiratory symptoms;
- if you or other participants in the conference hall are unwell, inform the conference organizers and arrange to get an assessment from a healthcare provider.

Conference fee: Standard fee for foreign participants: 200 EUR; Standard fee for domestic participants: 10000 RSD; **Discounts**: Members of SCS, Keynote lecturers and PhD Students: 50%; Invited lecturers 40%; Plenary lecturers & the last year winners (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.
Registration:
20. 09.2021 (8.00-9.00AM-2nd Floor) & 21.09.2021 (8.00-9.00AM–1st Floor)
Posters instalation:
21.09.201 (16.30-17.00) CLUB SASA

Useful telephone numbers:
Police:192
Firemen:193
Ambulance:194

Taxi services: For the taxi services from Belgrade Nikola Tesla Airport to any destination in Belgrade area and further, please contact TAXI INFO desk, located in the baggage area.

Time zone: Belgrade and Serbia are located in the Central European time zone region GMT + 1
Electricity: The electricity voltage in Belgrade is 220V. Electrical outlets are standard EU.
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.
Water: Tap water in Belgrade is safe to drink.

Abstracts and papers publication: The official language of the conference is English. Conference abstracts will be published in the **Book of Abstracts**.
Limited number of papers presented at the conference will be possible to publish in **Science of Sintering,** as weel as in the following Open Access Journals under special Article Processing Charges: **Fractal and Fractional** (spec.issue: The Materials Structure and Fractal Nature - eds.V.Mitic, C.Serpa, H-J.Fecht) and **Frontiers in Materials** (res.topic Advanced Structures and Properties of Electronic Ceramic Materials –eds.V.Mitic, Z.Sun, S-C. Tsay, J. De Los, S. Guerra and J.R. Hwu.

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 speaking desk at the beginning of the day when your presentation will be. 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/
Exchange office: „Hulk“, Vuka Karadžića 4
Tourist Information Centre: Knez Mihailova 5 http://www.tob.rs/en

Date	Time	Programme		Floor, Room
20th September Monday	**08.00-09.00**	**Registration**		2nd Floor, Hallway
	09.00-09.30	**Opening Ceremony**		2nd Floor, Great Hall
	09.30-09.40	**Short Break**		2nd Floor, Great Hall
	09.40-11.10	**Plenary Session** R.Gadow S.Tidrow N.Barišić		2nd Floor, Great Hall
	11.10-11.40	**Coffee Break & Photo Session**		2nd Floor, Hallway
	11.40-13.10	**Plenary Session** K.Maca B.Marinković W.Fahrenholtz		2nd Floor, Great Hall
	13.10-14.30	**Buffet Lunch**		Club SASA, Mezzanine
	14.30-15.50	**Plenary/Keynote Session** F.A.Khan C.Serpa Z.Nikolić		2nd Floor, Great Hall
	15.50-16.20	**Coffee Break**		2nd Floor, Hallway
	16.20-18.25	**Plenary/Keynote Session** M.Novak H.Zoz N.Filipović R.Castro		2nd Floor, Great Hall
	19.30	**Conference dinner**		Palace hotel
21st September Tuesday	**08.00-09.00**	**Registration**		1st Floor, Hallway
	09.00-11.05	**Session: Ceramic & Sintering Hall 3** D.Kosanović A.Stanković N.Labus N.Djordjević V. Mařák K.I. Rybakov R.Svintsitski	**Session: Nano- Opto- & Bio-Ceramic Hall 2** I.Dinić M.Vuković M.Rabasović V.Lojpur S.Stojanović N.Tatić B.Vrbica	1st Floor
	11.05-11.30	**Coffee Break**		
	11.30-13.50	**Session: Electroceramic, Modelling & Simulation Hall 3** S.Ribar V.Mitić M.Čebela B.Randjelović I.Radović D.Danković A.Stajčić	**Session: Catalysts Magnets & Renewal Energy Hall 2** Lj.Veselinović M.Rosić S.Marinović S.Krstić U.Čakar F.Veljković S.Stojiljković G.Cvetanović	
	14.00-15.00	**Buffet Lunch**		Club SASA, Mezzanine
	15.00-15.45	**Annual meeting of the Serbian Ceramic Society**		1st Floor, Hall 2
	15.45-16.30	**American Ceramic Society Serbian Chapter Round Table**		
	16.30-17.00	**Coffee Break**		1st Floor, Hallway
	16.30-17.00	**Poster Installation**		Club SASA, Mezzanine
	17.00-18.00	**Poster Session**		
	18.00	**Awards & Closing Ceremony**		

Monday, September 20, 2020

08.00 – 09.00 **Registration** **Hallway, 2nd Floor**

Great Hall, 2nd Floor

09.00 – 09.30 **Opening Ceremony of the Seventh Serbian Ceramic Society Conference: Advanced Ceramics and Application**
President of SCS - Prof.dr Vojislav Mitić, President of the General Assembly of the SCS - Dr. Olivera Milošević, President of SASA - Academician Vladimir Kostić, Deputy Minister of Ministry of Education Science and Technological Development - Dr. Marina Soković, National Assembly Deputy - Dr. Vladimir Orlić

09.30 - 09.40 **Short break**

Great Hall, 2nd Floor

09.40 – 11.10 **Plenary Session**
Chairpersons: Bojan Marinković

09.40– 10.10 **PL Suspension Flame Sprayed Metal Doped Calcium Phosphate Coatings with Antibacterial Properties for Infection Prophylaxis**
R. Gadow[1,2], A. Killinger[1], M. Blum[1] and A. Bernstein[3],
[1]Institute for Manufacturing Technologies of Ceramic Components and Composites, University of Stuttgart, Stuttgart, Germany
[2]Graduate School of Excellence for advanced Manufacturing Engineering (GSaME), University of Stuttgart, Stuttgart, Germany
[3] Musculoskeletal research lab, Clinics of Orthopedics and Trauma Surgery, University of Freiburg, Freiburg, Germany

10.10 – 10.40 **PL Reduced Search Space, Time and Cost, to Develop Halide Perovskites**
Steven C. Tidrow
New York State College of Ceramics, Alfred University, Alfred, NY, USA

10.40 - 11.10 **PL Cuprates: from complexity to simplicity**

Neven Barišić[1,2]
[1]Institute of Solid State Physics, TU Wien, Wiedner ` Hauptstraße 8, 1040 Wien Austria
[2]Department of Physics, Faculty of Science, University of Zagreb, Bijenička cesta 32, HR-10000, Zagreb, Croatia

11.10 - 11.40 **Coffee Break and Photo Session** **Hallway, 2nd Floor**

Great Hall, 2nd Floor

11.40 - 13.10 **Plenary Session**

Chairperson: Steven Tidrow

11.40 - 12.10 **PL Transparent alumina polycrystalline ceramics doped and co-doped with rare earth elements and transition metals for tailoring of luminescent properties**

K. Maca[1,2]; K. Drdlikova[1]; D. Drdlik[1,2]; J. Tasler[2], R. Klement[3]; D. Galusek[3,4]
[1] CEITEC BUT, Brno University of Technology, Purkynova 123, 612 00 Brno, Czech Republic
[2] Faculty of Mechanical Engineering, Brno University of Technology, Technicka 2, 616 69 Brno, Czech Republic
[3] FunGlass, Alexander Dubcek University of Trencin, Studentska 2, 911 50 Trencin, Slovakia
[4] Joint Glass Centre of the IIC SAS, TnUAD, FChPT STU, FunGlass, Studentska 2, 911 50 Trencin, Slovakia

12.10 - 12.40 **PL Negative and Near-Zero Thermal Expansion in $A_2M_3O_{12}$ and Related Ceramic Families**

Bojan A. Marinkovic[1], Patrícia Ponton[2], Carl Romao[3], Thaís Moreira[1], Mary Anne White[4]
[1] Department of Chemical and Materials Engineering, Pontifical Catholic University of Rio de Janeiro (PUC-Rio), 22453-900, Rio de Janeiro, RJ, Brazil
[2] Department of Materials, Escuela Politécnica Nacional, 170525, Quito, Ecuador
[3] Department of Chemistry, University of Oxford, Inorganic Chemistry Laboratory, South Parks Road, Oxford OX1 3QR, United Kingdom
[4] Department of Chemistry, Dalhousie University, Halifax, Nova Scotia B3H 4R2, Canada

12.40 - 13.10 PL High Entropy Ultra-High Temperature Ceramics: New Materials for Extreme Environments

William G. Fahrenholtz
Missouri University of Science and Technology
Department of Materials Science and Engineering
222 McNutt Hall; 1400 N. Bishop Avenue Rolla, MO 65409 United States

13.10 - 14.30 Buffet Lunch Club SASA

Great Hall, 2nd Floor

14.30 - 16.30 Plenary/Keynote Session
Chairperson: Mario Novak

14.30 - 15.00 PL Magnetocaloric properties and the critical point exponents of $Pr_{0.55}Ca_xSr_{0.45-x}MnO_3$ (x = 0.00, 0.05, 0.1 and 0.2) at PM-FM phase transition

F.A.Khan , M. A. A. Bally
Department of Physics
Bangladesh University of Engineering and Technology (BUET), Dhaka-1000, Bangladesh

15.00 - 15.25 KN Fractal reconstruction of irregular shapes

Cristina Serpa[1,2], Vojislav Mitić[3]
[1]ISEL - Instituto Superior de Engenharia de Lisboa, Lisbon, Portugal
[2]CMAFcIO - Centro de Matemática, AplicaçõesFundamentais InvestigaçãoOperacional, Faculdade de Ciências da Universidade de Lisboa, Campo Grande, 1749-016, Lisbon, Portugal
[3]Faculty of Electronic Engineering, University of Nis, 14 Aleksandra Medvedeva, 18000 Nis, Serbia

15.25 - 15.50 KN Gravity-induced skeletal structure evolution – an approach based on graph theory

BranislavM. Randjelović, Zoran S. Nikolić and Vojislav V. Mitić
University of Niš, Faculty of Electronic Engineering,
Aleksandra Medvedeva 14, 18000 Niš, Serbia

15.50 - 16.20 Coffee Break Hallway 2nd Floor

Great Hall, 2nd Floor

16.20 - 18.25 Plenary/Keynote Session
Chairpersons: Neven Barisic

16.20 - 16.55 KN Dirac and Weyl semimetals
- how topology governs materials properties –
Mario Novak
University of Zagreb, Faculty of Science, Department of Physics, Bijenička 32, 10 000 Zagreb, Croatia

16.55 - 17.20 KN
Henning Zoz
Zoz Group
Maltoz-Strasse
D-57482 Wenden

17.20 - 17.55 KN Insilico clinical trials of the vascular stents
Nenad Filipovic[1,2], Miljan Milosevic[1,2], Dalibor Nikolic[1,2], Milos Kojic[1,2], Georgia Karanasiou[3], Dimitris Fotiadis[3]
[1]BIOIRC Research and Developed Center, Kragujevac, Serbia
[2]University of Kragujevac, Kragujevac, Serbia
[3]Foundation for Research and Technology Hellas, Ioannina, Greece

17.55 - 18.25 PL Phase Diagrams for Nanoscale Ceramics
Ricardo H. R. Castro
University of California, Davis

19.30 Conference dinner Hotel Palas

Tuesday, September 21th, 2021

08.00 - 09.00 **Registration** **Hallway, 1st Floor**

Hall 3, 1st Floor

09.00 - 11.05 **Session: Ceramic Science & Sintering**
Chairperson: Nina Obradović

09.00 - 09.20 **INV Electronic Properties of BZT Nano-Ceramic Grades at Low Frequency Region**

Darko Kosanović[1], Viktor Pucky[2], Stanko O. Aleksić[3], Vladimir B. Pavlović[4] Vladimir A. Blagojević[1]
[1]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, Belgrade, 11000, Serbia
[2]Institute of Materials Research, Slovak Academy of Sciences, Watsonova 47, 04001 Košice, Slovakia
[3]Institute Iritel, Batajnicki put 23, 11 000 Belgrade
[4]Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080, Belgrade-Zemun, Serbia

09.20 - 09.40 **INV Synthesis and characterization of ZnO nano/micro crystals with enhanced sunlight-induced photo-catalytic activity**

Ana Stanković[1], Ljiljana Veselinović[1], Srečo Davor Škapin[2], Smilja Marković[1]
[1]Institute of Technical Sciences of SASA, 11000 Belgrade, Serbia
[2]Jožef Stefan Institute, 1000 Ljubljana, Slovenia

09.40 - 10.00 **INV Dilatometric study of the $ZnTiO_3$ phase transition kinetic influenced by nano powder sintering**

Nebojša Labus[1], Milena Rosić[2], Smilja Marković[1], Maria-Vesna Nikolić[3]
[1]Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000 Beograd, Serbia
[2]Laboratory for Material Science, Institute of Nuclear Sciences „Vinča“, University of Belgrade, Belgrade, Serbia
[3]Institute for Multidisciplinary Research, Kneza Višeslava 1, University of Belgrade, Belgrade 11030, Serbia

10.00 - 10.20 **INV DTA/TG Analysis And Phase Changes Of Activated Na_2CO_3**

Nataša Đorđević[1], Sanja Martinović[2], Slavica Mihajlović[1], Milica Vlahović[2], Jasmina Lozanović Šajić[3]
[1]Institute for Technology of Nuclear and Other Mineral Raw Materials, 86 Franchet d'Esperey Blvd., Belgrade, Serbia
[2]University of Belgrade, Institute of Chemistry, Technology and Metallurgy, 12 Njegoševa St, Belgrade, Serbia
[3]Institute of Health Care Engineering with European Testing Center of Medical Devic, TU Graz, 16 Stremayrgasse St, Graz, Austria

10.20 - 10.35 **ORL Electrophoretic deposition of plasma-activated hydroxyapatite powder densified by rapid sintering**

Vojtěch Mařák[1], Martina Ilčíková[2], Katarína Drdlíková[1], Daniel Drdlík[1, 3]
[1] CEITEC BUT, Brno University of Technology, Purkynova 123, 612 00 Brno, Czech Republic
[2] Department of Physical Electronics, CEPLANT, Masaryk University, Kotlarska 2, 611 37 Brno, Czech Republic
[3] Faculty of Mechanical Engineering, Brno University of Technology, Technicka 2, 616 69 Brno, Czech Republic

10.35 – 10.50 **ORL Rapid microwave sintering of electroceramics and biocompatible ceramics**

S.V. Egorov, A.G. Eremeev, V.V. Kholoptsev, I.V. Plotnikov, K.I. Rybakov, A.A. Sorokin, Yu.V. Bykov
Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod, Russia

10.50 – 11.05 **ORL 3DCeram and NewSpace applications**

Rouslan Svintsitski
3DCeram Sinto, Limoges, France

11.05 - 11.30 **Coffee Break** **Hallway, 1st Floor**

Hall 3, 1st Floor

11.30 – 13.30 **Session: Electroceramics, Modeling & Simulation**
Chairperson: Kirill Rybakov

11.30 - 11.50 **INV The ceramics materials density defined by artificial neural networks**

Srđan Ribar[1],Vojislav V. Mitić[2], Branislav Ranđelović[3], Dušan Milošević[2], Vesna Paunović[2], Hans Fecht[4], Branislav Vlahović[5]
[1]Faculty of Mechanical Engineering, University of Belgrade, 16 Kraljice Marije, 11000 Belgrade, Serbia
[2]Faculty of Electronic Engineering, University of Nis, 14 Aleksandra Medvedeva, 18000 Nis, Serbia
[3]Faculty of Teachers Education, University of Kosovska Mitrovica, Nemanjina, 38218 Leposavic, Serbia
[4]University of Ulm, Institute for Multifunctional Properties of Materials, Ulm, Germany
[5]North Carolina Central University, USA Durham NC, USA

11.50 - 12.10 **INV Fractals, Graphs and Neural Networks: The Holly Trinity of Nanostructures - An Overview and Comparison of Methods**

Vojislav V. Mitić[1], Branislav Ranđelović[1,2], Srdjan Ribar[3], Dušan Milošević[1], Marina Soković[4], Bojana Marković[1], Hans Fecht[5], Branislav Vlahović[6]
[1]Faculty of Electronic Engineering, University of Nis, 14 Aleksandra Medvedeva, 18000 Nis, Serbia
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[5]Institute of Multifunctional Properties of Materials, University of Ulm, Ulm, Germany
[6]North Carolina Central University, USA Durham NC, USA

12.10 - 12.30 **INV A multidisciplinary approach to multiferroics**

Maria Čebela[1,2]
[1] Institute for Nuclear sciences "Vinča", University of Belgrade, Serbia
[2]Department of Physics, Faculty of Science, University of Zagreb, Bijenička c. 32, HR-10000 Zagreb, Croatia

12.30 - 12.50 **INV Discrete mean square approximation applied on molecules and bacteria Brownian motion error calculation**

Branislav Ranđelović[1,2], Vojislav V. Mitić[1], Dušan Milošević[1],Bojana Marković[1], Vesna Paunović[1], Sanja Aleksić[1], Branislav Vlahović[3]
[1]Faculty of Electronic Engineering, University of Nis, 14 Aleksandra Medvedeva, 18000 Nis, Serbia
[2] Faculty of Teachers Education, University of Kosovska Mitrovica, Nemanjina, 38218 Leposavic, Serbia
[3]North Carolina Central University, USA Durham NC, USA

12.50 – 13.05 **ORL Fractal reconstruction of fiber-reinforced polymer composites**

Ivana Radović [a], Vojislav V. Mitić [b,c], Aleksandar Stajčić [d], Cristina Serpa [e,f], Srdjan Ribar [g], Branislav Randjelović[b,h] and Branislav Vlahović[i]
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[g]University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
[h]University of K. Mitrovica, Faculty of Teachers Education, Leposavic, Serbia
[i]Mathematics and Physics Department, North Carolina Central University (NCCU), Durham, North Carolina, US

13.05 - 13.20 **ORL Methods for modeling of NBTS induced threshold voltage shift in p-channel power VDMOSFETs**

Nikola Mitrović[1], Sandra Veljković[1], Snežana Đorić-Veljković[2], Vojkan Davidović, Snežana Golubović, Danijel Danković[1], Zoran Prijić[1]
[1]University of Niš, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia
[2]University of Niš, Faculty of Civil Engineering and Architecture, Aleksandra Medvedeva 14, Niš, Serbia

13.20 - 13.35 **ORL Magnetic materials, Curie-Weiss law and fractal correction**

Vojislav V. Mitić[1,2], Cristina Serpa[3,4] Aleksandar Stajčić[5], Kouros Khamoushi[6], Vesna Paunović[1], Sanja Aleksić[1] and Branislav Vlahović[7]
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[7]Mathematics and Physics Department, North Carolina Central University, Durham, NC 27707, USA

14.00 - 15.00 **Buffet Lunch** **Club SASA, Mezzanine**

Hall 2, 1st Floor

15.00 - 15.45 **Annual meeting of the Serbian Ceramic Society**

15.45 – 16.30 **American Ceramic Society Serbian Chapter Round Table**

16.30 - 17.00 **Coffee Break** **Hallway, 1st Floor**

Club SASA, Mezzanine

17.00-18.00 **Poster Session**

Chairpearsons: Suzana Filipovic, Ivana Dinic & Bojana Markovic

18.00 **Awards &Closing Ceremony**

Tuesday, September, 21st, 2021

08.00 - 09.00 **Registration** **Hallway, 1st Floor**

Hall 2, 1st Floor

09.00 - 10.45 **Session: Nano-, Opto- & BioCeramic**
Chairperson: Lidija Mancic

09.00 - 09.20 **INV Influence of solvothermal synthesis parameters on $NaY_{0.65}Gd_{0.15}F_4:Yb_{0.18}Er_{0.02}$ UCNPs structural, morphological and optical characteristics**
Ivana Dinic[1], Marina Vukovic[2], Marko Nikolic[3] and Lidija Mancic[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia
[2] Innovative Centre, Faculty of Chemistry Belgrade, University of Belgrade, Serbia
[3]Photonic Center, Institute of Physics Belgrade, University of Belgrade, Serbia

09.20 - 09.40 **INV Sonochemical synthesis of optically active fluorides**
Marina Vukovic[1], Ivana Dinic[2], Paula Jardim[3], Smilja Markovic[2], Ljiljana Veselinovic[2], Marko Nikolic[4], Lidija Mancic[2]
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[3]Department of Metallurgical and Materials Engineering, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil
[4]Photonic Center, Institute of Physics Belgrade, University of Belgrade, Serbia

09.40 - 10.00 **INV Nonlinear laser scanning microscopy for imaging of the cells labeled by up-converting $NaYF_4:Yb,Er$ nanoparticles**
Mihailo D. Rabasovic[1], Ivana Dinic[2], Aleksandra Djukic-Vukovic[3], Milos Lazarevic[4], Marko G. Nikolic[1], Aleksandar J. Krmpot[1], Lidija Mancic[2]
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[2] Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Belgrade, Serbia
[3] Department of Biochemical Engineering and Biotechnology, Faculty of Technology and Metallurgy, University of Belgrade, Serbia
[4] Institute of Human Genetics, School of Dental Medicine, University of Belgrade, Serbia

10.00 - 10.20 **INV Influence of the water flow lens system on performances of the different laboratory made Sb_2S_3-based and commercial solar cells**

Vesna Lojpur and Ivana Validžić
Department of Atomic Physics, Vinča Institute of Nuclear Sciences, National Institute of the Republic of Serbia, P.O. Box 522, 11001 Belgrade, University of Belgrade, Serbia

10.20 - 10.35 **ORL Preclinical studies of natural bone substitute material in different conditions and models - our experience**

Stevo Najman[1,2], Sanja Stojanović[1,2], Jelena Najdanović[1], Jelena Živković[1], Marija Vukelić-Nikolić[1], Ivica Vučković[3], Vladimir Cvetković[4], Jelena Vitorović[4]
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[2]University of Niš, Faculty of Medicine, Scientific Research Center for Biomedicine, Department for Cell and Tissue Engineering, 18000 Niš, Serbia
[3]Clinic of Dental Medicine Niš, Department of Maxillofacial Surgery, 18000 Niš, Serbia
[4]University of Niš, Faculty of Sciences and Mathematics, Department of Biology and Ecology, 18000 Niš, Serbia

10.35 – 10.50 **ORL Combination of Extracellular Matrix Hydrogels with Different Biomaterials as a Tissue Engineering Strategy**

Natalija Tatic[1,2], Christiani A Amorim[2], Anne des Rieux[2], Lisa J White[1]
[1]University of Nottingham, Nottingham, UK; [2]UCLouvain, Brussels, Belgium

10.50 – 11.05 **ORL Synthesis and characterization of Ag-loaded hematite nanocomposites**

Boško Vrbica,[1] Marija Šuljagić,[2] Dejan Jeremić,[3] Ljubica Andjelković,[2]Milica R. Milenković[1]
[1]University of Belgrade, Faculty of Chemistry, Studentski Trg 12-16, Belgrade, Republic of Serbia
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11.05 - 11.30 **Coffee Break** **Hallway, 1st Floor**

Hall 2, 1st Floor

11.05 – 13.00 **Session: Catalyst, Magnetic & Renewal Energy**
Chairperson: Zorica Mojovic

11.30 - 11.50 **INV $CaCu_3Ti_{4-x}Ru_xO_{12}$: Crystal structure, electrical and magnetic properties**

Lj. Veselinović[a*], M. Mitrić[b], L. Mančić[a], P. M. Jardim[c], S. D. Škapin[d], N. Cvjetićanin[e], S. Marković[a]
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[d]Jozef Stefan Institute, Ljubljana, Slovenia
[e]Faculty of Physical Chemistry, University of Belgrade, Studentski Trg 12-16, P.O. Box137, Belgrade, Serbia

11.50 - 12.10 **INV Modified glycine nitrate procedure synthesis and properties of nanostructured $Ca_{1-x}Gd_xMnO_3$ (x=0.05; 0.1; 0.15; 0.2)**

Milena Rosić[1], Nebojša Labus[2], Maria Čebela[1]
[1]Laboratory for Material Science, Institute of Nuclear Sciences „Vinča“, University of Belgrade, Belgrade, Serbia
[2]Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000 Beograd, Serbia

12.10 - 12.30 **INV Cobalt-based catalysts in catalytic oxidation of tartrazine activated by Oxone®**

Sanja Marinović, Tatjana Novaković, Tihana Mudrinić, Nataša Jović-Jovičić, Marija Ajduković, Aleksandra Milutinović-Nikolić, Predrag Banković
University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Department of Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Republic of Serbia

12.30 - 12.50 **INV Preparation and Characterization Of Active Carbon Microspheres Obtained From Fructose And Adsorption Application**

Sanja S. Krstić, Vladimir M. Dodevski, Đuro Čokeša, Aleksandar B. Devečerski, Radojka T. Vujasin, Ksenija V. Kumrić, Branka V. Kaluđerović
Institut za nuklearne nauke „Vinča" - Institut od nacionalnog značaja za Republiku Srbiju, Univerzitet u Beogradu, Beograd, Srbija

12.50 - 13.05 **ORL Natural active compounds in the prevention of oxidative stress**

Uroš Čakar[1], Mirjana Čolović[2], Maria Čebela[3], Nikolina Lisov[4], Aleksandar Petrović[4], Danijela Krstić[5], Brižita Đorđević[1]
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5. Institute of Medical Chemistry, Faculty of Medicine, University of Belgrade

13.05 - 13.20 **ORL Determination of corrosion products of Ag-Cu alloy by laser desorption ionization mass spectrometry**

Filip Veljković[1], Radovic Ivana[1], Drakulić Dunja[1], Dimitrijević Stevan[2], Dimitrijević Silvana[3], Stoiljković Milovan[1] and Veličković Suzana[1]
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[3]Mining and Metallurgy Institute Bor, Zeleni Bulevar 35, 19210 Bor, Republic of Serbia

13.20 - 13.35 **ORL Applications of nanofluids in geothermal energy**

Staniša Stojiljković, Dragan Stojiljković, Ivan Savić, Gradimir Cvetanović, Milena Živanović
Faculty of Technology, University of Niš, Serbia

13.35 - 13.50 **ORL Solar energy storage with phase changes materials for adsorption cooling**

Gradimir Cvetanović, Milena Živanović, Staniša Stojiljković
Faculty of Technology, University of Niš, Serbia

14.00 - 15.00 **Buffet Lunch** **Club SASA, Mezzanine**

Hall 2, 1st Floor

15.00 - 15.45	**Annual meeting of the Serbian Ceramic Society**
15.45 – 16.30	**American Ceramic Society Serbian Chapter Round Table**

16.30 - 17.00	**Coffee Break**	**Hallway, 1st Floor**

Club SASA, Mezzanine

17.00-18.00	**Poster Session** **Chairpearsons: Suzana Filipovic, Ivana Dinic & Bojana Markovic**
18.00	**Awards &Closing Ceremony**

Book of Abstracts

PL

Reduced Search Space, Time and Cost, to Develop Halide Perovskites

Steven C. Tidrow

New York State College of Ceramics, Alfred University, Alfred, NY, USA

There is recent significant interest in halide perovskites due to their potential to increase energy conversion efficiency of solar cells. Considering only the roughly 1000 potential "simple" halide perovskites, there is a need to reduce the material search space that addresses solar cell energy conversion technology requirements. The new simple material model is significantly outperforming Goldschmidt's tolerance factor formalism (GTFF), including the GTFF based SPuDS algorithm, in determining which materials will form, etc. Here, in order to assist program managers, scientists and engineers in significantly reducing the search space, time and cost, to find and develop halide perovskites that address solar cell technology requirements, NSMM is applied to address specific ranges of ionic radii space where "simple" and "simply mixed" halides form stable perovskites. NSMM is used to discern expected "simple" and "simply mixed" cubic halides from those of lower crystal symmetry and provide expected lattice volume as a function of temperature. NSMM uses geometric, planar and volume, constraints and Clausius – Mossotti relation to determine ion properties, radii and polarizability as a function of temperature, which are used to determine lattice parameter, volume, relative permittivity and some select specific phase transition temperatures of perovskites. For instance, NSMM mapping, Fig. 1, shows the perovskite series, $AMgC_3$, where A is Ag, Cs, H, K, Li, Na, Rb, or Tl and C is F, Cl, Br, or I. Note, NSMM correctly indicates that only $CsMgI_3$, $CsMgBr_3$ and $RbMgBr_3$ within the iodine and bromide series will form and reasonably correctly indicates that most if not all of the chloride and fluoride series of materials form. The temperature dependent lattice parameter, experiment and modeled, for $KMgF_3$ is shown in Fig. 2 along with expected relative permittivity in Fig. 3. Use of NSMM indicates that roughly one-half of the possible "simple" halide perovskites may not form and may be eliminated as potential candidate materials. Additionally, significant solid solution limitations can be inferred. Discussion will compare NSMM results with as much experimental data as possible to illustrate the strength of NSMM, a spreadsheet formulation, to provide some key parameters that can be used in more sophisticated software to provide additional material properties.

PL

Negative and Near-Zero Thermal Expansion in $A_2M_3O_{12}$ and Related Ceramic Families

Bojan A. Marinkovic[1], Patrícia Ponton[2], Carl Romao[3], Thaís Moreira[1], Mary Anne White[4]

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Crystal phases from $A_2M_3O_{12}$ and related ceramic families present great potential for a variety of applications, principally due to their capability to preserve low-density deficient garnet structure with more than 17 different cations and to change coefficient of thermal expansion in accordance to their chemistry. After more than 20 years since the first report on unusual thermal expansion in $A_2M_3O_{12}$ family, lot of research has been done in this field. The present review presents the history of studies of materials in the $A_2M_3O_{12}$ and related ceramic families, the findings of unusual thermal expansion and the present understanding of the mechanism, and related factors such as hydroscopic behaviour, and the monoclinic to orthorhombic phase transition. Other properties, including thermomechanical, thermal and electric conduction and optical properties, are presented in terms of challenges and opportunities for applications. One of the largest challenges is the production of monoliths, and various methods for consolidation and sintering are summarized. These ceramics have considerable promise when combined with other materials, and recent advances in such composites are presented. All of these matters are placed in the context of the applications of the $A_2M_3O_{12}$ and related ceramic families, which still present challenges for future materials researchers.

PL

High Entropy Ultra-High Temperature Ceramics: New Materials for Extreme Environments

William G. Fahrenholtz

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This presentation will report on the synthesis, densification, and properties of high entropy ultra-high temperature ceramics. High entropy ultra-high temperature ceramics are the subject of increasing research activity due to the potential for enhanced chemical stability and oxidation resistance at elevated temperatures. Synthesis methods affect the powder particle size and purity, which also impact the ability to densify the resulting powder. Densification is

typically conducted with applied pressure by hot pressing or spark plasma sintering. To date, the most commonly reported properties are hardness and modulus measured by nanoindentation. In our laboratory, high entropy carbides were synthesized by carbothermal reduction of oxides and high entropy borides were synthesized by boro-carbothermal reduction. Both processes produce sub-micron powders with oxygen contents below 1 wt%. Densification was accomplished by hot pressing of carbides and spark plasma sintering of borides. The presentation will summarize systematic studies of the mechanical and thermal properties of the high entropy ultra-high temperature ceramics that have been produced. The presentation will end with conclusions about the properties of high entropy ultra-high temperature ceramics compared to conventional materials.

PL

Suspension Flame Sprayed Metal Doped Calcium Phosphate Coatings with Antibacterial Properties for Infection Prophylaxis

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High Velocity Suspension Flame Spraying (HVSFS) has been successfully employed to produce a wide variety of bioceramic coatings for prosthetic devices and bone implants. The HVSFS process has proven to be capable to process biomaterials resulting in densesubmicro structured and well adherent coatings on various types of metal and ceramic substrates. Degradable bioceramic coatings offer a faster osseointegration and better adhesion ofendoprosthetic structures. A common problem that occurs after surgery and the applicationof implantsis the risk of infection due to the presence of bacteria which can result in severe post operative inflammation reactionsassociated with a high risk of losingthe implant. In a novel approach, metals with known antibacterial propertiesare incorporated into the coating as a nanosize dispersion and dopant to reduce the risk of inflammation.Metal doped coatings based on bioceramics were suspension flame sprayed using modified suspensions containing additional metals or metal salt based precursors. These coatings were evaluated regarding their microstructure and phase composition, as well as their in-vitro behavior in contact and interaction with critical bacteria including aspergillus aureus.The presence of nano sized metal and metal oxide particles in the coating were characterized using micro-Raman and HR-SEM. To evaluate the biocompatibility, a live/dead-assay studybased on MG-63 cells was performed. Results showed no evidence for any cytotoxic reaction but a distinct suppression of infection risk.

PL

Transparent alumina polycrystalline ceramics doped and co-doped with rare earth elements and transition metals for tailoring of luminescent properties

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Fully dense polycrystalline alumina with sub-micrometre grain size exhibits optical transparency in both the infrared and visible region with significant potential for a wide range of applications, e.g. transparent armours, visible-infrared windows, and envelopes for energy saving light sources. Additional property, as photoluminescence, even enhances the application potential of this material. The photoluminescence isusually attained by doping with rare earth elements and/or transition metals. Single doping performed in our previous work is now extended to co-doping for better adjustment of photoluminescent properties.In the beginning of the presentation the brief history of the processing of transparent ceramics at Brno University of Technology will be mentioned. Then the recent results dealing with doping and co-doping of transparent alumina and their properties will be presented and discussed.Innovative processing method based on proper treatment of dopants combined with novel pressure-less pre-sintering followed by Hot Isostatic Pressing was utilised for preparation of transparent doped alumina polycrystalline ceramics. The dopants under investigation were various rare earth elements (Eu, Er, Nd, Tb, Dy) and transition metals (Cr, Mn). The final products were characterized in terms of real in-line transmission, photoluminescence in visible and NIR spectral region, and also by hardness measurement. The effect of dopant type and its content on microstructure and related properties was also evaluated. In case of Eu-doped and Dy-doped alumina the RIT exceeded 55% which is unique compared to the results published so far. The combination of superior optical, luminescent, and mechanical (Vickers hardness exceeded 25 GPa) characteristics makes these materials a promising candidate for number of hi-tech applications.

PL

Cuprates: from complexity to simplicity

Neven Barišić[1,2]

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Advanced technologies based on materials science are driving the progress of our society. Today's capital challenges are related to clean energy and the IT sector. In this respect the phenomenon of high-temperature superconductivity, found in cuprates, is of undisputable technological importance. It also presents one of the most exciting, extensively investigated, yet still unresolved problems in condensed matter physics. A major difficulty in unravelling the mystery of high-T_c lies in the complexity of the materials and the phase diagram, where the delicate balance between material specific properties, disorder and the number of electronic phases superimpose. This multiplicity generated many exotic, often contradicting microscopic models. With carefully conducted experiments on improved single crystals, we have identified a series of surprisingly simple and universal features. Moreover, we have demonstrated that the itinerant holes exhibit Fermi-liquid behavior and become superconducting, and proposed that a localized charge in the unit cell provides the glue for the Cooper pairs.

PL

Magnetocaloric properties and the critical point exponents of $Pr_{0.55}Ca_xSr_{0.45-x}MnO_3$ (x = 0.00, 0.05, 0.1 and 0.2) at PM-FM phase transition

F.A.Khan, M. A. A. Bally

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Bangladesh University of Engineering and Technology (BUET), Dhaka-1000, Bangladesh

Polycrystalline manganite samples of $Pr_{0.55}Ca_xSr_{0.45-x}MnO_3$ (x = 0.00, 0.05, 0.1, and 0.2) has been synthesized by the solid state reaction technique to investigate its crystal structure, magnetic, and magnetocaloric properties of the material. Critical behaviour around PM-FM phase transition has been analyzed throughmodified Arrott plots (MAP), and critical isotherm analysis. XRD analysis reveals that all the samples are crystallized in the orthorhombic system with Pnma space group.The lattice parameters and the cell volume are found to have decreased with increasing Ca (x) content. Microstructure is observed with the field emission scanning electron microscopy (FESEM) imagesand the elemental compositions are determined by energy dispersive X-ray diffractometer (EDX). Temperature and field dependent magnetization measurement show that all the samples have undergone a second-

order FM to PM phase transition. Howeverthe transition temperature $T_C$has decreased from 290 K to 245 K with the increase in Ca (x) content from 0.00 to 0.20. To investigate the critical point exponents for the studied samples, modified Arrot plots (MAP) were constructed using mean field theory, 3-D Heisenberg model, 3-D Ising model and Tri-critical mean field model. The plot of relative slope as a function of temperature reveals that the mean field model is most suitable to calculate the critical point exponents of $Pr_{0.55}Ca_xSr_{0.45-x}MnO_3$which also indicates the existence of long range ferromagnetic order in the studied samples. The exponent δ determined from the Widom scaling relation is very close to the value calculated from the critical isotherms confirming the reliability of the calculated critical exponents and T_C values. The magnetocaloric effect (MCE) in terms of maximum entropy change, $(-\Delta S_m)_{max}$ and relative cooling power (RCP) was calculated from isothermal magnetization measurements around T_C, using Maxwell's thermodynamic relations. Both $(-\Delta S_m)_{max}$ and RCP increases with increasing Ca content suggests the suitability of this compound as a potential solid state refrigerent. Contribution of itinerant electron in the entropy change is found from modulating MCE with Landau theory of phase transition.

KN

Dirac and Weyl semimetals - how topology governs materials properties –

Mario Novak

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In the presentation, we shall give an overview of our recent progress in the field of matter with the non-trivial topology of the electron band structure. The talk aims to introduce the topic of topological matter to a broader research community. The topological matter has in recent years become a hot topic in the condensed matter physics. Potential applications of these materials range from the quantum computing to novel catalysts in electrochemistry. The talk will be focused on the electronic structure of topological insulators, 3D Dirac, and Weyl semimetals. We shall cover our results of single-crystalschemical synthesis, electrical and magnetic transport properties, and the results of different spectroscopic methods such as the optical THz-spectroscopy and angle-resolved photoemission spectroscopy (ARPES).

KN

Gravity-induced skeletal structure evolution - an approach basedon graph theory

BranislavM. Randjelović, Zoran S. Nikolić and Vojislav V. Mitić

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The influence of gravitational effects on grain coarsening during liquid phase sintering (LPS) is of both fundamental and practical interest in materials science, where an excess of liquid can cause shape loss with the formation of so-called elephant foot geometry. Only alloys with small quantities of liquid (smaller than 20 vol.%) are fabricated under gravity conditions. Settling of solid grains is a phenomenon common to several metallurgical processes such as LPS, where solid-liquid segregation in sintered structures is related to the density difference between the solid and liquid phases.Microstructural features that appear important in controlling the compact macrostructure are solid contact, grain coordination number, and dihedral angle. In that sense, for simulation of the evolution of solid skeleton structure, we will define a numerical model based on three-dimensional domain methodology for representation of solid grains and on submodels for gravity-induced settling (gravity-driven rearrangement denoted as free settling and compact slumping). Under definition skeleton structure will be computed by geometrical limitation for two grains in contact with an observable dihedral angle. The mentioned phenomena can be very elegantly described and modeled using graph theory in which grain centers are identified by vertices and a link (center-to-center distance) that join a pair of vertices by the edge. Time-dependent evolution

of graph data structure (consists of the set of vertices and the set of edges) will be used for gravity-induced settling represented by Free settling of isolated solid-phase domains (vertices) and Skeletal settling (or compact slumping) of a connected solid (graph) structure. Free settling means that isolated domains sink under gravity toward the experimental space bottom and/or slide down over the already settled domains, where a solid skeleton (graph) as a connected solid structure can also settle due to the gravity force (skeletal settling). Although both types of settling are usually described as sequential, there may be overlap between them. The advantages of this methodology are a simple mathematical approach and a relatively simple visual connection of technological parameters and phenomena that characterize LPS. If LPS were completely mapped to graphs, it would be possible to realize the more efficient simulation of microstructural evolution. The special advantage of this approach is that it is possible to use different algorithms for graph operations, as well as parallel algorithms for fast calculations on a large data set typical for multi-grain models with a huge number of grains.

KN

Fractal reconstruction of irregular shapes

Cristina Serpa[1,2], Vojislav Mitić[3]

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Irregular shapes requires non-classical approaches to analyze. Fractals are objects that have self-similarities which may be constructed iteratively by a simple initial configuration. The inverse process is difficult and a new method is now available to reconstruct a fractal model from real shapes. This is the fractal regression model, an effective model to find fractal coefficients and estimate Hausdorff dimension. The aim of the talk is to present this method and illustrate the difference regarding to the fractal interpolation used in applied sciences.

KN

Insilico clinical trials of the vascular stents

Nenad Filipovic[1,2], Miljan Milosevic[1,2], Dalibor Nikolic[1,2], Milos Kojic[1,2], Georgia Karanasiou[3], Dimitris Fotiadis[3]

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Today's clinical trials takes 10-12 years on average to bring a new drug or device to market, with limited change over the past decades in the linear and sequential process used to assess the efficacy and safety of drugs or devices. InSilc is EU funded project which developed the insilico clinical trial platform that is used for designing, developing and assessing coronary stents. The platform is based on the extension of existing multidisciplinary and multiscale models for simulating the drug-eluting BVS mechanical behaviour, the deployment and degradation, the fluid dynamics in the micro- and macroscale, and the myocardial perfusion, for predicting the drug-eluting BVS and vascular wall interaction in the short- and medium/long term. The whole process for the Mechanical Module development includes the design, set up and implementation of several finite element simulations performed with the advanced and beyond the state-of-the-art in-house BIOIRC's solver PAK. The solver achieves the simulation of nonlinear material and geometry problems, nonlinear contact problems, dynamics and statics with residual stress and strain analysis. The process that is followed, in general, includes the following steps: (i) creation of the 3D stent geometry (in case this is not available directly in a 3D format from the manufacturer), (ii) mesh generation, (ii) application of appropriate boundary conditions (depending on the test a variety of boundary conditions are applied). BIOIRC has developed a nonlinear material model that is applied in the finite element solver PAK for prescribing material property from uniaxial stress-strain experimental curves. It is an Open module used only in the Mechanical Modeling Module. Beside Mechanical Modelling Module, following exploitable products of InSilico are currently operative: 3D reconstruction and plaque characterization tool, the Deployment Module, the Fluid Dynamics Module, the Drug Delivery Module, the Myocardial Perfusion Module, the Degradation Module, the Virtual Physiology Module, the Virtual Population Database and the integrated InSilc cloud platform. Insilico clinical trials for vascular stent will open a new avenue in real clinical trials to reduce them and to replace in part and to decrease their expenses.

INV

$CaCu_3Ti_{4-x}Ru_xO_{12}$: Crystal structure, electrical and magnetic properties

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The $CaCu_3Ti_4O_{12}$ belongs to the large $ACu_3B_4O_{12}$ family of materials. Crystallographic *A* site is most often occupied by alkaline-earth metals or lanthanides, while *B* site is occupied by transition metals. The type of cations that build up the structure strongly affects the properties of these. The $CaCu_3Ti_4O_{12}$ has been extensively studied due to its high dielectric permittivity stable over a wide temperature and frequency range (up to 10^5, for 100-600 K and 10^2–10^5 Hz). Because of such characteristics, it has promising application in microelectronics. However, it has been shown that differences in the crystal structure and electrical properties of dielectric ceramics and metallic electrodes, may cause an energy barrier and occurrence of stress on the ceramic-electrode contact which reduces dielectric permittivity. Such stress can be prevented by using dielectric and electrode materials with as much as possible similar crystal structure, especially unit cell parameters. This investigation dealt with detailed structural (XRPD, HRTEM, SAED), dielectric and magnetic study of $CaCu_3Ti_{4-x}Ru_xO_{12}$ (CCTRO, x = 0, 1 and 4) materials. The results of structural refinement show that in cubic symmetry with space group $Im\bar{3}$, both titanium and ruthenium ions occupied crystallographic *B* site. Moreover, the variation in stoichiometry slightly affects the value of the unit cell parameters but changes electrical properties of studied material. Thus, substitution of even one atom of Ru in $CaCu_3Ti_{4-x}Ru_xO_{12}$ unit cell is enough to change material properties from dielectric to conductor solving the problem of stress appearance on the contact layer of dielectric/electrode in capacitors.

INV

Sonochemical synthesis of optically active fluorides

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Up-conversion is the optical property of materials which have ability to convert low energy photons (usually from infrared spectrum) into higher energy photons (from visible spectrum). Such compounds, usually lanthanide doped oxides or fluorides, have many applications in photoluminescence science and technology today. Currently, (β) $NaYF_4$:Yb,Er polymorph is considered to be the most efficient up-converting material. Its synthesis usually includes the usage of toxic solvents, long-term heating, high pressures, controlled gas atmosphere, etc. The aim of this work was to utilize rarely applied sonochemical synthesis for the stabilization of (β) $NaYF_4$:Yb,Er phase under mild and environmental friendly conditions. For this purpose, we performed ultrasonic treatment of common nitrate precursors and sodium fluorine for a different time. The obtained powders were analyzed in order to determine their phase composition and thermal stability, morphology, dopants distribution, particles surface purity and luminescent characteristics. Owing to this, the chemical and crystal phase transformations that occurred in specified periods of synthesis time are explained in detail. Moreover, it was shown that obtaining of uniformly doped (β) $NaYF_4$:Yb,Er mosocrystalline particles is possible after 2h of sonication.

INV

Electronic Properties of BZT Nano-Ceramic Grades at Low Frequency Region

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Barium zirconium titanate ceramics were prepared using solid state reactions of $BaCO_3$, TiO_2 and ZrO_2 at elevated temperatures. The prepared BZT was mechanically activated in the planetary ball mill from 0-120 min to achieve different powder grades from micro- to nano-sized particles. After the powder characterization by XRD and SEM the samples were pressed in disc shape and sintered at 1100 and 1200 °C in the air. The sintered samples were characterized by SEM. After that the silver epoxy electrodes were deposited on sintered disc samples. The disc samples capacitance and resistivity were measured in the low frequency region from 1 Hz to 200 kHz using a low frequency impedance analyzer. Sintering temperatures and powder grades were used as parameters. Finally, specific resistance ρ, dielectric permittivity (ε' + jε") and tgδ were obtained from the impedance measurements. The trends in electronic properties were analyzed: the relaxation effect of the space charge (inter-granular electric charges) vs. sintering temperature and ceramic grades. These show that mechanical activation has a significant effect on electrical properties, resulting in generally improved overall performance.

INV

Influence of solvothermal synthesis parameters on $NaY_{0.65}Gd_{0.15}F_4$:$Yb_{0.18}Er_{0.02}$ UCNPs structural, morphological and optical characteristics

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Monosized Up-Converting NanoParticles (UCNPs) with biocompatible surface and unique optical properties attract a great interest as new cell markers or drug delivery systems. The uppermost UC efficiency of β-$NaYF_4$:Yb/Er phase is due to its hexagonal *P63/m* space group

arrangement which could accommodate higher concentration of dopants at shorter distance. Stabilization of this phase in nanoparticles is usually achieved through thermal decomposition of organic precursors in the presence of solvents with a high boiling point. Here, for the same purpose, we used gadolinium co-doping during chitosan assisted solvothermal processing of inorganic precursor salts. Precursor concentration, solvent type, and synthesis time were varied in order to determine their influence on the β-$NaY_{0.65}Gd_{0.15}F_4$:$Yb_{0.18}Er_{0.02}$ phase crystallization. The XRPD analysis showed that lower surplus of fluoride ions during synthesis leads to formation of $Y_{0.65}Gd_{0.15}F_4$:$Yb_{0.18}Er_{0.02}$ orthorhombic phase, while the increase of fluoride content or prolongation of the processing time enhances formation α-$NaY_{0.65}Gd_{0.15}F_4$:$Yb_{0.18}Er_{0.18}$ phase. Along with it, the changes of UCNPs morphology from spindle to spherical shape is detected. All samples emit intense green emission due to the ($^2H_{11/2}$, $^4S_{3/2}$) → $^4I_{15/2}$ electronic transitions, after been excited with infrared light (λ=978 nm).

INV
Nonlinear laser scanning microscopy for imaging of the cells labeled by up-converting $NaYF_4$:Yb,Er nanoparticles

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The Nonlinear Laser Scanning Microscopy (NLSM) contributes to the cell labeling through addressing two main issues: photobleaching and phototoxicity. Moreover, an increase of the penetration depth and a reduction of background autofluorescence are achieved.We have used a multidisciplinary approach combining expertise in material science, nanoparticles synthesis and characterization, cancer cell and tissue labeling, and high resolution imaging, in order to accomplish *in vitro* imaging of the cancer cells. We have imaged the oral squamous carcinoma cells and human gingival cells. We have demonstrated that we are able to take high contrast images. We have shown position of the nanoparticles in cells, through co-localization of the cell auto-fluorescence and the nanoparticles up-conversion.We plan to improve our abilities through further optimization of the up-converting nanoparticles (smaller and brighter particles) and microscopy technique.

INV

Synthesis and characterization of ZnO nano/micro crystals with enhanced sunlight-induced photo-catalytic activity

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It is known that the functional properties of zinc oxide (ZnO) materials depend on their physico-chemical properties, such as optical properties and specific surface area.They are defined with structural characteristics, for example: the particle size and morphology, phase composition, crystallite size, crystallinity degree, as well as the crystal structure ordering, i.e., the presence of structural defects. The primary purpose of this study was to synthesize ZnO powders with various physico-chemical properties by optimizing the reaction conditionsin different processing methods. For example, reaction temperature or addition of various surfactants such as polyvinyl alcohol, polyvinyl pyrrolidone, or polyethylene oxide. In this study, to vary physico-chemical properties of ZnO particles, four different synthesis methods wereemployed: mechanochemical, hydrothermal, ultrasonicand microwave processing. Structural and morphological properties of prepared ZnO powders were characterized using a number of techniques such as: X-ray powder diffraction (XRPD), Raman and Fourier transform infrared (FTIR) spectroscopy, field emission scanning electron microscopy (FESEM), UV-Vis diffuse reflectance and photoluminescence (PL) spectroscopy. One of the functional properties of the synthesized ZnO powders that was particularly examined is photocatalytic activity. In order to examine ZnO as a photocatalyst, photodegradation of methylene blue (MB) dye was carried out under simulated and direct sunlight irradiation. The UV–Vis spectra showed that the modification of the particle size and morphology from nanospheres to micro-rods resulted in increased absorption, and a slight red-shift of the absorption edge. Besides, the band gap energy of the synthesized ZnO micro and nanocrystals showed the red shift compared to bulk ZnO. According to the results of a Raman spectroscopy, the enhanced visible light absorption of the ZnO micro and nanocrystals is related to two phenomena: the existence of lattice defects (oxygen vacancies and zinc interstitials), and the particle surface sensitization by different surfactants.

INV

Influence of the water flow lens system on performances of the different laboratory made Sb_2S_3-based and commercial solar cells

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Here, the behavior of different types of solar cells at a low light intensity, measured with and without using the water flow lens (WFL) system is investigated. This system enables the cooling of the surface of the solar cell/modules/panels, indirectly cooling the surrounding, and allows investigating of the influence of higher or lower intensities of the light with the inevitable change in the spectrum. All of these effects are very important and can greatly contribute to the better photovoltaic performance of the observed cells. In this study, laboratory-made and commercial solar cells were studied at 5 % sun and (or) 35 % sun using a tungsten and halogen lamp, respectively. Comparing the obtained results performed when the WFL system is used and left out, it was confirmed that the WFL system facilitates obtaining better photovoltaic properties for all investigated solar cells.

INV

Cobalt-based catalysts in catalyticoxidationoftartrazine activated by Oxone®

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Two different types of cobalt-based catalysts were synthesized and tested as Oxone® activators in catalytic oxidation of model dye, tartrazine. First type of catalyst was cobalt impregnated aluminum pillared montmorillonite, and the second one was cobalt-doped alumina. Aluminum pillared montmorillonitewas synthesized from Na-exchanged Wyoming clay and impregnated with cobalt using incipient wetnessimpregnation method. Cobalt-doped alumina catalysts were synthetized using the sol-gel method. Three calcination temperatures were employed: 500 °C, 1000 °C and 1100 °C. The degradation of tartrazine was monitored using Thermo Scientific Evolution 220 UV–Visible Spectrophotometer in the wavelength range from 200–600 nm.In this wavelength range the monitoring of decolorization, along with registering the emergence, followed by degradation,ofdetectable degradation products was achieved.The effect of the different reaction parameters on decolorization and degradation efficiency was tested, includingtheinfluence of the mass of catalyst, reaction temperature and initial pH. It was found that the increase of temperature and the mass of

catalysts were beneficial for the reaction.All investigated catalysts were found to be very efficient in the Oxone® initiated tartrazine decolorization and degradation.

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INV

Preparation and Characterization Of Active Carbon Microspheres Obtained From Fructose And Adsorption Application

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Carbon material with active surface properties have been synthesized by hydrothermal method from fructose using 40% and 80% phosphoric acid (H_3PO_4) solution, at temperature of 260°C and fructose concentration of 2M. The aim of this investigation was active carbon material synthesis which is completed by one step reaction, which was not the case in our previous works. Thus, compared with other samples from our works, this way is more economic and faster since both reaction of carbonization and activation was finished in one step. The hydrothermal process, in general, includes heat treatment of carbohydrate solutions under autogenous pressure at low temperatures (150–260 °C). Obtained solid carbon material has uniform morphology, amorphous structure and high content of oxygen functional groups. Prepared active carbon material is made up of spherical microsphere particles with the diameter in the range of 0.6-2.7 μm. The morphology and surface properties of obtained material were characterized by scanning electron microscopy (SEM), Fourier-transform infrared (FTIR) spectra. Adsorption and desorption isotherms of N_2 were measured on carbon containing material at -196 °C using the gravimetric McBain method. Adsorption from aqueous solutions of Methylene Blue (MB) onto prepared carbon material was conducted by changing concentration of MB from 200-500mg/dm^3. The best fit of the kinetic results was achieved by a pseudo second-order equation. Also, this nature of material is applicable in other systems regarding environmental protection and dye pollution prevention.

INV

DTA/TG Analysis And Phase Changes Of Activated Na_2CO_3

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Sodium carbonate material is used as a good sorbent of carbon dioxide from the atmosphere, and has gained increasing importance in environmental protection.In order to enhance its sorption ability, mechanochemicaly activatied sodium carbonate was investigated,and the occurred changes after the activation and the relaxation time in a controlled environment were monitored. Activation was performed in a vibro-mill for 2 and 7 minutes, and the activated samples were placed in an atmosphere of carbon dioxide at a humidity of 95 % for 96 hours, (the relaxation time). Differential thermal and thermogravimetric analyses were applied with the aim of determining the changes that occurred on the activated samples during the relaxation period.The decomposition temperature change of activated Na_2CO_3 samples, mass loss, and conversion degree of Na_2CO_3 to $NaHCO_3$ was monitored depending on activation and relaxation time periods.

INV

Modified glycine nitrate procedure synthesis and properties of nanostructured $Ca_{1-x}Gd_xMnO_3$ (x=0.05; 0.1; 0.15; 0.2)

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Nanocrystallinemanganites $Ca_{1-x}Gd_xMnO_3$(x=0.05, 0.1, 0.15, 0.2) were synthesized by a modified glycine-nitrate procedure. The subsequent studies were focused on the structural, microstructural and magnetic changes of the starting materials induced by calcination and sintering.Thermal treatments of the green bodies were carried out by conventional sintering method.Phase evolution, lattice parameters, chemical composition and magnetic properties were monitored by Differential thermal analysis (DTA), X-ray diffraction

(XRD),Induction coupled Plasma Atomic Emission (ICPES), Scanning electron Microscopy with Energy Dispersive Spectroscopy SEM/EDS and magnetic measurements on Superconducting Quantum Interference Device (Squid).DTA revealed phase transition at ≈918ºC.Chemical analysis has been done by ICPES and EDSwhich confirmed that nominal composition has been attained for all samples.XRD data were analysed by Rietveld refinement which showed that orthorhombic perovskite structure, S.G. *Pnma*(62), persisted with the change of Gd content, while unit cell parameters depended on the composition. Magnetic measurements show that electron doping by Gd^{3+} ions substantially changes $CaMnO_3$ antiferromagnetic behavior. After introduction of Gd^{3+} ions, significant ferromagnetic component appears due to an emergence of double exchange interaction between Mn^{3+}-Mn^{4+} ions. This resulted in appearance of a low temperature plateau in field cooled magnetization diagram as well as in hysteresis loop with the relatively high coercivity up to 2300 Oe.

INV

A multidisciplinary approach to multiferroics

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Multiferroics, materials where spontaneous long-range magnetic and dipolar orders coexist,represent an attractive class of compounds, which combine rich and fascinating fundamentalphysics with a technologically appealing potential for applications in the general area ofspintronics.Among the different types of multiferroic compounds, bismuth ferrite ($BiFeO_3$; BFO) stands out because it is perhaps the only one being simultaneously magnetic and strongly ferroelectric at room temperature.$BiFeO_3$ and $Bi_{1-x}Ho_xFeO_3$ ultrafine nanopowders were synthesized by the hydrothermal method. Here we use simple, low-cost and energy-saving hydrothermal method, which has advantages over the conventional methods. The influence of Ho doping on the crystal structure and magnetic properties of bismuth ferrite (BFO) nanopowders was investigated. The diffraction pattern was recorded at room temperature and atmospheric pressure in the absence of any re-heating of the sample. A fitting refinement procedure using the Rietveld method was performed which showed the incorporation of Ho^{3+} ions in the $BiFeO_3$ crystal lattice, where they substitute Bi^{3+} ions. All the samples belong to *R*3*c* space group.In addition, theoretical investigation using bond valence calculations have been performed in order to mimic pure and Ho doped $BiFeO_3$ compounds produced in the experiment. Various BFOpolymorphs were investigated as function of holmium concentration and final optimization of crystal structures has been performed on *ab initio* level using Density Functional Theory (DFT).Furthermore, electronic and magnetic properties of $BiFeO_3$ were investigated using combination of experimental and theoretical methods.Magnetic behavior of synthesized materials was investigated by

SQUIDmagnetometer in wide temperature interval (2-800 K). Splitting between the zero-field-cooled and field-cooled magnetization curves becomes more pronounced as the Ho concentration is increased, pointing to the development of weak ferromagnetic moment, which is usually connected with uncompensated spins or spin canting. Hysteresis loops show the same fact, attaining higher magnetization with more Ho included,andbecomingwider, i.e. magnetically harder.

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INV
Dilatometric study of the $ZnTiO_3$ phase transition kinetic influenced by nano powder sintering

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Sintering is often accompanied with phase transition. Phase transition kinetic is thus hard to deconvolute due to the superposition of the sintering and phase transition dimensional change phenomena. Metastabile perovskite phase $ZnTiO_3$ reforms to stabile spinel Zn_2TiO_4 at 950^{o}C with high kinetic rate. Dimensional change during heating of $ZnTiO_3$ nano powder compacts up to 1050^{o}C was monitored using dilatometric thermo mechanical analyzer TMA model SETSYS Evolution. Shrinkage of simultaneous sintering and phase transition were recorded. The obtained non-isothermally sintered specimens were then second run treated with same schedule. Sintering phenomenon of the $ZnTiO_3$ nanopowder compact was also recorded up to 900^{o}C with isothermal holding of 25 minutes. Here phase transition was avoided with lower temperature and isothermal holding. Second run heating, of isothermally obtained specimens at 900^{o}C, was recorded with non-isothermal heating schedule to 1050^{o}C. This has led to the dilatometric curve record of the $ZnTiO_3$ phase transition in polycrystalline bulk specimen, now recorded without sintering. In such a manner when kinetic is complex, the separation of phenomena such as sintering, linear expansion and phase transition are leading to the knowledge of their mutual interconnected relations. Also application of mathematical operations on dilatometric data leads to the established procedure for the sintering and phase transition data treatment.

INV

The ceramics materials density defined by artificial neural networks

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Predicting the ceramic materials properties and designing the desired microstructures characteristics are very important objectives in ceramic samples consolidating process. The goal of our research is to calculate the density within consolidated $BaTiO_3$-ceramic samplesfor different consolidation parameters, like sintering temperature, using obtained experimental data from the material's surface, by applying back propagation neural network (BP). This method, as a very powerful tool, provides the possibility to calculate the exact values of desired microelectronic parameter at the level of the grains' coating layers. The artificial neural networks,which have biomimetic similarities with biological neural networks, propagate the input signal forward, unlike the output signal, designated as error, which is propagated backwards spreading throughout the whole network, from output to input neuron layers.Between these two neuron layers, there are usually one or more hidden layers, where the grains of the sintered material are represented by network neurons.Adjustable coefficients, called weights, are forward propagated, like input signals, but they modify the calculated output error, so the neural network training procedure is necessary for reducing the error.Different consolidated samples density values, measured on the bulk, substituted the errors, which are calculated ascontribution of all network elements, thus enabling the density calculation of all constituents of ceramic structure presented by neural network. In our future research we plan to increase the number of neurons and hidden layersin order to improve this method to become even more accurate and precise.

INV

Fractals, Graphs and Neural Networks: The Holly Trinity of Nanostructures - An Overview and Comparison of Methods

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There are a lot of recently published research papers regarding representing nanostructures and biomimetic materials, using simple but powerful mathematical methods. In most of them, fractal theory, graph theory and neural networks are used. Having in mind variety of those methods, but in the same time complementarity and compatibility, they became very usefull tool, and we named it “Holly Trinity” of mathematical approach in nanostructures. In this research we give an overview on interesting results in modelling nanostructures and theire electrochemical and magnetic parameters, using those very actual and “easy to use” methods: fractal theory, graph theory and neural networks. We also compare them, in order to conclude about areas of their most useful applications.

INV

Discrete mean square approximation applied on molecules and bacteria Brownian motion error calculation

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Brownian motion, with its fractal nature, exists as a general phenomenon in both living and nonliving matter systems. Integration of these two systems structures is very important for nowadays complex and advanced ceramic materials designing and technology development.Therefore,the goal of our research is to analyze Brownian motion, as a

minimum joint characteristic of biophysical and condensed matter systems particles motion, in the frame of fractal nature similarities, which is essential for establishing biophysical-mathematical relation between them, represented by mathematical analytical equations. We performed the experiments with bacterial motion influenced by different energetic impulses, like music, and also we used some available data of molecular motion.By applying the discrete mean square approximation method on obtained results, which imply bacteria and molecule locations in coordinate system,we estimated linearregression functionsconsidering the best linear fit.We comparedthe experimental and approximated coordinates values through absolute and relative errors,and created the approximation plots for bacterial and molecular motion, as well. Also, we introduced nonlinear regression functionsand accordingly, coordinates values comparison by absolute and relative errors.The purpose of these mathematical error calculations by applying the discrete mean square approximation in our research paper is to optimize and precisely characterize biophysical and condensed matter systems particles Brownian motion, as a fundamental phenomenon linking and integrating two biunivocaly correspondent subsystems of nature - alive and nonalive matter.In our future research we plan to extandthe biophysical-mathematical processing and interpretation of this multidisciplinary subject in order to determine these systems' asymptotic approaching, which could be an excellent basis for their further integration, as an imperative of nowadays science.

ORL

Rapid microwave sintering of electroceramics and biocompatible ceramics

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We report recent results of experiments on rapid microwave sintering, a technique based on a controlled implementation of thermal instability that enhances mass transport. The compacted powder specimens were heated using a 24 GHz gyrotron system equipped with an infrared dilatometry. Specimens were sintered at heating rates up to 150 ℃/min with zero hold time. The materials under study were ZnO-based varistor ceramics, BaTiO3 and hydroxyapatite. With the latter material, multi-layer sintered structures have been obtained by repeated layer deposition and sintering. The densification kinetics is analyzed in its correlation to the development of thermal instability, and the sintering results are shown to depend on the absorbed microwave power density.

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ORL

3DCeram and NewSpace applications

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3D Printing is a technology which remains associated with prototyping and spare parts for most of the people. However, forefront sectors, like aerospace or biomedical, rapidly understood how to take advantages from it and jumped, from the very beginning, on the opportunity to actively participate to its development. They could see the possibilities to produce parts not possible with traditional processes, with new design to enhance parts and add functionalities to get better performances. And above all, 3D Printing works with different materials among which are the technical ceramics! For years, at 3DCeram, we have been working to challenge the prototype and material qualification steps to end to successes! Then we have arrived, now, to the production stage, the so-called mass customization. Is it now reliable? The answer arises from 2 case-studies coming from the aerospace field. The first one concerns a NewSpace player a nanosatellites builder, the second is a company that designs and manufactures spacecraft thrusters for nanosatellites.

ORL

Magnetic materials, Curie-Weiss law and fractal correction

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Neodymium zinc titanate (NZT) is a very attractive perovskite due to its magnetic and dielectric properties. Considering the microstructure influence NZT stability and performance, it is of great importance to establish an approach for the analysis and prediction of grain boundary phenomena. The fractal nature analysis has already proved to be valuable for the reconstruction and prediction of ceramics intergranular electrical properties. However, no researches were performed on the fractal analysis applied on magnetic materials. This method could give an insight in magnetic properties change from the bulk to the grain interface level. In this study, fractal analysis was applied for the Curie-Weiss law correction, introducing fractal correction into magnetic materials for the first time. NZT powders used in this research for fractal analysis were obtained after sintering at different temperatures in the range from 1450°C to 1675°C.Connection between the microstructure fractal nature and the resulting magnetic permeability has been established, enabling the application on different magnetic materials in the future. This creates a foundation for new researches that will lead to further miniaturization of satellite and mobile devices.

ORL

Combination of Extracellular Matrix Hydrogels with DifferentBiomaterials as a Tissue Engineering Strategy

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Extracellular matrix hydrogels (ECMh) mitigated inflammation, promoted stem cell differentiation and constructive tissue remodellingandwere used as a cell deliveryvehicle.This study aimed to investigate the possibility of combiningECMh with other biomaterialsto optimise ECMh mechanical properties, whilst maintaining their intended functionality.ECMh were formed by neutralising decellularised, digested material and by raising the temperature to 37°C. Time sweep test determined rheological properties (N=3).Slow gelation of spinal cord derived ECMh8 mg/mL indicated possible low resistance to cerebrospinal fluid flow prompting the addition of fibrinat a 25/75 v/v ratio. The “soft solid” nature of human bone ECMhcompared to bone tissue prompted the addition ofLaponite^{TM}clay colloidal dispersion (2.8 wt%),with demonstrated osteogenic properties. Tomake a transplantable structure and support the follicle growth and function, 1% alginate was added to ovarian ECMh.The hydrogel combinations had significantly higher storage moduli and gelation rates compared to the starting ECMh($p<0.05$).ECMh combination with other materials may widen ECMh utilisation potential.

ORL

APPLICATIONS OF NANOFLUIDS IN GEOTHERMAL ENERGY

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Heat transfer processes play an important role in the efficiency of geothermal energy systems. The replacement of conventional heat transfer fluids by nanofluids in heat exchangers is remarkable. The advances in nanotechnology have helped to achieve higher efficiency and cost saving in heat transfer processes. Nanoparticles are considered to be new generation materials having very good potential applications in the heat transfer area. Nanofluid, as a kind of new engineering material consisting of nanometer-sized additives and base fluids, has attracted great attention from investigators for its superior thermal properties and many potential applications. Nanoparticles of TiO2, Fe3O4, SiO2, h-BN and Al2O3 are selected as additives.In this paper, we analyse the reduction of heat transfer including the type of nanofluid, concentration and system specifications. According to the results of the research, the effect of the use of nanofluids on the rate of heat transfer became significant at high protocol speeds. In addition, the use of nanofluids can reduce the size between heat

exchangers used in a geothermal system. The main effects of the use of nanofluidee are the connection of the convective advantage of heat and loss pressures.

ORL
SOLAR ENERGY STORAGE WITH PHASE CHANGES MATERIALS FOR ADSORPTION COOLING

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As solar energy is most available in periods of high temperatures, the logical need for its transformation into cooling energy is indicated. One of the ways to transform stored thermal energy into refrigeration energy are absorption refrigeration devices that do not use compressors but use mixtures of refrigerants.Renewable energy sources have been of great interest because of their promising benefits. Solar thermal cooling technologies are used worldwide for industrial and home cooling needs. Overview of the working fluids used in this paper deals with diffusion absorption cooling technology, starting from a conventional NH_3/H_2O fluid mixture to potentially good working fluids such astrifluoroethanol-tetraethylene glycol dimethyl ether(TFE-TEGDME) and ionic liquid. The binary mixture (TFE)-(TEGDME) can be more advantageous for absorption cycles at high temperature levels than classical working systems. Any refrigerant must have a high latent heat of vaporization,non-toxic, environmentally friendly and not expensive. Many studies have been performed to improve the properties of coolants. Different working fluid pairs of solar-powered absorption cooling systems give different results in terms of system performance and environmental impact despite their limitations. Therefore, it is necessary to find the optimal working pair of coolant for the appropriate system of transformation of stored thermal energy into cooling energy. New coolants as a result are especially interesting.
With regard to energy security and environmental concerns, the performance of the refrigeration system needs to be improved, which can be achieved by modifying the system or the properties of the primary and secondary working fluids. Recently, nanowires or hybrid nanowires have gained interest in many engineering fields due to their excellent thermophysical properties, which can be easily used in cooling and air conditioning systems in many performance improvement systems. Increasingly intensive research on the preparation and characterization of nanowires (various thermophysical and electrical properties (density, heat capacity, viscosity, thermal conductivity, surface tension, electrical conductivity, freezing characteristics, etc.)). Applications of nanowires in refrigeration systems as coolant, lubricant, and secondary fluid are well grouped and considered. Finally, challenges and opportunities for future research have been identified, which will be useful for producers in this field.

ORL

Fractal reconstruction of fiber-reinforced polymer composites

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Polymers offer the possibility of different reinforcement incorporation due to a broad range of chemical structures.Along with this feature, their light weight and processing ease made them a class of materials that have been applied in construction parts, drug delivery agents or electronic devices. Epoxy-based composites have used as insulators in microelectronic devices due to its chemical resistance, good adhesion properties and endurance. As epoxies have low fracture resistance, they are often reinforced with different kinds of fibers.With thorough knowledge of the structure, physical properties can be predicted and included in the processing of future composites, especially that electronic materials minituarization brought micro- and nanoscale level properties at spotlight. Fractal nature analysis is a mathematical method that has proved to be efficient in grain interface properties applied on perovskite ceramic materials.In our study, fiber shape reconstruction and determination of Hausdorff dimension have been achieved with the application of fractal regression model employed in software Fractal Real Finder opening a new path for the prediction of reinforcement shape and size, all with the aim of processing composite materials with desired properties.

ORL

Determination of corrosion products of Ag-Cu alloy by laser desorption ionization mass spectrometry

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Silver alloys are generally used in the different fields of industry, including chemical processing, construction, heat exchangers, etc. Although Ag-Cu-Zn-Cd type of alloys, were widely exploited in the second half of the 20th century for their excellent properties, its use is forbidden in the EU due to the high toxicity of cadmium vapors. Ag-Cu-In type of alloy is a good alternative to Ag-Cu-Zn-Cd alloys, with great properties and can be used in various fields of industry. Most common methods for characterization of surface corrosion films of Ag-Cu alloys are: X-ray diffraction (XRD), scanning electron microscopy with energy dispersion spectroscopy (SEM-EDS), Raman spectroscopy and atomic force microscopy (AFM). Our current study focuses on the application of laser desorption ionization mass spectrometry (LDI MS) for determination of corrosion products of Ag-Cu alloy. The aim of this study was to confirm LDI MS as a fast, accurate and reliable method for determination of corrosion products on the surface of Ag-Cu-In alloy.

ORL

Natural active compounds in the prevention of oxidative stress

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Significant amount of natural active compounds are present in the fruit. Those compounds exhibit beneficial effect on the human health. Antioxidant properties are very important for health prevention. The aim of this study was to investigate natural active compounds from fruit wines and its activity on enzymes of antioxidant protection in vitro. Fruit wines were produced in controlled conditions during microvinifications. Phenolic profile of fruit wines were obtained by UPLC MS/MS, while enzymatic activity determined by spectrophotometric

methods. Fruit wines showed significant content of phenolic compounds among them it is possible to emphasize phenolic acids. Also fruit wines influenced on the activity of enzymes of antioxidant protection which could be used in the prevention of the oxidative stress.

ORL

Electrophoretic deposition of plasma-activated hydroxyapatite powder densified by rapid sintering

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In this work, the hydroxyapatite nanoparticles (HA) were subjected to Diffuse Coplanar Surface Barrier Discharge performed at atmospheric pressure to activate their surface. The effect of mentioned applied plasma treatment on the behaviour of HA particles dispersed inthe 2-propanol solvent during electrophoretic deposition (EPD) was investigated. It was found that activated particles strongly affected the consolidation process due to the change of deposition rate, which led to meaningful improvement indensitiesof plasma-treated samples.Thermogravimetric analysis and differential scanning calorimetry were performed on plasma-treated and as-received powders and deposits.Green bodies were subsequently densified using the pressure-less rapid sintering method with sintering rates up to 100 °C/min with 10 min dwell on sintering temperaturesranging from 1100 °C to 1300 °C. Faster heating rates allowed to reach nearly dense (>95 %)ceramic bodieswith reducedmean grain size at higher sintering temperatures and optimised phase composition.

ORL

Preclinical studies of natural bone substitute material in different conditions and models - our experience

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To avoid the use of autologous bone grafting, various bone substitutes are used today for the regeneration and repair of bone defects. Before potential clinical application, bone substitute materials are being tested in various models in preclinical studies to prove their biocompatibility and functionality. In our studies, we have used a variety of calcium phosphate-based biomaterials including hydroxyapatite-based substituents of natural origin, such as bovine bone substitute. Applying bone tissue engineering approach we have used them as carriers and scaffolds for cells and biologically active factors, combining one or more components such as: blood, platelet-rich plasma (PRP), bone marrow, adipose-derived stem cells (ADSCs), stromal vascular fraction (SVF) or whole adipose tissue, osteoblasts or endothelial cells obtained by induced differentiation from ADSC, macrophages, and various forms of vitamin D. Studies have been performed in various animal models *in vivo* such as: subcutaneous implantation in mice and rats, defects in calvary and tibia of rabbits, and femoral defect in rats. Healing of bone defects, osteogenic and vasculogenic activity in implants, as well as the reaction of the surrounding tissue was observed in early and late periods after implantation in order to see the dynamics of the process, in addition to the final outcome. For this purpose, various methods were used, such as histological staining, histomorphometry, immunohistochemistry, radiographic and analytical methods, as well as analysis of specific gene expression. In addition to *in vivo* testing, biomaterials were tested in various *in vitro* conditions as well. Changes in physicochemical properties of examined bone substitute material in various conditions were analyzed by methods such as SEM, EDX, FTIR and others. Our studies have shown that the degree of osteogenic process in examined models depends not only on the type of biomaterial used as a carrier of cells and tissues, but on the biological components that are combined with it, as well.

ORL
Synthesis and characterization of Ag-loaded hematite nanocomposites

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Hematite (α-Fe_2O_3) nanoparticles have been synthesized by thermal decomposition of iron(III)acetylacetonate precursor. The structure and morphology of the resulting powder were investigated by X-ray powder diffraction (XRPD), Fourier transformation IR (FTIR), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDS). Hematite-loading with silver was conducted using the reduction of silver nitrate by ascorbic acid realized by three different synthetic procedures – simple reduction process, ultrasonically supported reduction, and reduction after pre-treatment of hematite in Lugol's iodine. All synthesized hematite/silver samples were characterized withSEM, supported by EDS maps. Silver content was determined by Inductively Coupled Plasma Optical Emission spectroscopy (ICP-OES). The development of Ag-doped hematite nanocomposites, hetero-structures containing Ag and magnetic iron oxide,is indispensable in orderto take advantage of Ag containing nanocomposites in the field of biomedicine.

ORL
Methods for modeling of NBTS induced threshold voltage shift in p-channel power VDMOSFETs

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This study investigates the threshold voltage shift (ΔV_T) of the commercial IRF9520 p-channel power vertical diffused metal-oxide semiconductor fieldeffect transistors (VDMOSFETs) induced by negative bias temperature stressing (NBTS).Lengthy experiments are conducted with the goal to examine instabilities caused by NBTS at different stressing voltages (V_G) and different temperatures (T). Paper discussesthe progression of ΔV_T caused by

extensive pulsed and static gate stressing. Based on these experimental results, an equivalent electric circuit for modeling of the ΔV_T has been designed.Proposed circuit centers around capacitor, where the capacitor voltage corresponds to the threshold voltage shift. Capacitor voltage is regulated with charging and discharging of the capacitor through resistors. Since the switching working mode of these type of devices is prevailing, greater attention is given to the modeling of pulsed stress induced shift, rather than to the static stress. Designed circuit should also follow degradation-recovery cycles that occur during the pulsed stressing. Different methods for obtaining waveform that completely corresponds to these cycles are the main focus of this paper. With the variation of some of the modeling parameters,proposed circuit can be used to model instabilities that occur at different gate stressing voltages and at different elevated temperatures. Also, for the pulsed stressing, with additional circuitry, circuit can deliver results for different stressing duty cycles and frequencies. Exact values of resistance and capacitance of the elements of the modeling circuits are calculated and the modeling circuit is simulated in the appropriate software. Modeling acquired data is then compared to the experimental data for the same conditions and the modeling error is graphically presented. Mismatch between measured and modeled results of the $\Delta V_T$is slightly more noticeable in the starting phases of the stressing but tend to decline how the stressing time increases.

P

PRACTICAL APPLICATION OF TIO_2

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Significant research is devoted to investigation of nano-sized transition metal oxides, among which titanium-dioxide (TiO_2) has a very significant role. Due to its outstanding physical and chemical properties, low price, non-toxicity, stability, easy synthesis, possibility for modifications and commercial availability, TiO_2 has become one of the most important materials, applied in many scientific areas. Besides it excellent properties, TiO_2 is also readily modified with the employment of simple and inexpensive experimental procedures during which many factors can be varied in order to finely adjust the target property. This work reviews the application TiO_2 in some of the most challenging and important areas.

P

Effect of prolonged precipitation on morphology and crystal struture of the bacterial nanocelulose/Fe_3O_4 composite

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Cellulose is a biopolymer with a wide range of properties like biocompatibility, hydrophilicity, porosity, good mechanical properties, biodegradability and non-toxicity. The properties and application of cellulose based materials are related to the source of the cellulose production. Despite the fact that the plant cellulose is playing a leading role in obtaining cellulose fibers, it has been found that ecologically and economically, a better source for obtaining cellulose is by fermenting a particular strain of bacteria. Although bacterial nano cellulose (BCN) based materials can be used in numerous industries, from the paper and food industries to biomedicine, their application in electronics is limited because bacterial cellulose does not have conductive and ferromagnetic properties. Having this in mind in this research, the results of the development of nanocomposite materials based on BCN modified with Fe_3O_4 has been presented. The differences in the interaction of Fe_3O_4 nanoparticles and BCN obtained by varying precipitation parameters were investigated and

the effect of reaction time was followed by SEM-EDS, XRD, and FTIR analysis. It has been found that this type of modifications of the initial BCN, enables development of new composite materials with superior properties, which can be used in various fields of electronics.

P

Macrophages as cells suitable for use in bone tissue engineering in order to manage angiogenic process

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During bone defects repair, one of the main indicators that osteoreparation is going in the right direction is development of blood vessels network. Therefore, one of the tasks of bone tissue engineering is to find ways to stimulate angiogenic process. The approach of combining bioceramic biomaterials with cells and/or various factors is already well known. Macrophages have been shown to be suitable for use in this approach, because these cells can synthesize factors that activate and stimulate blood vessels development. Our experience shows that combining bioceramic biomaterial with untreated or pre-treated macrophages can affect the intensity and course of the angiogenic process. This influence depends on the agent used in pre-treatment and its concentration, but also on the time frames in which this effect has been analyzed.

P

Stem cells as biological triad component in bone tissue-engineered constructs

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Biological triad components (biomaterials, growth factors, cells) have precious importance in bone tissue engineering (BTE). Since presence of vascular network is necessary for bone tissue regeneration, numerous combinations of different biomaterials, various growth factors and different cell types have been employed in order to achieve adequate vascularization in bone defects treatment. To contribute to the solution of this problem, our aim was to examine the importance of addition of stem cells combined with a source of growth factors to hydroxyapatite-based biomaterial. Two types of bone tissue-engineered constructs were

prepared, implanted and, after different post-implantation intervals, compared regarding the expression of protein markers of vascularization and osteogenic process. Obtained results speak in favor of enrichment of bone tissue-engineered constructs with stem cells.

P

Dielectric characteristics of polymer nanocomposites based on PVDF and mechanically activated ZnO powder

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ZnO powder was mechanically activated for 10 and 30 minutes in a high energy planetary ball mill, and mixed with 2 wt% PVDF solution to obtain nanocomposite films (50 μm) by casting. ZnO powder activated for 10 and 30 minutes was used as filler. The difference in the dielectric properties for composites with the powder with prolonged time of mechanical activation was investigated, as well as the influence of ageing using dielectric measurements at higher frequencies. Dielectric measurement showed that the ageing process does not significantly affect the properties of the composites, while the prolonged activation times can be correlated with the changes in the values of the dielectric constant. The introduction of mechanically activated ZnO powders into the matrix leads to an increase in the dielectric permittivity of the polymer. Values of dielectric permittivity for different frequencies at 300 K decrease from approximately 3.1 (60 Hz) to 1.8 (30 MHz) for nanocomposite with ZnO activated for 10 minutes, while the permittivity for nanocopomosite with ZnO activated for 30 minutes permittivity was 2.6.

P

Enhanced dielectric properties of PVDF-based composites with $BaTiO_3$ ceramic decorated with Fe_2O_3

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The increase in the utilization of ceramic/polymer composites as components for electric devices is mainly based on their high chemical stability, mechanical strength, and flexibility. The polymers usually have poor dielectric performances. In order to increase the dielectric permittivity, ceramic fillers with high dielectric constant have been used as active fillers, and usually in large amounts, which have a detrimental effect on the mechanical properties of the composite. With the aim to enhance the dielectric properties of the composite without loss of polymer's flexibility, 5 wt.% of $BaTiO_3/Fe_2O_3$ core/shell powders, prepared by different synthesis conditions, was added into the PVDF matrix. The effect of the phase composition and morphology of the starting $BaTiO_3/Fe_2O_3$ core/shell filler on the crystal structure and lattice dynamics was investigated. Based on the results of the thermal analysis, TG/DSC, various parameters of ceramic/polymer composites were determined. We were able to corroborate that differences in the phase composition and morphology of $BaTiO_3/Fe_2O_3$ core/shell filler have an influence on the formation of various PVDF allomorph modifications, as well as the level of crystallinity. The dielectric performances of the pure PVDF and polymer/ceramic composites were measured. An enhancement in the dielectric permittivity and decrease in the loss tangent were revealed.

P

MAGNETIC FEATURES OF MnZn FERRITE FOR ELECTRONIC APPLICATIONS

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MnZn ferrites are one of the most common soft magnetic materials for application in microelectronics as a material for microwave components (transformers, transducers, inductors, magnetic fluids, sensors,). MnZn ferrites attracted attention due to wide range of relative magnetic permeability values (from 10^3 to 10^4), high resistivity (consequently low magnetic losses) as well as high thermal stability (high saturation magnetic flux density at high temperatures (B_s > 0.4 T at 100 ^{O}C) and a relatively high Curie temperature of about 230 ^{O}C).Recently, a variety of technologies have been examined for MnZn ferrite production: powder/ceramic injection moulding (PIM/CIM), chemical co-precipitation method, conventional ceramic processing, sol-gel or microemulsion.In this study a toroidal samples of MnZn ferrites with dimensions appropriate for applications in electronic industry (i.e. microelectronics: inner diameter 3.5 mm, outer diameter 7 mm, height 2 mm) were investigated. Magnetic properties were measured by hysteresis graph (B-H curve at level of magnetic excitation up to 1 kA/m and at different frequencies from 5 Hz to 10 kHz). Relative magnetic permeability as well as magnetic power (active) losses was analyzed as frequency dependent. Very stable maximum magnetic permeability was observed for magnetic field of 200 A/m in the frequency range from 50 Hz ($\mu_r \approx 480$) to 10 kHz ($\mu_r \approx 450$). Active power referred to unit mass of about 30 W/kg was recorded at frequency of 1 kHz (@ 280 mT). As the hysteresis losses are proportionally to the frequency (~ f) and eddy-current losses are proportionally to the square of frequency (~ f^2) it was performed separation between these two components from total magnetic power (active) losses. Numerical fitting of this functionality on frequency were performed and analysed. The results obtained were compared with the catalogue data for other MnZn ferrite components for applications in electronics.

P

Development of ring-shaped specimen design using Selective Laser Sintering fabrication technique

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This paper will present the development of PRNT (pipe ring notched tension specimen) in order to create a new method for testing thin-walled pipes for which there is no standard procedure. The SLS (Selective Laser Sintering) additive production technique was used to develop these specimens. The fabrication technique was chosen because of the speed of fabrication of the specimens, while the production of a model with a relatively homogeneous arrangement of materials within the model was provided. The material from which the models are made is PA2200 (polyamide) on a FORMIGA P100 device. PRNT specimens are made in a thickness in which it is not possible to test the specimens by the standard method and have one groove with a crack. The samples were tested on a universal machine for testing the mechanical properties of materials using a specially designed tool. Based on the obtained values of tensile properties and values of fracture mechanics parameters of these specimen, it was concluded that the test process is repeatable. In addition to experimental results, numerical calculations have contributed to an easier understanding of the behavior of the specimens. The homogeneity of the obtained results was a decisive factor in the continuation of the examination of the specimens of this geometry on the samples of seam and seamless pipes.

P

Investigations of Yttrium Oxisulfide (Y_2O_2S)

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Rare-earth oxysulfides have many applications such as solar energy, wind turbines, batteries for electric vehicles and mobile phones, cathode ray tubes, metal alloys, ceramic materials and so on. Their important feature is that those materials are wide-gap semiconductors. Yttrium oxide is one of the most important compounds of yttrium and is widely used in many ceramic materials[1] RE element-doped oxysulfides has been utilized for effcient luminescent use e.g., Eu-activated Y_2O_2S emits bright red-light under cathode-ray

excitation and has been widely used for televisions[2]. In this study we perform crystal structure prediction and investigate energy landscape of Yttrium Oxisulfide (Y_2O_2S). In order to predict new crystal structures, global optimizations on the energy landscape of Y_2O_2S has been performed. Afterwards, a local optimization has been performed using ab initio calculations. In particular various quantum mechanical methods have been applied: Density Functional Theory (DFT) with Local-Density Approximations (LDA) and Generalised Gradient Approximation (GGA), and hybrid B_3LYP (Becke, three-parameter, Lee-Yang-Parr) functional.

P

Approximation and Error Prediction in Electrochemical Parameters Calculation Using Neural Networks

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Various interesting results have been achieved in calculation of electrochemical parameters in nanomaterials, using neural networks. There appear some error, during those calculations, and it varies depending on number of neurons in layers. In this research we deal with errors, calculated for neural networks with *n=1,2…10*, neurons in first or second layer. We applied mean square approximation method, in order to get explicite formula for predicton of error, for other cases.

P

Gate oxide degradation of electronic components due to irradiation and bias temperature stress

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Although there are trends in the use of new materials and the production of electronic devices, the use of silicon is still very common. Therefore, the effects that occur in silicon and silicon dioxide, under various stresses, are still in intensive research. Some experiments aim to examine the electrochemical mechanisms in silicon dioxide, which could lead to the formation of defects. It is known that these imperfections could lead to some changes in very important parameters of electronic devices.These parameter changes can cause deterioration in device performance, which reduces the reliability of electronic devices. However, the issue of reliability is of great importance and that is why changes in parameters under the influence of various stresses are intensively investigated.In some application electronic components could be subjected to multiple stresses. In this light, our research group performed experiments to analyze the influence of radiation and negative bias temperature stress on threshold voltage changes of commercial p-channel vertical double diffused metal oxide semiconductor transistors, which are widely used.In addition, the densities of oxide trapped charges and interface traps are estimated based on the transfer characteristics, which are measured during the applied stresses (both radiation and negative bias temperature stress). It was observed that negative bias temperature stress after irradiation caused creation of oxide trapped charge and interface traps in the case of previous irradiation with low irradiation doses or without gate bias. In that case, the dominant mechanisms that lead to electrochemical reactions result in the formation of oxide trapped charges and interface traps. On the other hand, when the devices are irradiated with the polarization, it is observed that during subsequent negative bias temperature stress, mechanisms responsible for transformations are dominant. In this case, the electrochemical reactions cause the transformation of gate oxide trapped charges into interface traps. The result of these reactions is decrease of gate oxide trapped charges and the increase of interface traps. This research has the goal to clarify the nature of these mechanisms that can contribute to a better insight into changes in parameters that directly affect reliable operation under radiation and negative bias temperature stress conditions.

P

Biophysical and condensed matter systems particles Brownian motion fractal interpolation

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From the aspect of new advanced ceramic materials development, it is of substantial importance to establish the connection between biophysical and condensed matter systems, since it opens the perspective for their further and firmer integration. The integrative property of these two systems is their particles Brownian motion, in the frame of fractal nature similarities, which enables us to represent living and nonliving systems particles motion as the mathematical asymptotic approaching. Regarding the fact that electrons are the same within alive and nonalive matter, and if we behold molecules, as well as biomolecules, as "clusters" of electrons,we,considering this biomimetic approach, conducted some real bacterial motion experiments and also the theoretical molecule motion experiment in order to determine the relation between submolecular, molecular and microorganisms levels. Based on the obtained data we created mathematical analytical forms and accordingly, 3D interpolating diagrams for both bacterial and molecular motion. In our research we applied the fractal interpolation method to get 3D fractal interpolating diagrams, which provide improved insight into characterization and joint generalization of biophysical and condensed matter systems. The idea of our research is to open new frontiers in advanced ceramic materials designing by interconnecting and integrating living and nonliving matter systems structures and properties.

P

Electrical characteristics of doped $BaTiO_3$ Ceramics

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The influence of rare-earth additive content on the electric properties of doped $BaTiO_3$ ceramics is investigated. The concentration of additive (Ho, Er, and Yb) range from 0.01 to 1.0 wt%. The conventional solid-state reaction method was used to prepare $BaTiO_3$ ceramics. The samples were sintered at 1320°C for four hours. SEM analysis shows that all samples are characterized by polygonal grains. In $BaTiO_3$ samples doped with rare-earth ions of low concentrations (0.01 wt%), the grain size ranged between 8 and 25 μm. For the samples

doped with the higher dopant concentration (0.5 and 1.0 wt%), the average grains size is ranged from 3 to 10μm.Measurements of dielectric constant and dielectric losses as a function of frequency and temperature were performed to establish a correlation between the microstructure and dielectric properties of doped $BaTiO_3$ ceramics. The low doped samples display the high value of dielectric permittivity at room temperature. A nearly flat permittivity-temperature response is obtained in specimens with higher additive content. The amphoteric behavior of rare-earth ions leads to an increase in the dielectric constant and a decrease in dielectric losses in relation to undoped $BaTiO_3$ ceramics. The Curie temperature of doped samples was ranged from 126 to 130°C. Also, the electrical resistivity was measured in function of temperature at the different frequencies from 1kHz to 1MHz. With increasing additives concentration, the electrical resistance decreases to the concentration of 0.5 at% and then increases.

P

An overview of neural networks and graph theory applications on ceramic materials consolidation and electrophysical parameters

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The artificial neural networks, sometimes supported by graphs within graph theory, are very useful computing tool for mapping input-output data, inspired by biological neural networks information processing. The input signal is transfered forward, from input to output neuron layer, but the output error is propagated backwards, from output to input, thus, the method is called back propagation neural network (BP).Adjustable weight coefficients, influence the value of the output error and therefore, the process called training of the artificial neural network is performed, changing weight coefficients from random to correct values, to decrease the error which is then replaced by examined parameter and back propagated in order to determine precise values at the grain boundaries level. We applied this method for calculating ceramicsmicroelectronic characteristics, like relative capacitance anddensity, at the submicron level in thin layers between the grains, based on the experimentally obtained relating characteristics at the bulk samples surface, but it could be applied on conductivity,

resistance, and many other microelectronic parameters, as well. Also, we extended neural network application on grain sizes distribution as a function of sintering temperature, as well as, on establishing the relation between consolidation parameters, like applied voltage and sintering temperature as input vectors, and relative capacitance change.In this sense we used this method to define breakdown voltage, dielectric loss tangent and density, as well. It is of great importance to determine, predict and also design microstructure and properties of ceramic materials, which open new frontiers for further microelectronics miniaturization and integrations, and in our research we accomplished that by applying back propagation neural networks.

P

NOVEL GLASS-CERAMIC SEALANT WITH ADDITION OF ALUMOSILICATE-BASED WASTE MATERIAL FOR APPLICATION IN IT-SOFC

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In the present paper, possible application of novel concept synthesis method of glass-ceramic sealant with implementation of alumosilicate-based waste material in intermediate temperature solid oxide fuel cells (IT-SOFC) was investigated. Besides basic components for glass-ceramic sealant (sample GC0), for this purpose four additional sealant compositions with certain waste content, designated as GC1, GC2, GC3, GC4, were prepared for a comparative study. Waste was added in the basic sealant composition in such a way that certain percent of alumosilicate clay was substituted with alumosilicate-based waste material, with proper amount of water as a solvent. Waste share in compositions was 5, 10, 15 and 20% of total amout of alumosilicate clay as a replacement, respectively.A total of five different joint specimens were assembled by placing a sealant paste of 10mm thickness between two bricks to form brick/glass–ceramic/brick sandwich specimens appropriate for further heat treatments. Such formed 'green' joints were initially air-dried for 24h at room temperature, which was required for solvent to evaporate and cause initial bonding. Heating cycle in the period of four weeks was carried out in a chamber furnace. First day samples were heated to 200˚C for 2 h. Each day heating temperature was raised for 100 °C while dwelling time was prolonged for one hour, so by the end of the first week samples were heated to 600 °C for 6 hours. Next three weeks annealing of the samples was performed at 600 °C for 6 hours, 700 °C for 7 hours and 800 °C for 8 h, respectively, after what the thermal cycle was completed. The heating rate of the furnace at each heating step in the given joining process was 5 °C/min,while cooling was at natural speed. Mentioned firing temperatures were selected in accordance to common operating temperature range of IT-SOFC so as to simulate real working conditions. After the completion of the cycle, it was observed that all variants of the sealant withstood high temperatures without significant cracks or damage. Moreover, after detailed chemical, physical, mechanical and optical properties examination it was determined

that compositions remained unaltered, which clearly indicates to their stability and reliability that is required for their application as sealants for IT-SOFC components. In addition, this research shows the possibility of forming a cost-effective, environmentally-friendly and high-efficient sealant for application in IT-SOFC by incorporating waste materials in its composition, without significant negative effects on its performance and main properties.

P

Synthesis of spherical SBA-15 silica particles without the use of additional cosurfactant

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The synthesis of SBA-15 material with spherical particles is performed by the template method by using only a surfactant Pluronic P_{123}under acidic conditions. In the synthesis of SBA-15 with spherical particles, an HCl solution was used after specialised chemical treatment of clay purification. The dominant presence of the spheres with diameters up to around 2 μm was confirmed by the scanning electron microscopy(SEM) method. In contrast, the Energy-dispersive X-ray spectroscopy(EDS) confirmed that the spheres consisted only of SiO_2 in composition. In addition to the methods mentioned above, X-ray diffraction (XRD), and Fourier-transform infrared spectroscopy(FTIR) methods were used to characterise SBA-15 materials. Application of HCl solution after chemical treatment of clay purification represents the application of technology in the synthesis of spherical SBA-15.

P

Characterization of clay mineral from kolubara mining basin, Serbia, with a determined layered structure

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The clay minerals deposit from the mining basin Kolubara, Serbia, is a natural sediment material with high economic potential in many fields. The chemical composition of starting clay determined by inductively coupled plasma spectrometry shows that its main composition of SiO_2 is 88.00 wt.%. Organic impurities from clay have been removed by heat treatment at 600 °C for 2 h in air. After thermal treatment, an aqueous solution of HCl sedimentary mineral was chemically treated. Surface properties of starting clay and thermally and chemically treated clay (treated clay) were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), and particle size distribution method. The XRD analyses of the starting and treated clay confirmed that quartz is a significant phase, followed by the appearance of feldspar and smectite clays. The SEM method showed impressively layered microstructure on various magnifications for both groups of investigated materials. The average particle diameter value for starting clay was about 23 μm and about 53 μm for treated clay. These methods showed that the starting clay changed the surface properties during thermal and chemical treatment, resulting in the merging of clay layers.

P

Determination of cavitation resistance of glass-ceramics 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 0,7 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 0.03 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.

P

Study of iodine (n) and tin (p) doped Sb_2S_3 nanoparticles by detail X-ray photoelectron spectroscopy

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X-ray photoelectron spectroscopy (XPS) measurements were used for analyzing the incorporation of iodine (I) and tin (Sn) into the stibnite (Sb_2S_3) lattice obtained *via* the hot-injection method. The X-ray diffraction (XRD) technique revealed the visible presence of one phase, the pure orthorhombic structure of Sb_2S_3 with the *Pnma* group. Scanning electron microscopy (SEM) showed long columnar structures with length of few nanometers and diameter of about 150 nm.The incorporation of I and Sn into Sb_2S_3 was verified by comparing the XPS spectra of the non-doped Sb_2S_3 and iodine and tin-doped samples, by the distinctive appearance of characteristic *3d* peaks of iodine and tin. As well, the relative amounts of I and Sn dopants were determined from the I $3d_{5/2}$ and Sn $3d_{5/2}$, respectively. The obtained, lesser than expected, amount of dopants is likely due to a possible weakening of I and Sn signals. Shifting of the valence band towards higher (I-doped Sb_2S_3) or lower (Sn-doped Sb_2S_3) energies, related to the non-doped sample, also confirmed the successful incorporation of dopant atoms in the Sb_2S_3 lattice.

P

Sol-gel synthesis of titanium dioxide in acidic conditions

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To obtain the titania (TiO_2) nanoparticles, the conventional sol-gel method under acidic conditions, pH around 2, was employed. After synthesis, the obtained powder was calcinated at 500 and 700 °C. The X-ray diffraction analysis confirmed that the heat-treated powder at 500 °C was anatase phase, while the heat-treated powder at 700 °C was the mixture of anatase and rutile phase. The crystallite size of the anatase phase at 500 °C was 15 nm whereas at 700 °C crystallite size of the anatase was 47 nm and 63 nm for the rutile phase. The characteristic FE–SEM images revealed well distributed spherical shaped nanoparticles. An average diameter of nanoparticles was in the range of 20 – 30 nm. The average size of nanoparticles in the sample treated at 500 °C was lower than the nanoparticles in the one treated at 700 °C. Therefore, the specific surface area of synthesized pure TiO_2 after heat treatment at lower temperatures is higher, promising better absorption and photocatalytic activity.

P

Experimental and theoretical study of nanostructured $Ca_{1-x}Gd_xMnO_3$ (x=0.05; 0.1; 0.15; 0.2)

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Experimental and theoreticalmethodshave been used to investigate the octahedral tilting and related effects of $Ca_{1-x}Gd_xMnO_3$(x = 0.05; 0.1; 0.15; 0.2) compound. Both methods have shown that orthorhombic-perovskite structure (space group *Pnma*) is the most stable form and according to Glazer's classification belongs to $a^-b^+a^-$ tilt system. Bond valence calculations (BVC) have shown ten additional perovskite-related modifications of the equilibrium $Ca_{1-x}Gd_xMnO_3$structure, and their stability has been investigated as function of Gd doping. We have further studied the influence of gadolinium amount on Mn-O bond angles and distances, tilting of MnO_6octahedra around all three axes and deformation due to the presence of Jahn-Teller distortion around Mn^{3+}cation, and calculated the amount of Mn^{3+} in the system. BVCapproach is a simple, fast and efficient way of calculating the amount of Mn^{4+} and Mn^{3+} in the doped perovskite compound, which, to the best of our knowledge, has not been done before. The infrared reflection spectra of $Ca_{1-x}Gd_xMnO_3$samples confirmed XRD results that $Ca_{1-x}Gd_xMnO_3$nanopowders are of *Pnma*-1 structure and that the tilting of octahedra are increased with Gddoping. The EPR (electron paramagnetic resonance) spectra are in accordance with the assumption that EPR linewidth is Mn-O-Mn angle dependent. The studied samples showed that small octahedra tilting in these samples brought only a small change of the EPR linewidth.

P

PHONON INVESTIGATIONS IN $YVO_4:Eu^{3+}$ NANOPOWDERS

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In this work two methods of preparation of yttrium orthovanadate nanopowders were presented: Solid State Reaction (top – down approach) and Solution Combustion Synthesis (bottom – up approach). For starting structural characterization, X – Ray Powder Diffraction (XPRD) and Field Emission Scanning Electron Microscopy (FESEM) were used. We report the change in reflection spectra in europium doped YVO_4 nanopowders with comparison to its bulk analog. In UV – Vis reflection spectra we consider the change in values of band gap in these structures, after resizing it from bulk to nanomaterial. In Far – Infrared (FIR) reflection spectra, we registered the existence of Surface Optical Phonon (SOP) and different multi – phonon processes which alter the reflection spectra of bulk YVO_4. The influence of Eu ions is reflected through multi – phonon processes that occur and are connected with energy transfer from YVO_4 lattice to Eu ions. All IR spectra were modeled using classical oscillator model with Drude part added which takes into account the free carrier contribution. Since our samples are distinctively inhomogeneous materials, we use Effective Medium theory in Maxwell Garnett approximation to model its effective dieletric function.

P

HUMAN USE CLAY: ORAL, SKIN TERTMAN AND BODY BATHING

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Clay has been known to, and used by, humans since antiquity. Indeed, clay hasbeen implicated in the prebiotic synthesis of biomolecules, and the very origins of lifeon earth.Bentonite is any clay composed predominantly of montmorillonite claymineral of the smectite group whose main properties are: particles of colloidal size,high degree of layer stacking disorder, high specific surface area, moderate layercharge, large cation exchange capacity, variable interlayer separation, depending onambient humidity, propensity for intercalating extraneous substances, including organiccompounds and macromolecules, and ability of some members (e.g., Li+ and Na+ exchanged forms) to show extensive interlayer swelling in water; under optimumconditi- ons, the layers can completely dissociate. It is also referred to as exfoliatedclay. Clay has also become indispensable to modern living. Clay is nonpollutingand can be used as a depolluting agent. Of great importance for the nearfuture is

the potential of some clays to be dispersed as nanometer-size unit particlesin a polymer phase, forming novel nanocomposite materials with superior thermomechanicalproperties. The diversity of structures and properties of clays, and theirwide-ranging applications, make it difficult to compile a comprehensive referencetext on clay science.In this paper, we analyze three ways of applying clay to humans. The first is oral drinking of clay previously immersed in water, the second is the treatment of skin in the liver area with a cream based on clay and plant extracts, and the third way of applying clay is an emulsion based on clay, plant extracts and vegetable oils.With this systemic approach, the digestive tract is cleansed, the organism is supplied with trace elements, and clay is drunk in the morning on an empty stomach. The other part is a cream based on clay and plant extracts that is applied to the liver before going to bed. This speeds up the circulation and metabolism in the liver during sleep. The third part is body bathingwith a clay-based emulsion, which cleanses the lymphatic system, then supplies the body with the missing minerals, then energizes the whole body and finally inhales the body.

P

Drupe fruit and derived products as a promising source of natural active compounds against oxidative stress

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Drupe fruit like peach are rich source of compounds which possess beneficial effect on human organism. One of many derived products is fruit wine which is also good source of above mentioned compounds. The aim of this study was to investigate in vitro activity of peach wines by monitoring activities of antioxidant protection enzymes and lipid peroxidation (malondialdehyde level) both in vitro. Fruit wines were produced in controlled conditions during microvinifications. Enzymatic activity determined by spectrophotometric methods. Analyzed wine samples showed significant activity on antioxidant protection enzymes and decreased malondialdehyde level. Results indicate that peach wines showed protective activity against free radicals.

P

Surface chemistry and structural properties of proton-beam irradiated graphene oxide paper

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Graphene oxide (GO) is a promising material for the futuregraphene-based electronics where the surface chemistry and structural properties of GO may play an important role. One of the unique methods with great potentialfor controllable modification of materials' properties is the ion beam irradiation. In the present study, GO paper was irradiated with 15 keV proton-beam to a fluences from $5\times10^{16}$to 2×10^{17} ionscm^{-2}, while Fourier-transform infrared spectroscopy (ATR-FTIR), X-ray photoelectronspectroscopy (XPS) and Raman spectroscopy (RS)were used for the examination of surface chemistry and structural properties of the irradiated material. It was shown that proton beam irradiation leads to a partial reduction of GOwith the preferential removal of the alkoxy and epoxy groups. With the increasing fluence, the oxygen content from the XPS method and the intensity ratioof D and G Raman bandsboth showed decreasing trends. When oxygen content was compared to relative areas of specific functional groups and parameters of Raman peaks an interesting correlation was found that suggest optimal fluences for tuning the surface chemistry and structural properties of GO. The observed effects on surface chemistry and structural propertiescan be ascribed to physical and chemical effectsof ion beam irradiation. The interaction of functional groups with H-atom was investigated using DFT andsemi-empirical (SE) approach. SE calculations revealed that the reduction of the epoxy group appears at H-atom energies below 1.5 eV. This work identifies ion beam irradiation as a preferable technique for selective removal of surface oxygen groups and structural modification of GO where the applied fluence can be used for tuning the degree of change.

P

An Unusual Behavior of the Briggs-Rauscher Oscillatory Reaction with Addition of Bentonite Clays

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The Briggs-Rauscher (BR) reaction is visually the most interesting oscillating reaction, in which the oxidation of malonic acid by a mixture of hydrogen peroxide and iodate is catalyzed by Mn^{2+}metal ion in acidic solution. It is very sensitive to different analyte addition. Ordinarily,analyte addition causes the linear response of the BR oscillating system, which is used fordetermining the analyte'santioxidant/antiradicalor catalytic activity. In order to investigate the effects of different clay addition on BR oscillatory dynamics, bentonite clays from different deposits: Wyoming (Swy-2), Texas (STx-1b), Idaho (SbId-1), Arizona (SAz-2), Bogovina and Mečji Do, both from Serbia, were applied. In the case of bentonite clays addition, the response of the BR oscillating system resulted inacomplex behavior pattern. Meaning that the addition of all investigated clays causeda complex function oscillatory period *vs.* clay'smass, which passes through the maximum. The position of maximum varied for different bentonite clays. However, it is the first time to obtain such a behavior pattern. Results found areof great importance for the examination of catalytic and heterogeneous phenomena of oscillatory processes in general.

P

ENVIRONMENTAL PRODUCT DECLARATION (EPD) FOR CLAY CONSTRUCTION PRODUCTS

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Environmental Product Declarations (EPD) for clay construction products provide important information about those products and their use. The professional and technical foundations of the EPD must be verifiable and must meet the requirements of ISO 14025 for ecolabels, the ISO 21930 for EPD for building products, and the more specific EN 15804 for Product Category Rules (PCR) for construction products EPD. Each EPD needs to cover all life cycle stages of a product (module A-D). Life Cycle Assessment (LCA) analyzes all phases of the life cycle of a construction product, takes into account the different impacts of these phases on the environment, evaluates, analyzes and interprets the results. In this study, LCA analysis for clay construction products has been conducted with the One Click LCA software, developed by Bionova Ltd, Finland. All processes have been modelled based on the inventory

data given in the Ecoinvent database (v3.6). Based on the results, the production phase (modules A1-A3) contributes the most to the environmental impact. Taken as a whole, most impact categories are dominated by energy processes and consumption of raw materials.

P

Preparation of Active Carbon Material By Activation With Various Hydroxide And Characterization Of Their Properties

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The aim of this research is to obtain active carbon material from the plane tree fruit. The precursor was first treated with hydrothermal synthesis and then mechanochemically activated with various hydroxides and finally carbonization was done to promote activation.It can be concluded that by acting of different hydroxides (NaOH, BaOH, LiOH, KOH) in the same mass ratio and using the same precursor and the same process, totally different materials with different structure and morphology are obtained.The initial composition of the precursor as well as the final product (active carbon materials) were analyzed using a proximative and ultimate method. The active area surface, volume and pore size was determined using the BET method. Verification of surface-active reaction groups in the identified structures was carried out through Fourier-transform infrared (FTIR) spectroscopy. Morphology of resulting activated carbon materials has been investigated by scanning electron microscopy (SEM) and X-ray diffraction (XRD). The application of the obtained materials is reflected in the fact that we removed the waste, we prevented the pollution of nature, and on the other hand we have obtained material that can be used for various purposes, for example, air and water filters, heating briquettes, fertilizer for plants, superconductors, etc.

P

THE SEM/EDS ANALYSIS OF ZEOLITE MINERALS

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The SEM/EDS analysis is one of the most important methods for characterizing and determining the morphology of minerals.In scanning electron microscopy (SEM), a highly energetic and focused electron beam scans the sample and normally provides an extremely enlarged image of the morphology of the sample, as well as information on its chemical composition using an energy dispersive spectrometer (EDS) detector. In this paper are presented the SEM/EDS investigation of natural zeolit deposit Igros and Zlatokop.

P

STRUCTURAL AND CHEMICAL PROPERTIES OF ZEOLITE FAU-TOPOLOGY

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Zeolite FAU is a synthetic product formed by various process of synthesis. The unit cell of zeolite of FAU topology contains 192 (Si, Al) O_4 - tetrahedra, it has tesseral symmetry and the unit cell parameter is ~ 25 A Key words: feldspar, hyalophane, crystalochemical properties.The FAU aluminosilicate network consists of a series of β-cages, which are tetrahedrally connected via D6R secondary building units. On this paper are presented the results of structural and crystalochemical analysis zeolite FAU topology. The SEM/EDS methods and X-ray powder diffraction analysis are useful for analysis.

P

Structural And Functional Investigation Of Fe/Pb/Zr-co-doped Barium Titanate Ceramics: From Theory To The Experiment

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Mixtures of high purity powders of 50 mass% Fe, 4 mass% Pb, 3 mass% Zr and 43 mass% $BaTiO_3$ were activated in a rotary ball mill for durations ranging from 30 min to 300 min; samples were then sintered in the air atmosphere for 2 hours at 1200 °C. Crystal structure prediction has been performed using Bond ValenceCalculation (BVC) method.Moreover, theoretical stability of theperovskite structure for synthesized and calculated Fe/Pb/Zr-co-doped barium titanatecompounds has been investigated using the Goldschmidttolerance factor (Gt) and global instability index (GII).It was observed that magnetization of the system decreased after the sintering, with the most dramatic drop of 90.11% belonging to the sample activated for 150 min. In comparison with initial powders, X-ray powder diffractiondata confirmed the presence of newphases of $BaFe_{12}O_{19}$ and $Ba_{1.696}Ti_{0.228}O_3$ in sintered samples. Utilizing the field emission scanning electron microscopy (FESEM), it was found that with the increase of activation time the morphology of the samples progressed from irregural, spherical grains to mostly rod-like ones. Energy dispersive X-ray (EDX) analysis identified the presence of Pb and Zr occupying the same locations on the surface of sintered samples, whilst Fe was uniformly deployed regardless of the activation time.

P

Structural, magnetic and photocatalytic properties of ZnOnanopowder

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Removal of organic pollutants from the waste water will bethemost challenging objective in the future. The photodegradation using the zinc oxide (ZnO)is one of the bestpromising material due to low price and high efficiency. Zinc oxide nanoparticles were synthetized by self propagatingroom temperature reaction of zincnitratewith sodium hydroxide.After reaction powder wascalcinated at 1100°C for 4 h in furnace. The diffraction patterns were recorded at room temperature and atmospheric pressure in the absence of any re-heating of the samples. The temperature dependence of magnetization was measured in the field of 1000 Oe and temperature range from 2 to 300 K using MPMS5 SQUID magnetometer. Photocatalytic properties were determined using the degradation of organic dye Methylene Blue (MB). Hg UV lap was used for irradiating the solution of MB and ZnOnanopowder. The photodegradation of MB was monitored by decreasing 664 nm peak during 120 min, after this period of time we observed 95% of reduction from the starting dye concentration. Nanopowder of ZnO show strong photocatalytic performance and can be used for further investigation and applications.

P

$BiFeO_3$ fine powder controlled hydrothermal process synthesis and characterization

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From the technological point of view, the mutual control of electric and magnetic properties is an attractive possibility, but the number of candidate multiferroic materials is limited. One of the most studied of them, $BiFeO_3$, has critical conditions for synthesizing single phase since the phase temperature stability range is very narrow. Bismuth ferrite (BFO) particles were synthesized by controlled hydrothermal process, where the particles of small sizes and high purity were obtained. A fitting refinement procedure using the Rietveld method was performed. Bismuth ferrite crystallizes in the perovskite type structure (α-$BiFeO_3$) with rhombohedral space group R3c. The effects of thermal treatment through applied hydrothermal method on the obtained BFO grains morphology were evaluated by SEM and TEM analyses.SEM analysis showed that grains are very well crystallized, with non-fragmented crystal flats. Individual particles HRTEM analysis confirmed the evidence of ultra-fine single crystal particles, with characteristic (012) crystal planes. Furthermore, HRTEM confirmed the existence of twin stacking faults responsible for synthesized fine particles enhanced magnetic properties. The EPR results suggested the existence and participation of electrons trapped by vacancies or defects. It has been proposed that the existence of $Fe^{3+}-O_V$ defect complex could be generated at elevated temperatures followed by formation of Fe^{3+} ions, which intensely provide the local 3d moments.

P

Structural and magnetic properties of Ag-doped CuO nanopowders

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The influence of Ag doping on the crystal structure and magnetic properties of CuO nanopowders was investigated. Nanoparticles of copper–silver oxide solid solutions with composition $Cu_{1-x}Ag_xO$(x=0.01–0.05) were successfully produced by using self–propagating room temperature synthesis using reaction between metal nitrates and sodium hydroxide. Prepared powders were calcinated at 700 °C for 2 h. The diffraction pattern was recorded at room temperature and atmospheric pressure in the absence of any re-heating of the sample. A fitting refinement procedure using the Rietveld method was performed which showed the incorporation of Ag^{3+} ions in the CuO crystal lattice, where they substitute Cu^{2+} ions. Magnetic behaviour of synthesized materials was investigated by SQUID magnetometer in temperature interval 2-400 K. Copper(II) oxide exhibits ferroelectricity driven by magnetic order at temperature as high as 230 K [1]. Multiferroic phase is present above the first order phase transition at T_{N1}= 213 K and exists up to the subsequent first order phase transition T_{N2}= 230 K . It was shown that disorder in the form of impurities can stabilize the ferroelectric phase what was a motivate to dope CuO with Ag in order to improve further its multiferroic properties.In$Cu_{1-x}Ag_x$Osmall change of magnetic properties were observed if compared to CuO.

P

THE MINERALOGY OF NATURAL FELDSPAR HYALOPHANE

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The tectosilicates, including all polymorphic forms of SiO_2, feldspar, feldspatoids, scapolites as well as zeolites, represent one of the most represented groups of minerals in the lithosphere. The feldspars found great application in various fields of industry, especially in the field of aluminosilicate ceramics. In this paper are presented the crystalohemical and mineralogical properties of natural feldspar hyalophane.

P

THE CLAY MINERALS FROM GREDA DEPOSIT

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The term "clay" refers to natural materials composed of fine minerals, which in their composition contain water molecules, which give it the property of plasticity, which is lost by drying processes.The basic physical and chemical characteristics of clay are low permeability, the possibility of cation exchange, thermal structural stability, swelling processes.These characteristic properties appear as a consequence of the crystal structure, in which the layers of SiO_4, tetrahedra, extend infinitely in two dimensions.In this paper are presented the basic structural and crystallochemical properties of clay from Greda deposit.

P

Preparation and Characterization Of Active Carbon Microspheres Obtained From Fructose And Adsorption Application

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A carbon-rich solid product has been synthesized by hydrothermal treatment from fructose with phosphoric acid (H_3PO_4) at temperature of 250°C and pH value of 0.65. The concentration of the precursor was constant, i.e. 2M of fructose in form of aqueous solution. The formation of the carbon-rich solid material through the hydrothermal carbonization of fructose is the consequence of dehydration reactions. Obtained carbon material is made of spherical micrometer-sized particles with the diameter in the 4-7 μm. The structure and surface chemical properties of obtained material were characterized by scanning electron microscopy (SEM), Fourier-transform infrared (FTIR) spectra. Investigation of surface area was determined by gravimetric McBain method where adsorption and desorption isotherms of N_2 were measured on carbon material at -196 °C. Adsorption of Methylene Blue (MB) onto prepared carbon material were conducted by changing concentration of MB from 200-500 mg/dm ^{3} from aqueous solutions of investigated dye. Kinetic results were determined by a pseudo second-order equation.

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Thermodynamic Data Analysis Of Sodium Carbonate To Bicarbonate Conversion Reaction

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During mechanical activation, the energy of treated material is raised to a higher level that can lead to the chemical transformation of the activated material. This is the point that should be considered as a phenomenon of the mechanochemical transformations appearing as a result of mechanical activation. Sodium carbonate as a substance that is often subjected to mechanochemical synthesis was mechanically activated in this study.Sodium carbonate is also a well-known material for being used as a good sorbent of carbon dioxide from the atmosphere, and as such has gained increasing importance in environmental protection. The conversion reactions of sodium carbonate to sodium bicarbonate under the specified environment of carbon dioxide and moisture were studied, and the thermodynamic data such are changes in enthalpy, entropy, and Gibbs energy at the temperature range of 0-160 ° C are given.

P

Investigation of bentonite characteristics from deposit „Bijelo Polje" Municipality Bar (Montenegro) for application in geopolymers and hybrid cement binders

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Since the late seventies of twentieth century geopolymers have been investigated as a new type of aluminosilicate binders which will eventually replace traditional cement based structural materials. Geopolymers are the three-dimensional synthetic inorganic polymers, which contain amorphous and semi-amorphous crystal microstructures. Hybrid binders are structural materials which combine alkali activated raw materials and cement in its mix-design. In this paper the characteristics of bentonite, which are important for its application in geopolymers and hybrid cement binders, were thoroughly investigated in order to evaluate its proneness to alkali activation. Bentonite samples from three different deposits were submitted to detail testing. Elaborate physico-chemical and mineralogical characterization was

conducted. Determined moisture contents in bentonite samples were from 20.54 % to 24.15 %. Hygroscopic moisture was in range 7.99 - 8.99 %, and specific mass was in range 2.42 - 2.52 g/cm^3. Grain-size analysis of the bentonite samples was conducted using Sympatec laser sizer. Mineralogical analysis highlighted smectite, α-crystbalite, quartz, and feldspar as the most aboundant mineral phases. DTA/TG analyses were conducted to monitor thermal behavior of the bentonite samples in thermal range 20 – 1000 °C. Cation exchange capacity, CEC, (Ca^{2+}, Mg^{2+}, Na^{+}, and $K^{+)}$ was also conducted. Obtained total CEC values were from 66.16 meq/100g to 78.97 meq/100g. Plasticity of bentonite samples was determined using Atterberg – Casagrande methodology. Also Moisture absorption coefficient (using Enslin –Neff methodology), pH values and dioxin content in samples were tested. It was determined that investigated bentonite samples showed high potential for application in construction materials, i.e. geopolymers and hybrid binders.

P

The influence of pH on catalytic degradation of tartrazine in presence of Oxone® activated by cobalt-supported carbon-smectite catalyst

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In this work cobalt-supported carbon-smectite catalyst was synthesized and tested as peroxymonosulfate (in form of Oxone®) activator in the degradation of food dye tartrazine. The incipient wetness impregnation method was used to introduce cobalt species into chitosan-smectite biocomposite. The impregnated sample was carbonized in a tube furnace at 500 ºC in a nitrogen atmosphere. The obtained catalyst was characterized by FTIR spectroscopy and N_2 physisorption. The FTIR spectra indicated the presence of bands characteristic for carbonaceous structures. It was observed that the presence of cobalt has a significant impact on the textural properties of the resulting cobalt-supported carbon-smectite catalyst. Catalytic tests were performed in 50.0 mg dm^{-3} tartrazine solution using 10 mg of catalyst in the presence of 0.130 mmol Oxone®. As the first step in catalytic degradation of tartrazine solution, decolorization was monitored using UV-Vis spectrophotometry at λ_{max}= 426 nm. The catalytic process was fast at 30 ºC and besides decolorization included further degradation of products of tartrazine oxidation. After 60 minutes of reaction, the degree of decolorization reached 97%. The influence of the initial pH of reaction solution on catalytic efficiency was tested.

P

Structural and electrochemical properties of gamma LiV_2O_5 cathode

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For its capability to reversibly remove and insert lithium ions in the range of $0 \leq x \leq 1.4$, gamma polymorph phase of $Li_xV_2O_5$ makes a solid candidate for cathode application in rechargeable batteries. Accommodation of lithium in concentrations higher than $x \approx 1.4$ brings stability issues related to the transformation towards the metastable ζ phase, which significantly limits utilization of higher capacities the material could achieve. The presented investigation has been conducted on γ-LiV_2O_5 powder obtained via solid state reaction at high temperatures. Structural refinement of the prepared γ phase has been carried out. Based on bond valence analysis of γ as well as of metastable γ' and ζ phase, which occur at low and high lithium concentrations, respectively, mechanism is proposed for the observed capacity decrease. Electrochemical characteristics of γ-LiV_2O_5 were investigated in both aqueous and organic electrolyte in the voltage range 4-2.3 V vs. Li^+/Li in order to record performances of all three occurring phases, γ and both lithium poor γ' (high voltage region) and lithium rich ζ (low voltage region). Ionic exchange of Li^+ with Mg^{2+}, Ca^{2+} and Al^{3+} in their respective aqueous electrolytes has been conducted to examine potential use of the material in the post-lithium rechargeable batteries.

P

The effect of hydrothermal synthesis parameters on cation-doped calciumhydroxyapatite

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Calcium hydroxyapatite (HAP) presents the main mineral component of human bones and teeth, and thus is widely used bioceramic material for thehard tissue repair and regeneration. The biological HAP is never found pure in nature butdoped with multiple therapeutic ions, such as Cu, Mg, Sr, Zn, etc., which are found to play important roles in bone metabolism and growth. Hence, foreign cations have been introduced into the synthetic calcium

hydroxyapatite, in order to induce a specific biological response after implementation, such as osteogenesis, angiogenesis, improved cell attachment and proliferation. However, the presence of the cations leads to the lattice distortion of the calcium-hydroxyapatite, resulting in different physico-chemical and mechanical properties. The hydrothermal synthesis of calcium hydroxyapatite leads to nanosized rod-like particles, which were found to possess properties close to those of the biological HAP. The aim of this study was to investigate the effect of hydrothermal synthesis parameters on physico-chemical and mechanical properties of mono- and binary cation-doped calcium hydroxyapatite by employing XRD, SEM and Hardness by Vickers tests. The temperature applied during the hydrothermal synthesis (150-180 °C) was found to influence the hardness of the HAP based compacts sintered at 1200 °C.

P

Electrochemical characterization of cobalt phases onto alumina supported cobalt catalysts

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This work describes the possible application of cyclic voltammetry (CV) for obtaining information about cobalt phases onto alumina supported cobalt catalysts.Starting from the same amount of ingredients, two catalysts with different phases of cobalt were prepared: Co_3O_4-A obtained by manual grinding of Co_3O_4 and alumina in an agate mortar and $CoAl_2O_4$-A obtained mechanochemically using a planetary ball mill.The final productswere characterized by the temperature-programmed reduction (TPR) and CV. The TPR profile of Co_3O_4-A showed peaks between 200–500°C characteristic of Co_3O_4 reduction, while the profile of $CoAl_2O_4$-A was altered in the whole temperature region and especially by the appearance of new peaks in the region of temperatures of 600–900^{o}C.This result indicated that a certain amount ofhard-to-reduce cobalt aluminate is generated during milling. CVin alkaline solution revealed that theoxidation/reduction of cobalt in $CoAl_2O_4$-Aoccurred at more negative potentials compared with cobalt in Co_3O_4-A.Negative shift of peak potential well correlated with the appearance of high-temperature TPR peak and could be ascribed to the cobalt phase which has lower tendency to get reduced. These findings encourage the idea of using the CV as low cost and rapid assay for distinguishing the cobalt phases onto alumina.

P

Simulation and modeling of rear earth perovskite ceramics materials at Microwave Frequencies

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The structural properties, phase assemblage, and dielectric properties of Nd (Zn1/2Ti1/2)O3 (NZT) ceramics were investigated using several methods, such as the high-resolution x-ray diffraction (XRD) analysis, differential scanning calorimetry (DSC), scanning electron microscopy (SEM), Transmission electron microscopy (TEM), the temperature-dependent microwave resonator characterization, and finally, after simulation an atomic structural model purposed for NZT. Single-phase NZT ceramics were produced at numerous sintering temperatures ranging from 1250ºC to 1500ºC. Based on the several tests and analysis, we have found that NZT has monoclinic crystal structure. The NZT demonstrate perovskite structure where neodymium located at the corner and A site of cube while Titanium and Zinc are placed at B site and shows 1:1 ordering. we measured electrical property of NZT, and our results shows that temperature of the resonant frequency (τf) value is equal to -48 when sintering temperature is 1500 °C, the quality factor Q×f value of 42000 at 4.3 GHz and finally dielectric constant value (εr) is equal to 36. The results of this scientific research could be very important for modern advance applications in Microelectronic miniaturization, particularly antennas and microwave filters in mobile telecommunications.

P

Clay sample preparation by microwave digestion for Fe determination using inductively coupled plasma optical emission spectrometry

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This paper presents the optimization of clay sample preparation using microwave digestion for the determination of Fe using inductively coupled plasma optical emission spectrometry (ICP OES). The optimization of the method was performed using following factors: mass of the investigated sample, volume of acids - nitric (HNO_3), hydrofluoric (HF), and phosphoric (H_3PO_4), and microwave digestion temperature. Iron concentrations were used as responses. Twenty seven samples and two certificated reference materials (CRM) were destroyed using different combinations of conditioning (i.e. variations of the mass of samples, volumes of acids, and temperatures). The following optimized conditions were established after full factorial design: digestion time of 20 min, sample amount of 0.1 g, 8 ml H_3PO_4, 2 ml HNO_3, 1 ml HF, and digestion temperature of 230 °C. The efficiency in decomposing clays with

concentrated acids was higher than 80 %. This condition allowed final digests in total concentration of Fe. The method was validated and applied for the determination of Fe in aluminosilicate samples. The optimized method allows the determination of iron with quantification limit of 0.01 mg/kg. The precision (expressed as relative standard deviations) was determined using five replicates of two samples of clays and the results obtained were 1.68 % and 2.07 % for iron. The accuracy was confirmed by the analysis of two certified reference material (NCS DC CRM 60106 and NCS DC CRM 60102). The proposed method was applied for the determination of iron in clays from Serbia. The metal concentrations found varied from 1.86 % to 5 % for iron.

P

Geopolymers to replace traditional ceramics: A preliminary investigation

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In an attempt to conduct the geopolimerization of raw clay and waste clay brick mixture, several experimental sets are conducted. Commercialwater glass and 10 M KOH in a mass ratio of 2.5:1 was used as an activator. Samples are made in the form of 5×5×5 cm^3cubes and 12×2.5 cm^2tiles. The important results characterizing non-activated and activated samples after 14, 21, and 28 days are followed. Instrumental analyses were employed to determine the chemical and mineralogical content of the studied materials and to follow the changes introduced by the chemical alkaline activation (XRF, XRD, FT-IR, DSC/TGA, and dilatometry). The microstructure of the materials is recorded by microscopic technique (FESEM). The tile-shaped specimens behaved better than the cubes during the onset of drying, were more stable, and had fewer cracks. Besides, longer drying times induced better mechanical characteristics to the products, and also pre-curing in steam conditions is concluded to be beneficial. This was the first detailed study to show thatit is possible to replace traditional ceramic with new materials, while avoiding thermal treatment and meeting the needs of the circular economy and sustainable development.

P

Application of Artificial Neural Networks in performance prediction of cement mortars with various mineral additives

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Prediction of physico-mechanical and thermo-mechanical properties of cement mortars with different mineral additives based on materials' starting compositions by means of machine learning models is an essential feature in contemporary civil engineering. In this study, the prediction of performances of seventeen mortar mixtures based on Portland cement (CEM I 42.5R) with mineral additives and subsequent comparison with properties of mortars in which various cement types were used as binders was conducted using artificial neural network (ANN) modeling. Analytical model comprised discrimination based on similarities and differences between composite mortars and mortars based on 6 different cement types (without additives). The employed cements were: ordinary Portland cement, moderate heat hydration cement, high early strength cement, low heath hydration cement, high sulphate resistant cement, calcium aluminate cement, and high alumina cement. The mineral additives used were: fly ash, bottom ash, zeolite, bentonite, perlite, vermiculite, pyrophyllite, micro silica, silica fume, spinel, chamotte, calcinated clay, kaoline clay, alumina, limestone, talc, and copper slag. This investigation designates the impacts of various process parameters, such as the concentration of SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, K_2O, Na_2O, TiO_2, SO_3, and LoI, and their effects on the quality of mortars with additives. The characteristics of mortars were evaluated regarding the dependent parameters such as: pozzolanic activity, heath of hydration, setting time, compressive strength, split tensile strength, compressive and split tensile strength under various temperatures up to 1000 °C, refractoriness, and sulphate resistence. Cluster Analysis and Principal Component Analysis were used for estimating the effect of ascertained process parameters on the quality of cements and additives. Artificial neural network model was employed to foresee the quality of cement mortars with additives of discovered outputs and its results show the high suitability level of anticipation: 0.999 during the training period, which can be regarded appropriately enough to correctly predict the observed outputs in a wide range of processing parameters. The developed ANN model displayed high predictive accuracy and it can be used in civil engineering for prediction of properties of novel mineral additives if their chemical composition is known.

P

Insights into the effect of aluminum oxyhydrates properties on theirelectrochemical behavior

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Alumina oxyhydrates have different structural and textural properties, as well as different density of surface functional groups. Three alumina oxyhydrates with different water content, 3mol H_2O/ mol Al_2O_3 (gibbsite), 1mol H_2O/ mol Al_2O_3 (boehmite) and 0.6 mol H_2O/ mol Al_2O_3 (α,γ-alumina phase), were used in this study. The samples were used as modifiers of carbon paste electrode. Their electrochemical behavior toward ferricyanide/ferrocyanide redox probe was evaluated by electrochemical impedance spectroscopy and cyclic voltammetry.Ferricyanide/ferrocyanide redox system has a well-known electrochemical behavior and is sensitive to the changes occurring at the electrode surface. The lowest charge transfer resistance was obtained for α,γ-alumina phase. The redox process of ferri/ferro redox probe on investigated electrodes exhibited a quasi-reversible behavior, since the obtained values of peak-to-peak separation are greater than 59 mV value expected for a reversible process.The response toward quinone/hydroquinone redox probe was evaluated by cyclic voltammetry in buffered solutions at various pH.Gibbsite and boehmite showed expected response, while the surface groups of α,γ-alumina phase enabled quinone oxidation to proceed through two pathways simultaneously. The surface chemistry of investigated samples influenced their electrochemical properties.

P

Characterization of Tamnavaclay by X-ray powder diffraction method

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The X-ray powder diffraction method on a polycrystalline sample is one of the basic methods used in the characterization of aluminosilicate minerals.The clay minerals represent a complex system, in which more than one phase is present.The main problems in analysis of clay minerals is weak crystallinity, preferential orientation, as well as the appearance of asymmetry.In this paper are presented the results of analysis of smectic type clay from Tamnava area. For investigation was use the method of X-ray powder diffraction and SEM analysis.

P

Characterization of polyurethane network/montmorillonite nanocomposites

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The aim of this work was to characterize the series ofnovel polyurethane network nanocomposites (PUNN) with different soft segment content (30-60 wt.%) based on organicallymodified montmorillonite as a nanofiller (Cloisite 30B; 0.5 wt.%). Hydroxyl-terminated ethoxypropyl-poly(dimethylsiloxane) was used as soft segment, while 4,4'-methylenediphenyl diisocyanate and Boltorn® hyperbranched polyester of the third pseudogeneration as the hard segment components. PUNNs werethermally and mechanically characterized by TGA, DSC, DMTA andnanoindentation measurements. The thermal stability of PUNNs increases with increasing soft segment content. PUNNsexhibit glass transition temperatures of the soft and hard segments as a consequence of the microphase separated morphology.The storage modulus in the rubbery plateau for PUNNs increased with decreasing soft segment content as consequenceof higher crosslinking density. As soft segment content decreased from 60 to 30 wt.%, the Young modulus and hardness increase from 119 to 673 MPa and from 14 to 75 MPa, respectively.Higher Young´s modulus and storage modulus of PUNN films were observed as compared to segmented PU/organoclay nanocomposites and for pure PU networks based on hyperbranched polyester and PDMS presented in the literature.Due to the improved properties, developed nanocomposites can be considered as promising materials usable in coating applications.

P

Mesoporous silica nanoparticle/polyurethane network nanocomposites for the removal of metal ions from aqueous solution

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The influence of fillers (mesoporous silica nanoparticles (MSN)) on the capability of the polyurethane nanocomposite (PUN) materials to adsorb and hence remove different metal ions, of relevance to water pollution, from aqueous solutions was investigated.Prepared materials were immersed in solutions ofmetal ions ($AgNO_3$, $AsCl_3$, $CdCl_2$, $Pb(NO_3)_2$, $CuSO_4 \cdot 5H_2O$)and the adsorbed amounts were quantified through energy-dispersive X-ray spectroscopy (EDX) measurements. The obtained results showed that even the low ratio of the filler (1 wt.%),influenced the affinity of the tested metal ions for surface adsorption, which is promising for potential application of this type of materials inenvironmental remediation. and selective sensing. In comparison to the purepolyurethane material, PUN-MSN and PUN-PEGMSN (PUN prepared with 2-[methoxy(polyethyleneoxy)6-9propyl]trimethoxysilane-functionalized MSN (PEGMSN)) showed significantly higher adsorption only in the case of Cu(II) ion. Curiously, in case of PUN-PEGMSN material significantly lower amount of Ag(I) was adsorbed in comparison to pure polyurethane and PUN-MSN materials. Further research work is necessary to increase the ratio of the MSN fillers within the PUN materials, to achieve higher selectivity and capacity of the materials for binding different metal ions from the aqueous environment.

P

Microstructural and optical properties of $MgAl_2O_4$ Spinel: Effect of Mechanical Activation, Yttrium and Graphene addition

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Magnesium aluminate and other alumina-based spinels attract attention due to their high hardness, high mechanical strength, and low dielectric constant. $MgAl_2O_4$ was produced by solid-state reaction between MgO and α-Al_2O_3 powders. Mechanical activation of 30 minutes in a planetary ball mill was used to increase the reactivity of powders. Yttrium oxide and graphene were added to prevent abnormal grain growth during sintering. Samples were sintered by hot-pressing under vacuum at 1450 ^oC. Phase composition and microstructure of sintered specimens were characterized by X-ray diffraction analysis and scanning electron microscopy. Rietveld analysis revealed 100 % pure spinel phase in all sintered specimens, and decrease in crystallite size with the addition of yttria or graphene. Density measurements indicated that the mechanically activated specimen reached 99.6 % relative density, while other specimens were above 96.5 % relative density. Furthermore, the highest solar absorbance and highest spectral selectivity as a function of temperature were detected for the mechanically activated specimen with graphene addition. Mechanical activation is an efficient method to improve the densification behaviour of $MgAl_2O_4$ produced from mixed oxide powders, while additives improve microstructure and optical properties.

P

Determination of physico-mechanical properties of cotton/polyester blends with carbon fibre

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As technology grows, the use of electrical and electronic systems has increased, and with it the need for quality protective clothing. Conductive fabrics for protective clothing against electrostatic charge or electromagnetic radiation must also satisfy the comfort of wearing. The main problem with the installation of conductive filler in the fabric is the violation of its mechanical properties: flexibility, stretchability, and durability during use. To evaluate the durability and comfort of woven fabrics obtained from cotton/polyester blends with the same percentage of carbon fiber, tensile properties, abrasion resistance, compression properties, air permeability, thermal and water vapor resistance were investigated. The analysis showed that the sample with the higher fabric weight, thickness, percentage of PES fibers and lower total porosity and open area shows the greater values of maximum force, elongation, thermal resistance and resistance to water vapor, as well as lower air permeability and lower mass loss which occurs after a 5000 number of abrasion movements. Results of compressibility and compressive resilience showed that differences between samples are not statistically significant. The examination showed that the investigated samples with carbon fiber have appropriate comfort properties and durability.

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