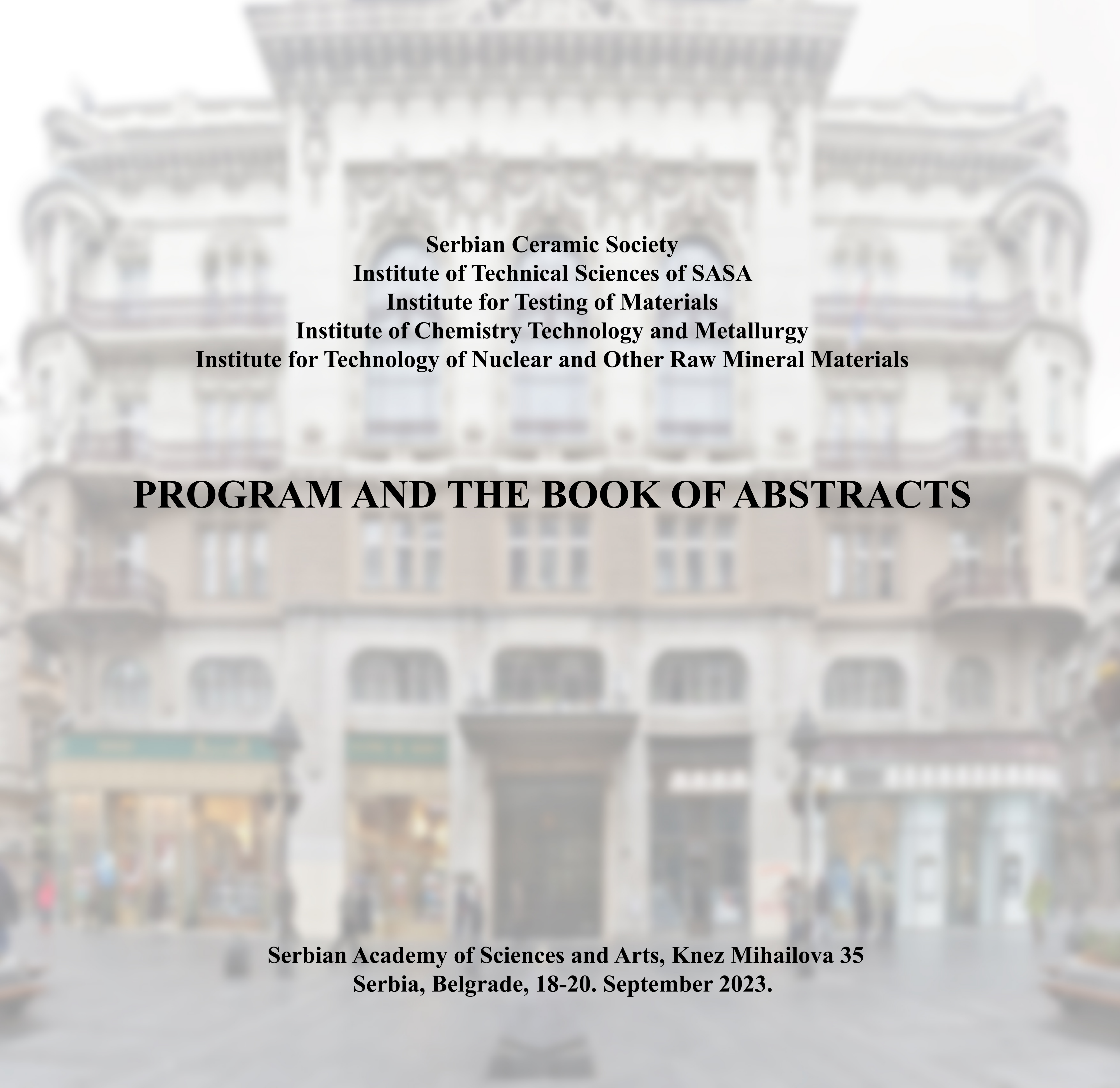
Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION XI
New Frontiers in Multifunctional Material Science and Processing



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, 18-20. September 2023.

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Serbia, Belgrade, 18-20th September 2023.

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Dear colleagues and friends,

We have great pleasure to welcome you to the Advanced Ceramic and Application XI 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. 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 nano-ceramic 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 9 sessions..

Dr. Nina Obradović
President of the Serbian Ceramic Society

Dr. Suzana Filipović
President of the General Assembly of the
Serbian Ceramic Society

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:

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Dr. Lidija Mančić SRB

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Institut za tehnologiju nuklearnih i drugih mineralnih sirovina

ANALYSIS
LABORATORY EQUIPMENT

Туристичка организација Београда
Tourist Organization of Belgrade

ITNMS
INSTITUT ZA TEHNOLOGIJU NUKLEARNIH I DRUGIH MINERALNIH SIROVINA

ИНСТИТУТ ИМС IMS INSTITUTE

Acknowledgements:

Ministry of Science, Innovations and Technological Development RS
Serbian Academy of Sciences and Arts
Institute of Technical Sciences of SASA, Institute of Physics BU
Hotel Palace, Shenemil

Република Србија
МИНИСТАРСТВО НАУКЕ,
ТЕХНОЛОШКОГ РАЗВОЈА И
ИНОВАЦИЈА

Institut tehničkih nauka
SANU

САНУ

УНИВЕРЗИТЕТ У БЕОГРАДУ
ИНСТИТУТ ЗА ФИЗИКУ | БЕОГРАД
ИНСТИТУТ ОД НАЦИОНАЛНОГ
ЗНАЧАЈА ЗА РЕПУБЛИКУ СРБИЈУ

HOTEL PALACE
BEOGRAD

Shenemil

Conference Program and Abstracts

Program and Abstract’s Contents

Book of Abstracts

The Eleventh 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 2.5 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 Hall2 (1stfloor), KnezMihailova 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.

Conference fee: Standard fee for foreign participants: 400 EUR; Standard fee for domestic participants: 12000 RSD; **Discounts**: Members of SCS, Invited lecturers and PhD Students: 50%; 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 and Gala dinner at site will be available only in cash.
Registration:
18. 09.2023 (8.00-9.00A.M.-2nd Floor) & 19-20.09.2023 (8.00-9.00A.M.–1st Floor)
Posters instalation:
19.09.2023 (16.30-17.00) & 20.09.2023 (8.30-9.00)CLUB SASA
After each session, participants should remove their posters!

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.**

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 Palace, Topličin venac 23; http://www.palacehotel.co.rs/
Exchange office: „Hulk“, Vuka Karadžića 4
Tourist Information Centre: KnezMihailova 5,http://www.tob.rs/en

Date	Time	Programme	Floor, Room
18th September Monday	**08.00-09.00**	**Registration**	2ndFloor, Hallway
	09.00-09.30	**Opening Ceremony**	2nd Floor, Great Hall
	09.30-10.00	**Award ceremony - Academician V. Radmilovic**	
	10.00-10.15	**Short break & Photo session**	
	10.15-12.00	**Electrochemistry & Catalysis** O. Guillon M. Vujkovic F. Hausen J. Ackovic	
	12.00-12.30	**Coffee Break**	2ndFloor, Hallway
	12.30-14.15	**Electrochemistry & Catalysis** M. Ajdukovic N. Tomic M. Maksumov Z. Mravik K. Milosevic J. Vujancevic	2nd Floor, Great Hall
	14.15-15.00	**Buffet Lunch**	Club SASA, Mezzanine
	15.00-17.30	**Nano, Opto & Bio-ceramics** C. Balaszi K. Balaszi M. Culo D. Milojkov Z. Vasiljevic M. V. Nikolic	2nd Floor, Great Hall
	19.00	**Conference dinner**	Palace Hotel
19th September Tuesday	**08.00-09.00**	**Registration**	1st Floor, Hallway
	09.00-11.30	**Modelling & Simulation** D. Zagorac M. Mirkovic M. Zlatar M. Peric D. Malenov N. Milosavljevic	1st Floor, Blue Hall
	11.30-12.00	**Coffee Break**	1st Floor, Hallway
	12.00-14.10	**Nano, Opto & Bio-ceramics** P. Ferreira Y. Wu S. Stojanovic K. Colic B. Miljevic L. Mancic	1st Floor, Blue Hall
	14.10-15.00	**Buffet Lunch**	Club SASA, Mezzanine
	15.00-17.20	**Renewable energy & Composites** M. Spreitzer P. Zabinski S. Maslovara S. Brkovic M. Marinkovic D. Sciti	1st Floor, Blue Hall
	17.20-19.00	**Poster Session I & Exibitions ***	Club SASA, Mezzanine
	***16.30-17.00**	**Poster Session I & Exibitions Installation**	Club SASA, Mezzanine

20th September Wednesday	**08.00-09.00**	**Registration**	1st Floor, Hallway
	09.00-10.00	**Poster Session II****	Club SASA, Mezzanine
	10.00-12.00	**Basic Ceramics & Sintering** F. Kern G. E. Hilmas V. Pavlovic P. Tatarko D. Galusek	1st Floor, Blue Hall
	12.00-12.30	**Coffee Break**	1st Floor, Hallway
	12.30-14.05	**Basic Ceramics & Sintering** W. G. Fahrenholtz S. Filipovic J. Zivojinovic W. Yared A. Peles Tadic A. Radosavljevic	1st Floor, Blue Hall
	14.05-15.00	**Buffet Lunch**	Club SASA, Mezzanine
	15.00-17.25	**Cement, Clay, Refractories & Glass, Electroceramics** A. Reka D. Sekulic K. Cajko M. Vasic S. Stojiljkovic M. Suljagic N. Djordjevic	1st Floor, Blue Hall
	17.25-18.00	**Awards & Closing Ceremony**	1st Floor, Blue Hall

**** 8.30-09.00** **Poster Session II Installation** Club SASA, Mezzanine

Monday, September 18th, 2023.

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

Great Hall, 2nd Floor

09.00 – 10.00 **Opening Ceremony of the XI Serbian Ceramic Society Conference: Advanced Ceramics and Application XI**

President of SCS – Dr. Nina Obradović, Short music programme, Dr. Marina Soković – Representative of Ministry for Science, Award Ceremony–Academician V. Radmilović

10.00 - 10.15 **Short break and Photo Session**

Great Hall, 2nd Floor

10.15 – 12.00 **Electrochemistry & Catalysis**

Chairpersons: Maja Pagnacco & Dalibor Marinković

10.15– 10.45 **PL Protonic ceramics for hydrogen technologies**

O. Guillon[1,2,3], L. Schäfer[1], M. Ivanova[1], M. Kindelmann[1], M. Bram[1]
[1]Institute of Energy and Climate Research: Materials Synthesis and Processing (IEK-1), ForschungszentrumJülich GmbH, 52425Jülich, Germany
[2]RWTH Aachen University, Institute of Mineral Engineering (GHI), Department of Ceramics and Refractory Materials, 52064 Aachen, Germany
[3]Jülich-Aachen Research Alliance: JARA-Energy, 52425 Jülich, Germany

10.45 – 11.15 **PL What have we achieved regarding the development of rechargeable Na-ion batteries?**

Milica Vujković
University of Belgrade - Faculty of Physical Chemistry, Studentski trg 12-16, Beograd

11.15 - 11.45 **PL Electrochemical Strain Microscopy to reveal local Lithium-ion mobility in solid state electrolytes**

N. Schön[1,2], P. Veelken[1,2], N. Scheer[1,2], F. Hausen[1,2]
[1]Forschungszentrum Jülich, IEK-9, 52428 Jülich, Germany
[2]RWTH Aachen University, IPC, Landoltweg 2, 52065 Aachen, Germany

11.45 – 12.00 **ORL Electrochemical testing of iron phosphor tungsten bronzes as potential electrode material**

Jovana Acković[1], Zoran Nedić[2], Tamara Petrović[2], Ružica Micić[1]MajaPagnacco[3], Pavle Tančić[3]
[1]Faculty of Sciences and Mathematics, University of Priština in KosovskaMitrovica, Lole Ribara 29, 38220 Kosovska Mitrovica, Serbia
[2]University of Belgrade - Faculty of Physical Chemistry, Studentski trg 12-16, Belgrade, Serbia
[3]University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Department of Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia

12.00 - 12.30 **Coffee Break** **Hallway, 2nd Floor**

Great Hall, 2nd Floor

12.30 - 14.15 **Electrochemistry & Catalysis**

Chairpersons: Maja Pagnacco & Dalibor Marinković

12.30 - 12.50 **INV Evaluation of cobalt supported chitosan-derived carbon-smectite catalysts in Oxone® induced dye degradation**

Gordana Stevanović, Nataša Jović-Jovičić, Jugoslav Krstić, Sanja Marinović, Predrag Banković, Marija Ajduković
University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Department of Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Republic of Serbia

12.50 - 13.10 **INV From brookite-based nanopowder towards titanate nanoribbons: structure and application**

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

13.10 - 13.30 **INV Friction Force Microscopy as a tool to investigate (electro)catalyticprocesses at surfaces**

M. Maksumov[1,2], A. Kaus[2,3], Z. Teng[4], K. Kleiner[4], F. Gunkel[3], F. Hausen[1,2]
[1]Forschungszentrum Jülich, IEK-9, 52428 Jülich, Germany
[2]RWTH Aachen University, IPC, Landoltweg 2, 52065 Aachen, Germany
[3]Forschungszentrum Jülich, PGI-7, 52428 Jülich, Germany
[4]University of Münster, MEET, Correnstraße 46, 48149 Münster, Germany

13.30 – 13.45 **ORL Graphene oxide/12 tungstophosphoric acid nanocomposites – achieving favorable properties with ion beams for electrochemical supercapacitors**

Željko Mravik[1], Milica Pejčić[1], Jelena Rmuš Mravik[1], Blaž Belec[2], Danica Bajuk-Bogdanovic[3], Sonja Jovanović[1], Smilja Marković[4], Nemanja Gavrilov[3], Vladimir Skuratov[5], Zoran Jovanović[1]
[1]Center of Excellence for Hydrogen and Renewable Energy (CONVINCE), Laboratory of Physics, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia
[2]Materials Research Laboratory, University of Nova Gorica, Ajdovščina, Slovenia
[3]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia
[4]Institute of Technical Sciences of SASA, Belgrade, Serbia
[5]Flerov Laboratory of Nuclear Reactions, Joint Institute for Nuclear Research, Dubna, Moscow region, Russia

13.45 – 14.00 **ORL Kinetics and mechanism study of photocatalytic degradation using heterojunction semiconductors**

Ksenija Milošević[1], Davor Lončarević[1], Melina Kalagasidis Krušić[2], Tihana Mudrinić[1], Jasmina Dostanić[1]
[1]University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Department of Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Republic of Serbia
[2]University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11000 Belgrade, Republic of Serbia

14.00 – 14.15 **ORL Detection of bisphenol S via screen-printed electrodes**

Jelena Vujančević[1,2], Špela Trafela[2], Neža Sodnik[2,3] , Zoran Samardžija[2] and Kristina Žagar Soderžnik[2,4]
[1]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, 11000 Belgrade, Serbia
[2]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova cesta 39, SI-1000 Ljubljana, Slovenia
[3]University of Ljubljana, Faculty of Chemistry and Chemical Technology, Večna pot 113,
SI-1000 Ljubljana, Slovenia
[4]Jozef Stefan Postgraduate School, Jamova cesta 39, SI-1000 Ljubljana, Slovenia

14.15 - 15.00 **Buffet Lunch** **Club SASA**

Great Hall, 2nd Floor

15.00 - 17.30 **Nano, Opto & Bio-ceramics**
Chairpersons: Lidija Mančić & Ivana Dinić

15.00 - 15.30 **PL Current Status and Future Trends in Nanocarbon added Ceramics**

Csaba Balázsi
Institute for Technical Physics and Materials Science, Centre for Energy Research, Eötvös Loránd Research Network, 1121 Budapest, Konkoly-Thege str. 29-33, Hungary

15.30- 16.00 **PL Ceramic biomaterials: From traditional technologies to novel applications**

Katalin Balázsi
Thin Film Physics Department, Centre for Energy Research, 1121 Budapest, Konkoly-Thege M. str. 29-33, Hungary

16.00 - 16.30 **PL Long, rich and exotic path from insulating to metallic states in strongly correlated ceramic materials**

Matija Čulo
Institut za fiziku, Bijenička cesta 46, HR-10000 Zagreb, Croatia

16.30 – 16.50 **INV Luminescence transitions of Pr^{3+} ($4f^2$) in fluorapatite nanocrystals for potential biomedical application**

Dušan V. Milojkov[1], Gordana D. Marković[1], Miroslav D. Sokić[1],Vaso D. Manojlović[2], Dragosav R. Mutavdžić[3], Goran V. Janjić[4]
[1]Institute for Technology of Nuclear and Other Mineral Raw Materials, 86 Franchet d Esperey St., 11000 Belgrade, Serbia
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[4]Institute for Chemistry, Technology and Metallurgy, University of Belgrade,Njegoševa 12, 11000 Belgrade, Serbia

16.50 – 17.10 **INV Biosynthesis of ZnO nanoparticles using agro-waste with antibacterial and antioxidant activity**

Zorka Vasiljevic[1], Jovana Vunduk[2], Milena Dojcinovic[1], Dragana Bartolic[1], Milos Ognjanovic[3], Nenad Tadic[4], Goran Miskovic[5], Maria Vesna Nikolic[1]
[1]University of Belgrade, Institute for Multidisciplinary Research, Kneza Viseslava 1, Belgrade, Serbia,
[2]The Institute of General and Physical Chemistry, Studentski trg 12/V, Belgrade, Serbia,

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[4]Faculty of Physics, University of Belgrade, Studentski trg 12, Belgrade, Serbia
[5]Silicon Austria Labs, High Tech Campus Villach Europastraße 12, A-9524 Villach, Austria

17.10 – 17.30 **INV METAL OXIDE NANOPARTICLES AS ACTIVE FOOD PACKAGING COMPONENTS**

Maria Vesna Nikolic[1], Zorka Vasiljevic[1], Jasmina Vidic[2]
[1]University of Belgrade- Institute for Multidisciplinary Research, Kneza Viseslava 1, Belgrade, Serbia,
[2]Université Paris-Saclay, INRAE, AgroParisTech, Micalis Institute, Jouy en Josas, France

19.00 – 23.30 **Conference Gala dinner** **Hotel Palace**

Tuesday, September 19th, 2023.

Hallway, 1st Floor

08.00 - 09.00 **Registration**

Hall 2, 1st Floor

09.00 - 11.30 **Modelling& Simulation**
Chairpersons: Marko Perić & Magdalena Radovic

09.00 - 09.30 **PL Modeling & Simulation of Advanced CeramicMaterials**
D. Zagorac[1,2]
[1]Institute of Nuclear Sciences Vinča, Materials Science Laboratory, Belgrade University, Belgrade, Serbia
[2]Center for the synthesis, processing, and characterization of materials for use in extreme conditions "Cextreme Lab", Laboratory for Theoretical Investigation of Materials (L-TIM), Belgrade, Serbia

09.30 - 10.00 **PL Structural analysis using the powder diffraction method of different structures from the calcium phosphate group of materials**
Miljana Mirković
Department of Materials, „VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia

10.00 - 10.30 **PL Rational Design of Single-Ion Magnets – Computational Chemistry Approach**
Matija Zlatar[1] and Maja Gruden[2]
[1]University of Belgrade – Institute of Chemistry, Technology and Metallurgy, Njegoševa 12, Belgrade, Serbia
[2]University of Belgrade – Faculty of Chemistry, Studentski trg 12-16, Belgrade, Serbia

10.30 - 10.50 **INV DFT Analysis of Hyperfine Couplings in *d* and *f* metal complexes with Tetrahydro Borate Ligands**
M. Perić, Z. Milanović, M. Radović, M. Mirković, A. Vukadinović, D. Stanković, D. Janković, S. Vranješ-Đurić
„VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, 11001 Belgrade, Serbia

10.50 - 11.10 INV **Modelling of stacking interactions relevant to non-metallic electronic materials**
Dušan P. Malenov
University of Belgrade – Faculty of Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia

11.10 – 11.30 **INV The power of machine learning**
Nataša Milosavljević
Faculty of Agriculture, University of Belgrade

11.30 – 12.00 **Coffee Break** **Hallway, 1st Floor**

Hall 2, 1st Floor

12.00 – 14.10 Nano, Opto & Bio-ceramics

Chairpersons: Smilja Marković & Marina Vuković

12.00 - 12.30 **PL Understanding the Cathode Battery Material $LiMn_2O_4$ by Advanced Electron Microscopy**
Paulo J. Ferreira[1,2,3]
[1]INL – International Iberian Nanotechnology Laboratory, Braga, Portugal
[2]Mechanical Engineering Department and IDMEC, Instituto Superior Técnico, University of Lisbon, Lisboa, Portugal
[3]Materials Science and Engineering Program, The University of Texas at Austin, Austin, Texas, USA

12.30 - 13.00 **PL Research of transparent ceramics for optical and photonic applications**
Yiquan Wu
Kazuo Inamori School of Engineering, New York State College of Ceramics Alfred University, New York, USA

13.00 - 13.20 **INV *In vitro* and *in vivo* experimental models to study bioceramics-based biomaterials**
Sanja Stojanović[1] and Stevo Najman[2]
[1]Department of Biology and Human Genetics, Faculty of Medicine, University of Niš, 18000 Niš, Serbia
[2]Department for Cell and Tissue Engineering, Scientific Research Center for Biomedicine, Faculty of Medicine, University of Niš, 18000 Niš, Serbia

13.20 - 13.40 **INV Structural integrity analysis of a hip implant with a ceramic-ceramic sliding surface**
Katarina Čolić[1]

[1]University of Belgrade, Innovation Center of Faculty of Mechanical Engineering,Belgrade, Serbia

13.40 – 13.55 **ORL Visible Light Driven Photocatalytic Ceramic Based Nano-Composites**

Bojan Miljević[1], Romana Cerc Korošec[2], John Milan van der Bergh[1,3], Vesna Miljić[1], Snežana Vučetić[1], Jonjaua Ranogajec[1]

[1]University of Novi Sad, Faculty of Technology, Department of Materials Engineering, Bul. cara Lazara 1, 21000 Novi Sad, Serbia

[2]University of Ljubljana, Faculty of Chemistry and Chemical Technology, Večna pot 113, 1000 Ljubljana, Slovenia

[3]Liverpool John Moores University, Built Environment and Sustainable Technologies (BEST) Research Institute, L3 2ET, Liverpool, United Kingdom

13.55- 14.10 **ORL β-$NaYF_4$:Yb,Tm@TiO_2-Acac core-shell structure for efficient photocatalysis**

Lidija Mančić[1],Ivana Dinić[1], Lucas A. Almeida[2], Jessica Gil-Londoño[2], Marina Vuković[3], Paula Jardim[4], Bojan A. Marinkovic[2]

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[3]Innovative Centre, Faculty of Chemistry, University of Belgrade, Serbia

[4]Department of Metallurgical and Materials Engineering, Federal University of Rio de Janeiro,
Rio de Janeiro, Brazil

14.10 - 15.00 **Buffet Lunch** **Club SASA**

Hall 2, 1st Floor

15.00 - 17.20 **Renewable Energy & Composites**
Chairpersons: Milica Marčeta Kaninski

15.00 – 15.30 **PL Epitaxial oxides on semiconductors: growth perspectives and device applications**

Matjaž Spreitzer[1], Lucija Bučar[1], Hsin-Chia Ho[1], Urška Trstenjak[1], Zoran Jovanović[1,2], Gertjan Koster[1,3]

[1]Advanced Materials Department, Jožef Stefan Institute, Ljubljana, Slovenia

[2]Laboratory of Physics, Vinca Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia

[3]MESA+ Institute for Nanotechnology, University of Twente, Enschede, The Netherlands

15.30 – 16.00 **PL The role of epitaxial layer of oxides on surface of hydrogen evolution electrocatalyst**

Piotr Żabiński
Faculty of Non-Ferrous Metals, AGH UniversityA. Mickiewicza 30, 30-059 Kraków, Poland

16.00 – 16.20 **INV Possibilities of integrating alkaline electrolyzer with ionic activators in micro combined heat and power systems**

Sladjana Maslovara[1], Dragana Vasic Anicijevic[2], Vladimir Nikolic[1], Mirjana Kijevcanin[3],Milica Marceta[1]
[1]Institute of General and Physical Chemistry, Studenstski trg 12/V
[2]Vinca Institute of Nuclear Science, Mike Petrovica Alasa 12-14
[3]Faculty of Technology and Metallurgy, Karnegijeva 4

16.20 – 16.40 **INV Investigation of tungsten-carbide-oxideas the anode catalysts supports for the proton exchange membrane fuel cells**

Snežana Brković[1], Milica Marčeta Kaninski[2], Ivana Perović[1], Slađana Malovara[2], Nikola Zdolšek[1], Petar Laušević[1], Vladimir Nikolić[2]
[1]University of Belgrade, Vinča Institute of Nuclear Sciences, Mike Petrovića Alasa 12-14, 11351, Vinča, Belgrade, Serbia
[2]Institute of General and Physical Chemistry, Studentski trg 12/V, 11158, Belgrade, Serbia

16.40 – 17.00 **INV Alumina supported catalysts for biodiesel production**

Milos Marinkovic[1], Milica Marceta Kaninski[1], Vladimir Nikolic[1], Stevan Blagojevic[1], Hadi Waisi[1], Aleksandra Zarubica[2]
[1]University of Belgrade, Institute of General and Physical Chemistry, Studentski trg 12/V, P.O. Box 45, 11158 Belgrade, Serbia
[2]University of Niš, Department of Chemistry, Faculty of Science and Mathematics, Višegradska 33, 18000 Niš, Serbia

17.00 – 17.20 **INV Processing and testing of UHTCMCs for aerospace applications**

D. Sciti[1], A. Vinci[1], L. Zoli[1], S. Mungiguerra[2], R. Savino[2]
[1]CNR-ISSMC, National Research Council of Italy - Institute of Science, Technology and Sustainability for Ceramics, Via Granarolo 64, 48018 Faenza, Italy
[2]University of Naples, Dept. of Industrial Engineering, Naples – 80125 Naples

17.20 - 19.00 Poster Session I & Exibitions Club SASA

Wednesday, September 20th, 2023.

Hallway, 1st Floor

08.00 - 09.00 **Registration& Poster Installation**

09.00 - 10.00 **Poster Session II** **Club SASA**

Hall 2, 1st Floor

10.00 - 12.00 **Basic Ceramics& Sintering**
Chairpersons: Suzana Filipović & Jelena Živojinović

10.00 - 10.30 **PL The role of powder selection and microstructure homogeneity to mechanical properties of zirconia toughened alumina composites**

Frank Kern
Institut für Fertigungstechnologie keramischer Bauteile UniversitätStuttgart Allmandring 7B, D-70569 Stuttgart

10.30 - 11.00 **PL Thermal, Electrical, and Mechanical Properties of (Ti,Cr)B_2 Ceramics**

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

11.00 - 11.20 **INV Hybrid Nanoscale Materials for Convergent Technologies**

V. B. Pavlović[1], G. Vuković[2], M. Nikolić[3], V.P. Pavlović[4], M.Perić[5], S. Nenadović[5], M. Ivanović[5], M. Mirković[5], V.Djoković[5], S. Knežević[5], M.Suljagić[6], Lj.Andjelković[6], A. Janićijević[7], D. Kovačević[7], S.Filipović[8], J. Vujancević[8], B. Vlahovic[9]
[1]University of Belgrade, Faculty of Agriculture, Belgrade, Serbia
[2]University of Wisconsin-Madison, USA
[3]University of Kragujevac, Faculty of Agronomy, Čačak, Serbia
[4]Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia
[5]University of Belgrade, Institute of Nuclear Sciences Vinca, Belgrade, Serbia
[6]University of Belgrade, Department of Chemistry, IChTM, Belgrade, Serbia
[7]The Academy of Applied Technical Studies Belgrade, Belgrade, Serbia

[8]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Belgrade, Serbia
[9]North Carolina Central University, Durham, NC, USA

11.20 - 11.40 **INV Novel Diboride Ceramics for Extreme Environment Applications**
Peter Tatarko[1], Inga Zhukova[1], Naser Hosseini[1], Salvatore Grasso[2], Vasanthakumar Kombamuthu[3], Zdeněk Chlup[4], Alexandra Kovalčíková[5],Monika Tatarková[1], Ivo Dlouhý[3], Ján Dusza[5]
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[3]CEMEA – Center of Excellence for Advanced Materials Applications, Slovak Academy of Sciences, 845 11 Bratislava, Slovakia
[4]Institute of Physics of Materials, Czech Academy of Sciences, Žižkova 22, 616 00 Brno, Czech Republic
[5]Institute of Materials Research, Slovak Academy of Sciences, Watsonová 47, 04001 Košice, Slovakia

11.40 - 12.00 **INV Various strategies and dopants for the preparation of dense $MgAl_2O_4$ ceramics by SPS**
Ali Talimian[1], Ali Najafzadeh[2], Václav Pouchlý[3], Karel Maca[3] and Dušan Galusek[1, 2]
[1]Centre for functional and surface-functionalized glass, TnUAD, Trenčín, Slovakia
[2]CETEC BUT, Brno, Czech Republic
[3]Joint glass centre of the IIC SAS, TnUAD and FChPT STU, Trenčín Slovakia

12.00 - 12.30 **Coffee Break** **Hallway, 1st Floor**

12.30 - 14.05 Basic Ceramics & Sintering

Chairpersons: Darko Kosanović & Adriana Peleš Tadić

12.30 – 12.50 **INV Densification of Dual Phase High Entropy Boride-Carbide Ceramics by Pressureless Sintering**
William G. Fahrenholtz, Steven M. Smith II, and Gregory E. Hilmas
Materials Science and Engineering Department, Missouri University of Science and TechnologyRolla, MO 65409 United States

12.50 – 13.05 **ORL Optimization of processing parameters for high entropy dual phase ceramics**
S. Filipovic[1,2], S. Smith[1], N. Obradovic[1,2], G. Hilmas[1], W. Fahrenholtz[1]

[1]Materials Science and Engineering, Missouri University of Science and Technology, Rolla, Missouri, United States
[2]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Belgrade, Serbia

13.05 – 13.20 **ORL Influence of Fe Doping on the Crystal Structure and Optical Properties of Mechanically Activated $SrTiO_3$ Powders**

J. Živojinović[1], A. Peleš Tadić[1], D. Kosanović[1,5], N. Tadić[2], Z. Vasiljević[3], S. M. Lević[4], N. Obradović[1]
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[4]University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia
[5]Department of Materials Science and Engineering, Missouri University of Science and Technology, Rolla, MO 65409, USA

13.20 – 13.35 **ORL Why delamination cracks occur in ceramics manufactured via DLP, and how to eliminate them**

Wadih Yared
Institute for Manufacturing Technologies of Ceramic Components andComposites, University of Stuttgart, Germany

13.35 – 13.50 **ORL Structural characteristics of $MgAl_2O_4$ spinel**

A. Peleš Tadić[1], J. Živojinović[1], N. Tadić[2], S. M. Lević[3], S. Marković[1], V. Pavlović[3], S. Filipović[1], N. Obradović[1]
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[2]University of Belgrade, Faculty of Physics, 11000 Belgrade, Serbia
[3]University of Belgrade, Faculty of Agriculture, 11080 Belgrade, Serbia

13.50 – 14.05 **ORL Diatomic earth: Structure and modification**

Petar Knežević[1], Nikola Vuković[2], Katarina Mihajlović[1], Marko Vujaković[1], Katarina Pantović-Spajić[2], Ana Radosavljević-Mihajlović[2]
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[2]Institute for Technology of Nuclear and other mineral raw materials, Franshe D Epere 86, Serbia

14.05 - 15.00 **Buffet lunch** **Club SASA**

Hall 3, 1st Floor

15.00 – 17.20 **Cement, Clay, Refractories & Glass, Electroceramics**
Chairperson: Anja Terzić & Milica V. Vasić

15.00 - 15.20 **INV Production of lightweight porous cementitious materials from diatomite via hydrothermal technology**
Arianit A. Reka
Department of Chemistry, Faculty of Natural Sciences and Mathematics, University of Tetovo, Blvd. Ilinden n.n., 1200 Tetovo, Republic of North Macedonia

15.20 - 15.40 **INV Electrical and humidity sensing properties of LNTO ceramics with ZnO as functional additive**
Dalibor L. Sekulić[1], Radoš R. Raonić[2], Tamara B. Ivetić[2]
[1]University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia
[2]University of Novi Sad, Faculty of Sciences, Novi Sad, Serbia

15.40 - 16.00 **INV Chalcogenide glasses as memristive materials**
Kristina O. Čajko[1], Dalibor L. Sekulić[2], Svetlana R. Lukić-Petrović[1]
[1]University of Novi Sad, Faculty of Sciences, Novi Sad, Serbia
[2]University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia

16.00 - 16.15 **ORL The lumped approach in drying modeling of roofing tiles – variable effective diffusivity determination**
Miloš R. Vasić[1], Milica V. Vasić[1]
[1]Institute for testing of materials, Bulevar vojvode Mišića 43

16.15 – 16.30 **ORL Moisture regulation in urban spaces with clay-based plaster**
Milena Živanović[1], Gradimir Cvetanović[1], Staniša Stojiljković[1], Semir Osmanagić[2], Goran Manić[3], Vesna Manić[4]
[1]University of Niš, Faculty of Technology Leskovac
[2]Archaeological Park: Bosnian Pyramid of the Sun Foundation, Visoko
[3]Institute of Occupational Health, Niš
[4]University of Niš, Faculty of Science, Department of Physics,Niš

16.30 - 16.45 **ORL Origin and sustainability of negative ions in the air**
Milena Živanović[1], Gradimir Cvetanović[1], Staniša Stojiljković[1], Semir Osmanagić[2], Goran Manić[3], Vesna Manić[4]
[1]University of Niš, Faculty of Technology Leskovac
[2]Archaeological Park: Bosnian Pyramid of the Sun Foundation, Visoko

[3]Institute of Occupational Health, Niš
[4]University of Niš, Faculty of Science, Department of Physics, Niš

16.45 - 17.05 **INV $BaTiO_3/Ni_xZn_{1-x}Fe_2O_4$ (x =0, 0.5, 1) composites synthesized by thermal decomposition: The influence of phase composition on their magnetic and electrical properties**
M. Šuljagić[1], L. Andjelković[1]
[1]University of Belgrade-Institute of Chemistry, Technology and Metallurgy, Department of Chemistry, Njegoševa 12, 11000 Belgrade

17.05 - 17.25 **INV Mechanochemical synthesis of strontium titanate**
Nataša Đorđević[1], Milica Vlahović[2], Slavica Mihajlović[1]
[1]Institute for Technology of Nuclear and Other Mineral Raw Materials, Franchet d'Esperey Blvd. 86, Belgrade, Serbia
[2]University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia

17.25 - 18.00 **Awards & Closing Ceremony** **Hall 2, 1st Floor**

Book of Abstracts

PL1

Protonic ceramics for hydrogen technologies

O. Guillon[1,2,3], L. Schäfer[1], M. Ivanova[1], M. Kindelmann[1], M. Bram[1]

[1]Institute of Energy and Climate Research: Materials Synthesis and Processing (IEK-1), ForschungszentrumJülich GmbH, 52425Jülich, Germany
[2]RWTH Aachen University, Institute of Mineral Engineering (GHI), Department of Ceramics and Refractory Materials, 52064 Aachen, Germany
[3]Jülich-Aachen Research Alliance: JARA-Energy, 52425 Jülich, Germany

Proton conducting oxide ceramics are relevant for key technologies such as steam electrolysis, fuel cells and catalytic membrane reactors. This class of materials comprises various crystal structures (e.g., perovskite, fluorite, etc.), however the most promising candidates for energy conversion devices are the cubic and orthorhombic perovskites, such as acceptor-substituted $BaZrO_3$, $BaCeO_3$, and their solid solutions (BZCY).

Our research in this field is multifaceted, i.e. from the synthesis of materials with improved electrical properties to powders, pastes, slurries processing required to fabricate fully operative electrochemical devices. The performance of such devices depends, amongst others, on the gas tightness of the solid electrolyte/membrane. Due to their refractory nature, the conventional densification of BZCY ceramics represents a very challenging aspect and requests temperatures of at least 1600°C. Therefore, it is necessary to explore new strategies for densification of BCZY membranes.

As an alternativeapproach to modify the sintering mechanisms, cold sintering offers the possibility to reach high densities at much lower processing temperatures (350°C) by applying chemistry-based approach combined with mechanical pressure. However, materials with excellent conductivity and ultrafine grains (that could increase the fracture strength) could be achieved only after grain boundary crystallization induced by a post thermal treatment (at 1300°C).

PL2

What have we achieved regarding the development of rechargeable Na-ion batteries?

Milica Vujković

University of Belgrade - Faculty of Physical Chemistry, Studentski trg 12-16, Beograd

Over the past ten years, the battery scientific community has been strongly focused on the development of different sodium insertion structures in effort to find suitable anode and cathode materials for Na-ion batteries that meet commercial needs. The driving force behind this development is a safe and sustainable system that would be independent of the critical raw elements such as lithium and rely on abundant and evenly dispersed elements such as sodium.

The talk will provide our recent research activitieson development of electrode materials for Na-ion batteries, including biomass-derived carbon as an anode and polyanionic phosphate $Na_4Fe_3(PO_4)_3P_2O_7$ as a cathode. It will be based on the use of simple synthesis routes,

structural characterization methods (XRD, FTIR, RAMAN) and electrochemical examination of developed materials in Na-containing organic and aqueous electrolytes using Cyclic Voltammetry and Galvanostatic cycling. Key synthesis steps for designing hard carbon surface and polyanionic composition, with a high capability of storing Na ions, will be identified and elaborated. The results will be discussed in terms of strengths &weaknesses of materials as well as next steps towards developing a safe and reliable Na-ion full cell.

Acknowledgments: The research was supported by the NATOSPS Programme under G5836-SUPERCARgrant.

PL3

Modeling & Simulation of Advanced Ceramic Materials

D. Zagorac[1,2]

[1]Institute of Nuclear Sciences Vinča, Materials Science Laboratory, Belgrade University, Belgrade, Serbia
[2]Center for the synthesis, processing, and characterization of materials for use in extreme conditions “Cextreme Lab”, Laboratory for Theoretical Investigation of Materials (L-TIM), Belgrade, Serbia

Innovative materials used in high-technology applications are called advanced materials. These materials can be completely new or typical traditional materials (e.g., metals, ceramics)whose properties have been enhanced to become advanced. This talk will cover the theoretical investigation of various advanced ceramic materials in connection to the experimental results. The first part will include the basics of modeling and structure prediction of ceramic materials, such as global optimization, quantum mechanics, and supercell method, as well as current developments in the Inorganic Crystal Structure Database (ICSD), theoretical crystal structure data, and data mining.In the next part, theoretical methods will be applied to the specific ceramic compounds. A plethora of state-of-the-art quantum mechanical methods will be presented, including Density-functional theory (DFT),LDA-PZ and GGA-PBE, or hybrid B3LYP and HSE functionals, and a combination of quantum mechanics with data mining and global optimization, as well as the newly developed Primitive Cell approach for Atom Exchange (PCAE) method applied on ZnO/ZnS polytypic (hetero)structures and unknown Cr_2SiN_4 compounds. Finally, the theoretical modeling of materials properties has been presented. Since many of the investigated materials show a large number of desirable properties for industrial applications,*ab initio* calculations of electronic, elastic, and mechanical properties will be presented and compared with experiments when available.

PL4

Long, rich and exotic path from insulating to metallic states in strongly correlated ceramic materials

Matija Čulo

Institut za fiziku, Bijenička cesta 46, HR-10000 Zagreb, Croatia

In contrast to conventional materials, conducting electrons of many advanced materials interact strongly with one another, giving rise to large correlation effects that prevent their free motion through the crystal lattice. Instead, these strongly correlated electrons often become localized at specific crystal sites, forming a long range spin, charge and/or orbital order, on top of the underlying crystal lattice. Such electron orderings are usually accompanied by opening of the so-called correlation gap at the Fermi level, which causes the insulating behavior. These insulating ordered electron states can be destroyed by changing e.g. temperature, pressure, magnetic field, or doping, which thus leads to insulator-to-metal transitions. The path from the insulating to the metallic phase, however, is not trivial, but usually includes various intriguing intermediate phases. In this talk I will focus on two large families of ceramic materials with such large correlation effects: manganites and cuprates, the insulator-to-metal transitions of which are accompanied by the famous colossal magnetoresistance and high-temperature superconductivity, respectively. I will present our detailed magnetotransport measurements on $La_{1-x}Ca_xMnO_3$,Pb/La-doped $Bi_2Sr_2CuO_{6+\delta}$and $Tl_2Ba_2CuO_{6+\delta}$, which indicate the presence of various exotic phenomena such as phase separation, spin-dependent variable-range hopping, strange metal transport and dual nature of conducting electrons.

PL5

Ceramic biomaterials: From traditional technologies to novel applications

Katalin Balázsi

Thin Film Physics Department, Centre for Energy Research, 1121 Budapest, Konkoly-Thege M. str. 29-33, Hungary

The 400 000 artificial hip joint operations made every year in the word and there are 25 000 000 people with a total hip replacement. The wear and risk of the implant loosening increases so that after 10 years 10-20% of the implants have to be renewed. Biomaterials used for implant should possess some important properties in order to long-term usage in the body without rejection. The biocompatibility, mechanical, chemical and surface properties play a key role in the creation of sufficient and long term functional replacements.

New fundamental research outcomes with industrial perspectives are given for understanding the applications of ceramics in load-bearing and low-load-bearing bioimplants with directions for future developments. Nowadays, Si_3N_4 is a new bioceramic with extremely good mechanical properties. Hydroxyapatite (HA) is a widely used bioceramic in implantology considering its high bioactivity. A bioactive coating (HA) on the bioinert ceramic implant's surface (Si_3N_4) could help avoid the rejection from the body in the critical early few days after the operation. The preparation of bioceramics will be showed from traditional

technologies to novel applications. The main trends and fundamental scientific problems will be discussed.

PL6

Thermoelectric Properties of $M_2O_3(ZnO)_n$ Nanowires

Velimir R. Radmilović

Serbian Academy of Sciences and Arts, Knez Mihailova 35, 11000, Belgrade, SERBIA

Meeting the demands for sufficient energy supply that has a minimal impact on the environment will be one of the biggest challenges facing humanity in the 21st century. This requires exploring many different avenues of research and development, including harvesting of heat, lost during primary energy production and conversion processes. One of such avenues is the field of thermoelectric materials, which demonstrate energy harvesting capabilities based on the Seebeck effect i.e. conversion of the temperature gradient into electric power, with potential applications in sensors, portable electronics, medical devices, etc.Thermoelectric $M_2O_3(ZnO)_n$ nanowires (M = In, Ga, Fe), synthesized using facile solid-state diffusion, enabled us to control their defect structure at the atomic level. Two kinds of defects, planar, parallel to basal wutzite planes, and zigzag, parallel to pyramidal planes, facilitate decoupling of electrical and thermal properties through quantum confinement effects and control of phonon scattering. In summary, $M_2O_3(ZnO)_n$ polytypoid nanowires were converted from pure ZnO nanowires using a simple preferential diffusion process along line defects, which can be used to produce a wide range of ZnO alloys with controllable alloy concentration and layer density. From this study it is apparent that better control of nano-scale features could be the key in developing next-generation thermoelectric materials.

PL7

Current Status and Future Trends in Nanocarbon added Ceramics

Csaba Balázsi

Institute for Technical Physics and Materials Science, Centre for Energy Research, Eötvös Loránd Research Network, 1121 Budapest, Konkoly-Thege str. 29-33, Hungary

The plenary lecture will give a comprehensive view on innovative developments made in the field of nanocarbons e.g. carbon black, carbon nanotubes, graphene added ceramics highlighting the key issues related to integration technology and improvements in the mechanical, tribological or functional properties as a result. Among non-oxide ceramics the silicon nitride based ceramics are well-known as low density materials with high strength and toughness. Silicon nitride, known as a typical dielectric material, is an ideal candidate for several structural applications, even at high temperatures. The addition of graphene or carbon nanotubes to silicon nitride to create ceramic nanocomposites gives rise to promising applications in a wide range of fields such as electronics, biomedical aids, membranes, flexible wearable sensors and actuators, energy systems. The presentation shows how the use of different reinforcing phases and sintering methods affects microstructure and as a result, mechanical properties, electrical conductivity and tribological properties of the final silicon nitride nanocomposites. The prospective future applications will be also discussed.

PL8

The role of powder selection and microstructure homogeneity to mechanical properties of zirconia toughened alumina composites

Frank Kern

Institut für Fertigungstechnologie keramischer Bauteile UniversitätStuttgart Allmandring 7B, D-70569 Stuttgart

Zirconia toughened alumina (ZTA) materials offer improved strength and toughness at slightly reduced hardness compared to alumina. ZTA is used in commodities such as cutting tools but also in high performance biomedical applications where excellent mechanical properties and reliabilty are crucial. While the basic reinforcement mechanisms: transformation toughening, microcracking and residual stress and their relation to composition are basically understood, producing excellent ZTA is still an issue.ZTA materials based on unstabilized and stabilized zirconia were manufactured from different alumina and zirconia starting powders, different stabilizer contents and compounding processes and characterized with respect to mechanical properties, phase composition and microstructure. The effects of processing and composition are demonstrated.In fully dense materials of nominally identical composition powder selection has a strong effect on mechanical properties with strength and toughness values varying by up to 50%. The aim to reach a tailored size distribution of zirconia in the microstructure to maximize transformation toughening depends on the selection of the “right” zirconia powder and a proper homogenization process. A sinter to size strategy to adjust the microstructure by overfiring is of limited value.In case of ZTA materials with a zirconia fraction at or over the percolation threshold stabilizer has to be added. It is shown that in such materials homogeneity is even more important to avoid over-stabilization and manufacture materials with a combination of high strength and toughness and a limited content of monoclinic phase.

PL9

Electrochemical Strain Microscopy to reveal local Lithium-ion mobility in solid state electrolytes

N. Schön[1,2], P. Veelken[1,2], N. Scheer[1,2], F. Hausen[1,2]

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Solid State Batteries require a detailed knowledge of surface and interfacial reactions at a process relevant scale as key for developing materials with advanced functionality. Lithium Aluminum Titanium Phosphate, $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$, is a typical representative of a ceramic solid state electrolyte with NASICON type structure, exhibiting superior lithium ion conductivity. The appearance of secondary phases of aluminum phosphate under certain manufacturing conditions demonstrate the need for understanding the correlation of lithium ion mobility and microstructure. Furthermore, new challenges arise in optimizing interfacial processes in hybrid electrolyte systems. Atomic Force Microscopy (AFM) is an ideal tool for such investigations. In this contribution, Electrochemical Strain Microscopy (ESM), an advanced AFM mode, is presented. A clear contrast between LATP and the secondary phase occurring during preparation is observed, exhibiting a significantly reduced Li-ion mobility in secondary phase areas. In order to correlate chemical information with the ESM signal, Energy-Dispersive X-ray Spectroscopy (EDX) is utilized in a correlative approach. Furthermore, the signal origin in ESM is critically discussed. The presentation concludes with an investigation of the ionic conductivity at the interface between polymer and ceramic in a hybrid electrolyte. Clear interfacial effects between polymer and ceramic particles are observed and critically discussed.

PL10

Thermal, Electrical, and Mechanical Properties of (Ti,Cr)B_2 Ceramics

Gregory E. Hilmas

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

Titanium diboride (TiB_2) is an ultra-high temperature ceramic, having a melting temperature of >3200°C, but also high strength and hardness, as well as high electrical and thermally conductivity. Due to its unique properties, TiB_2 is used in many industrial applications, including cutting tools, evaporation boats, and as inert cathodes in Hall-Heroult aluminum production. This presentation will focus on recent results from our research group studying the effect of Cr solid solution additions on the thermal, electrical, and mechanical properties of (Ti,Cr)B_2 ceramics. The (Ti,Cr)B_2 ceramics containing varying amounts of Cr contents were synthesized by boro/carbothermal reduction. The powders were then consolidated by spark plasma sintering. The coefficients of thermal expansion were determined for the principle crystallographic directions by variable temperature X-ray diffraction. Thermal diffusivity was measured by the laser flash method and used to calculate thermal conductivity. Electrical resistivity was measured using the 4-point van der Pauw method. Hardness was measured using Vickers indentation, and flexure strength was measured in four-point bending. The presentation will initially focus on the densification behavior, grain size, and other microstructural effects, and then discuss any systematic changes in properties that occur as the Cr content of the (Ti,Cr)B_2 ceramics changes.

PL11

Rational Design of Single-Ion Magnets – Computational Chemistry Approach

Matija Zlatar[1] and Maja Gruden[2]

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[2]University of Belgrade – Faculty of Chemistry, Studentski trg 12-16, Belgrade, Serbia

In recent years, there has been a growing interest in single-ion magnets thatdisplay a bistable (up/down) magnetic spin state below specific critical temperature because of their potential applications. Single-ion magnets exhibit magnetic properties like those observed in conventional bulk magnets but are of molecular origin.Obtaining single-ion magnets working at room temperature is reduced to understanding Zero-Field-Splitting parameters determining the magnetic anisotropy ofisolated transition metal complex. In this talk, the computational study of magnetic anisotropyin a series of transition metal complexes will be presented when changing the metal ion or the ligands in a controlled way. We will discuss the influences of coordination number, molecular symmetry, ligand field strength, spin-orbit coupling,spin and oxidation states, redox potential, spin and charge localization, electronic degeneracies, etc. A fundamental understanding of all these factors is a prerequisite for fulfilling our ambition - to develop a new generation of single-ion magnets.

Acknowledgments:This research was supported by the Science Fund of the Republic of Serbia, #7750288, Tailoring Molecular Magnets and Catalysts Based on Transition Metal Complexes – TMMagCat.

PL12

Understanding the Cathode Battery Material $LiMn_2O_4$ by Advanced Electron Microscopy

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The need for portable energy storage has led to the creation of a Li-ion battery industry. Of the many cathode chemistries for Li-ion batteries, $Li[Mn_2]O_4$ is an appealing cathode due to its moderate capacity, environmentally-friendly and cost-effective Mn, and high rate capabilities due to its cubic spinel framework, allowing 3D Li^+ diffusion. Yet, this material has shown capacity loss, attributed to the dissolution of Mn to the electrolyte. In this work we show by HAADF STEM that a restructured surface is formed in this material, where a stable surface layer of Mn_3O_4, followed by $Li_{1+x}Mn_2O_4$ subsurface with retention of bulk $LiMn_2O_4$ is formed. Recent advances in STEM also allow us to obtain images proportional to the projected potential, electric field and charge distribution, by using differential phase contrast technique (DPC). Thus, in this work we use DPC to determine the Li, Mn and O atomic positions, thus providing a novel insight into the structure of $LiMn_2O_4$. Our results show local regions depleted in Li and the existence of Mn atoms in tetrahedral sites occupying a typical Li atom position, or occupying a free octahedral site in the same column, in agreement with the Mn disproportionation reaction reported for such compound.

PL13

The role of epitaxial layer of oxides on surface of hydrogen evolution electrocatalyst

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Catalysts can be successfully prepared by a simple electrochemical process. Their surface composition distinguishes catalytic activity toward hydrogen or oxygen evolution reactions. In this work, uniform Co-Ni cones were synthesized using the one-step method from an electrolyte containing a crystal modifier. Electrodeposited layers were oxidized and/or reduced in the furnace at 100°C. Freshly electrodeposited coating was stored in air atmosphere for seven days. This results in an epitaxial oxide layer forming on the surface of the catalyst. Changes in the surface composition, confirmed by the XPS method, strongly influenced the wettability, catalytic performance, and size of evolved hydrogen bubbles. The conical Co-Ni surface with epitaxial oxides layer formed in a controlled way possesses the best catalytic activity towards hydrogen and oxygen evolution. Conversely, the spontaneously formed oxide layer decreases the catalytic performance in mentioned reactions compared with the fresh sample. That open an possibility to control electrocatalytical activity of material by proper grow of thin layer of oxides. The proper storage of synthesized samples is also essential due to their desired catalytic applications. Proposed controlled oxidation can be an accessible way to increase nanomaterials catalytic performance.

PL14

Structural analysis using the powder diffraction method of different structures from the calcium phosphate group of materials

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Calcium-phosphate materials consist of ions that are stable in physiological conditions, which makes them extremely biocompatible, showing exceptional resistance to microbiological influences, changes in the pH of the environment, and having a very low solubility product in physiological conditions. One of the basic methods of structural investigation of materials is the X-ray diffraction method on a polycrystalline sample, where, depending on the need, different crystallographic programs can be used to calculate structural parameters.The aim of this work is to present the ten-year results of the structural characteristics of doped and pure calcium phosphate materials with reference to the use of different crystallographic programs

and crystallographical databases for determining the required and specified structural and phase characteristics. All materials were synthesized with reference to the principles of green chemistry, where acetate solutions were used, unlike nitrates, from which these materials are mainly obtained by the precipitation method. Results show that PDXL2 software is preferably usedin the case of nanocrystalline materials, while for materials with micro grain size, the powder cellsoftware should be used. For quick and efficient determination of the unit cell parameter, it is good to use the Wincell program. For detailed refinement of structure, the Full Prof program should be used. It is recommended to use the Vesta program for displaying crystal structures due to its extremely simple use.

PL15

Research of transparent ceramics for optical and photonic applications

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Transparent ceramics are highly promising materials, with some properties exceeding that of single crystal and amorphous materials in a wide range of optics and photonics applications. To develop high quality transparent ceramic materials for such applications, it is essential to study the fundamental science aspects involved in the synthesis and processing of the materials, in order to achieve the required transparency and microstructures. Furthermore, processing transparent optical materials with anisotropic crystal structures presents additional significant challenges, due to the inherent characteristics of optical anisotropy in polycrystals. In an attempt to process transparent non-cubic ceramics to achieve nanostructure grain size, a field-assisted sintering method is studied in which the ceramic samples can be quickly densified without significant grain growth. Transparent ceramics can be made by dry and wet forming techniques. The gel-casting is a near-net shaping process for simple and complex shapes of ceramic fabrication. A newly developed gelling system has been investigated to develop transparent complex-shaped ceramics, which is promising to fabricate large-size and complex-shaped transparent ceramics for optical and photonic applications. Additionally, digital processing through additive manufacturing has great potential as a new method for fabricating optical materials.

PL16

Epitaxial oxides on semiconductors: growth perspectives and device applications

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Epitaxial integration of transition metal oxides with semiconductors offers various phenomena for novel device applications, specifically bringing ferroelectric, ferromagnetic, electro-optic, photocatalytic, multiferroic, piezoelectric and other properties to the well-established silicon platform. A convenient way of integrating functional oxides with Si(001) substrate is through a $SrTiO_3$ (STO) intermediate layer, which can be fabricated on Si(001) in epitaxial form and with high crystallinity using.

The epitaxial growth of functional oxides on silicon substrates requires atomically defined surfaces, which are most effectively prepared using SrO- or Sr-induced deoxidation and passivation. As-prepared surfaces enable overgrowth with various oxides for novel device applications. In our work pulsed laser deposition (PLD) was used to integrate oxides with silicon. We showed the ability to prepare highly-ordered sub-monolayer SrO- and Sr-based surface structures, including two-domain (2×3)+(3×2) pattern at 1/6 ML Sr coverage as determined by the reflection high-energy electron diffraction (RHEED) technique. On the passivated silicon surface epitaxial layers of STO was grown by the method of kinetically controlled sequential deposition. Detailed study of initial deposition parameters proved to be extremely important in achieving epitaxial relation of STO with the underlying substrate. On as-prepared pseudo-substrate different functional films were gown for applications in microelectromechanical systems and electrochemical devices.

INV1

$BaTiO_3/Ni_xZn_{1-x}Fe_2O_4$ (x =0, 0.5, 1) composites synthesized by thermal decomposition: The influence of phase composition on their magnetic and electrical properties

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To examine the influence of phase composition on the magnetic, dielectric, and ferroelectric properties of perovskite/spinel composites, $NiFe_2O_4$, $ZnFe_2O_4$, and $Ni_{0.5}Zn_{0.5}Fe_2O_4$ were *in situ* prepared by thermal decomposition onto $BaTiO_3$ surface. Acetylacetonate complexes were used as the precursors. The synthesized powders were compressed to pellets and additionally sintered at 1150 °C and 1300 °C. X-ray powder diffraction (XRPD) and scanning electron microscopy (SEM) coupled with electron dispersive spectroscopy (EDS) were used for the comprehensive study of phase composition and morphology. The magnetic and electrical properties were performed in detail. The optimal phase composition was found in the $BaTiO_3/NiFe_2O_4$ composite sintered at 1150 °C. This resulted in wide frequency range stability of relative dielectric constant. Furthermore, optimal phase composition in $BaTiO_3/NiFe_2O_4$ led to suitable properties such as low conductivity and ideal-like hysteresis loop behavior. These functional properties of $BaTiO_3/NiFe_2O_4$ make this composite a promising candidate for further studies on multiferroic properties.

INV2

Processing and testing of UHTCMCs for aerospace applications

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Materials used for thermal protection systems of space vehicles need to withstand extreme temperatures and intense mechanical vibrations during launch and re-entry into the Earth's atmosphere. The conditions they are exposed to, including extremely high temperatures, chemically aggressive environments, and rapid heating and cooling, surpass the capabilities of current materials. Ultra-high-temperature ceramics, such as borides and carbides of early transition metals, belong to a class of materials that possess melting points exceeding 3000°C, high thermal and electrical conductivities, and excellent ablation resistance. However, their low fracture toughness and poor thermal shock resistance pose major obstacles to their implementation. In the past few years, a new class of materials labelled UHTCMCs (ultra-high temperature ceramic matrix composites) has been developed combining a UHTC rich matrix with carbon fibres. In this presentation, we will showcase the recent advancements in the manufacturing of UHTCMCs and discuss their mechanical and environmental testing. By optimizing the compositions and textures, we have achieved outstanding resistance to ablation

for flat UHTCMC surfaces during arc jet tests, as well as erosion resistance for nozzle inserts during propulsion tests. Additionally, we have designed a special series of tests to expose UHTCMC bars to arc jet conditions and subsequently measure the impact of surficial oxidation on the flexural strength.

INV3

Mechanochemical synthesis of strontium titanate

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In this work, SrO and TiO_2 were mechanochemically activated for 520 minutes. The X-Ray Diffraction Analysis determined that strontium titanate was obtained. The starting components reacted in an amount of 99.1%. Phase changes during the reaction were analyzed and the dynamics of mechanochemical synthesis were defined. The occurrence of an intermediate compound (activated complex) on the reaction path from the reactant to the stable product of the reaction was assumed and experimentally proven. The rate constant of the mechanochemical neutralization reaction between strontium oxide and titanium oxide is defined. A mathematical relation with the basic thermodynamic and other physicochemical parameters of the process was established.

INV4

Various strategies and dopants for the preparation of dense $MgAl_2O_4$ ceramics by SPS

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Dense $MgAl_2O_4$ ceramics are usually fabricated by pressure-assisted methods, such as SPS. Discoloration of $MgAl_2O_4$ by carbon contamination often prevents fabrication of transparent bodies. Use of LiF, which acts both as a sintering aid and impurity scavenger was described to promote densification and eliminate carbon contamination. The present contribution describes alternative approaches for the preparation of dense $MgAl_2O_4$ by SPS without carbon contamination.

A two-stage heating profile was used to produce transparent $MgAl_2O_4$ without sintering aids at 1250°C. The effect of critical temperature on transparency and carbon contamination was investigated: higher critical temperature resulted in higher contamination. LiOH was also used as an alternative to LiF. The addition of 0.3 wt% LiOH promoted densification, limited grain growth, and decreased the activation energy of sintering. While adding small amounts of LiOH, up to ca. 0.3 wt%, was beneficial for densification while suppressing grain growth, there existed a critical concentration of Li^+ that accounted for preferential incorporation of Li^+ into $MgAl_2O_4$ lattice. Transition metal fluorides were also found to promote densification, while acting as a source of optically active dopants. MnF_2 and CoF_2 promoted the densification as effectively as LiF but caused significant grain growth.

INV5

From brookite-based nanopowder towards titanate nanoribbons: structure and application

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TiO_2 nanopowder based on brookite phase was synthesized using sol-gel hydrothermal method. For the purposes of preparing one-dimensional (1D) nanoribbons, the obtained TiO_2 nanopowder was used as a precursor following an alkaline hydrothermal approach, after which an annealing process took place. The aim of the talk is to provide insight into the effect of the nature of brookite-based nanoparticles on the formation of titanate. Besides that, the results will be discussed in terms of correlation of materials photocatalytic activity with morphological and structural properties. The crystal structure of the synthesized nanomaterials was analyzed by X-ray powder diffraction (XRPD). Besides the XRPD pattern, the structural and morphological characteristics of obtained nanopowders and nanoribbons were also investigated by Raman spectroscopy and Field Emission Scanning Electron Microscopy (FESEM). Conventional and high-resolution transmission electron microscopy (TEM/HRTEM), was carried out for further morphological and crystal structure examination. Synthesized nanostructures were tested in photocatalytic degradation of Reactive Orange (RO16) azo-dye, since these dyes represent the most toxic ones among various types of dyes. The TiO_2 brookite-based nanopowdershowed the best photocatalytic efficiency, whereas the titanate after annealing were much faster in degradation in comparison with titanate obtained after hydrothermal process.

INV6

DFT Analysis of Hyperfine Couplings in *d* and *f* metal complexes with Tetrahydro Borate Ligands

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Metal complexes with BH_4^- ligands show extravagant structural and dynamic properties, and possess many important and applicable qualities (potent reducing agents and catalysts, materials for hydrogen storage). Electron paramagnetic resonance (EPR) is very important for the characterization of complex compounds, determination of their electronic configuration and geometry. Also, Density Functional Theory (DFT) can predict EPR parameters and

explain them more profoundly. Of particular importance is the analysis and prediction of hyperfine coupling constants for lanthanide complexes with BH_4^- ligands, given that there is not much data in the literature. Within this paper hyperfine coupling constants of *d* and *f* metal complexes with BH_4^- ligands have been determined by DFT calculations, and analyzed in detail. Calculations predicted that proton hyperfine coupling constants are very small in the case of complexes of *f* elements, and are present only due to weak polarization. The increase of covalence and the number of unpaired electrons does not significantly affect the change of constants of BH_4^- ligands, but only of protons that are bound by σ bonds.

INV7

Modelling of stacking interactions relevant to non-metallic electronic materials

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Tetrathiafulvalene (TTF) and tetracyanoquinodimethane (TCNQ) are organic compounds of great importance for the development of non-metallic materials, most notably charge-transfer salts. Parallel packing is very common in crystal structures containing TTF and TCNQ units, and the formation of stacking interactions between these fragments influences the conductivity properties of these materials. The geometries of these stacking interactions were described based on the crystal structures deposited in the Cambridge Structural Database that contain TTF or TCNQ pairs. The calculations of interaction energies between two neutral TTF molecules, as well as between two neutral TCNQ molecules, performed at B2PLYP-D3BJ/6-311++G** and TPSS-D3/def2-TZVP levels of theory, respectively, showed that the geometries of the strongest stacking interactions correspond to the most frequent ones in the crystal structures. The strongest interactions have energies of -9.96 kcal/mol and -8.03 kcal/mol for TTF and TCNQ dimers, respectively, showing the ability of these molecules to form strong stacking interactions. The obtained energies were supported by the SAPT energy decomposition analysis, as well as the electrostatic potential surfaces of isolated monomers, showing the nature of these stacking interactions. The strongest stacking interactions are shown to be the ones that support the high conductivity of TTF and TCNQ-based materials.

INV8

Evaluation of cobalt supported chitosan-derived carbon-smectite catalysts in Oxone® induced dye degradation

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Wastewaters polluted with high concentration of dyes are produced by various industries. Therefore, it is important to perform treatment of the dye-contaminated waters before their discharge into recipients in order to protect the environment. Sulfate radical-based advanced oxidation processes that involve use ofactivated Oxone® can be used for degradation of dyes. In this work,nanocomposite catalysts constituted ofCo supported on smectite with chitosan-derived carbon were used for activation of Oxone. Catalysts were synthetizedusingan impregnation-carbonization procedure and denoted as Co/cCh-S-*T* (*T* stands for applied carbonization temperature). The carbonization was performed in the temperature range from 400°C to 700°C in the flow of N_2 providing inert atmosphere. The synthesized catalysts were fully characterized using XRPD, XPS, FTIR, HR-TEM, and low-temperature N_2-physisorption analysis, and evaluated in the Oxone® induced oxidative degradation of food dye tartrazine. The best performing catalyst was investigated in detail regarding catalytic degradation of tartrazine with respect to degradation time and different experimental parameters (dye concentration, Oxone® concentration, temperature, and initial pH of the reaction solution). The kinetic and thermodynamic parameters were calculated from the experimental results.The selected catalyst showed excellent performance in the Oxone® initiated tartrazine degradationat low temperatures (even at 25°C) and in the wide range of pH values.

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INV9

Electrical and humidity sensing properties ofLNTO ceramics with ZnO as functional additive

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Among various materials used as sensing elements of the humidity sensors, the nanostructured ceramics based on various metal oxides offer several advantages such as high chemical, mechanical and thermal stability, as well as their porous nature that enables the rapid response dynamics and broad range of operation. In this paper, we report on electrical and humidity sensing properties of lithium–niobium–titanium–oxide (LNTO) ceramics with ZnO as functional additive, which have been synthesized by solid–state reaction method.

Structural analysis of nanostructured porous LNTO ceramics was performed by means of SEM, X–ray diffraction and Raman spectroscopy measurements. In the frequency range from 100 Hz to 10 MHz, the room temperature impedance responses of synthesized samples indicated that LNTO ceramics exhibit semiconducting nature (NTCR–type behavior) and non–Debye type of relaxation phenomena. In order to establish correlation between the microstructures and electrical properties, the obtained impedance spectra were modeled using an equivalent electrical circuit based on only one parallel *R–CPE* element. As part of a systematic study, the dependence of impedance response on the relative humidity has been also evaluated. At room temperature and frequency of about 15 kHz, the prepared LNTO ceramics with 2% ZnO and 5% ZnO as sensing materials showed a linear response of impedance change within the wide relative humidity range from 15% to 85%. The experimental results demonstrated that good sensing linearity and stability, small humidity hysteresis error (~ 3%), relatively fast response time (~ 11 s) and recovery time (~ 15s) can be attributed to the high surface area and porous structure of synthesized LNTO ceramics.

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INV10

Luminescence transitions of Pr^{3+} ($4f^2$) in fluorapatite nanocrystals for potential biomedical application

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Fluorapatite (FAP) crystals have drawn significant interest over the last few decades as important hosts matrix for optically active trivalent rare earth ions, due to the strong crystal field splitting and large transition cross-sections. Nano-sized FAP particles doped with rare earth ions have been extensively studied as luminescent materials for biomedical applications for cell labeling and bioimaging, as well as antimicrobial agents for therapeutics.

Fluorapatite nanoparticles doped with praseodymium ions (Pr^{3+}) were prepared by the co-precipitation method and characterized. The different number of Pr^{3+} ($4f^2$) transitions in the ultraviolet and visible parts of the spectrum was investigated by photoluminescence spectroscopy. Multivariate Curve Resolution–Alternating Least Squares (MCR-ALS) analyses of fluorescence spectra and *ab initio* calculation indicated that Pr^{3+} ions are preferentially substituted Ca2 (*6h*) sites in FAP lattice. In addition to the substitution of cations, there is also the substitution of anionic species such as OH^-, CO_3^{2-}, and NO_3^-, which

are confirmed by the CHNS method. The obtained samples were tested as bioimaging and antibacterial agents and can potentially be used for further biomedical research.

INV11

Chalcogenide glasses as memristive materials

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Nowadays memristive materials are an attractive field of study due to their importance in application in artificial neural networks inspired by biological neurons and synapses. Chalcogenide glasses (ChG) are promising memristive materials considering that they possess good resistive switching properties which are necessary for the fabrication of the active layer of the memristive devices.This study reports memristive properties of silver doped Ag-$As_{40}S_{30}Se_{30}$ ChG glasses as an active layer in Ag/chalcogenide sample/Ag memristive structure. Experimental results showed that the investigated samples with different silver concentrations possess bipolar resistive switching characteristics. Namely, under the influence of external voltage stimulus, these materials change their resistance between two different states i.e. high resistance state (HRS) and low resistance state (LRS) at low current values. Further, constant value of memory window in whole measurement temperature range remains the same indicating its stability. Good resistance ratio between HRS and LRS and its good switching endurance are beneficial for its application in memristive devices. Also, analysis of the obtained results showed that the doping with Ag affects the resistive switching voltage by decreasing its value with increasing the silver concentration. Direction of the pinched memristive loops indicates possible filamentary type of resistive switching effect that was explained through the formation and degradation of the silver conductive filament in ChG materials. Furthermore, presence of phase separation in these materials may be crucial in the formation of conductive filaments in active layer of memristive devices.

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INV12

Novel Diboride Ceramics for Extreme Environment Applications

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The present work reports the preparation, characterisation, and mechanical properties of novel diboride ceramics for extreme applications. It is divided into three parts. The first will focus on the effect of rare-earth (RE) oxides and RE zirconates (2 – 10 wt.%) on the densification, microstructure, and mechanical properties of ZrB_2-25vol.%SiC composites. The ablation resistance of the RE-containing composites was significantly improved by 80 % when compared to RE-free diborides. In the second part, highly pure (Ti-Zr-Hf-Nb-Ta)B_2 high-entropy boride ceramics (HEBs) were produced by two-step spark plasma sintering, consisting of boro/carbothermal reduction of oxide precursors and pressure-assisted sintering. The room temperature mechanical properties of HEB continuously increased with the increasing amount of SiC up to 20 vol.%, while the dynamic oxidation rate of the materials significantly decreased. The third part will focus on the preparation of highly textured TiB_2 ceramics by slip casting an aqueous suspension in a magnetic field of 9 T, followed by sintering using SPS. The sintered material exhibited a Lotgering orientation factor of 0.90, with the c-axis of TiB_2 oriented parallel to the magnetic field and SPS pressing direction. The textured TiB_2 material exhibited a significant anisotropy in mechanical properties, such as hardness, elastic modulus and wear resistance.

INV13

Alumina supported catalysts for biodiesel production

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Chemical synthesis of the Al_2O_3-based catalysts, supported with the selected dopant (KI) was aim of this study. The catalysts were synthesized by modified (sol-gel, reflux and hydrothermal) method using aluminum-trisecbutoxide as a precursor. The optimal conditions for the synthesis, modification and activation of the catalyst were examined. Physico-chemical characterization of synthesized catalysts was performed (analysis of textural, structural, morphological, thermal and surface properties of catalysts). The catalysts activity were tested in transesterification reaction. The influence of different process parameters (reaction temperature, stirring rate, mass fraction of the catalyst, molar ratio of reactants, influence of co-solvent, etc.) on the reaction yield were studied. The modified sol–gel method for synthesis of γ-Al_2O_3 catalyst support is proven to be the most favorable for obtaining the catalyst with superior catalytic performances in transesterification of sunflower oil. A maximum conversion (triglycerides to methyl esters) of 99.99% was achieved using the SG-TS-KI/γ-Al_2O_3-770 catalyst under following optimal process parameters: reflux of methanol, 12:1 methanol to sunflower oil molar ratio, 2 wt% catalysts loading, 600 rpm stirring rate, 10 wt. % dichloromethane and 4 h of the reaction run.

INV14

Densification of Dual Phase High Entropy Boride-Carbide Ceramics by Pressureless Sintering

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Dual-phase, high-entropy boride-carbide ceramics were densified by conventional powder processing and pressureless sintering. Powders were synthesized by a two step process consisting of carbothermal reduction of oxides to form the carbide phase, then partial conversion of the carbide to boride by reaction with boron carbide. Relative densities up to ~96% were obtained for ceramics containing about 30 vol% high entropy boride and 70 vol% high entropy carbide. Isostatic pressing at 200 MPa resulted in higher relative densities of both the green bodies and final ceramics compared to uniaxial pressing. The highest relative density of 96.3% was achieved for a ceramic that was isostatically pressed at 200 MPa and sintered at 2300°C for 2 hr. Grain sizes of the resulting ceramics were ~2 μm. This presentation will discuss the processing and properties of the dual phase boride-carbide ceramics.

INV15

Metal oxide nanoparticles as active food packaging components

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Replacement of non-degradable food packaging materials with a biodegradable alternative enables reduction of environmental pollution. Metal oxides nanoparticles are good candidates for enhancing and ensuring good mechanical, thermal and barrier properties of biodegradable polymer packaging films. Their incorporation in biodegradable food packaging films has also lead to enhanced antioxidant, antifungal and antibacterial properties of the food packaging and also oxygen barrier properties, UV protection, oxygen and ethylene scavenging resulting in an active food packaging material. The synthesis method has a significant influence on the resulting properties of metal oxide nanoparticles. Green synthesis using plant extracts and extracts of plant bio-waste as reducing and capping agents are one direction for obtaining metal oxide nanoparticles with improved antioxidant and antimicrobial properties. Utilization of bio-waste materials both for metal oxide nanoparticle synthesis and as a source of biopolymers for packaging enables better environmental protection and ensures a circular bio-economy. In selection of metal oxide nanoparticles suitable for application in active packaging bio-nano-composites special attention needs to be paid to nanoparticle migration and cytotoxic activity in order to produce safe, active and biodegradable food packaging materials for the future.

INV16

Production of lightweight porous cementitious materials from diatomite via hydrothermal technology

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Industrial minerals like limestone, gypsum and diatomite are abundant in North Macedonia. The first two are very much utilized in the construction industry, while diatomite has not found a utilization yet. In this research the diatomite from Kavadarci region has been used for the production of lightweight porous cementitious materials via hydrothermal technology. The ICP-MS results of the starting material show that it is over 93% SiO_2, with insignificant amount of impurities. XRPD shows that the diatomite is in amorphous state, while SEM images show that this material has a very interesting morphology with many pores in the nanometric range. The hydrothermal process of the mixtures of diatomite and portlandite has been carried out in autoclave at 135°C for 3 hours. The products of the hydrothermal synthesis are porous lightweight cementitious materials that have compressive strength from 15 – 20 MPa and bulk density in the range 0.72 – 0.92 g/cm^3.

INV17

Biosynthesis of ZnO nanoparticles using agro-waste with antibacterial and antioxidant activity

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Green synthesis is a more sustainable option using renewable biomass such as plants as reducing or stabilizing agents compared to toxic chemical compounds. These biological substances also behave as capping agents, which control the size and shape of the nanoparticles. In this work, ZnO nanoparticles (NPs) have been prepared *via* a simple, low cost and ecofriendly method using citrus fruit peel and extracts as biological reducing agents. Zinc nitrate and zinc acetate were used as a source of zinc ions.XRD analysis revealed the formation of a ZnO wurtzite phase without impurities. Synthesized ZnO NPs with an average electronic band gap ~3 eV were obtained and found to have round-like, hexagonal-like or needle-like structures depending on precursor type. EDS analysis showed a homogeneous distribution in Zn and O elements, attributed to single-phase ZnO constituents. Antibacterial and antioxidant activities of synthesized NPs were evaluated. Obtained results showed that ZnO synthesized from nitrate precursors are more effective in inhibiting growth of *Salmonella* and *Staphylococcus Aureus*. Antioxidant activity of ZnO NPs determined using CUPRAC and ABTS assays showed higher activity of ZnO obtained using nitrate precursors. The maximum scavenging activity of 90% was observed at the concentration of 10 mg/ml.

INV18

Friction Force Microscopy as a tool to investigate (electro)catalytic processes at surfaces

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A thorough understanding of (electro)catalytic surface transformations under dynamic reaction conditions is of utmost importance for a knowledge-based catalyst design. Friction Force Microscopy (FFM) as an atomic force microscopy based technique is capable to obtain materials specific information in addition to electrical and structural properties of catalysts in liquid media and under electrochemical conditions. This is especially relevant as surface transitions at early catalytic activity are subtle and might be easily overseen by pure topography mapping.

It is the objective of this work to demonstrate the capabilities of FFM for investigating (electro)catalysts. It has been shown earlier that the frictional behavior of a bare metal differs significantly from its oxy/hydroxy-terminated surface under electrochemical conditions.

The new results on combined electrochemical and frictional experiments on well-defined epitaxial perovskite oxide structures in aqueous liquids are illustrated. This approach represents the first application of these technique with respect to (electro)catalysis. Simultaneously recorded cyclic voltammograms and lateral forces, so-called frictograms, allow to correlate subtle and local surface transformations and the applied potential precisely.

In conclusion, FFM represents a versatile new operando technique to investigate (electro)catalytic reactions under dynamic conditions on a local scale with high sensitivity to materials and structural changes.

INV19

The power of machine learning

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The application of artificial intelligence (AI) is everywhere. The aim of this paper is to show some of the applications of machine learning (ML) in all sciences. We will pay special attention to the application of ML in materials. Models that are currently being applied and to which problems they are being applied with reference to some new model proposals that have not yet been tested. Optimization algorithms often require an iterative evaluation of the objective function. Therefore, computationally efficient modelling approaches are essential in implementing and speeding up the subsequent optimization algorithms. In recent years, the application of Deep Neural Networks (DNN) has become widespread in various fields due to their ability to capture nonlinear dynamics in complex models

INV20

Hybrid Nanoscale Materials for Convergent Technologies

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The convergence of nano-, bio-, and information technologies is based on the understanding of complex hierarchical structures and systems, as well as on the material unity at the nanoscale and on technology integration from that scale. A growing interest in these technologies is a result of their potential to provide solutions to numerous societal challenges, such as advanced healthcare, environmental remediation, sustainable development, and adoption of cyber-physical systems based on the Internet of Things and the Internet of Systems. Taking into account that hybrid nanomaterials possess extraordinary physical and chemical properties derived from their size in the nanoscale, the aim of this work is to present the connection between processing parameters and multifunctional properties of nano scale hybrid materials, focusing on the study of ceramic-polymer structures before they can be nano-engineered into functional devices. The unique functionality of these nanostructures has enabled their applications in numerous devices such as: micro and nano-electro-mechanical systems (MEMS/NEMS), sensors, microactuators, surface acoustic wave devices, polymer electrolyte membrane fuel cells, switches, thermistors, resonators and filters, electrooptic devices, etc. In this study special attention has been paid to their applications in the fields of electronics, biotechnology, environmental protection and remediation.

INV21

In vitro and *in vivo* experimental models to study bioceramics-based biomaterials

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Bioceramics-based biomaterials are widely used in bone tissue engineering and regenerative medicine and there is still a great need for development and improvement in this area. In recent years, more attention has been focused on personalized approaches and the creation of personalized, customized implants and solutions in regenerative medicine, made for specific clinical situation and patient. Prior to potential clinical application, biomaterials have to be thoroughly tested in preclinical studies, to prove their biocompatibility and functionality. For that purpose various *in vitro* cell and *in vivo* animal experimental models have been used. The selection of an adequate experimental model is made based on the type of biomaterial, physicochemical properties, form and its potential application. Tissue engineering triad concept (biomaterial, cells and biologically active factors) has been applied when using biomaterials in order to improve their functionality. We have studied a variety of bioceramics, mostly calcium phosphate-based bioceramics of natural and synthetic origin and composite biomaterials, alone or in combination with different cell types and bioactive factors, such as glycosaminoglycans, vitamins, antibiotics and others. *In vitro* biocompatibility and functionality of bioceramics has been studied in various 2D and 3D cell models and conditions applying numerous methods to study cell functions in interactions with biomaterials. Various animal models *in vivo*have been used such as subcutaneous implantation in mice and rats, bone defects in calvary and tibia of rabbits, and femoral defect in rats. Healing of bone defects, osteogenic and vasculogenic process in implants, as well as the surrounding tissue reaction to implanted bioceramics was studied by histological, histomorphometrical, immunohistochemicaland specific gene expression analysis.
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INV22

Possibilities of integrating alkaline electrolyzer with ionic activators in micro combined heat and power systems

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The utilization of renewable energy sources such as wind and solar increases the available options for a decentralized electricity grid. Water electrolysis is among the most perspective methods of technical development. Cost reduction in electrolyzers is possible only through the development of electrocatalysts and cathode materials. The primary outcomes of the research were the characterization and testing of ionic activators added in a standard solution of 6M KOH in alkaline electrolyzers and integrated into combined heat and power systems. We found that ionic activators based on d-metals such as Ni, Cu, Co or Cr and Mo salt in a standard solution of 6M KOH improve the reduction in energy consumption by about 18%, compared to a non-activated system. The energy efficiencies of the electrolyzer with an activated system were about 70% on the different applied current densities. Increasing the energy efficiency of the electrolytic process is achieved by thermal integration, that is, by connecting the heat exchanger with the electrolyzer and the fuel cell. By establishing the connection of the heat exchanger with the alkaline electrolyzer with ionic activators and the fuel cell, it is possible to increase energy efficiency by thermal integration of the electrolytic process.

INV23

Structural integrity analysis of a hip implant with a ceramic-ceramic sliding surface

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In this paper an analysis of a structural integrity of a hip implant with a ceramic-ceramic sliding surface is presented. The primary reason for introducing this alternative sliding surface is the superior wear resistance of ceramics compared to metal-to-metal or metal-to-polymer sliding surfaces. These and other improved properties, such as resistance to further oxidation (resulting in inertness within the body), high strength and low friction, require the use of controlled, small and uniform grain size (typically less than 5μm) ceramic materials. Cavities within the ceramic materials increase stress and degrade mechanical properties. In ceramics, stresses from thermal contractions are critical because plastic deformation cannot occur, as in the case of ductile materials. Since fracture behavior is one of the critical implant design parameters, it is necessary to understand fracture initiation and its subsequent growth, in order to prevent the catastrophic failure of the implant. Therefore, this paper is focused on the integrity of hip implants with an aim to improve their performance and reliability. When the fracture mechanics parameter, i.e. the measure of toughness of the material in the presence of a finite length crack within the region pertaining to Hooke's Law, is the critical stress intensity factor K_{Ic}, linear elastic fracture mechanics can be applied in biomedical implant design made of ceramic materials. Fatigue fracture studies are aimed towards determining the factors influencing prosthesis behavior in real exploitation conditions. Results presented in this paper indicate that further studies should encompassed numerical analysis of mechanical properties of the materials using the complicated geometries of implants themselves.

INV24

Investigation of tungsten-carbide-oxideas the anode catalysts supports for the proton exchange membrane fuel cells

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A significant research efforts are directed towards the development of compact energy supply devices, so-called stacks of fuel cells, which might be located near or at the point of energy consumption. For widespread use, the most practical are fuel cells with proton exchange membrane, which produce clean electricity, heat and water, at low temperatures. The price of the catalyst limits the mass production and large-scale utilization of fuel cells. Within our research, non-stoichiometric tungsten-carbide-oxide ($W_xC_yO_z$) were developed as support for catalysts based on PtRu for PEM fuel cells. The conductivity, morphology and structure of the synthesized catalysts were investigated. Cyclic voltammetry, linear scan voltammetry and rotating disk electrode voltammetry were used to determine performance of obtained PtRu/$W_xC_yO_z$ catalysts. Special attention was given to the analysis of CO poisoning. The catalyst with the best performance (30% PtRu/$W_xC_yO_z$) has higher number of active sites for HOR and the highest interfacial region which contributes the improved CO tolerance, in relation to the other tested catalysts. By testing this catalyst as an anode catalyst in a single PEM fuel cell, a significantly lower power drop was obtained (16,3%) compared to a single fuel cell that uses commercial catalysts (35,3%). These results highlight the potential of PtRu/$W_xC_yO_z$ catalysts in mitigating performance degradation caused by CO poisoning in PEM fuel cells.

ORL1

Diatomic earth: Structure and modification

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One of the most interesting secondary raw materials within the Kolubara Basin is diatomaceous earth or diatomite, with reserves of 308.670 t in fields B and C.Chemical and mineralogical tests were performed on diatomaceous earth samples.The results of these tests are presented in this paper.Diatomite is a soft sedimentary rock formed by the deposition of cell walls (frustulae) of single-celled algae-diatoms at the bottom of sea and lake basen. Diatom frustules consist of two parts that lie on top of each other and represent a highly porous skeleton of amorphous hydrated silica. Diatom frustule size ranges from 1 μm to 1 mm, usually 10-200 μm.The specific area (S_{BET} (m^2/g)) is 47.6. The SEM/EDS, BET and FTIR methods were used for characterization. Based on the presented results, diatomaceous earth can be used in the pharmaceutical, ceramic and food industries.

ORL2

β-$NaYF_4$:Yb,Tm@TiO_2-Acac core-shell structure for efficient photocatalysis

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Novel hybridcore shell structurewith extensive absorption was synthesized by a two-step wetchemical route. Up-converting β-$NaYF_4$:Yb,Tm core was obtained through EDTA assisted hydrothermal process, while the shell of anatase TiO_2-Acetylacetonate charge transfer complex (TiO_2-Acac) was formed over these *via* sol-gel method. Tetracyclinewas used to investigate photocatalytic efficiency of obtained structure under irradiation of reduced power Vis and NIR spectra. Owing to the fact that $^1D_2 \rightarrow {}^3F_4$ and $^1G_4 \rightarrow {}^3H_6$ emission of Tm^{3+} matches well with the absorption edge of TiO_2-Acac, radiation-reabsorption and FRET processes improve the overall generation of reactive oxygen species and degradation of tetracycline. Beside it, formation of tetracycline intermediates immediately after the addition of this novel hybrid core-shell structures, making them a promising material for water purification through the synergy of catalytic and photocatalytic processes.

ORL3

Graphene oxide/12 tungstophosphoric acid nanocomposites – achieving favorable properties with ion beams for electrochemical supercapacitors

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In recent years graphene oxide (GO)/12-tungstophosphoric acid (WPA) nanocomposites have demonstrated promising potential for electrochemical supercapacitors. However, to enhance their performance, it is necessary to modify the surface chemistry of GO to minimize the influence of basal plane oxygen groups, which hinder the material's conductivity. Additionally, some degree of structural modification of WPA is desired. In this regard, ion beam irradiation presents a promising method to simultaneously optimize surface chemistry of GO and structurally modify WPA. To accomplish this, ion beam irradiation is employed for modification of individual components as well as their nanocomposites with varying mass ratios. Different ion species, fluences and energies were utilized depending on the sample type, ranging from 10 keV C to 710 MeV Bi. Spectroscopy methods were employed to gain insight into the type and degree of structural modification in WPA. A direct correlation is observed between the parameters of the ion beams and the resulting structural changes. As the disordering increases, the structure transitions from partially modified to increased bond breaking, ultimately leading to reconnected bronze-like structures. By increasing the fluence, a gradual modification of the structure and surface chemistry of GO was possible. The effects of irradiation on GO and WPA are particularly pronounced in irradiated composites, where higher capacitance is measured.

ORL4

Influence of Fe Doping on the Crystal Structure and Optical Properties of Mechanically Activated $SrTiO_3$Powders

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Iron-doped strontium-titanate ($SrTiO_3$) powders with various iron(III) oxide (Fe_2O_3) weight percentages (1.5, 3 and 6 wt%) were prepared by a solid-state method in the presence of mechanical activation (10, 30 and 120 min). A systematic investigation by XRD, SEM and Raman spectroscopy has been undertaken to evaluate the role of dopant on the microstructural and morphological study of the perovskite oxideobtained. The optical properties of the different iron-doped and activated Fe-$SrTiO_3$ powders have been also evaluated. The results demonstrated that Fe has been substituted into the lattice and surface layers of particles of $SrTiO_3$ powders and the absorption edge shifted to higher wavelength values with increasing activation time and dopant weight percentage. The lowest value of the band gap (E_g=3.20 eV) was registered for the longest activation (120 min) and the highest weight percentage of dopant (6 wt%). Combining doping with mechanical activation, led to lower values of Eg and that fact could be used in subsequent studies to make Fe-$SrTiO_3$ more suitable photocatalysts.

ORL5

Detection of bisphenol S via screen-printed electrodes

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Screen-printed electrodes are economical, easy-to-use electrochemical sensors that can be used for *in-situ* real-time monitoring of toxic substances. This work represents a comparison of two SPEs electrodes for the detection of bisphenol S (BPS). BPS is an endocrine-

interrupts the hormonal system in humans and shows a genotoxic, cytotoxic and cancer-promoting effect. Fast and reliable detection of bisphenols is very important. Chromatographic and spectroscopic techniques are the most used methods for the detection of bisphenols, however they are expensive, complicated and consume a lot of time. On the other hand, electrochemical sensors are promising since they are fast, reliable and simple methods for in-situ measuring. In the present work the detection of BPS was performed via screen-printed electrodes with carbon nanoparticles and carbon single-wall nanotube working electrodes. Determination of BPS was carried out by cyclic voltammetry (CV) and differential puls voltammetry (DPV). The influence of different concentrations of BPS, scan rate and influencing BPA on detection were studied. Screen-printed electrodes showed very good electrochemical activity, sensitivity and repeatability. Screen-printed electrodes enable the miniaturization of sensors elements, using smaller volumes of samples, rapid and low cost detection without generating dangerus waste.

ORL6

Structural characteristics of $MgAl_2O_4$ spinel

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Magnesium aluminate spinel ($MgAl_2O_4$) is a material with good mechanical, chemical, and thermal properties, low dielectric permeability and loss tangent. Based on those properties, $MgAl_2O_4$has found a significant application in refractory ceramics, ceramics windows, integrated electronic devices, etc. Also, it possesses a high chemical and radiation resistance. In this research, MgO was calcined at 1000^{o}C for an hour, with a step of 10^{o}C/min to avoid presence of hydroxide or carbonate. MgO and Al_2O_3 powders were mixed in a one-to-one molar ratio afterwards. The powders were mechanically activated for 15, 30, and 60 minutes. The mass ratio of powder and balls was 1:40. The mechanically activated powders are pressed in the tablets, under the pressure of 0.5 t. The pressed powders were heated up to 1300 ^{o}C with a step of 10 ^{o}C/min and held for 1 h for the reaction. Reacted pellets were crushed and sieved. Obtained spinel powders were sintered at 1450 ^{o}C for 2 h. Both sintered and non-sintered samples were investigated by XRD and SEM. The particle size distribution of the reacted powders was investigated bylaser diffraction analysis. Raman spectroscopy was used to determine the lattice vibration in the sintered samples. All results are in accordance with our previous results, and the pure dense spinel phase is obtained.

ORL7

Optimization of processing parameters for high entropy dual phase ceramics

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High entropy carbide/boride (HEC/HEB) ceramics are materials with a wide range of possible applications in harsh environments due to their good mechanical properties, oxidation resistance, and thermal stability. They are usually formed by the solid solutioning of four or more transition metals (TM) in the boride and carbide lattice. In this research, boro/carbothermal reduction was used to form an individual diboride and carbide phases from oxide mixtures. The stoichiometry of the reaction was varied in order to synthesize pure dual phase ceramics. The reacted powders were spark plasma sintered (SPS) or hot pressed (HP), using a two-step process, to produce dense ceramics and to develop the solid solutiosn. Ceramics processed by SPS still contained residual oxides, while ceramics produced by HP were nominally phase-pure high entropy dual phase materials. Preferential segregation of the TMs was detected by energy dispersive spectroscopy. Vickers hardness measurements confirmed that the highest hardness was obtained for specimens densified by HP at 1950°C that contained no residual oxides and had the smallest grain size. The hardness increased from 25.7 ± 0.2 GPa to 33.6 ± 2.2 GPa with decrease applied load from 9.81N to 0.49N, respectively.

ORL8

Kinetics and mechanism study of photocatalytic degradation using heterojunction semiconductors

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Photocatalytic processes have been recognized as promising and sustainable methods for pollutant degradation and energy conversion. Due to the simplicity of the process, capacity for using renewable and pollution-free solar energy, mild reaction conditions, reasonable reaction time, complete pollutant degradation, no harmful byproducts, and cost-effectiveness, photocatalytic degradation processes are more promising than conventional physical methods. Due to its favorable properties, TiO_2 semiconductor has been used as an ideal candidate for photocatalytic reactions. However, large band gap, fast e^-/h^+ recombination, and low light harvesting efficiency are the main obstacles that restrict its practical application. Using g-

C_3N_4 semiconductor in combination with $TiO_2$is an excellent strategy to enhance the photocatalytic activity under visible light irradiation. In this study, g-C_3N_4/TiO_2photocatalyst was successfully synthesized and used in single and simultaneous photodegradation of cationic Methylene Blue and anionic Orange G dyes. To examine the heterojunction between g-C_3N_4 and TiO_2 and the mechanism of the transport pathway of photogenerated e^-/h^+, the photoluminescence spectra and radical scavenger study were applied. The present research offers a novel approach in reaction mechanism analysis for degradation of dye pollutants in single/mixed solutions and suggests a strategy for determination of heterojunction type in g-C_3N_4/TiO_2 systems.

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ORL9

The lumped approach in drying modeling of roofing tiles – variable effective diffusivity determination

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In this paper, the drying modeling of roofing tiles was done using a "lumped" approach. In other words, several forces that are influencing internal moisture transport are combined to create effective moisture diffusivity. For this reason, the effective diffusivity coefficient was added to Cranck's diffusion equation. In their earlier works, the authors published the solution to the diffusion equation, which assumes that effective diffusivity is constant. It was demonstrated that, particularly if shrinkage is not taken into account during the computation stage, the simulated drying curves differ from the experimental results. The next step was to ascertain the time-dependent effective diffusivity and to more precisely anticipate the drying kinetic. The general functional relationship between effective moisture diffusivity and Fourier number was first determined to fulfill this assignment. Experimental proof of the proposed model was provided. Less than 3% of the outcomes from the simulation and the experiment deviated from each other. This was a resounding affirmation that effective diffusivity is not constant during drying and that all internal transport mechanisms are observable in their time-dependent relation.

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ORL10

Electrochemical testing of iron phosphor tungsten bronzes as potential electrode material

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In this work, synthesized 12-tungstenphosphoric acid ($H_3PW_{12}O_{40} \cdot nH_2O$, PWA) was further ionically exchanged with Fe^{3+} ions, which led to the formation of the FePWA salt ($FePW_{12}O_{40}$ x nH_2O,). FePWA was then subjected to thermal analysis (TGA/DTA), which determined the phase transition temperature (i.e.. when the Keggin anion collapses). The temperature of collapsing the Keggin anion is about 600 °C, at which phosphate tungsten bronzes doped with iron (FePWB) are obtained. Obtained FePWB was further characterized by XRPD and FTIR, which confirmed the formation of the desired structure. FePWA and FePWB were examined as an electrode material for aqueous rechargeable batteries due to the channels and cavities present in their structure. Experiments were done in aqueous solutions of 6 M $LiNO_3$ by cyclic voltammetry. The differences in the redox processes of heteropoly acid salts and iron-doped bronze were discussed thoroughly and correlated with the XRPD and FTIR results. The catalytic activity is also investigated by Briggs-Rauscher method followed potentiometricaly.

ORL11

Why delamination cracks occur in ceramics manufactured via DLP, and how to eliminate them

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Digital Light Processing (DLP) of ceramics allows the creation of ceramic parts with unprecedented resolution for various applications, from medical tooling to archeological restoration. However, the manufacturing of a crack-free sintered ceramic part using DLP has been an arduous challenge in bothindustrial and academic research. Thus, as a result of numerous experimental and analytical studies, this contribution provides a guide for the elimination of delamination cracks in sintered ceramic parts manufactured via DLP. Photo-rheology, UV/Vis spectrophotometry and multiple microscopy techniques were used to critically analyze the formation of delamination cracks, their culprits and the possible methods to eliminate such cracks. It was found that proper particle dispersion, sufficient air extraction, optimized resin formulation, optimized printing parameters and sound design

principles jointly contribute to the manufacturing of a delamination cracks-free ceramic part using DLP. In this oral contribution, the author will address each one of the aforementioned factors from a practitioner's perspective, offering practical knowledge for a more successful additive manufacturing of ceramics using DLP.

ORL12

Moisture regulation in urban spaces with clay-based plaster

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Unbaked country on the base clay is renewable building material. It is required for processing low energy. By combining salts, and organic materials we can make mortar or tiles with good sorption characteristics. It is known that sorption moisture and heat are highly dependent on the amounts of water contained in her porous network and her evolution with external conditions (temperature, humidity). A kilogram of porous material on the base clay can adsorb 10 to 20% of moisture in the ratio of the own mass. Installation of tile on the base soil, clay and accessories should be done close to the ceiling because water vapour is lighter from the air. Thereby without investment Energy can regulate humidity premises. Cubic air contains 10 to 20 g of moisture. Relative humidity which is optimal for humans is 45-65%. The optimal humidity is about 55%. The goal of the work is presentation possible natural tile or plaster from the unbaked clay with additions to regulate relative humidity in urban areas spaces. In summer because of the climate and in the winter because of the radiator the relative decreases in humidity in the premises where they are staying people. Regulation moisture sorption and desorption held not only humidity air already and composition. This also saves energy how does heating like that and cooling.

ORL13

Origin and sustainability of negative ions in the air

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Negative ions are molecules with additional electrons. They are odourless, tasteless and invisible molecules. We breathe abundance in certain environments like table waterfalls, beaches and mountains. When coming to our blood flow, anions produce biochemical reactions who is neutralized free radicals, they revitalize cellular metabolism and protect the

Body and mind from harmful effects and stressors Surroundings like a table are electromagnetic fields.

Vedas mention negative ions in the context of a vital environment; which carry atoms of oxygen which are good for life in the middle and the health of people. Rigveda and Ayurveda are indicated on thenegative ions. At the crossing centuries, the winner Nobels prize for physics, Dr Philippe Eduard Anton Lenard, confirmed that the negative ions are found in very big density in the basin waterfalls and on the sea Dr Svante August Arrhenius, a Swedish chemist who got Nobel's prize for chemistry in 1903, he discovered that the air is full of negative ions nearby waterfalls and the forest He formulated his theory electrolytic dissociation or "ionization". Negative ions increase the supply of oxygen to the brain to be whole neurological the system is active. The increased presence of negative ions is in caves, tunnels, mountains, nearby waterfalls, and mowed-down meadows. Leaves plants to produce negative John, and dew grass produces negative ions. A balance of positive and negative ions exists in nature. However, urban environments with concrete, product combustion, electronic devices, and antennas contain significantly more positive ions. Because very much short times existence it is necessary all the time to have treasure elevated negative in the relationship on the positive ions. With this work, we will process conditions of origin negative ions in nature and utilise a generator with goal extensions of their times' duration.

ORL14

Visible Light Driven Photocatalytic Ceramic Based Nano-Composites

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Aiming to invent an efficient self-cleaning solution for inner spaces, the goal of this research was to develop a pure visible light driven photocatalytic suspension which can be applied onto interior walls and wall paints. Ceramic based nano-composite layered double hydroxides (LDH), known as materials suitable for carrying certain active functional molecules, were used to carry metal-doped TiO_2. As titania is a very good photocatalyst, although active only in the UV region, doping with transition metals was used for the reduction of the activation (band-gap) energy. Series of molybdenum doped and tungsten doped TiO_2-ZnAl-LDH suspensions were synthesized using a modified low supersaturation co-precipitation route at various pH values and with different dopant to titanium ratio.

Detailed material characterization studies by means of scanning and transmission electron microscopy (SEM/TEM), thermogravimetry (TG), dynamic scanning calorimetry (DSC), as well as microstructure analysis by X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR) were performed. The photocatalytic self-cleaning properties of the optimally synthesized TiO_2 doped LDH suspension were assessed when applied on stone, brick, wall paint and glass substrates after having been illuminated only with LED visible

light. They were subsequently compared to the properties of commercially available self-cleaning solutions for application on mineral substrates.

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Poster Session I (P1-P13) Club SASA 19th September, 17.20-19.00

P1

Laser-induced graphene on PEO/PDMS composites

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Laser-induced graphene (LIG) has emerged as one of the most promising materials for flexible functional devices. One-step fabrication of LIG offers advantages such as low cost, patterning of desired geometries, and high sensitivity. However, previous attempts to obtain LIG on elastomeric substrates have been unsuccessful, limiting its potential for use in stretchable electronics. In this study, we propose using a substrate composed of polydimethylsiloxane (PDMS) and poly(ethylene oxide) (PEO) with a low molecular weight as a platform for manufacturing LIG. A series of PDMS/PEO materials with varying concentrations of PEO (1, 5, 10, 20, 30, 40 and 50 wt.%) were prepared using a cast-based approach, starting from divinyl-terminated-PDMS and poly(methyl-hydrogensiloxane). The prepared PDMS/PEO/graphene composites were characterized using Raman spectroscopy, Fourier transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM) analysis. FTIR analysis confirmed the structure of the prepared PDMS/PEO and PDMS/PEO/graphene materials. The results demonstrated that the prepared PDMS/PEO composites exhibited a higher degree of graphenization compared to pure PDMS networks. SEM analysis revealed the formation of a porous graphene structure. Based on these findings, the PDMS/PEO/graphene composites show promise for further investigation as electronic device applications.

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P2

Structural and thermal properties of PDMS/Triton/laser-induced graphene composites

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Laser-induced graphene (LIG) has recently been proposed as a viable option for fabricating various types of flexible electronic devices due to its excellent mechanical stability and electrical properties. During laser induction of graphene on polymers, the high temperature generated with the laser breaks C-O, C=O, and N-C bonds in polymers, leading to the recombination of C and N atoms. Additionally, the rapid release of carbonaceous and nitric gases results in the formation of 3D porous structures. This approach offers a one-step, chemical-free synthesis method for producing porous graphene on polymer surfaces. Moreover, it is a fast and cost-effective technique that is ideal for flexible electronics and energy storage devices. In this study, graphene was formed on a poly(dimethylsiloxane) (PDMS)/Triton substrate with varying concentrations of Triton (1-30 wt.%) using CO_2 laser irradiation. The effects of Triton content on the structural, thermal, and surface characteristics of PDMS/Triton and PDMS/Triton/graphene materials were investigated. The prepared PDMS/Triton/graphene materials were thoroughly examined using X-ray diffraction analysis (XRD), thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and water contact angle analysis. XRD analysis confirmed the presence of graphene in the material. The thermal and surface properties of the proposed materials can be easily adjusted by manipulating the Triton concentration. The hydrophilicity of the prepared PDMS/Triton materials increased compared to pure PDMS, which is hydrophobic. It was found that the success of LIG formation depends on Triton content, increasing with higher concentration of Triton in the PDMS matrix. The presented results aim to address the existing challenges associated with stretchable polymers suitable for flexible electronic device applications.

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P3

Lime based mortars: compositional and microstructural compatibility for use in restoration

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Lime-based mortars are one of the mostly applied materials through construction history. Since the possibilities of acquiring mortar samples for testing from the historical site locations are very restrict, it was necessary to involve different techniques for the characterization of original mortars, from chemical, mineralogical and microstructural point of view. Similarly, for the characterization of the newly prepared mortars intended for restoration purposes, same testing methods are proposed. In this work some of the testing techniques that show potential in this area are presented, emphasizing their strong points and weaknesses. Laboratory-prepared lime mortars, were tested using FTIR, TG-DTA, XRF, XRD, MIP, SEM-EDX and Raman Spectroscopy, before and after exposure to the action of soluble salts. Peaks positioned at 3640 cm^{-1}, 875 cm^{-1} and 1418 cm^{-1}, measured by FTIR, are good indicators of presence of portlandite ($Ca(OH)_2$) and calcium carbonate, respectively. Similarly, TG-DTA peaks around 480 ºC and between 600 ºC and 800 ºC also indicate their presence, with the possibility of quantitative evaluation. Quantifying the presence of soluble salts was performed using XRF measurements. Distribution of the salts and reaction products between salts and mortar matrix was analyzed using SEM images. In some cases, type of reaction products, were registered using Raman Spectroscopy. Unexpectedly, they were not detected through XRD analysis. According to performed analyses tested mortars show good potential as restoration materials.

P4

Effect of grain size and domain structure on electrical properties of rare earth doped $BaTiO_3$ ceramics

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The influence of microstructure, grain size, and domain structure on the electrical properties of Ho, Er, and Yb-doped $BaTiO_3$ ceramics was investigated in this paper. The samples were doped with rare earth ions from 0.01 to 1.0 at% and sintered at 1320°C and 1350°C. The samples were obtained by conventional solid-state sintering technique.

All samples sintered at a low temperature (1320°C) are characterized by a fine-grained microstructure with an average grain size of 2-6 μm. In the samples doped with a higher concentration of dopants (greater than 0.5at%) and sintered at a higher temperature (1350°C), the appearance of secondary abnormal grains with a domain structure was noticed. All investigated samples are insulators and show high electrical resistivity. For ceramics doped with a lower concentration of additives (0.01 and 0.1 at% Ho, Er, and Yb) sintered at 1350°C, the higher values of the dielectric constant were obtained. Lower values of dielectric constant were measured for samples with an additive content above 0.5 at%, and they are a consequence of secondary abnormal grain growth and the presence of non-ferroelectric phases. All investigated samples have low dielectric loss values, ranging from 0.01 to 0.06. Dielectric parameters, characteristic for this type of doped ceramics, such as Curie temperature, Curie constant, and Curie - Weiss temperature, were calculated for all samples.

P5

Fabrication of porous anorthite-based ceramics using solid wastes for cost-effective thermal insulation of buildings

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There is a global tendency to reduce the consumption of energy required for heating as well as cooling buildings. Therefore, thermal insulation technology becoming important in preventing both, the gain and loss of heat through the building envelope. This work aims to evaluate the feasibility of using inexpensive raw materials such as kaolin and waste material such as seashells and banana peel for fabrication of the sustainable anorthite-based porous ceramics for thermal insulation. Kaolin was used as a source of Al_2O_3 and SiO_2, seashells as a source of CaO whereas banana peel was used as a pore former. The phase composition, bulk density, open porosity, compressive strength, microstructure, and thermal conductivity of the ceramic samples, were analyzed. The obtained results showed that the variation of pore

former (banana peel) content and sintering temperature was an effective way to control the thermo-mechanical properties of the obtained anorthite ceramics. Samples with open porosity (1.4 – 45%), compressive strength (>15 MPa), bulk density (1.87-2.62 g/cm^3), and thermal conductivity (0.097-3.67W/mK) were obtained after sintering of samples with different percent of banana peel at 1100–1200 °C. It suggests that the obtained porous ceramics can be used for cost-effective thermal insulation of buildings.

P6

Tailoring the ZnO/RuO_2 ratio in composite electrocatalysts for efficient HER and OER

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The increasing demand for efficient catalysts has raised concerns about the limited availability and high cost of platinum group metal (PGM) catalysts. Ruthenium dioxide (RuO_2) has shown remarkable catalytic activity; however, its extensive use is hindered by its high cost. To tackle this challenge, we investigated the utilization of zinc oxide (ZnO) as a promising alternative to reduce reliance on expensive RuO_2 catalysts while maintaining catalytic performance by synthesizing ZnO/RuO_2 composites in various mass ratios (1:1, 2:1, 10:1) through microwave processing of a precipitate, followed by calcination at temperatures of 300 and 600 °C. The crystallinity and phase purity of the particles were analyzed using X-ray powder diffraction (XRD) and Raman spectroscopy. Surface chemistry was examined by Fourier-transform infrared (FTIR) spectroscopy. Field emission scanning electron microscopy was employed to investigate the morphology and particle size. Photoluminescence and UV-Vis diffuse reflectance spectroscopy were utilized for analyzing the optical properties. The electrocatalytic activity of the materials were evaluated via linear sweep voltammetry in both acidic (0.1 M H_2SO_4) and alkaline (0.1 M NaOH) electrolytes. The ZnO/RuO_2 composites exhibited outstanding catalytic performance for both the hydrogen evolution reaction (HER) and the oxygen evolution reaction (OER) in both types of electrolytes.

P7

Physical changes of Ti – TiO_2 – oxidant system, by intensive thermo – chemical oxidation with rapid thickness growth of dielectric oxide layer n - conductivity type

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Titanium oxidation process is thermodynamically spontaneous and its speed depends on kinetic and diffusion process parameters. According to optical measurements results, the oxide layer formed on titanium has a thickness of only 1.7 nm. A layer of this thickness is formed at room temperature within two hours, and in 40-50 days it grows to 3.5 nm. TiO_2 is a non-stoichiometric dielectric oxide of n-type conductivity. The goal of this work is to significantly speed up the oxidation process by thermo-chemical oxidation and achieve oxide thicknesses over 100μm. An intensive thermo-chemical process creates disorders with oxygen vacancies excess ($O_{\square}^{\bullet\bullet}$) and with a smaller representation of interstitial disorders ($Ti_{\bullet}^{\bullet}$). By thermo-chemical oxidation of Ti - TiO_2 - oxidant system, by choosing numerous oxidants, a composite system was obtained with a significant increase in disorder degree of active centers - defects about 10^{18} to $10^{20}/cm^3$. Thus, the significantly disordered structure of Ti – TiO_2 – oxidant system can be a very active dielectric diode in Ti – TiO_2 – M system (M is some vaporized metal). Such a diode has stable rectification properties at high temperatures up to 10^6 times, which makes it more reliable compared to the active element of semiconductive p-n diode system.

P8

Characterization of nanostructured spinel ferrite obtained by mechanochemical synthesis

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Powdery $CoFe_2O_4$ has been obtained by mechanochemical synthesis in a planetary ball mill. The obtained sample has been studied using a variety of characterization techniques: X-ray diffraction (XRD), Raman spectroscopy, far infrared (FIR) reflectivity and attenuated total reflectance (ATR) in combination with *Fourier-transform infrared* (FTIR) *spectroscopy* in mid IR spectra. The investigated $CoFe_2O_4$ sample showed a typical cubic spinel XRD pattern. In the Raman and IR spectra are observed all of first-order Raman and IR active modes. Weak sub-bands activated by structure disorder are seen also. As nanoparticle sample of $CoFe_2O_4$ are macroscopically cubic, their main Raman and IR modes are assigned as in normal cubic spinel. It is observed that the value of $x = 0.58$ obtained from Raman spectrum,

is in good agreement with the value obtained by XRD-structural analysis (0.51). Raman spectrum is fitted with 7 Lorentzian peaks. To analyze the IR spectra, we used *Kramers-Krönig*analysis. Measurement of magnetization, i.e. coercivity, enable the calculation of the anisotropy coefficient $K_1 = 4.02 \cdot 10^5$ J cm^{-3}, which is very high in cobalt ferrite. The 57Fe-Mössbauer spectrum of the $CoFe_2O_4$ sample was measured at room temperature in □ ± 12 mm s^{-1} Doppler velocity range. The 57Fe-Mössbauer spectrum of the $CoFe_2O_4$ sample was fitted with the extended Voigt-based fitting method.

P9

Photocatalytic activity of $SrGd_2O_4$ down and up-convertor systems

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Issues with air and water pollution have become a worldwide problem. Photocatalysis is a technique that holds promise for resolving these urgent issues due to its sustainability, affordability, and environmental friendliness. Recently, anti-Stokes and Stokes luminescence materials have been identified as potentially efficient candidates for photocatalysis exploitation. Under irradiation, doping different Ln^{3+} ions in an inorganic host will induce designable down and up-conversion emissions beginning in the UV and extending to the NIR region. This investigation will examine the photocatalytic application of the chosen samples. All samples were successfully prepared *via* sol-gel assisted combustion method. X-ray Powder Diffraction pattern proved that all samples crystallize as a pure orthorhombic phase of $SrGd_2O_4$. Scanning and transmission electron microscopy was used for morphology characterization and it revealed the existence of porous agglomerated round-shaped particles favorable for photocatalytic application. Energy Dispersive X-ray Spectroscopy showed the presence of dopant ions and even distribution of all constituting elements. Under simulated solar light irradiation, the photocatalytic characteristics of down-convertors were investigated in the photocatalytic degradation of organic dye methyl orange (MO). During the experiment, a UV/Vis spectrometer was utilized to measure a drop in MO concentration in water solutions. Aliquots of the working solutions were taken at precise time intervals, and the results show that the dye breakdown rate was successful after 4 hours. Methylene blue (MB), as a test pollutant, was used to investigate its photocatalytic efficiency under irradiation of simulated sunlight of up-conversion samples. The obtained results were encouraging because more than 50% of the starting dye concentration was mineralized after 4 hours of exposure to the simulated Sun irradiation.

P10

Characterization of polyurethane/ferrite nanocomposites

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Polyurethane (PU) nanocomposite materials, offer very desirable advantages over pure PU materials,as the nanocomposites have enhanced thermal, surface, mechanical and biological properties. The main goal of this study was to develop a new kind of novel nanocomposites consisting of crosslinked PUs (based on poly(dimetylsiloxane) and hyperbranched polyester) and ferrite nanoparticles (based on copper and zinc) for possible application as coatings on biomedical devices and implants. A series of PU/ferrite nanocomposites was prepared by *in situ* polymerization in solution. Characterization of prepared nanocomposites nanocomposites was conducted by Fourier transform infrared spectroscopy (FTIR) and atomic force microscopy (AFM). Copper and zinc releases were investigated by microwave plasma atomic emission spectrometry (MP-AES). Characteristics of the prepared nanocomposites when in contact with a biological environment were examined through testing their biocompatibility, and adhesion of fibroblast cells. The presence of the nanoferrite nanoparticles influenced on surface and biological properties of PU nanocomposites. The prepared PU nanocomposites with noncytotoxic chemistry could be used as promising materials for vascular implants development.

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P11

Impact of synthesis parameters on the properties of polymer/MXene nanocomposites

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MXenes are a relatively new class of 2D nanomaterials with promising properties. The functional groups on the surface of the nanosheets play a vital role in interacting with other materials, especially in nanocomposites. Biocompatibility, admirable mechanical properties, and thermal stability are the most significant properties of poly(dimethylsiloxane)-based polyurethanes (PU). They are highly convenient for applications in electronic devices and implants. In this study, the MXene content was 1 wt. % for two series and 0.5 wt. % for the other two series, while the soft segment content was 50 wt. % for all the series. The nanocomposites were obtained using an *in-situ* polymerization method. The timing of adding the MXene nanoparticles to the reaction mixture was also varied to examine the changes in the physico-mechanical properties of the nanocomposites. Differential scanning calorimetry (DSC), scanning electron microscopy (SEM), and tensile tests were conducted to analyze the properties of the resulting materials. The glass transition temperature is highest for the series in which MXenes are added in the first phase of polyaddition after the solvation of MDI, while the series with 0.5 wt.% MXene added later into the reaction exhibit two transitions. SEM images revealed uneven distribution and agglomeration of MXene nanoflakes when added into the siloxane prepolymer. The tensile test indicated that the series with 0.5 wt. % nanoflakes have significantly lower Young's modulus and tensile strength. The distribution of nanoparticles and surface morphology are strongly influenced by the timing of adding the MXene dispersion into the reaction mixture, as well as the nanoparticle content.

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P12

The osteogenic effect of Germanium-doped hydroxyapatite nanoparticles on dental pulp stem cells

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Most of the applications for various forms of ion-doped hydroxyapatite have been geared towards pharmacy, dentistry and medicine. This study presents the first biological, response to germanium-doped hydroxyapatite (Ge-HAp). Viability, osteogenic differentiation induction and colony formation potential of dental pulp stem cells (DPSCs) in the presence of Ge-HAp and pure, Ge-free HAp nanoparticles was assessed. DPSCs were isolated from semi-impacted wisdom teeth extracted from systemically sound patients. MTT was used to determine cell viability after 1, 3, and 7 days of incubation. The effect of Ge-HAp on the expression level of osteodifferentiation markers (RUNX2, ALP, and OCN) was determined using RT-qPCR, and mineralized nodule formation was confirmed using Alizarin Red S staining. The colony-forming unit assay was utilized to evaluate the colony-formation potential of the DPSC. Low dosages of Ge-HAp increased cell viability compared to HAp after a week. Ge-HAp increased cell culture mineralization more than HAp. Ge-HAp substantially upregulated all three osteogenic markers relative to control and Ge-free HAp-exposed cells. HAp and especially Ge-HAp hindered stem cell colony formation. As demonstrated above, Ge-doped HAp nanoparticles have great promise in regenerative medicine due to their biocompatibility and osteoinductivity.

P13

Influence of N^{5+} ion irradiation on physicochemical properties of bismuth vanadate

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Photoelectrochemical (PEC) cells for solar-energy conversion have received huge interest as a promising technology for renewable energy production. For the efficient application of such cells, it is necessary to develop adequate photoelectrodes. Recently, bismuth vanadate ($BiVO_4$) has emerged as a promising photoanode due to its visible light harvesting properties, band edge positions and low-cost of synthesis. In this study, the effects of N^{5+} ion irradiation

(75keV, 2 × 10^{14} and 4 × 10^{14} ions/cm^2) on physicochemical properties of hydrothermally synthesized $BiVO_4$ thin films were examined. From X-ray diffraction (XRD) study can be concluded that initial monoclinic material didn't sustain any phase transition after irradiation. Also, preferential orientation remained dominantly along [010] direction with a slightly increasing share of [121] oriented growth, especially after irradiation with 2 × 10^{14} ions/cm^2. XRD measurements showed shift towards the higher 2θ after irradiation which indicates that interplanar distances decreases. The highest level of crystallinity was observed for the sample irradiated with fluence of 4 × 10^{14} ions/cm^2. Scanning electron microscopy (SEM) revealed prismatic morphology of all samples with an average grain size of 600 nm without visible traces of irradiation.Raman spectroscopy confirmed presence of bands that correspond to the monoclinic scheelite phase. X-ray photoelectron spectroscopy (XPS) analysis of V 2p confirmed presence of V^{5+} and V^{4+} while analysis of O 1s confirmed presence of oxygen in the form of lattice oxygen and in the form of hydroxide. UV-Vis Diffuse Reflectance spectroscopy revealed that calculated band gap decreases with the increase of fluence.

Poster Session II (P14-P45) Club SASA 20th September, 09.00-10.00

P14

Approaches to improve photo(electro)catalytic properties of ZnO-based materials

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Due to their tunable multifunctional properties zinc oxide (ZnO) based materials have attracted extensive scientific and technological attention. Since they combine different properties such as electrochemical activities, chemical and photochemical stability, non-toxicity, biocompatibility, etc. ZnO-based materials have been used in electronics, opto-electronics, biosensing, bioimaging, drug and gene delivery, implants, antimicrobial and anticancer agents. Successful application of ZnO as photoelectrocatalysts arises from its wide band gap (3.37 eV) which can be easily adjusted by different approaches such as: metal and non-metal ion doping, hydrogenation, introducing of crystalline defects, modifying particle morphology and surface chemistry. During the years, to synthesize zinc oxide (ZnO) nanoparticles with improved visible light absorption we have used a fast and environmentally-friendly microwave processing of a precipitate which enable formation of crystalline defects. To further enhance photo(electro)catalytic properties we have employed approaches such as: (1) the incorporation of iron ions into the crystal structure ($Zn_{1-x}Fe_xO$), (2) sensitization of the particles' surface with cetyltrimethylammonium bromide, Pluronic F127 and polyethylene oxide, and (3) composites with ruthenium oxide (ZnO/RuO_2) and graphene oxide (ZnO/GO and ZnO/rGO). To correlate structural and functional properties, prepared materials were characterized using XRD, FTIR, Raman, UV-Vis DRS, and PL spectroscopy, also FESEM; photocatalytic activity of the samples were tested toward

decolorization of methylene blue, while their photoelectrochemical activity for water splitting were tested through linear sweep voltammetry in different electrolytes.

P15

Examination and characterization of nanostructured $Co_{0.9}Ho_{0.1}MoO_4$

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The nanostructured powderwas synthesized by the glycine nitrate procedure (GNP) because it proved to be the most effective and simplest method suitable for controlling the composition and morphology of $Co_{0.9}Ho_{0.1}MoO_4$. To prepare nanostructured $Co_{0.9}Ho_{0.1}MoO_4$, metal nitrates, and glycine were mixed in appropriate stoichiometric ratios. For the preparation of the technologically important $Co_{0.9}Ho_{0.1}MoO_4$, the combustion process has proven to be a promising method that achieves control of stoichiometry, homogeneity, and purity. The synthesized samples were examined by DTA, X-ray diffraction (XRD), Fourier transform infrared (FT-IR) spectra, Spectroscopy, Field emission scanning electron microscopy (FESEM), and nitrogen adsorption method. The acquired nanopowder showed a tendency for agglomeration, inhomogeneous microstructure, and plate-like crystals. The photocatalytic activity of the obtained $Co_{0.9}Ho_{0.1}MoO_4$nanopowders was evaluated by the photocatalytic degradation of crystal violet in an aqueous solution. After photocatalytic testing and all the above-mentioned characterizations, it was shown that these nanostructured materials represent promising solutions in photocatalytic processes toward green chemistry and sustainable development.

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P16

One-Step Synthesis of Biocompatible $NaY_{0.65}Gd_{0.15}F_4$:Yb,Er Upconverting Nanoparticles for *In Vitro* Cell Imaging

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There is a great technological interest in synthesis of lanthanide doped upconverting nanoparticles (UCNPs) with controlled crystal phase, morphology and intense luminescence properties suitable for biomedical use. A conventional approach for synthesis of such particles comprises decomposition of organometallic compounds in an oxygen-free environment, followed either with a ligand exchange, or biocompatible layer coating. Biocompatible $NaY_{0.65}Gd_{0.15}F_4$:Yb,Er nanoparticles used in this study were synthesized through chitosan assisted one-pot hydrothermal synthesis and were characterized by X-ray powder diffraction (XRPD), Fourier-transform infrared (FTIR) spectroscopy, scanning electron microscopy coupled with energy dispersive X-ray spectroscopy (SEM/EDS) and photoluminescence measurement (PL). Due to the presence of the amino groups at their surface, excellent biocompatibility and notably low cytotoxicity against MRC-5 cells (line of normal human fibroblasts) and A549 cells (human lung cancer cells) were detected using MTT assay. Furthermore, upon 980 nm laser irradiation, particles were successfully used *in vitro* for labeling of both, MRC-5 and A549 cells.

P17

Characterization of NTC thick film thermistor paste $Cu_{0.2}\,Ni_{0.5}\,Zn_{1.0}\,Mn_{1.3}O_4$

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A powder of $Cu_{0.2}Ni_{0.5}Zn_{1.0}\,Mn_{1.3}O_4$ composition for custom thermistor was prepared by using a certain mixture of metal oxides and solid state reaction at 1000 °C/4h in air. The obtained thermistor powder was milled in the planetary ball mill and agate mill for a prolonged time to achieve submicron powder. The prepared thermistor powder was further characterized by using XRD and SEM techniques. After that, the thermistor powder was pressed into small disc-shaped samples and sintered at 1150 °C/2h. The sintered samples were also characterized by using XRD and SEM. The main electrical properties such as nominal resistance R and thermistor exponential factor B were measured in the climatic test chamber. After that, the thick film paste was prepared using the same powder, an organic vehicle and a glass frit. The paste was printed on alumina substrate, dried at 150 °C / 30 min and sintered in

air at 850 °C / 10 min in the hybrid conveyor furnace. The planar electrodes were printed on the sintered NTC thermistor layer using the PdAg thick film paste. The electric properties of sintered thick film thermistor were also measured in the climatic test chamber. The obtained results were used for development of novel self-heating thermistor applications.

P18

Corrosion behavior of Ni-P-based amorphous and nanocrystalline alloys

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Powder alloys consisted of amorphous ultrafine powders have many favorable functional characteristics, and therefore find application in composite materials production, catalysis, ferrofluids, magnetic recording media and powder metallurgy. Amorphous alloys, as kinetically and thermodynamically metastable materials, are prone to structural transformations at elevated temperatures or pressures, or during prolonged application under mild conditions. Corrosion properties of such materials, being influenced by the microstructure, significantly affect their suitability for practical application.

Ni-P-based powder materials with different chemical composition and microstructure were prepared using chemical reduction method. For the as-prepared and thermally treated materials, detailed microstructure and morphology analyses were performed. By using electrochemical methods, corrosion properties of the as-prepared and thermally treated materials were studied in different environments, including neutral, acidic and alkaline media of different concentrations. Relatively good corrosion resistance of the studied Ni-P-based materials was observed. It is indicated that the microstructure and chemical composition of the studied materials affect the mechanism of formation and composition of the oxide/hydroxide layer nearby the electrode surface, thus influencing the corrosion behavior of the material.

P19

The effect of different particle sizes of bentonite from the Bogovina deposit on the Briggs-Rauscher oscillatory reaction

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The Briggs-Rauscher oscillatory reaction, which represents the oxidation of malonic acid in the presence of hydrogen peroxide and potassium iodate catalyzed by manganese ion in an acidic environment, proved to be extremely sensitive for testing insoluble materials, such as bronzes and clays. It was shown that origin of bentonite has high impact on the length of the

oscillation time. In this work, the influence of different sizes of bentonite particles from the Bogovina deposit on the Briggs-Rauscer oscillatory reaction in the conditions of a closed reactor was investigated. Five particle sizes of bentonite, (< 25 μm, < 50 μm, < 75 μm, < 150 μm and < 300 μm) having identical mass of 0.15 g, were tested. The addition of different particle sizes of Bogovina clay does not significantly influence the basic BR oscillogram.

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P20

Synthesis and characterization of luminescent Pr^{3+}–doped hydroxyapatite nanopowder as a potential biomaterial for bioimaging applications

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Praseodymium doped calcium hydroxyapatite (PrHAP) nanopowder was synthesized by the co-precipitation method and characterized by X-Ray Diffraction, Fourier Transform Infrared, and Fluorescence Spectroscopy. Characterization studies from XRD and FTIR spectra showed that obtained crystals are monophase hydroxyapatites and that the sample particles are of nano size. A fluorescence study has shown that PrHAP particles have fluorescent emission under UV- Visible excitation. These results may open new avenues for developing bioactive materials for bone regeneration and fluorescent probes for bio-imaging applications

P21

Vertically aligned TiO_2 nanorod array as an electron transport layer in perovskite photodiode

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The development of metal oxide-based electron transport layers in perovskite solar cells (PSCs) is being intensively researched to achieve highly efficient PSCs. They offer the advantage of higher charge carrier mobility and stability compared to typical organic materials. To reduce the recombination of charge carriers, methylammonium lead bromide ($MAPbBr_3$) perovskite was coupled with vertically aligned TiO_2 nanorods (NRs) as an

electron transport layer in this study. The TiO_2 NRs were grown on commercial FTO glass in hydrothermal conditions. Titanium (IV) isopropoxide (TTIP) was added in drops, slowly, in the diluted solution of HCl. The obtained precursor solution was transferred into a Teflon-lined stainless steel autoclave which contained FTO substrates and heated at 150 °C for 2 h. Then, the substrates were cleaned using DI water and ethanol and annealed at 500 °C for 30 min. The solution of $MAPbBr_3$ in dimethylformamide (DMF) was deposited on TiO_2 NRs by spin coating technique. FESEM results showed that TiO_2 NRs were porous and oriented vertically upwards to the substrate and that the perovskite material filled the space between TiO_2 NRs. Diffuse reflectance spectroscopy measurement of the sample proved that the absorption edge of the prepared TiO_2 NRs/$MAPbBr_3$ was extended into the visible range. By measuring the *I-V* characteristics of the sample in the dark and under visible light, a hysteresis curve was obtained. Prepared TiO_2 NRs/$MAPbBr_3$ photodiode will be the basis for the construction of solar cells.

P22

Carbonized chitosan-bentonite as electrode material

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Bentonite clay has shown to be a versatile material that can be easily modified and applied as an adsorbent, (electro)catalyst, or as a support for (electro)catalyst. The carbon-clay composites combine a relatively high specific surface area of the clay with a good electrical conductivity of carbon.In this paper, the effect of the applied carbonization procedure on the electrochemical properties of bentonite-carbon composite was investigated. Chitosan-modified bentonite was carbonized by conventional thermal degradation and by the hydrothermal procedure. The electrochemical characterization was performed by cyclic voltammetry and electrochemical impedance spectroscopy. The response to $Fe(CN)_6^{3-/4-}$ and $Ru(NH_3)_6^{2+/3+}$ redox probe showed that the thermally treated sample shows somewhat higher electrochemical activity and lower charge-transfer resistance. However, an investigation of composites activity toward aminophenazone, performed in the pH range 3-9 showed that the hydrothermally obtained sample shows higher activity at pH above 5, while the thermally obtained sample was more active at pH below 5.

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P23

Investigation of nanostructured $Ca_{0.9}Er_{0.1}MnO_3$ obtained by sucrose nitrate procedure

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Nano-crystalline $Ca_{0.9}Er_{0.1}MnO_3$ oxide with a perovskite structure was synthesized by the sucrose nitrate procedure (SNP), with the help of sucrose, which plays the role of fuel and complexant. Other chemicals used are calcium nitrate tetrahydrate $Ca(NO_3)_2\times4H_2O$, manganese nitrate hydrate $Mn(NO_3)_2\times H_2O$, erbium nitrate pentahydrate $Er(NO_3)_3\times5H_2O$. Metal nitrates and sucrose were mixed in stoichiometric ratios, in order to obtain a perovskite with a crystalline structure. The resulting $Ca_{0.9}Er_{0.1}MnO_3$ is calcined for 15 minutes in the temperature range from 800°C to 1000°C. Diffraction thermal analysis (DTA), X-ray diffraction analysis (XRD), Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and inductively coupled plasma ICP were used to characterize the obtained powder.

P24

Experimental and numerical determination of the fracture strength of PA12 material on specimens produced by selective laser sintering

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This paper presents the influence of geometry on the determination of the stress intensity factor KI on specimens produced by the selective laser sintering technique.The analysis of the determination of the stress intensity factor includes experimental and numerical tests. For this purpose, two geometries of specimens were used. Flat specimens with crack loaded in tension and ring specimens loaded on the inner wall. To understand the influence of geometry, specimens and their identical models were tested with three different ratios between the width of the test specimens and the initial length of the crack. Both types of specimens used for this experiment were made from polyamide PA12 utilizing the SLS (selective laser sintering)

additive manufacturing process. The specimens are tested using the Shimadzu AGS-X 100 kN universal equipment for measuring mechanical characteristics of materials. The tensile testing is complemented by the GOM Aramis 2M system, which is utilized for digital image correlation and surface displacement tracking. For the numerical analyzes, we used the finite element method (Abaqus CAE software) to determine the KI factor based on the experimentally obtained results. The values of stress intensity factor for PA12 material show some different results for different types of specimens and effects of the type of production technique. We will present all the results and detail of examination in this paper.

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P25

Luminescent features of cerium doped phosphate tungsten bronze

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Due to the interesting mechanical, chemical, and optical features, phosphate tungsten bronzes (PWBs) constantly attract a lot of attention and have been intensively investigated. Furthermore, PWBs, as inert inorganic solids, with rare-earth ions incorporated in their structure, exhibit interesting and practical electronic features. Cerium doped phosphate tungsten bronze (Ce-PWB) was prepared by thermal phase transformations of cerium salt of 12-tungstophosphoric acid ($CePW_{12}O_{40}\cdot 6H_2O$=Ce-PWA). Synthesized Ce-PWA salt was then heated in a furnace, in a temperature range from room temperature to 650 °C (at 10 °C min^{-1}), during which brownish crystals of Ce-PWB formed. In this work are analyzed the fluorescent properties of 12-tungstophosphoric heteropoly acid, $H_3PW_{12}O_{40}\cdot 29H_2O$ (PWA) with Keggin's anion structure, Ce-WA salt, and Ce-PWB. According to the obtained results of the characterization of the luminescent features, both samples emit in deep blue region, suggesting their potential use as a blue emitting source for white light LED's.

P26

Ciprofloxacin adsorption onto Co/chitosan-derived carbon/smectite nanocomposite obtained by the hydrothermal synthesis

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Nowadays, environmental pollution caused by antibiotics attracts extensive attention. Adsorption has been successfully applied in the treatment of wastewater loaded by pharmaceutics, while diverse natural and eco-friendly materials have been recognized as promising adsorbents. In this work smectite clay from Bogovina (Serbia) and biopolymer chitosan (derived from waste of crustaceans) were used as eco-friendly starting materials for the adsorbent synthesis. The combination of transition metal, carbon materials, and clay minerals represents a useful way to develop functional nanocomposites with benefiting synergistic properties of all components.

Simple, one-step hydrothermal procedure conducted at 180 °C for 24h was applied for synthesis of cobalt/smectite/chitosan-derived carbon (H_Co/C-S) nanocomposite. The sample was characterized using XRPD, FTIR, and low-temperature N_2-physisorption analysis and tested as adsorbent of ciprofloxacin (CPX). The effects of temperature, initial pH, and CPX concentration on the adsorption process were investigated. The adsorption results were fitted by Langmuir, Freundlich, and Sips adsorption isotherms. Additionally, CPX adsorption was described by appropriate kinetics and thermodynamic parameters. It was found that temperature increase had the beneficial effect on CPX adsorption, while investigated adsorbent was efficient in a broad pH range (4-8). The H_Co/C-S adsorbent was found to be efficient in the removal of CPX antibiotic.

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P27

Modelling of Ar^+ ions in CF_4 gas

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Understanding plasma distribution, characteristics and phenomena is important for the development and optimization of semiconductor device manufacturing plasma equipment, such as etching and deposition tools. For this reason, plasma simulation is currently being utilized at every stage of equipment design, development and improvement. The cross section sets obtained by applying Denpoh-Nanbu theory to Ar^+ on CF_4 collisions were found to be in general qualitative and in part quantitative agreement with data from the literature. The Monte Carlo technique was applied to perform calculations of transport parameters. Calculated cross sections can be used to obtain transport coefficients, specially mean energy, reduced mobility

and rate coefficients for low and moderate reduced electric fields *E/N* (E-electric field strength; N-gas density) and accounting for the non-conservative collisions.

P28

Co supported chitosan–derived carbon–smectite–catalyst for oxygen evolution reaction in simulated alkaline seawater solution

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Seawater electrolysis has recently been recognized as a new hope for affordable renewable energy storage. However, its practical application is still limited due to the presence of various electroactive ions in seawater. For example, the chloride ions compete with the oxygen evolution reaction (OER) causing low efficiency of the OER, and corrosion of both the anode and the cathode. To overcome these issues, the development of catalysts with high activity and selectivity towards OER is of primary importance.Herein, Co supported chitosan–derived carbon–smectite nanocomposite (Co/cCh-S) was tested as an electrocatalyst for the OER in alkaline and simulated alkaline seawater solution. Co/cCh-S was previously synthetized using impregnation–carbonization method at 400 °C in an inert atmosphere and characterized in detail. The electrochemical performance of Co/cCh-S modified GCE was studied by cyclic voltammetry, linear sweep voltammetry, and electrochemical impedance spectroscopy. According to the obtained values for onset potential, overpotential, and Tafel slope, the Co/cCh-S electrode could be considered a good electrocatalyst for OER in an alkaline solution. Moreover, no noticeable change in the performance of the Co/cCh-S electrode was observed in the presence of chloride ions. This work could be a starting point for designing an inexpensive, earth-abundant OER catalyst for seawater electrolysis.

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P29

The influence of anion on properties of ion-exchange Cu-alumina

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Alumina can be obtained in several different phases depending on the synthesis parameters. All these phases have different morphology, crystal structure, water content, and surface chemistry that determines their application as catalysts or support for the (electro)catalyst.

In this paper, the influence of anion on the electrochemical properties of copper-modified alumina was investigated. Two types of alumina with different water content, 3 mol H_2O/ mol Al_2O_3 (designated as T) and 0.6 mol H_2O/ mol Al_2O_3 (designated as G), were used in this study. Copper-modified alumina samples were prepared by ion exchange with a solution of $CuSO_4$, $CuCl_2$, or $Cu(NO_3)_2$. The obtained samples were characterized by DR UV/Vis spectroscopy and cyclic voltammetry.

The DR UV/Vis results showed a broad band in the range of 300 – 600 nm corresponding to the ligand-to-metal charge transition band.

The results showed that copper-modified G alumina showed a higher current originating from copper after the ion exchange procedure, regardless of the anion used. The order of activity was $SO_4^{2-} > Cl^- \approx NO_3^-$ for G alumina and $SO_4^{2-} \approx Cl^- > NO_3^-$ for T alumina.

P30

The effect of the initial temperature and pH on textile dye catalytic oxidative degradation using cobalt-doped alumina catalysts

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Two cobalt-doped alumina catalysts were synthesized using the sol-gel method, calcined at 1000 °C and 1100 °C, and denoted CoA-1000 and CoA-1100, respectively. Catalysts were previously characterized using XRPD, TPR-H2, and N2 low-temperature physisorption methods. Both aluminas were tested as catalysts in the oxidative degradation of textile dye Orange G in the presence of Oxone® as a source of sulphate anion radicals. Degradation was monitored using UV-Vis spectroscopy at wavelength λ=478 nm, where the characteristic chromophore group has a peak maximum. The effect of temperature and initial pH on Orange G degradation efficiency was investigated. The influence of temperature was followed in the range from 30 ºC to 60 ºC, and the effect of the pH in the range from 2 to 9. In all experiments, CoA-1000 was found to be a more efficient catalyst than CoA-1100. With the temperature increase, the degradation rate increased for both catalysts. The reaction was the fastest at $6<pH<8$. The differences in textural and structural characteristics between CoA-

1000 and CoA-1100 can explain the differences in their activity as catalysts in investigated reaction. Both cobalt-doped alumina catalysts were found to be efficient in the degradation of Orange G in the presence of Oxone.

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P31

Simultaneous degradation of two textile dyes Orange G and Basic blue 41

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Cobalt-doped alumina catalyst was tested in peroxymonosulfate-induced degradation of two textile dyes: anionic-Orange G (OG) and cationic-Basic Blue 41 (BB). Oxone®, mixed salt containing peroxymonosulfate as an active component, was used as an oxidizing agent. Catalytic tests were performed in a thermostated reactor equipped with a mechanical stirrer. Dyes degradation was followed using a UV-Vis spectrophotometer. Characteristic peak maximum in UV-Vis spectrum was identified at λ=478 nm for OG, and at λ=609 nm for BB. Two OG concentrations were applied: 20 mg dm-3 and 50 mg dm^{-3}. BB concentration was 20 mg dm-3 in all experiments. The reaction temperature was 30 ºC. Apart from simultaneous dyes degradation, single-component solution degradation tests were also performed. Both dyes were found to be degradable in single dyes systems, with OG showing a higher degradation rate. When it comes to simultaneous degradation, it was noticed that the degradation of the BB did not occur while OG was present in the system. This phenomenon can probably be attributed to the difference in the molecular structure and charge of the investigated dyes.

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Catalytic oxidative degradation of Orange G dye: the effect of different reaction parameters

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Catalytic oxidative degradation of a textile dye Orange G was investigated in the reaction system where oxidant Oxone® was used as a source of $SO_4^{\cdot -}$ anion radicals. Cobalt-doped alumina was tested as a heterogenous catalysts for Oxone® activation. The catalyst was synthetized and calcined at 500 °C. The influence of different reaction parameters was followed: the Oxone® dosage, Orange G concentration and initial pH of the reaction solution. The Oxone® dosage was varied from 10 mg to 80 mg. Small differences in degradation efficiency were observed but mass of 40 mg of Oxone® was found to be optimal in the first hour of the reaction. The effect of the Orange G concentration was investigated in the range from 20 mg dm^{-3} to 50mg dm^{-3}. For the concentration of 20 mg dm^{-3} the reaction was much faster than for other investigated concentrations. The effect of the pH was tested in the range from 2 to 9. The optimal pH range was found to be between 6 and 9, but reaction was feasible also for lower pH. It can be concluded that investigated catalyst is applicable with high efficiency in the wide range of Oxone® dosages, dye concentrations and initial pH values.

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P33

Construction and demolition mix waste in traditional ceramics

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Due to the enormous global need for solid waste recovery and usage, the European Green Deal was created to emphasize waste recycling and zero-waste economies in construction and building materials. This comprehensive study investigates the effect of using mixed construction and demolition waste (CDW) in clay bricks. The mixed CDW waste was combined in ratios ranging from 5 % to 45 % with two soil types (alluvial and laterite) and the bricks were fired at three temperatures (700, 850, and 900 °C). The optimal combinations were 10 % CDW fired at 700 °C and 25 % CDW at 850 or 900 °C, for which mineralogical and microstructural analyses are carried out. Although firing at 700 °C results in less efficient waste utilization, it is advantageous and advised for lowering carbon emissions and energy consumption. The study's conclusions hold promise for sustainable resource use and a lower carbon footprint. Furthermore, utilizing mixed demolition and construction waste reduces the amount of waste dumped in unexpected places and improves the long-term conservation of natural resources. The Sustainable Development Goals of the United Nations and a circular economy are both advanced by this research. In the following study, the life-cycle assessment of the produced bricks will be provided.

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P34

Technical features of Pb-Zn slag that allow its valorization and application

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According to earlier physical-chemical and mineralogical analysis, slag from "Topionica"-Veles (Northern Macedonia) represents a potentially important raw resource. It is an inhomogeneous raw material with considerable nonferrous metal content, particularly Pb, Zn, Cu, and Ag (considered as a precious metal). This technogenic resource's mineralogical analysis revealed a very complex composition: amorphous phase, lead alloys, zinc alloys, wüstite (FeO), sphalerite, galena, cerussite, elemental silver, elemental copper, elemental iron, magnetite, spinel, rutile, hematite, troilite (FeS). The most abundant phase is an amorphous phase (glassy matrix) composed of spinel, silicate, and mixed (spinel-silicate). The sample has substantially less wüstite, that appears as skeletal inclusions in the glassy matrix. SEM investigation revealed the presence of Fe-Mn-Zn spinels in the Pb-Zn slag, as well as Pb and Zn alloys. These alloys are primarily composed of Cu. The grains of these phases are up to 100µm appearing as inclusions (usually as complex inclusions with a glassy matrix of elemental iron and wüstite). Grains bigger than 100µm in length are typically free or have simple inclusions. The biggest grains in the aforementioned stages have diameters of up to 300µm. The mineralogical study revealed that the Pb-Zn slag is a very complex raw material. It is required to investigate it in detail and establish the methods in which it can be done in order to value it and eventually apply it. Every stage of the preparation process has to be accompanied by numerous analyzes that will indicate the relevance of the preparation process and ways of concentrating useful components into commercial products.

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P35

The influence of print orientation and print location on the mechanical characteristics of specimens obtained by SLS technology

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SLS technology has become popular in various industries due to its ability to produce complex components with less effort than traditional methods. The study used PA 12, a commonly used material in SLS printing, to create three types of specimens that were tested for their mechanical characteristics. The specimens were designed based on ISO standards (i.e. ISO 178, ISO 527-2, ISO 604) and printed on the Fuse 1 (FormLabs, Summerville, MA) 3D printer in four batches. These batches differed according to the printing orientation (i.e. horizontal and vertical) and the printing location (i.e. in the middle and on the edge of the powder bed). The printed specimens were then tested on subjected to a standard tensile testing machine (SHIMADZU AGS-X 100kN).

The study found that the specimens printed according to ISO 178 standard vertically in the middle of the powder bed had the smallest deviations in mechanical characteristics. On the other hand, the specimens printed based on ISO 604 standard had the biggest deviations. These findings suggest that the printing orientation and location on the powder bed can affect the mechanical properties of SLS-printed components.

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P36

X-ray fluorescence spectroscopy of eggshells as a potential raw material in the construction industry

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Due to its chemical composition based on $CaCO_3$ and low price, eggshells, as waste from one of the most widely consumed foods worldwide, are receiving increased attention in building and construction industry studies. The goal of this study was to see if the chemical composition of eggshells could be utilized to distinguish eggs from different production systems. In Serbia, eggs were taken at random from ten commercial cages and ten commercial free-range flocks. Using energy dispersive X-ray fluorescence spectroscopy (EDXRF) and a chemometrics approach, twenty eggshell samples from each flock were tested for element composition (Ca, P, Mg, Na, Al, Cu, Mn, Fe, K, S, and Zn). Analysis showed that free-range eggshells had higher levels of macrominerals (P, Mg, and Na) but lower levels of microminerals (Cu, Fe, K, S, and Mn) than caged eggshells ($P<0.05$). A large

degree of variability within and between production systems was observed for all tested elements. The findings suggest that EDXRF and chemometric analysis of eggshell elemental profiles could provide a useful and effective tool for distinguishing between free-range and caged eggs.

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Heavyweight Ultra-High-Performance Concrete with Micro-Reinforcement

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The impacts of nano-silica addition, steel micro-reinforcement, and aggregate type on the mechanical properties and durability of ultra-high-performance concrete (UHPC) were studied. As aggregates, quartz and barite were used. The amounts of steel fibers and nano-silica were alternated. Six concrete mixes were produced with quartz sand, and the remaining six concrete mixes were designed with barite sand. Fibers made about 3-5% of the concrete composition's mass. In a 2-5% concentration, nano-silica was used as a cement replacement. The inclusion of nano-silica significantly boosted the compressive strength of UHPC. The compressive and flexural strengths were also positively impacted by fiber supplementation ranging from 3% to 5%. The amount of fiber utilized proved to be more influential than the aggregate used. The UHPC concrete's durability was increased as all samples were highly resistant to freezing and thawing cycles. UHPC designed with barite aggregate demonstrated good X and gamma ray absorption at energies below 300 keV.

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P38

Development of recycled cement made from biowaste

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Many studies on techniques for diminishing the environmental impact, reducing greenhouse gas emissions, and decreasing industrial and biowaste have been conducted with the mutual goal of achieving sustainable development. The use of industrial byproducts as raw materials for cement clinker production is becoming more common in the Portland cement industry. Eggshell is a biowaste produced in huge quantities by households and the food industry. Eggshell powder has a trigonal-calcite structure and properties similar to limestone; therefore, it can substitute limestone in the cement clinker mix design. In this work, bio-waste cement was produced at temperatures below the standard 1470°C utilizing mechanically activated

eggshell powder. Under the same conditions as bio-waste cement, limestone cement clinker was also synthesized. Instrumental tests (X-ray diffraction, scanning electron microscopy, differential scanning calorimetry, and thermogravimetry analysis) were employed to analyze the mineral phases in the produced cements. The results showed that eggshell-cement had four major cement clinker phases (C_3S, C_2S, C_3A, and C_4AF) that were identical to those in ordinary commercial Portland cement. As a result, this study demonstrated that it is possible to recycle eggshell waste to partially substitute limestone as a raw material for cement clinker manufacturing.

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Mechanical properties of zirconium diboride ceramics

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Zirconium diboride(ZrB_2) belongs to the group of ultrahigh temperature ceramics (UHTCs) because of its high melting point (3250°C). Due to its excellent properties, such as the melting temperature, high strength and hardness, high thermal and electrical conductivities relative to otherceramics and good corrosion resistance to molten metals, it has attracted great interest from materials scientists.Fully dense ZrB_2 ceramics were successfully obtained by hot pressing at 2150^oC for 10 minutes. Prior to hot pressing, commercially available ZrB_2 powder was ball milled for 24hr with ZrB_2 media. Carbon was added as a densification aid in the amount of 0.5 wt.% using phenolic resin.For mechanical testing, three different methods were compared. Three point bending was performed in air at room temperature and the obtained strength was 546±55 MPa. Four-point bend strengths were measured under same conditions resulting in strengths of 476±112 MPa. Finally, the fracture toughness of pure ZrB_2 ceramics was determined by the chevron notched beam method to be 4.1 ± 0.5 MPa·$m^{1/2}$. The obtained results of mechanical testing make this ceramic material applicable as cutting tools, and parts for hypersonic aerospace vehicles.

P40

New opportunities for material characterization using photoacoustics methods

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The photoacoustic effect is the result of sound waves forming as a result of the interaction between matter and light. A photoacoustic signal is the sound produced when a sample of any aggregate state interacts with the modulated light that illuminates that sample. Photoacoustics is a branch of photothermal science that bases its research on this effect. The thermodiffusion and thermoelastic components, which represent this signal as two fundamental components, undoubtedly contain information about the initial signal. The thermoelastic component can be compared to low-pass RC filters and represented by Bode diagrams of amplitude and phase.Using Bode diagrams, the cut-off frequency of the photoacoustic signal may be determined andis given as a function of the sample thickness. The sample is often positioned on top of themicrophone and surrounded by air in a photoacoustic setup for material characterisation. Theinfluence of the light source causes a temperature difference on the illuminated and non-illuminated side. The objective of determining the cut-off frequency is to develop a new system for characterizing materials in which they are thought of as surface absorbers. Aluminum and silicon samples were utilized in the experiment, and it was demonstrated that the analogy is accurate no matter which material is under consideration.

P41

Electrochemical characteristics of V_2O_5/rGO synthesized by sol-gel method in water electrolyte

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Today, rechargeable Li- ion batteries have widespread use as power sources. However, the organic electrolytes used in these batteries are toxic, so the use of aqueous electrolytes is preferred. Vanadium pentoxide has been intensively studied as a cathode material for use in batteries with aqueous electrolytes. In this work, the V_2O_5 composite with reduced graphene oxide was synthesized by a simple sol-gel synthesis. Material was characterized by XRD, thermal analysis and optical microscope. The electrochemical properties of the composite material were examined by the method of cyclic voltammetry at different polarization speeds.

Aqueous electrolytes $LiNO_3$, $NaNO_3$ and Mg $(NO_3)_2$ were used. These characteristics were correlated to determine for which type of batteries the tested composite can be used, as well as how reduced graphene oxide affects the stability and capacity value of V_2O_5.

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The effect of stabilizing agents on physicochemical properties and cell viability of composite hydrogel Collagen/Selenium nanoparticles

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As the most abundant protein in the human body, collagen has been drawing the attention of many researchers from the biomedical field for a long time. It can be found as a constituent in versatile commercially available products. In the hydrogel form, it is used often in designing novel platforms for drug delivery or cell growth. On the other side, Selenium nanoparticles (SeNPs) are a relatively new selenium form that has proven records in enhanced antimicrobial, anticancer, antiviral, antioxidative activity, and reduced toxicity compared to other selenium forms. Therefore, in this work, we have examined the effects of different stabilizing agents, used in the preparation of selenium nanoparticles, on the formation, structure, and biocompatibility of composite hydrogel Collagen/SeNPs. Differential scanning calorimetry (DSC), Fourier-transform infrared spectroscopy (FTIR), optical microscopy, and cell viability (MTT assay) were used for the characterizations of obtained hydrogels. SeNPs were synthesized by the chemical reduction in the form of colloidal solutions using (i) bovine serum albumin, (ii) chitosan, and(iii) glucose as stabilizing agents.

P43

Influence of $BaTiO_3$ Filler on Tensile Strength of Complex Multifunctional Systems Based on Polyvinylidene Fluoride and Bacterial Nanocellulose

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This study aimed to analyze the influence of $BaTiO_3$ (BT) filler on the tensile strength of complex multifunctional films. On the one hand, the films consisted of PVDF and bacterial nanocellulose functionalized with Fe_3O_4 magnetite, while on the other hand, a comparative investigation was conducted on films with the same components (PVDF/BNC/Fe_3O_4) but with the addition of BT. Special focus was placed on mechanical characteristics using a tensile testing apparatus. The experimental research involved preparing samples with varying BT content - films of BNC/Fe_3O_4/PVDF and films of BNC/Fe_3O_4/BT. The morphology of the

samples and structural changes, induced by the presence of BT, were analyzed through SEM-EDS analysis. XRD analysis was performed for additional structural investigation. Research findings indicate a significant increase in tensile strength with BT, likely due to interactions between BT and the polymer matrix. These results underscore the potential for enhancing the mechanical properties of multifunctional films through controlled addition of BT. This research contributes to understanding the role of BT as a reinforcing factor in mechanical properties, opening perspectives for applications in various technical and technological fields. Further work should focus on a detailed analysis of the interaction mechanisms between BT and the polymer matrix to better comprehend the basis for improved tensile strength. Additionally, optimizing formulations of multifunctional films can enable adaptable applications in specific engineering scenarios. In conclusion, this study provides valuable insights into enhancing the mechanical properties of complex films through strategic BT addition, paving the way for innovative technical applications in the future.

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Kinetic of the $ZnTiO_3$ to Zn_2TiO_4 phase transition observed on nano dimensional powder and polycrystalline bulk specimen using thermal analysis - DTA and dilatometer

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Phase transition from $ZnTiO_3$ to Zn_2TiO_4 represents second order phase transition from perovskite (zinc metatitanate) with a hexagonal ilmenite structure (R¯3) to inverse spinel (zinc orthotitanate) cubic structure (Fd¯3m) stable from room temperature to its melting (liquid) was identified during sintering of $ZnTiO_3$ nanopowder. Kinetic of the phase transition has been observed as dimensional changes using dilatometric device thermo-mechanical analyzer TMA SETARAM model SETSYS Evolution and as thermal changes with SETARAM SETSYS Evolution TGA-DTA/DSC device. Two forms of specimens were employed nanopowder and polycrystalline sintered bulk specimen. It was found that sintering process and relaxation of the nanodimensional powder particles stress phenomena strongly influence kinetic of the phase transition. Dilatometric results known from previous investigations are now compared with differential thermal analysis results.

P45

Morphological and structural characterization of Co-rich ferromagnetic amorphous wires and glass-covered microwires

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Among ferromagnetic materials, researchers are focusing on cobalt-based alloys due to their soft magnetic properties, appropriate for various sensing elements such as wires or ribbons, or films. In the present work, Co-rich ferromagnetic amorphous wires and glass-covered microwires ($Co_{68.15}Fe_{4.35}Si_{12.5}B_{15}$ and $Co_{72.5}Si_{12.5}B_{15}$ alloys) were studied.

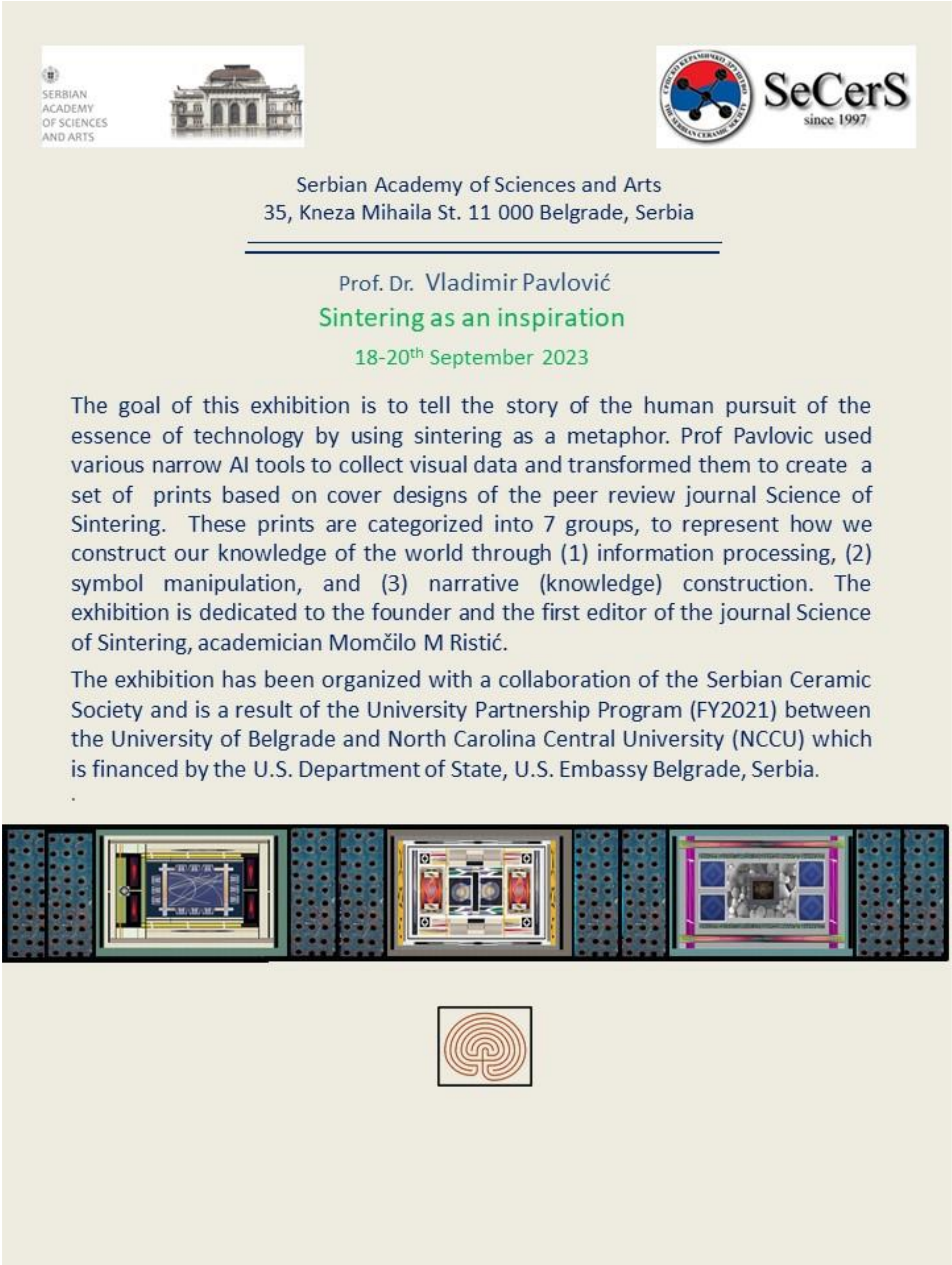
Two different rapid quenching processes were used for the production of the investigated samples:

- amorphous wires with a diameter of 105 – 120 μm were obtained by the in-rotating-water melt-spinning method, and
- glass-covered microwires with a metallic core diameter of about 25 μm and a total diameter of about 40 μm (the ratio of metallic core radius vs. total radius $\rho = 0.625$) were prepared by the glass-coated melt spinning technique.

It is very well known that intrinsic mechanical stresses are induced during rapid melt quenching. In the case of glass-protected samples, there are also stresses induced by the Pyrex glass coating. Moreover, magnetic hysteresis curves depend on the mechanical stress distribution. There is an optimal wire diameter as well as a ratio parameter ρ for the giant magnetoimpedance GMI-effect that has been successfully exploited in magnetic sensors. Therefore, the morphological and structural characterization of two different Co-based cylindrical samples is important as an initial analysis of possible sensing elements.

Morphological and structural characterization of the investigated samples was performed using Optical Microscopy (OM) and Scanning Electron Microscopy (SEM) with Energy Dispersive Spectroscopy (EDS). The microstructural morphology of the surface observed by OM reveals surface roughness that can affect the distribution and movement of magnetic domains, and thus the magnetic properties of wires. The metal cores of glass microwires have a lower level of surface roughness. Elemental EDS microanalyses confirmed the presence and homogeneous distribution of constituent elements of both alloys in the form of wires or microwires.

Exhibition



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Prof. Dr. Vladimir Pavlović

Sintering as an inspiration

18-20th September 2023

The goal of this exhibition is to tell the story of the human pursuit of the essence of technology by using sintering as a metaphor. Prof Pavlovic used various narrow AI tools to collect visual data and transformed them to create a set of prints based on cover designs of the peer review journal Science of Sintering. These prints are categorized into 7 groups, to represent how we construct our knowledge of the world through (1) information processing, (2) symbol manipulation, and (3) narrative (knowledge) construction. The exhibition is dedicated to the founder and the first editor of the journal Science of Sintering, academician Momčilo M Ristić.

The exhibition has been organized with a collaboration of the Serbian Ceramic Society and is a result of the University Partnership Program (FY2021) between the University of Belgrade and North Carolina Central University (NCCU) which is financed by the U.S. Department of State, U.S. Embassy Belgrade, Serbia.

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Exhibition

Prof. Dr. Vera Petrović

Ceramics in my heart