Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION VI
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 2017.

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Dear Colleagues,

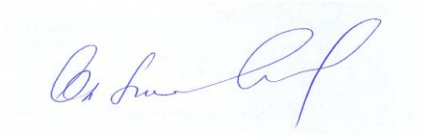
We have great pleasure to welcome you to the Advanced Ceramic and Application Conference VI organized by the Serbian Ceramic Society in cooperation with the Institute for Testing of Materials, Institute of Technical Sciences of SASA, Institute of Chemistry Technology and Metallurgy and Institute for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

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

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

For the first time Advanced Ceramic and Application Conference hosting delegations from Republics of Ghana, Nigeria, Niger and Cameroon with the idea to connect, share and provide positive influence to the scientific and industrial communities all around world.

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



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

Conference Topics

- Basic Science & Sintering of Ceramics
- Nano, Bio- & Opto Ceramic
- Electro & Multifunctional Ceramics
- Magnetic, Catalytic & Composite Materials
- Renewable Energy, Heritage & Archeology
- Industrial Talks

Conference Co-chairmens:
Prof. Dr. Vojislav Mitić SRB
Prof. Dr. Olivera Milošević SRB
Prof. Dr. Marcel Van de Voorde EU
Prof. Dr. Rainer Gadow GER

Conference Programme Chairs:
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Dr. Nina Obradović SRB

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Dr. Nebojša Romčević SRB
Dr. Zorica Lazarević SRB
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Dr Anja Terzić SRB

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Acknowledgements:

The Conference Organizers are grateful to the Ministry of Education and Science of the Republic of Serbia for financial support, as well as to the Serbian Academy of Sciences and Arts, European Academy of Sciences and Arts, American Ceramics Society, Institute of Technical Sciences of SASA, Archeological Institute of SASA, Institute of Physics UB, Vinča Institute of Nuclear Sciences - Laboratory of Physics (010), Electrical Engineering Institute Nikola Tesla and High School-Academy for Arts and Conservation, Serbian Orthodox Church.

David W. Johnson, Jr., PhD

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September 4, 2017

An open letter to the organizers, attendees and guests of the Sixth Serbian Ceramic Society Conference - Advanced Ceramics and Application VI

Dear Conference organizers, attendees and guests:

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

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

I have reviewed the program for your meeting and commend the organizers on having again chosen timely topics of scientific and engineering importance and for having included as speakers so many well known and talented people in the field of ceramics.

I regret that I am not able to attend this meeting. Nevertheless, I offer to all organizers, attendees, and guests my warmest greetings to what I believe will be a most rewarding meeting.

Sincerely,

David W. Johnson, Jr.

Conference Program

Program and Abstract's Contents

Conference Information:

Conference venue: Serbian Academy of Sciences and Arts, Great Hall (second floor) and Halls 1, 2 (first floor), Knez Mihailova 35, Belgrade, Serbia
Conference dinner (with invitation): Restaurant Peking, Vuka Karadžića 2
Conference fee: Standard fee for foreign participants: 150 EUR; Standard fee for domestic participants: 6000 RSD, Members of SCS and PhD Students: 50% Discount, Plenary & Keynote lecturers as well as the last year winners for oral and poster presentations: Free of charge.
Invoice and bank details for Conference fee payment: Banka Intesa ad Beograd, Account No. 160-380150-55, notification: Conference fee – participant name.
Paying of the conference fee at site will be available only in cash.
Currency: The official currency in Serbia is dinar, abbreviated RSD. Money may be exchanged in all banks and authorized exchange offices. Exchange rate for 1 EUR is around 120 RSD. Cash may be taken from ATMs 24 hours a day. Credit cards are accepted in shops, hotels and restaurants.

Abstracts and papers publication: The official language of the conference is English. Conference abstracts will be published in the Book of Abstracts Conference. Papers presented at the conference can be submitted for publishing in Science of Sintering.For more details please contact nina.obradovic@itn.sanu.ac.rs

NEW!!! Serbian Ceramic Society and Springer *are delighted to announce that two publication series will draw on the research and innovation of ACA Conferences: the annual* ***Selection of Papers*** *– a compilation of selected research from the most recent conference (in two forms: research papers (6-10 pages) and review papers (more than 16 pages), and new* ***Scientific Status Reports –*** *a series of topical books of review chapters (20-30 pages each) aimed at bringing the latest developments in the different fields of ceramic science to a broader audience as a part of* ***Springer's Materials Science series****. This new series will aim to gather research and innovation of Advanced Ceramic and Application Conferences over the past years and present it to a completely new audience. For more details about deadlines for submitting the manuscripts please contact vladimir.blagojevic@itn.sanu.ac.rs*

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

Additional Conference information president@serbianceramicsociety.rs
http://www.serbianceramicsociety.rs/about.htm

Recommended places near the Conference venue:
Hotel: Hotel Palas, Topličin venac 23; http://www.palacehotel.co.rs/
Exchange office: „Hulk", Vuka Karadžića 4
Tourist Information Centre: Knez Mihailova 5

Water: Tap water in Belgrade is safe to drink.

Program Overview

Date	Time	Programme		Floor, Room
September, 18, Monday	**08.00-09.00**	**Registration**		2nd Floor, Hall
	09.00-09.30	**Opening Ceremony**		2nd Floor, Great Hall
	09.30-09.40	**Short Break**		2nd Floor, Hall
	09.40-11.40	**Plenary Session 1**		2nd Floor, Great Hall
	11.40-12.00	**Coffee Break & Photo Session**		2nd Floor, Hal
	12.00-14.00	**Plenary Session 2**		2nd Floor, Great Hall
	14.00-15.00	**Buffet Lunch**		Club SASA, Mezzanine
	15.00-17.30	**Plenary Session 3**		2nd Floor, Great Hall
	20.00	**Conference dinner (with invitations)**		Restaurant Peking
September, 19, Tuesday	**08.00-09.00**	**Registration** **Posters Installation**		1st Floor, Hall
	09.00-10.45	**Session: Basic, Modelling & Sintering 1** Red Hall	**Session: Nano, Opto & Bio 1** Blue Hall	1st Floor
	10.45-11.00	**Coffee Break**		1st Floor, Hall
	11.00-12.55	**Session: Basic, Modelling & Sintering 2** Red Hall	**Session: Nano, Opto & Bio 2** Blue Hall	1st Floor
	12.55-14.00	**Buffet Lunch**		Club SASA, Mezzanine
	14.00-16.00	**Session: Electro & Multifunctional 1** Red Hall	**Session: Magnetic, Catalytic & Composite 1** Blue Hall	1st Floor
	16.00-16.20	**Coffee Break**		
	16.20-18.05 **16.20-17.50**	**Session: Electro & Multifunctional 2** Red Hall	**Session: Magnetic, Catalytic & Composite 2** Blue Hall	
	18.05-19.00	**Poster Session**		1st Floor, Hall
September, 20, Wednesday	**09.30-10.50**	**Session: Renewable Energy, Heritage & Archeology 1**		1st Floor, Blue Hall
	10.50-11.10	**Coffee Break**		
	11.10-13.15	**Session: Renewable Energy, Heritage & Archeology 2**		
	13.15-14.30	**Buffet Lunch**		Restaurant Peking
	14.30-15.30	**Session: Industrial Talks, Cooperation & Sponsors**		
	15.30-16.45	**Annual meeting of Serbian Ceramc Society**		
	16.45-17.30	**Forming Chapter of ACerS for Serbia (and extended region)**		1st Floor, Blue Hall
	17.30	**Closing Ceremony**		

Monday, September 18th, 2017

Hall, 2nd Floor

08.00 – 09.00 **Registration**

Great Hall, 2nd Floor

09.00 – 09.30 **Opening Ceremony of the Sixth Serbian Ceramic Society Conference: Advanced Ceramics and Application**
Prof.dr Vojislav Mitić, Dr. Olivera Milošević, Prof. Vladimir Pavlović, Dr Rainer Gadow, Predsednik SANU Akademik Vladimir Kostić, Predstavnici MNTR, Visoki predstavnici Vlade RS

09.30 - 09.40 **Short break**

Great Hall, 2nd Floor

09.40 – 11.40 **Plenary Session 1**
Chairpersons: Marcel van de Voorde, Olivera Milošević

09.40 – 10.10 **PL1 Nano-glasses: The Key to a New Age of Technologies – A Glass Age?**
Herbert Gleiter[1,2]
[1]Karlsruhe Institute of Technology KIT D-76021 Karlsruhe, Germany
[2]Herbert Gleiter Institute of Nanoscience Nanjing University of Science and Technology, Nanjing 10094, China

10.10 – 10.40 **PL2 Nano/ microstructure control of advanced materials by smart powder processing**
Makio Naito, Takahiro Kozawa, Akira Kondo
JWRI, Osaka University, Japan

10.40 - 11.10 **PL3 Silicon in Polymers for Green Science and Enviroment**
Reuben Jih-Ru Hwu, Hung Chuang, Uttam Patil, Susan Shwu-Chen Tsay
Department of Chemistry, National Tsing Hua University,Hsinchu 30013, Taiwan, R.O.C.

11.10 - 11.40 **PL4 The Influences of Ordering and Nano-Structures on the Properties Perovskites and Derivatives**

Darryl P. Butt[1], Patrick Price[2]
[1]College of Mines and Earth Sciences, University of Utah, USA
[2]Dept. of Materials Science and Engineering, Boise State University, Boise, ID

Hall, 2nd Floor

11.40 - 12.00 **Coffee Break and Photo Session**

Great Hall, 2nd Floor

12.00 - 14.00 **Plenary Session 2**
Chairpersons: Reuben Jih-Ru Hwu, Herbert Gleiter

12.00 - 12.30 **PL5 Fabrication of PZT thin films: Combinatorial Chemistry and FGM**

Gang He
Faculty of Materials Science and Chemistry China University of Geosciences, China

12.30 - 13.00 **PL6 3D-inkjet printing of bioceramics and bioglass scaffolds for bone repair and regeneration**

Rainer Gadow, Steffen Esslinger, Matthias Blum, Peter Krieg
Institute for Manufacturing Technologies of Ceramic Components and Composites, IMTCCC, University of Stuttgart, Stuttgart, Germany

13.00 - 13.30 **PL7 How new X-ray techniques can support the development of Ceramics**

Alex Dommann[1], Antonia Neels[2]
[1]Empa, Swiss Federal Laboratories for Materials Science and Technology, Switzerland
[2]Center for X-ray Analytics, Überlandstrasse 129, 8600 Dübendorf, Switzerland

13.30 - 14.00 **PL8 Identifying the fundamental mechanisms that limit of modern microwave ceramic dielectric performance**

Nathan Newman
Materials Program, Arizona State University, USA

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

Great Hall, 2nd Floor

15.00 - 17.00 **Plenary Session 3**
Chairpersons: Makio Naito, Rainer Gadow

15.00 - 15.30 **PL9 Optimized zirconia thermal barrier coatings (TBC) for efficient systems**
Saleem F. Shaukat[1], R. Farooq[2]
[1]COMSATS Institute of Information Technology, Sahiwal, Pakistan
[2]Department of Chemical Engineering, COMSATS Institute of Information Technology, Lahore, Pakistan

15.30 - 16.00 **PL10 Low Energy Syntheses of Ceramic Nano Powders**
Daniel Ribero, Cengiz Bagci, Qun Yang, Waltraud M. Kriven
Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign

16.00 - 16.30 **PL11 Modelling, simulation and experimental validation of ceramic forming by powder compaction**
Andrea Piccolroaz
Department of Civil, Environmental and Mechanical Engineering, University of Trento, Via Mesiano 77, Italy

16.30 - 17.00 **PL12 Impact of Temperature Dependent Ion Properties, Radii and Polarizability**
Steven C. Tidrow
New State College of Ceramics, Kazuo Inamori School of Engineering, Alfred University, Alfred, NY 14802

17.00 - 17.30 **PL13 Novel Semiconductor and Epitaxial Nanocomposite Materials for Energy Conversion and Optoelectronic Applications**
Joshua M. O. Zide
Materials Science and Engineering, University of Delaware, Newark, Delaware, USA

20.00 **Conference dinner (with invitation)** **Restaurant Peking**

Tuesday, September 19th, 2017

Hall, 1st Floor

08.00 - 09.00 **Registration**
Posters and Exibition Installation

Red Hall, 1st Floor

09.00 - 10.45 **Session: Basic Ceramic Modelling and Sintering**
Chairpersons: Vladimir Buljak, Nina Obradović

09.00 - 09.30 **PL14 Advantages and Challenges of the Reaction SPS in Manufacturing of Ceramic Matrix Nanocomposites**
Andrey V. Ragulya
Frantsevich Institute for Problems in Materials Science NAS of Ukraine
3, Krzhizhanovski St., 03142 Kiev, Ukraine

09.30 - 9.55 **KN-BMS1 Theoretical study of skeletal structure evolution during liquid phase sintering**
Zoran S. Nikolić
University of Niš, 18000 Niš, Univerzitetski trg 2, Serbia

09.55 - 10.20 **KN-BMS2 Coated Wireless Light Emitters for Efficient Up Scaling of Photocatalytic Processes**
Bastien O. Burek[1,2], Detlef W. Bahnemann[2,3], Jonathan Z. Bloh[1]
[1]DECHEMA Forschungsinstitut, Germany,
[2]Leibniz Universität Hannover, Germany,
[3]Saint-Petersburg State University, Russia

10.20 - 10.45 **KN-BMS3 Negative and Zero Thermal Expansion Ceramics (Thermomiotics)**
Bojan A. Marinkovic, Patrícia Ponton, Luciana Prates Prisco
Department of Chemical and Materials Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

Hall, 1st Floor

10.45 - 11.00 **Coffee Break**

Red Hall, 1st Floor

11.00 - 12.55 **Session: Basic Ceramic Modelling and Sintering 2**
Chairpersons: Boris Feigelson, Bojan Marinković

11.00 - 11.25 **KN-BMS4 Complex constitutive models in powder compaction: from curve fitting to material mechanical characterization**
Vladimir Buljak
University of Belgrade, Mechanical Engineering Faculty, Department of Strength of Materials

11.25 - 11.45 **INV-BMS1 Characterization of Au-mercaptotriazole crystals using the spectroscopy methods**
Silvana B. Dimitrijević[1], Z. Ž. Lazarević[2], S. P. Dimitrijević[3]
[1]Mining and Metallurgy Institute Bor, Zeleni bulevar 35, 19210 Bor, Serbia
[2]Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia
[3]Innovation Center Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

11.45 - 12.05 **INV-BMS2 Iron oxide functionalized wollastonite based adsorbents for oxyanions removal**
Jelena Rusmirović[1], Aleksandar Marinković[2], Nina Obradović[3], Vera Pavlović[4], Vladimir Pavlović[3,5]
[1]Innovation Center of the Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia
[2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia
[3]Institute of Technical Sciences of the SASA, Belgrade, Serbia
[4] Faculty of Mechanical Engineering, Belgrade, Serbia
[5]Faculty of Agriculture, University of Belgrade, Belgrade, Serbia

12.05 - 12.25 **INV-BMS3 Dilatometer as a scientific tool**
Nebojša J. Labus[1], Vladimir B. Pavlović[2], Zorka Ž. Vasiljević[1], Maria Vesna P. Nikolić[3]
[1]Institute of Technical Sciences of Serbian Academy of Sciences and Arts, Belgrade, Serbia
[2]Faculty of Agriculture, Department of Physics, University of Belgrade, Belgrade, Serbia
[3]Institute for Multidisciplinary Research, University of Belgrade, Serbia

12.25 - 12.40 **OR-BMS1 Zinc oxide-based materials with enhanced sunlight-driven photo- and photo-electro-catalytic activity**

Smilja Marković[1], Vladimir Rajić[2], Ivana Stojković-Simatović[2], Dragan Uskoković[1]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia
[2]Faculty of Physical Chemistry, University of Belgrade, Serbia

12.40 - 12.55 **OR-BMS2 Synthesis, characterization & bacterial activity of ZnO and Histidine incorporated ZnO**

Shraddha Mahakal[1], Surekha Satpute[2], Kiran Adhi[1], Shabana Shaikh[3]
[1,3]Center for Advanced Studies in Material Science & Condensed Matter Physics Department of Physics, Savitribai Phule Pune University, India
[2]Department of Microbiology, Savitribai Phule Pune University, India

12.55 - 14.00 **Buffet Lunch** **Club SASA, Mezzanine**

Blue Hall 2, 1st Floor

09.00 - 10.45 **Session: Nano, Opto, Bio Ceramic 1**
Chairpersons: Christina Graf, Lidija Mančić

09.00 - 09.30 **PL15 Phase Transformations and Formation of Hierarchical Structures in Composites under Loading**

S. N. Kulkov[1], S. P. Buyakova[2]
[1]Tomsk State University, Institute of Strength Physics and Materials Science SB RAS
[2]Tomsk Polytechnic University

09.30 - 09.55 **KN-NOP1 Novel Nucleobase-Functionalized Carbon Nanotubes for Biomedical Applications**

Susan Shwu-Chen Tsay, Uttam Patil, Mohit Kapoor, and Reuben Jih Ru Hwu
Department of Chemistry, National Tsing Hua University, Hsinchu 30013, Taiwan, R.O.C.

09.55 - 10.20 **KN-NOP2 Nucleation theory and growth of surface nanostructures**

Vladimir G. Dubrovskii[1-3]
[1]St. Petersburg Academic University, Khlopina 8/3, 194021, St. Petersburg, Russia

[2]Ioffe Physical Technical Institute RAS, Politekhnicheskaya 26, 194021, St. Petersburg, Russia
[3]ITMO University, Kronverkskiy pr. 49, 197101 St. Petersburg, Russia

10.20 - 10.45 **KN-NOP3 *In vivo* models for examination of biomaterials and scaffolds as mesenchymal stem cells carriers in bone regeneration applications**

Stevo Najman[1], Jelena Najdanović[1], Sanja Stojanović[1], Vladimir Cvetković[2], Jelena Živković[1], Marija Vukelić-Nikolić[1], Ivica Vučković[3], Zoran Golubović[4]
[1]Department of Biology and Human Genetics and Department for Cell and Tissue Engineering, Faculty of Medicine, University of Niš, Serbia
[2]Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, Niš, Serbia;
[3]Clinic of Stomatology, Faculty of Medicine, University of Niš, Serbia;
[4]Clinical Center Niš, Faculty of Medicine, University of Niš, Serbia

Hall, 1st Floor

10.45 - 11.00 **Coffee Break**

Blue Hall 2, 1st Floor

11.00 - 12.55 **Session: Nano, Opto, Bio Ceramic 2**
Chairpersons: Susan Shwu-Chen Tsay, Nathan Newman

11.00 - 11.25 **KN-NOP4 Colloidal Silica Particles – a Simple Material with Fascinating Possibilities**

Christina Graf
Fachbereich Chemie- und Biotechnologie, Hochschule Darmstadt, Darmstadt, Germany

11.25 - 11.45 **INV-NOP1 Development of dense and controlled porous nano-structured biomaterials based on hydroxyapatite**

Djordje Veljović
Faculty of Technology and Metallurgy, University of Belgrade, Serbia

11.45 - 12.05 **INV-NOP2 New aspects in processing of hydroxyapatite ceramics**

Miodrag J. Lukić
Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Belgrade, Serbia

12.05 - 12.25 **INV-NOP3 Self-assembly on surfaces and nanotechnology**

Jelena Manojlovic
Faculty of Mechanical Engineering, University of Nis, Nis, Serbia

12.25 - 12.40 **OR-NOP1 Synthesis of ZnO:Ag core-shell nanoparticles with enhanced photocatalytic properties by single - and two-steps USP**

L. Muñoz-Fernandez[1], G. Alkan[2], O. Milošević[3], M. E. Rabanal[1], B. Friedrich[2]
[1]University Carlos III of Madrid and IAAB, Department of Materials Science and Engineering and Chemical Engineering, Avda.Universidad 30, 28911 Leganes, Madrid, Spain.
[2]IME Process Metallurgy and Metal Recycling, Intzestraße 3, 52072 Aachen, Germany.
[3]Institute of Technical Sciences of SASA, Serbia.

12.40 - 12.55 **OR-NOP2 In-vitro visualization of primary tumor cells using up-conversion nanophosphors**

Lidija Mancic[1], Aleksandra Djukic-Vukovic[2], Ljiljana Mojovic[2], Mihailo Rabasovic[3], Aleksandar J. Krmpot[3], Ivana Dinic[4], Antonio MLM.Costa[5], Olivera Milosevic[1]
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[2]Department of Biochemical Engineering and Biotechnology, Faculty of Technology and Metallurgy, University of Belgrade, Serbia
[3]Photonic Center, Institute of Physics Belgrade, University of Belgrade, Zemun, Belgrade, Serbia
[4]Innovation Center of the Faculty of Chemistry, University of Belgrade, Serbia
[5]Department of Chemical and Materials Engineering, Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil

12.55 - 14.00 **Buffet Lunch** **Club SASA, Mezzanine**

Red Hall, 1st Floor

14.00 - 16.00 **Session: Electro and Multifunctional Ceramic 1**
Chairpearsons: Darryl Butt, Gang He

14.00 - 14.25 **KN-EM1 Processing and Applications of Nanocrystalline Diamond Hybrids and Engineered Diamond Microparts**

Hans Fecht
Ulm University, Institute oif Micro and Nanomaterials, Ulm, Germany

14.25 - 14.50 **KN-EM2 Thermodynamics of Vapor-Liquid-Solid Growth**

Jonas Johansson
Solid State Physics and NanoLund, Lund University, Lund, Sweden

14.50 – 15.15 **KN-EM3 The use of ceramic coating by ESD technique to improve the service life of copper spot welding caps**

Şükrü Talaş
Afyon Kocatepe Univesity, Faculty of Technology, ANS Campus, Afyonkarahisar, Turkey

15.15 - 15.40 **KN-EM4 Some practical application of TiO_2**

Mirjanić D. Lj.[1], Pelemiš S.[2]
[1]Academy of Sciences and Arts of Republic of Srpska, B&H
[2]Faculty of Technology, University of East Sarajevo, B&H

15.40 - 16.00 **INV-EM1 Granular material transport and mixing - DEM/CFD numerical approach**

Lato Pezo
University of Belgrade, Institute of General and Physical Chemistry, Belgrade, Serbia

Hall, 1st Floor

16.00 - 16.20 **Coffee Break**

Red Hall, 1st Floor

16.20 - 18.05 **Session: Electro and Multifunctional 2**
Chairpearsons: Dragana Jugović, Saleem F. Shaukat

16.20 - 16.40 **INV-EM2 Assessing electrical properties of ceramic samples**

D. Olćan[1], N. Obradović[2], S. Filipović[2], A. Terzić[3], V. Pavlović[2], M. Kachlik[4], K. Maca[4], A. Djordjević[1]
[1]School of Electrical Engineering, University of Belgrade, Serbia
[2]Institute of Technical Sciences, Serbian Academy of Sciences and Arts, Belgrade, Serbia
[3]Institute for Testing of Materials IMS, Belgrade, Serbia
[4]EITEC BUT, Brno University of Technology, 61600 Brno, Czech Republic

16.40 - 17.00 **INV-EM3 Electrocatalytic hydrogen production on a nickel electrode modified with V_2O_5+Co co-deposit: The synergetic electronic effect**

Nebojša I. Potkonjak
University of Belgrade, Vinča Institute of Nuclear Sciences, Belgrade, Belgrade, Serbia

17.00 - 17.20 **INV-EM4 Kinetic investigation of various thermally-induced processes in ceramic materials**

Andrei Rotaru
INFLPR-National Institute for Laser, Plasma and Radiation Physics, Laser Department, Bucharest, Romania

17.20 - 17.35 **OR-EM1 Effect of annealing temperature on structural and surface morphology of ceramic electrolyte for IT-SOFC applications**

Shabana P. S. Shaikh[1], Kiran P. Adhi
[1]Center for Advanced Studies in Materials Science & Condensed Matter Physics, Department of Physics, Savitribai Phule Pune University, Pune 411007.India.

17.35 - 17.50 **OR-EM2 Fractal nature Heywang model correction and Brownian motions**

Vojislav V. Mitic[1,2], Goran Lazović[3], Vesna Paunovic[1], Ljubisa Kocic[1]
[1]University of Nis, Faculty of Electronic Engineering, Nis, Serbia
[2]Institute of Technical Sciences of SASA, Belgrade, Serbia
[3]University of Belgrade, Faculty of Mechanical Engineering, Serbia

17.50-18.05 **OR-EM3 Reusable thermal heat pillow based on clay and phase change materials for human use**

Milena S. Stojiljković, Staniša T. Stojiljković
Faculty of Technology Leskovac, University of Niš

Hall, 1st Floor

18.05-19.00 **Poster Session**

Blue Hall, 1st Floor

14.00 - 16.00 **Session: Magnetic, Catalysts and Composites 1**
Chairpersons: Margarita Gabrovska, Waltraud M. Kriven

14.00 - 14.25 **KN-MCC1 Restrained Nanosintering as a Path to Produce Designed Nanostructured Solids**
Boris N. Feigelson
U.S. Naval Research Laboratory, 4555 Overlook Ave., SW, Washington, DC 20375, USA

14.25 - 14.50 **KN-MCC2 Development and Evaluation of glass-like and glass-ceramic Protection Coatings for Metals, Steels and Glasses**
Martin Amlung
INM – Leibniz Institute for New Materials, Campus D2 2, D-66123 Saarbruecken, Germany

14.50 – 15.15 **KN-MCC3 Joining of ceramics by brazing alloys**
Fiqiri Hodaj
Grenoble Institute of Technology, Univ. Grenoble Alpes, CNRS, Grenoble INP, SIMAP, F-38000 Grenoble, France

15.15 - 15.40 **KN-MCC4 Mechanical treatment of Me_IC- $Me_{II}B$-$Me_{III}O$ powders and sintered ceramic composites properties**
S. P. Buyakova[1], S. N. Kulkov[2]
[1]Tomsk State University, Institute of Strength Physics and Materials Science SB RAS
[2]Tomsk Polytecnic University, Tomsk, Russia

15.40 - 16.00 **INV-MCC1 Influence of mechanical activation on the alternations in quality of raw materials for production of construction ceramics: chemometric approach**
Anja Terzić
Institute for Testing of materials IMS, Belgrade, Serbia

Hall, 1st Floor

16.00 - 16.20 **Coffee Break**

Blue Hall, 1st Floor

16.20 - 17.45 **Session: Magnetic, Catalysts and Composites 2**
Chairpersons: Fiqiri Hodaj, Martin Amlung

16.20 - 16.40 **INV-MCC2 Wet-chemical approach for Ni deposition in BCY15 ceramic matrix: Structure and anode cermet activity in pSOFC**
M. Gabrovska[1], D. Nikolova[1], E. Mladenova[2], D. Vladikova[2], S. Rakovsky[1], Z. Stoynov[2]
[1]Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria
[2]Acad. Evgeni Budevski Institute of Electrochemistry and Energy Systems, Bulgarian Academy of Sciences, Sofia, Bulgaria

16.40 - 17.00 **INV-MCC3 Surface activity of ceramics/surfactants interface**
Stevan Blagojević
Institute of General and Physical Chemistry, Belgrade, Serbia

17.00 – 17.20 **INV-MCC4 Monolith catalysts based on Mn oxides with additive (Cu, Ni, Co, Fe, La, Ce) for deep oxidation of hydrocarbons**
N. V. Shikina[1], S. A. Yashnik[1], A. A. Gavrilova[1], S. R. Khairulin[1], Z. R. Ismagilov[1,2]
[1]Boreskov Institute of Catalysis, Novosibirsk, Russia
[2]Institute of Coal Chemistry and Materials Science, Federal Research Center of Coal and Coal Chemistry, Kemerovo, Russia

17.20 - 17.35 **OR-MCC1 Bone Ash Reinforced Geopolymer using Metakaolin from Metamax (MT), Mymensingh Clay(MW) and Synthetic Mymensingh Clay (MW-SYN)**
A. W. Bhuiya, D. Ribero, M. Hu, P. F. Keane, W. M. Kriven
Department of Materials Science and Engineering,
University of Illinois at Urbana-Champaign, Urbana, IL, 61921, USA

17.35 - 17.50 **OR-MCC2 Novel sintered clay ceramics with combined utilization of steel mill scale waste and municipal sewage sludge**
X. Spiliotis[1] , V. Karayannis[2] , S. Lamprakopoulos[1] , K. Ntampegliotis[1], G. Papapolymerou[1]
[1]Department of Civil Engineering, University of Applied Sciences of Thessaly, 41110, Larissa, Thessaly, Greece

[2]Department of Environmental Engineering, Western Macedonia University of Applied Sciences, 50100, Kozani, Western Macedonia, Greece

Hall, 1st Floor

18.05 - 19.00 Poster Session

Wednesday, September, 20th, 2017

Blue Hall, 1st Floor

09.30 - 10.50 **Session: Renewable Energy, Heritage & Archeology 1**
Chairpersons: Biljana Djordjević, Feroz Kahn

09.30 – 10.00 **PL16 Innovative Manufacturing of Advanced Silicon Nitride Ceramics and Components for Sustainable Society**
Hua-Tay Lin
School of Electromechanical Engineering, Guangdong UniversityTechnology, Guangzhou 510006, China

10.00 - 10.25 **KN-REHA1 Circumstance, experiment and superstition: testing the notion of tradition in West Balkan pottery-making**
Richard Carlton
Newcastle University and The Archaeological Practice Ltd, Newcastle upon Tyne NE4 7LJ, UK

10.25 - 10.50 **KN-REHA2 Future lights in ceramics - a new award for European ceramists: expectations, experiences, results**
Wilhelm Siemen
Porzellanikon – Staatliches Museum für Porzellan Selb/Hohenberg an der Eger Werner-Schürer-Platz 1, 95100 Selb, Germany

Hall, 1st Floor

10.50 - 11.10 **Coffee Break**

Blue Hall, 1st Floor

11.10 - 13.20 **Session: Renewable Energy, Heritage & Archeology 2**
Chairpersons: Smilja Marković, Hua-Tay Lin

11.10 - 11.35 **KN-REHA3 A Review On The Selection of Anode Materials For Solid-Oxide Fuel Cells**
Shabana P. S. Shaikh[1], K. P. Adhi[1]
[1]Advanced Materials Processing Lab, Department Of Physics, SP, Pune University, Pune, India-411007

11.35 - 12.00 **KN-REHA4 Structural and Magnetic properties of magnetron sputtered Fe/Cu Nanoparticles thin films**

F. A. Khan[1], E. Kita[2]
[1]Department of Physics, Bangladesh University of Engineering and Technology(BUET),Dhaka-1000, Bangladesh
[2]Institute of Applied Physics, University of Tsukuba, Tsukuba Ibaraki, Japan

12.00 - 12.20 **INV-REHA1 The Inportance of Ethnoarchaeology in Ceramic Technology Research**

Biljana Djordjević
National Museum in Belgrade, Trg Republike 1A, Belgrade, Serbia

12.20 - 12.40 **INV-REHA2 Fluorine doping of cathode materials for rechargeable batteries**

Dragana Jugović
Institute of Technical Sciences of SASA, Belgrade, Serbia

12.40 - 13.00 **INV-REHA3 Spectroscopy study of $LiFePO_4$ catode materials for Li-ion battery prepared in the thermo-acoustic reactor**

Zorica Ž. Lazarević[1], Janez Križan[2], Gregor Križan[2], Valentin N. Ivanovski[3], Miodrag Mitrić[3], Martina Gilić[1], Nebojša Ž. Romčević[1]
[1]Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia
[2]Maistrova ulica 19A, 2250 Ptuj, Slovenija
[3]Institute of Nuclear Sciences Vinča, University of Belgrade, Belgrade, Serbia

13.00-13.15 **OR-REHA1 Comparative analysis of mortars from the archeological sites Gamzigrad (Romuliana) and Caričin Grad for the purpose of making compatible repair mortars**

Gordana A.Topličić-Ćurčić [1], Vojislav V. Mitić [1, 2, 3], Ana J.Momčilović-Petronijević [4], Dragan M. Đorđević[5], Dušan Z. Grdić [6], Nenad Ristić[7]
[1] University of Nis, The Faculty of Civil Engineering and Architecture, Nis, Serbia
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[6] University of Nis, The Faculty of Civil Engineering and Architecture, Nis, Serbia,

[7]University of Nis, The Faculty of Civil Engineering and Architecture, Nis, Serbia

Restaurant Peking

13.15 - 14.30	**Buffet Lunch**
14.30 - 15.30	**Industrial Talks, Cooperation & Sponsors** **Chairpersons: Rainer Gadow, Waltraud Kriven, Zorica Ž. Lazarević, Vojislav Mitić**
15.30 - 16.45	**Annual meeting of Serbian Ceramic Society**
16.45 -17.30	**Forming Chapter of ACerS for Serbia (and extended region)** **H.T. Lin, Steven Tidrow, Vojislav Mitic**
17.30	**Closing Ceremony**

Book of Abstracts

PL1
Nano-glasses: The Key to a New Age of Technologies – A Glass Age?

Herbert Gleiter

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Herbert Gleiter Institute of Nanoscience
Nanjing University of Science and Technology
Nanjing 10094, CHINA

Today's technologies are based primarily on utilizing crystalline materials such as metals, semiconductors or crystalline ceramics. The way to a new world of technologies based on non-crystalline materials may be opened by means of nano-glasses. Nano-glasses consist of nanometer-sized glassy regions connected by (nanometer-wide) interfacial regions with atomic and electronic structures that do not exist in melt-cooled glasses. Due to their new atomic/electronic structures, the properties of nano-glass differ from the corresponding properties of melt-cooled glasses. For example, FeSc nano-glasses were (at 300K) strong ferro-magnets although the corresponding melt-cooled glasses were paramagnetic. Similarly, the ductility, the biocompatibility, the catalytic properties of nano-glasses were improved by up to several orders of magnitude.

Just like in the case of crystalline materials, the properties of which may be changed by varying the sizes and/or chemical compositions of the crystallites, the properties of nano-glasses may be changed by varying the sizes and/or chemical compositions of the glassy clusters. This analogy opens the perspective that a new age of technologies - a "glass age"- may be initiated by utilizing the new properties of nano-glasses and modifying their properties by varying the sizes and/or chemical compositions of the glassy clusters.

PL2
Nano/ microstructure control of advanced materials by smart powder processing

Makio Naito, Takahiro Kozawa, Akira Kondo

JWRI, Osaka University, Japan

Recently, various novel powder processing techniques were rapidly developed for advanced material production due to the growing of high-tech industry, especially in consideration of green and sustainable manufacturing. Smart powder processing stands for green and sustainable powder processing technique that creates advanced materials with minimal energy consumption and environmental impacts. Particle bonding technology is a typical smart powder processing technique to make advanced composites. The technology has many unique features. Firstly, it creates direct bonding between particles without any heat support or binders of any kind in the dry phase. The bonding is achieved through the enhanced particle surface activation induced by mechanical energy, in addition to the intrinsic high surface reactivity of nanoparticles. Using this feature, desired composite particles can be successfully fabricated.

By making use of particle bonding, a new one-pot processing method to synthesize nanoparticles without applying extra heat was developed. Furthermore, one-pot processing achieving both the synthesis of nanoparticles and their bonding with another kind of particles to make nanocomposite granules was also developed. The assembling of these composite particles and granules will lead to the control of nano/microstructure of advanced materials. As a result, it can custom various kinds of nano/micro structures and can produce new materials such as all-solid-type LIB and SOFC with a simpler manufacturing process.

On the other hand, by carefully controlling the bonding between different kinds of materials, separation of composite structure into elemental components is also possible, which leads to the development of novel technology for recycling composite materials and turns all of them to high-functional applications. As an example, the development of novel recycling method of glass-fiber reinforced plastics (GFRP) will be introduced.

PL3
Silicon in Polymers for Green Science and Environment

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

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

Electronic effects resulting from silicon can direct organic reactions of various types. Because of a silyl group present at the beta position of the reactants, some reactions originally do not proceed and now turn to be feasible. Some reactions originally lead to a mixture of products and now produce an exclusive product. Some reactions originally afford the desired product in a low yield and now generate it efficiently.

In the development of silicon-containing photo-degradable polyketones, an unprecedented silicon-directed Norrish type I cleavage was developed. Placement of an Me_3Si group at the beta position in cycloalkanones provided a regioselective control in cleavage of the C1-C2 bond in Me_3Si-C-C2-C1(=O)-Cw moiety. The quantum yields and the photolysis rates were also increased in comparison with non-silylated cycloalkanones. For efficient synthesis of poly(1,3-diketone)s, a new reaction was developed in the conversion of 2-nitro compounds to the corresponding ketones by a "single-flask" method. It meets the requirement of Green Science.

This novel strategy was applied to the development of photo-degradable silicon-containing polyethylene glycols. An advanced example for the degradation of silicon-containing polyureas will also be illustrated. These outcomes may expedite and advance the ceramic development and applications.

PL4
The Influences of Ordering and Nano-Structures on the Properties Perovskites and Derivatives

Darryl P. Butt[1], Patrick Price[2]

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[2]*Dept. of Materials Science and Engineering, Boise State University, Boise, ID*

Using a combination of x-ray and neutron diffraction, dilatometry, electron microscopy, magnetometry, and various thermal analysis methods, the stability, phase relations, micro- and nano-scale structures of $La_xA_{1-x}FeO_{3-y}$ were assessed, with emphasis on understanding the effects of divalent cation substitutions and temperature on nano-scale structure and properties. Reitfeld refinement and neutron diffraction were used to assess atomic positions of atoms and vacancies in order to characterize the mechanisms of the phase transformations. A pseudo-binary phased diagram is derived that helps to explain cation solubility limits, new phase formation and phase separation, and order-disorder transformations. We describe the ranges of composition and temperature where there are opportunities for using these materials for ion transport and catalyst applications.

PL5
Fabrication of PZT thin films: Combinatorial Chemistry and FGM

Gang HE

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Lead Zirconate Titanate is an intermetallic inorganic compound with the chemical formula $Pb[Zr_xTi_{1-x}]O_3$ ($0 \leq x \leq 1$), also called PZT. It is a perovskite material that shows a marked piezoelectric effect, and used in a number of practical applications such as ultrasonic transducers and piezoelectric resonators. Recently, demand for dielectric capacitors with higher energy-storage capability is increasing for power electronic devices due to the rapid development of electronic industry.

Changing the order of phase dispersion in ceramic materials could change the dielectric behavior of traditional ceramics from no-dielectric-relaxation into characteristics of dielectric relaxation. On the base of this idea, a series of $Pb_{1-x}La_x(Zr_{0.65}Ti_{0.35})_{1-x/4}O_3$ thin films with different compositional gradient structures are designed and prepared by the method of Combinatorial Chemistry and Functionally Graded Materials (FGM). It is suggested that a variety of functional ceramic thin films with abundant distinct property could be designed and fabricated by the idea of combinatorial chemistry and functionally graded materials.

PL6
3D-inkjet printing of bioceramics and bioglass scaffolds for bone repair and regeneration

Rainer Gadow, Steffen Esslinger, Matthias Blum, Peter Krieg

Institute for Manufacturing Technologies of Ceramic Components and Composites University of Stuttgart, Allmandring 7b, 70569 Stuttgart, Germany

Bone degradation and fractures represent a significant concern to human health and to the increased population life expectancy. When such defects overcome a certain critical size, body induced autorepair cannot restore lost skeleton functionality. Medical treatment involves bone grafting, a common surgical procedure with more than 2.0 million grafting procedures performed worldwide each year. Autologous bone grafts are currently the golden standard treatment but are associated with donor-site complications, risk of infection and size limitations. Artificial bioscaffolds with tailored porosity, architecture and composition present an alternative to autologous grafts and are excellent 3D templates to provide structural support for the newly formed bone.

Progress in material science and the better understanding of bone-healing biology resulted in the development of numerous alternative bone graft substitutes, such as calcium phosphates and bioglass products. Furthermore, constant developments of the additive manufacturing techniques in medicine enabled custom-made scaffolds of complex geometries. The combination of bioceramic materials and the powder inkjet printing process enables the fabrication of osteoconductive and osteoinductive scaffolds, mimicking natural bone strength, readily available, patient-specific, cost effective and available in the required amount.

In this work, fabrication of scaffolds was carried out by the inkjet powder process with a commercial 3D inkjet printer. This low temperature printing technique holds great promise in manufacturing bone scaffold substitutes with enhanced properties over traditional techniques and great flexibility in employed materials. The aim of this study is to investigate the processing and the possible biomedical use of 3D powder-printed tricalcium phosphate/bioglass composite scaffolds for the reconstruction of bone defects. The fabricated scaffolds were computer-aided designed (CAD) with different geometries and pore interconnectivity. Powder feedstock requirements were optimized through the spray-drying granulation process. Control over the co-current spray-drying parameters yielded bioceramic feedstock with optimal granulometry and morphological characteristics. Characterization techniques utilised in this study included flowability tests, differential thermal analysis (DTA), scanning electron microscopy (SEM), compressive strength testing and X-Ray diffraction (XRD) phase composition analysis.

PL7
How new X-ray techniques can support the development of Ceramics

Alex Dommann, Antonia Neels

Empa, Swiss Federal Laboratories for Materials Science and Technology, Center for X-ray Analytics, Überlandstrasse 129, 8600 Dübendorf, Switzerland

New X-Ray analytical developments to characterize ceramic materials will be presented and illustrated on a variety of examples. The Empa laboratory for X-ray analytics is dedicated to utilize and continuously improve X-ray based analysis methods to support material research. The development of new ceramics and the materials property enhancement is strongly connected to the possibilities for a comprehensive analysis of their properties.

Analytical methods do not only provide knowledge about the materials, but also support understanding of the production process of these materials. The presentation concentrates on novel techniques that have demonstrated great potential for supporting applications for hard coatings, semiconductors or medtech. Also how X-ray analytical methods can support the detection of failure modes will be discussed through detecting subtle changes in the microstructure of ceramic materials and their impact on aging processes.

PL8
Identifying the fundamental mechanisms that limit of modern microwave ceramic dielectric performance

N. Newman

Materials Program, Arizona State University, USA

Future satellite communication and cellular systems requires low-loss temperature-compensated microwave ceramics with enhanced dielectric constants. Despite the practical importance of achieving a small loss tangent and near-zero temperature coefficient of resonant frequency (τ_F) in these materials, a fundamental understanding of which physical mechanisms are responsible for determine these important parameters has not been firmly established. I will describe my group's efforts using modern experimental and theoretical condensed matter methods to identify the responsible mechanisms in practical materials. We show that the dominant loss mechanism in commercial microwave materials comes from spin excitations of unpaired transition-metal d electrons in exchange coupled clusters at reduced temperature. At room temperature, we correlate the dominant loss mechanism with polaron transport. We also show that the properties of commercial cell-phone base station filters, are optimized by adding dopants or alloying agents, such as Ni or Co, to $Ba(Zn_{1/3}Ta_{2/3})O_3$ and $Ba(Zn_{1/3}Nb_{2/3})O_3$ to adjust τ_F to zero. This occurs as a result of the temperature dependence of $\varepsilon_\rho\mu_r$ offsetting the thermal expansion.

PL9
Optimized zirconia thermal barrier coatings (TBC) for efficient systems

S. F. Shaukat[1], R. Farooq[2]

[1]*COMSATS Institute of Information Technology, Sahiwal, Pakistan*
[2]*Department of Chemical Engineering, COMSATS Institute of Information Technology, Lahore, Pakistan*

A variety of systems in energy, defense, gas-turbine engines and innovative ceramic materials sectors rely on thermal barrier coatings (TBCs). Zirconia yttria ($ZrO_2.Y_2O_3$) coating deposited by plasma spray method is widely in practice in many industries and especially in the above mentioned industries for the improved efficiencies and power. An extensive research has been carried out to investigate the effect of stabilizer on the performance of ZrO_2 thermal barrier coatings, using a number of techniques. The morphology, mechanical properties, internal strain evolution and other characteristics have been determined, using the latest techniques. The optimization of the process, including a suitable heat treatment to densify the yttria-stabilized-zirconia (YSZ) top-coat and the development of a resulting crack network has been explored. It has been observed that the porosity content is uniformly distributed and pore size is of micro level. It has been revealed that, in case of small porosity content, hardness values of thermal barrier coating with stabilizing effect of yttria are not very high and moreover the phase change in coating affects the hardness values of the overall coating. The microscopic images confirmed the plastic deformation in the base metal in the region close to the coating. There is also validation of change in grain size of base metal in the coating region. The change in grain size is the result of sample being over heated during the coating process.

PL10
"Low Energy Syntheses of Ceramic Nano Powders"

Daniel Ribero, Cengiz Bagci, Qun Yang, Waltraud M. Kriven

Department of Materials Science and Engineering,
University of Illinois at Urbana-Champaign

Solid state reaction is the traditional and the most used method to produce ceramic powders at industrial scales. The main disadvantages of this method are that it relies on slow solid state diffusion requiring high temperatures and long times, followed by multiple grinding steps. Doping with minor elements and complex chemistries are particularly difficult processes using conventional high energy methods. The alternative sol gel approach has disadvantages of costly precursors such as alkoxides or metal organic chemicals.

The organic-inorganic steric entrapment method developed in our laboratory and patented in the USA offers a simpler and less costly alternative route to ceramic powder syntheses, particularly for oxide powders. Soluble precursors such as nitrates are mixed in a solution so that the cations are homogeneously dispersed with high chemical accuracy and prevented from selective precipitation by the addition or organic steric entraping agents, such as polyvinyl alcohol for aqueous solvents, or ethylene glygol or polyethylene glycol / alcohol

mixtures for non-aqueous solutions. Multi component oxides of complex chemistries can be readily fabricated as amorphous or nano-crystalline, softly agglomerated powders of high specific surface areas. Examples of oxides made by this method include $LiFePO_4$ which can be formed within minutes at 300 °C. Several other lithium ion battery materials have been made at low energies through a comprehensive and systematic understanding of the effects of relevant processing parameters. This method can be scaleable in a continuous process.

Non-oxide nanopowders of SiC, Si_3N_4 and SiAlONs have been prepared at 1,000°C below conventional synthesis methods such as the Acheson process. The method is based on carbothermal reduction or carbothermal reduction and nitridization of aluminosilicates obtained from clays via a geopolymerization processing route. The self-assembled nanoparticulates constituting geopolymer formed at ambient temperatures lead to the advantage of rapid solid-state reaction with fine carbon particles and a reducing flowing gas. Detailed TEM, EDS and SEM coupled with XRD confirm the nanoparticle nature of the resulting powders.

PL11
Modelling, simulation and experimental validation of ceramic forming by powder compaction

Andrea Piccolroaz
Department of Civil, Environmental and Mechanical Engineering, University of Trento, Via Mesiano 77, Italy

A novel approach to the modelling and simulation of the industrial compaction process of ceramic powders is proposed, based on a combination of: (i) continuum mechanics modelling of the constitutive response of the material; (ii) experimental testing combined with micromechanical modelling for material parameter identification and calibration; (iii) finite element discretization and computer implementation of the mechanical model. The capabilities of the proposed approach are highlighted through computer simulations of realistic industrial compaction processes. The presented methods and the pointed out results pave the way for the introduction of so-called virtual prototyping into the industrial practice of ceramic forming processes In this way, industrial processes can be numerically simulated to detect the distribution of residual stress, density, and elastic properties within the green body, with the purpose of improving design through minimization of defects and regularization of the density distribution

PL12
Impact of Temperature Dependent Ion Properties, Radii and Polarizability

Steven Clay Tidrow

New State College of Ceramics, Kazuo Inamori School of Engineering, Alfred University, Alfred, NY 14802

Society faces a series of critical challenges, with regard to energy, water, environment, limited resources, etc., for sustaining or improving current standards of living and the quality of life of earth's rapidly growing population. Such challenges can be overcome through timely discovery, development and deployment of affordable materials which enable specialized devices.

Our material science and engineering communities' ability to more rapidly discover and develop new materials is hampered by our limited ability to *a priori* predict material lattice parameter and structure. At all length scales, material properties depend upon the atoms and their geometric, Euclidian, fractal, and/or other, arrangement in constituting materials. Through knowledge of the geometric arrangement of atoms, a wide range of material properties can readily and rapidly be determined using presently available theory and algorithms. Using temperature dependent genome-like ion properties, radii and polarizability, developed within the new "simple" material model (NSMM), we illustrate the wide range of "simple" and "simply mixed" perovskite properties that can be modeled and *a priori* predicted as well as illustrate the superiority of NSMM over Goldschmidt's tolerance factor formalism. Discussions also include the constructs used in development of unconventional properties recently observed from dipole-like substituted "simple" and "simply mixed" perovskites that significantly outperform conventional "simple" and "simply mixed" perovskites as energy storage materials.

PL13
Novel Semiconductor and Epitaxial Nanocomposite Materials for Energy Conversion and Optoelectronic Applications

Joshua M. O. Zide

Materials Science and Engineering, University of Delaware, Newark, Delaware, USA

Advances in electronic materials (specifically, semiconductors and nanocomposites) enable new device technologies and improve the properties of existing technologies. In this talk, I will present efforts within my group on the growth of new materials by molecular beam epitaxy and the resulting advances in solar cells, thermoelectrics, and optoelectronics.

Specifically, I will discuss two material systems: (1) nanocomposites consisting of metallic nanoparticles (such as ErAs and TbAs) within III-V semiconductors (such as InGaAs and GaAs), and (2) dilute bismuthide semiconductors in which bismuth is incorporated into III-V materials to reduce the bandgap significantly, with unique band alignments that cannot be easily achieved in other materials. In these new materials, electronic, thermal, and optical properties can be quite different from those of conventional materials, with significant promise for applications in a variety of (opto)electronic devices.

PL14
Advantages and Challenges of the Reaction SPS in Manufacturing of Ceramic Matrix Nanocomposites

Andrey V. Ragulya

Frantsevich Institute for Problems in Materials Science NAS of Ukraine
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The results of recent research of the Field Assisted Sintering of ceramic matrix nanocomposites based on nitrides and borides are summarized in this overview. Conventional ceramic paradigm itself represents a combination of particulate technologies methods, which include powder synthesis stage, powder consolidation, sintering, and treatment. This approach is quite universal, but it faces a number of challenges, mostly because of difficulties to achieve uniform component distribution through the bodies of multiphase materials. The nanocomposites represent the most promising class of bulk nanomaterials. Engineering of nanocomposites can exploit the R. Cannon hypothesis of the phase and space restrictions of grain growth during sintering or high temperature creep aimed at marriage of the best combination of structural and functional properties. The manufacturing of ceramic nanocomposites, however, is still a challenge for practice.

The recently developed nanocomposites in the TiN/TiB_2, ZrN/ZrB_2, TiN/ZrN-ZrB_2/TiB_2 systems were obtained by FAST technique including flash-SPS. The competitive mechanical properties of the obtained ceramics will be illustrated.

PL15
Phase Transformations and Formation of Hierarchical Structures in Composites under Loading

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Deformation and fracture of metal matrix composites under various loading schemes are studied. The investigations conducted have shown that in conditions far from transformation the hinder material is deformed by dislocation glide as an ordinary BCC crystal. In this case, the yield stress of the binder is inversely proportional to the carbide spacing; in alloys with high solid phase content it is not achieved up to fracture. Cracks are generated along weakest regions, namely, carbide - carbide and carbide -binder interfaces. Material fracture is catastrophically brittle.

The study of alloy deformation close to the structural transition temperature has shown that there are transformations in the binding phase. They are different in character, which is governed by a highly non-uniform stress state of me hinder. During loading even in the region of elastic behavior of the composite the microstructure changes from a dispersed domain to banded structure. The latter is typical of intermediate shear structures. In electron-diffraction patterns diffusion spots and then extra reflections appear both in commensurable and incommensurable locations with different commensurability parameters and in different

directions of the reciprocal lattice. This character of transformation is induced by a very complex stress state formed around solid particles during composite loading under high stress gradients arising in the binder.

At strains above the elastic limit of the composite the dispersed structure consisting of misoriented fragments of the binder phase and martensite domains is formed in binder region under most stressed conditions. Electron-diffraction patterns of these regions have typical rings.

At high deformalion of the composite one can see zones with almost uniform intensity in some binder regions (primarily near hard particles boundaries and in thin inter-particle layers. These regions give continuous diffusion rings in electron-diffraction patterns that sometimes contain arcs in main azimuthal directions. Such a diffraction character corresponds to a quasi-amorphous matter.

So, during deformation of composites near the phase transformation temperature in one component the "quasi-amorphous state" is realized in the this phase with the formation of a hierarchical microcrystalline, highly misoriented structure with characteristic size of crystallites less than 10 nm. This structure has high plasticity and strong hardening from the beginning of loading. It governs an efficient transfer of external load to hard particles, inducing dislocation glide even in, for example, typically brittle titanium carbide particles.

The physical meaning of such behavior of binders with unstable structure in composites is decreasing of scale level of plastic deformation due to the formation of the microcrystalline structure of the binding phase during non-uniform loading.

PL16
Innovative Manufacturing of Advanced Silicon Nitride Ceramics and Components for Sustainable Society

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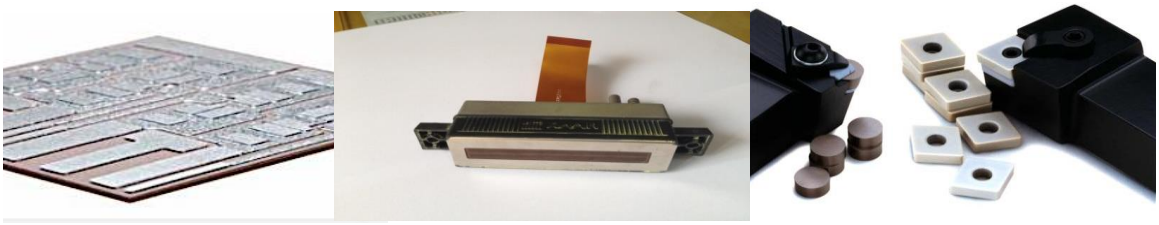
Guangdong province of China initiated an “Innovative and Entrepreneurial Research Team” program in 2010 aiming to facilitate the growth and development of various strategically industrial sectors in Guangdong province via the introduction of talented experts from oversea. The research funding provided ranges from 10 to 80 millions per team project. This lecture will provide an overview of an innovation team project entitled “Advanced Manufacturing of High Performance Ceramic Components” funded by Guangdong provincial government. The objective of this team project is to develop and commercialize various advanced silicon nitride ceramic components, such as power electronic ceramic substrate, cutting tool, and 3D printing spray nozzle, to ultimately achieve sustainable manufacturing and energy saving for targeted strategically important industries in Guangdong province and also China. The approach and goal of each task will be presented and discussed in the presentation.



Research supported by Guangdong Innovative and Entrepreneurial Research Team Program (NO. 2013G061).

KN-BMS1
Theoretical study of skeletal structure evolution during liquid phase sintering

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In this paper densification (or compact densification) and structural development during liquid phase sintering (LPS) will be numerically investigated. Solid skeleton structure will be introduced by definition of skeleton units determined by equilibrium dihedral angle and formation of large solid skeletons arranged in long chain of connected solid-phase domains (skeleton networks). In this approach it will be assumed that the skeletal structure develops early in the process and hence it is important to define a model based on inter-grain behavior. Central to such study will be unit problems for interaction of grains within solid skeleton. The compact will be modeled as a three-dimensional random assembly of solid-grains interacting mechanically through their contacts (inter-grain level), whereas skeletal structure evolution (SSE) could then be related directly to the neck size of contacting solid-grains. SSE will be based on free-settling procedure in which solid-grain domains fall under gravity over already settled domains and, if there are no contacts between domains, settled domains continue their motion till they reach a position of their local equilibrium. SSE will be simulated by an algorithm based on neck growth law and grain-level methodology. It will be assumed that Stokes's law settling usually dominates microstructure formation. Thus, the settling procedure (displacement of the center of mass of settled domains) will be simulated by computation of settling time interval and average migration distance.

Theoretical study of densification during LPS must also consider SSE influenced by some essential topological constraints, because they can cause grain rearrangement and the development of the pore distribution during LPS. Taking into account the mobility of pores in an LPS structure and the solid phase morphology, densification can take place by buoyancy driven pore migration.

In that sense, we will define modified numerical model based on domain methodology and sub-models for constrained SSE. Skeletal structures will be computed by geometrical limitation for two grains in contact with an observable dihedral angle. Once formed, grain contacts grow to satisfy the dihedral angle, and beyond that point neck growth is paced by the grain growth rate. It must be note that rigorous topological characterization of skeletal structure requires reducing the solid-phase space into a node network, which emphasizes connectivity. Some types of topological constraints that depend of skeleton structure present a central problem in developing the time dependent SSE.

Simulation of SSE for W-Ni alloy will be used as a model experiment. Different morphological changes taking place during extended sintering of LPS materials can produce microstructures which may have potential for theoretical investigation. Analysis of grain coarsening due to the neck growth poses other particular computational difficulties and will be considered in a separate paper.

KN-BMS2
Coated Wireless Light Emitters for Efficient Up Scaling of Photocatalytic Processes

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The importance of heterogeneous photocatalysis in fundamental and applied science expanded rapidly over the last decades. However, current photocatalytic processes have many engineering limitations such as illumination efficiency and reactor design, hence industrial implementation is still limited to select few cases and only on a small scale. Large scale photocatalysis especially in the case of high catalyst loadings is limited mainly by the penetration depth of light into the reactor, which typically does not exceed a few millimeters.

Internal illumination is a promising technique that achieves good illumination efficiency and enables a more flexible choice of reactor types. Different types of internal illumination such as immersion lamps or optical fibers have successfully been applied. Compared to those methods, wireless coupling of internal light sources, further called Wireless Light Emitters (WLEs), has great advantages for up-scaling photocatalytic processes.

We will present completely integrated photocatalyst-coated wirelessly-powered photocatalyst spheres as a novel means to perform heterogeneous photocatalytic reactions. We will explain the working principle of the coated WLEs and show results of the characterization of the coatings. Further, we will present three different model reactions with the coated WLEs: the generation of hydrogen peroxide, the reduction of nitrobenzene and the degradation of methylene blue to demonstrate the wide scope of applications.

Finally, we will discuss the future perspective of this technique and the importance of the system for up scaling photocataytic processes.

KN-BMS3
Negative and Zero Thermal Expansion Ceramics (Thermomiotics)

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It is common knowledge that most solids change their dimensions when the temperature changes. Usually, the dimensions increase with increasing temperature, and this is referred to as positive thermal expansion (PTE). This thermally induced change in dimension of a material, in a confined environment, can lead to significant mechanical stress. If the stress exceeds the strength of the material, the material will shatter owing to the propagation of microcracks, quite possibly with disastrous consequences. On the other hand, very few materials shrink with increasing temperature, giving rise to negative thermal expansion (NTE), while in some even more rare cases dimension does not change at all,

causing an uncommon phenomenon denominated zero thermal expansion (ZTE). The basic mechanism causing thermal contraction in thermomiotics (from the Greek, 'thermo' for 'heat' and 'mio' for 'contract') and related phases is the large amplitude, low-energy, transverse vibration of atoms in the middle of A-X-M linkages (A and M are cations, while X is commonly an oxygen anion) resulting in decrease of A-X-M angles and A-M non-bonding distances. This shrinkage mechanism competes with the thermal expansion arising from the asymmetry of the potential well.

The discovery of ZrW_2O_8, the first ceramic phase exhibiting large negative thermal expansion (*i.e.*, thermomiotic behavior) over a wide temperature range, followed by recognition of similarly unusual thermal expansion (negative, zero or low-positive) in a few structurally related ceramic families awakened interest in these materials due to their exotic nature and potential applications. Regarding the eventual applications of these novel phases with unusual thermal expansion, most current efforts focus on their role as thermal expansion tuning fillers, counteracting the large positive thermal expansion of a matrix such as a polymer, metal, or conventional ceramic.

The near-zero thermal expansion phases from thermomiotic ceramic families are also natural candidates for thermal shock resistance applications, considering the Hasselman thermal shock resistance figures of merit for mild (R') and severe (R) heating conditions.

This lecture has purpose to present the general principles and mechanisms for negative and zero thermal expansion and to discuss the current trends in use of these materials, especially for thermal shock resistance applications.

KN-BMS4
Complex constitutive models in powder compaction: from curve fitting to material mechanical characterization

Vladimir Buljak

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Powder compaction is a process in which granular material becomes gradually cohesive through mechanical densification. To simulate this process usually soil constitutive models are employed. However during compaction phase material passes through wide range of pressure and changes significantly elastic properties. Such circumstance limits the use of constitutive models with linear elasticity followed by appropriate hardening law, and a more general framework is required, in which elastic properties are dependent on plastic deformation. The use of complex constitutive models which tend to capture most of the physical processes that are taking place during the compaction, results in governing equations with an elevated number of parameters. Such circumstance makes the calibration process rather demanding, as some of the parameters require high pressure experiments. Within the usual praxis, quantification of diverse parameters is performed through various destructive tests, performed on a green body (a solid body resulting from a compaction test), with tendency to directly relate experimentally measured quantities to the parameter of interest. This procedure however, has limited applicability for the present case, since some of the parameters have vague physical interpretation, or are difficult to measure.

An alternative strategy for mechanical characterization is based on the use of inverse analysis methodology, which is centered on minimization of discrepancy function between experimentally measured quantities and their computed counter-part. With this strategy the identification of parameters can be performed using only data collected from a compaction tests. The large complexity of the considered constitutive models makes the inverse problem typically ill-possed, so various regularization techniques have to be applied, while the experimentally measured quantities have to be extended to ascertain good sensitivity to sought parameters. Within this lecture, some innovative methodological procedures are presented apt for the calibration of constitutive models used for powder compaction. A reference is made to modified Drucker-Prager "cap" plasticity model with field dependence, and to a more sophisticated Bigoni-Piccolroaz model specifically developed for powder compaction. Results presented corroborate the conclusion that, for the calibration purposes of complex constitutive models, governed by large number of parameters, a systematic approach needs to be adopted in order to avoid particular solutions related to a single experiment, resulting in non-representative material parameter sets, which manage to fit one experiment only.

KN-NOP1
Novel Nucleobase-Functionalized Carbon Nanotubes for Biomedical Applications

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Single-stranded DNA (25-aptamer of mixed dA, dT, dG, and dC) with a deliberate sequence was used to entwine with functionalized single-walled carbon nanotubes (*f*-SWCNTs) for the first time. Their external surface of pristine SWCNTs was functionalized covalently with multiple triazole–(ethylene glycol) ligands attached to dA, dT, dG, or dC. This method of hybridization involves the formation of hydrogen bonds between nucleobases of ssDNA and dA, dT, dG or dC of *f*-SWCNTs. It deviates from the reported π–π stacking between the nucleobases of DNA and the external sidewalls of nanotubes. The structural properties of the *f*-SWCNTs and its ssDNA complex have been characterized by spectroscopic (including CD and Raman), thermogravimetric (TGA), and microscopic (TEM) methods. Additionally, the hybridization processes were found to depend upon the solvents employed, temperature applied, pH adjustment, and sonication conditions.

Our results show that these new biochemically-imitated carbon nanotubes exert similar biochemical properties as a complementary ssDNA in dsDNA. As a result, they can be applied to deliver a variety of DNA aptamers and possess a great potential as gene carriers. Moreover, this new nanomaterials also holds promise for biotechnological, anti-viral therapeutic and other biomedical applications.

KN-NOP2
Nucleation theory and growth of surface nanostructures

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In this talk, I will explain how nucleation theory can be used for predictive growth modeling of surface nanostructures, with a particular emphasis put on vapor-liquid-solid nanowires synthesized by the vapor-liquid-solid (VLS) method. In many cases, understanding and controlling specific size-dependent features of the nucleation process at the nanoscale yields otherwise unattainable physical properties of individual nanostructures as well as statistics within their ensembles. Recent examples include tuning the crystal structure of III-V nanowires, self-ordering effects on the size distributions induced by the so-called nucleation antibunching in anno-sized catalysts, and unusual morphologies of surface nanostructures. These features originate from a special type of timescale hierarchy for kinetic growth processes in nanosystems, which is interesting from fundamental viewpoint and should be applicable for a wide range of new functional nanomaterials.

KN-NOP3
In vivo models for examination of biomaterials and scaffolds as mesenchymal stem cells carriers in bone regeneration applications

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Various biomaterials of natural and artificial origin can be used as a scaffolds and carriers for mesenchymal stem cells in purpose of bone regeneration and defect reparation. Bone regeneration materials should be the microenvironment and support for the cells so they can migrate, adhere, proliferate and differentiate allowing new bone tissue formation or mimics the biological structure and function. In our research we have been used adipose derived mesenchymal stem cells (ADMSC) that we induced in vitro toward osteogenic cells or endothelial cells, or applied as freshly isolated stromal vascular fraction of adipose tissue. We applied ADMSC together with biomaterials as bone tissue engineered constructs in order to investigate the osteogenic process. Various *in vivo* experimental models can provide useful data on bone regeneration and repair mechanisms. In our studies we used orthopic bone forming models in rats and rabbits, as well as ectopic implantation models in mice and rats.

Assessment of implants and surrounding tissue was performed using numerous methods such as histological staining, histomorphometry, immunohistochemistry, radiographic methods, specific gene expression analysis, and others. Appropriate combination of models, methods and approaches in experimental research of bone regeneration is very important for obtaining the useful guidelines for clinical applications.

KN-NOP4
Colloidal Silica Particles – a Simple Material with Fascinating Possibilities

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Silica particles in the nano- to micrometer range can be easily prepared by wet colloidal approaches such as the Stöber process. The size and monodispersity of these systems can be well controlled. Due to the various possibilities to tune their properties, their chemical inertness, and their biocompatibility these materials are widely used as model systems and in different applications from photonics to biomedicine. In his presentation, first ways and limitations to adjust the size and polydispersity and to tune the surface properties, especially the roughness of these materials are discussed. Subsequently, results on the uptake of silica particles in cells and tissue, especially in human skin, biological effects and possible risks and perspectives arising from these findings will be presented.

Many of the fascinating opportunities of silica particles are based on the formation of core-shell structures. General approaches to obtain silica coated particles as well as silica colloids with defined shells consisting of various metals are shown and compared with literature approaches. Some of the properties and possible uses of the resulting systems are discussed. For the usage of silica and silica-coated particles for example in antireflecting coatings, sensors or superhydrophobic surfaces, or sensors, it is often important to arrange such particles on smooth or structured surfaces. New approaches to achieve extended non-closed packed arrays of such materials on smooth as well as on concave-structured surfaces are shown.

KN-EM1
Processing and Applications of Nanocrystalline Diamond Hybrids and Engineered Diamond Microparts

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Nanocrystalline and ultrananocrystalline diamond combines the remarkable properties of conventional diamond, such as extreme hardness and wear resistance and a coefficient of friction of about 0.01. Here, we report on the correlation between avg. grain size and the relevant mechanical properties of phase pure NCD and UNCD layers synthesized by chemical vapour deposition on silicon single crystal wafers with diameters up to six inches. The UNCD films consist of ultra small (ca. 5 nm) equiaxed grains resulting in ultra smooth

surfaces with surface roughness equivalent to the grain size and transparent appearance. The mechanical properties have been investigated and show that due to the large number of grain boundaries with highly disordered atomic structure the Young's modulus is decreased from about 1010 to 500 -700 GPa but fracture strength is increased from 1 GPa to ca. 5 GPa. This makes the material very attractive for several applications.

As a step further, by a sophisticated combination of high-precision photolithographic techniques and efficient reactive ion etching processes (RIE) complex shaped microparts can be designed and fabricated. A number of different current examples and applications will be discussed, such as lubrication-free and wear-resistant microcomponents and hybrids for high-precision mechanical devices, sensors for harsh environments, MEMS components and ultra-sharp cutting tools for bio-applications.

KN-EM2
Thermodynamics of Vapor-Liquid-Solid Growth

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Vapor-Liquid-Solid (VLS) growth is a technologically highly important growth mode used to grow semiconductor nanowires and the examples we will consider concern growth of gold alloy seeded III–V semiconductor nanowires. The aim of this presentation is to demonstrate how phase diagram and thermochemical data can be used to deepen the thermodynamic understanding of vapor-liquid-solid (VLS) growth. We use the CALPHAD (CALculation of PHAse Diagrams) method to retrieve thermodynamic data. In order to understand VLS growth of nanowires we construct and interpret various vertical phase diagram sections using these data. The systems we have investigated are gold alloy catalyzed GaAs and InAs. From our thermodynamic data, we also determine realistic chemical potentials and use these in nucleation modeling. In particular, we calculate the composition of gold alloy catalyzed ternary nanowires in the material system InGaAs as well as other related systems. In conclusion, these results are very important for understanding the thermodynamic limitations of metal particle catalyzed nanowire growth. This kind of modeling approach is very promising when searching for new materials combinations and could replace resource demanding experimental trial-and-error.

KN-EM3
The use of ceramic coating by ESD technique to improve the service life of copper spot welding caps

Şükrü Talaş

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The joining processes that are used in automotive industry often need spot welding for the joining of sheet materials. The specific points in these welding are that they are carried out in short time and in elevated number with a certain pressure on them. However, copper caps are expected to endure against pressure, temperature that is released during the passage of the current. The easy deformation and oxidation behaviour of copper caps appear with

increasing temperature of medium and also need to be cleaned and cooled or replaced for the continuation of joining process. With ceramic phase coating, the service life is expected to increase at least twice and provide an economic advantage for the manufacturer. The benefits that comes from coating are, not only the extension of service life but also mechanical and corrosive resistance and even the stiffness can be considered. At the same time, coating electrodes that can be produced in different shapes can eliminate the need for sharpening and the increase in the resistance appearing in copper caps, resulting in an efficient use of these electrodes. Ceramic coatings leave a thick layer of high temperature resistant and high impact toughness material on the copper cap surface. By changing the ESD (Electro Spark Deposition) parameters such as voltage, frequency etc.., different coating thicknesses of the ceramic coating on the copper electrode can be obtained.

KN-EM4

Some practical application of TiO_2

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

KN-MCC1

Restrained Nanosintering as a Path to Produce Designed Nanostructured Solids

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With designed bulk nanostructured solids, one could potentially combine properties that are mutually exclusive in a single bulk material, and, as a result, dramatically improve the desired performance. However, a major research challenge and roadblock is how to produce 3D nanostructured materials consistently with the required phases arranged in designated spatial order that are at the same time fully dense without porosity (monolithic) and detrimental phases. Known state-of-the-art techniques for producing bulk nanostructures cannot simultaneously meet all these requirements. As a result, the inherent properties of such bulk monolithic nanostructured materials are greatly unknown and unexplored.

We developed an Enhanced High Pressure Sintering (EHPS) process for restrained nanosintering to make monolithic nanostructured materials from nanoparticles while retaining

their initial size and structure. Using this approach, monolithic nanocrystalline transparent ceramics with grain size down to 3.5 nm is demonstrated. Such ceramics exhibit a 40% increase in hardness over a corresponding order of magnitude reduction in grain size and suggests that Hall-Petch type (strengthening via grain size reduction) relations exist in ceramics down to 15 nm.

Application of the restrained nanosintering to core/shell nanoparticles offers fundamentally new means for design of nanostructured solids and tailoring basic properties of such artificial materials. To provide flexibility in core/shell nanoparticles design, a particle atomic layer deposition (p-ALD) reactor was incorporated in the EHPS facility. The new setup allows to controlling environment during all stages of the nanoparticles processing, atomic layer deposition and sintering. Monolithic core/shell nanocomposite ceramics was produced and characterized for the first time.

KN-MCC2
Development and Evaluation of glass-like and glass-ceramic Protection Coatings for Metals, Steels and Glasses

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Since several years, pure glass-like coatings are well known for protection against corrosion and wear up to 500°C [1]. Based on this, new glass-ceramic coatings were developed, which withstand temperatures up to 900°C without loss of the protective properties. In addition, tribological and easy-to-clean functions are incorporated by ceramic components like SiC [2].

These results were obtained by a combination of glass matrix with ceramic matrix, which, after sintering at temperatures between 500°C and 900°C shows more stability than a pure glass-like matrix and can be used even now for protective coatings of cardiovascular stent materials [3]. Investigations of corrosion protection and wear resistance have shown, that the known protection by alkali glass-like systems is combined with a higher hardness, depending on the ceramic amount. This increased hardness (up to an average of 10.000 MPa with 20 wt.% SiC) is further on flexible and can be formed to a certain extent.

A further advantage of the new coatings is the easy-to-clean function combined with tribological behaviour. Especially if the coating is sintered under inert atmosphere (nitrogen, argon) at 500°C to 800°C, the contact angles against water have values of 100° to 110° and the surface energy was calculated to 20.1 mJ/m^2, which is the best stage for these temperatures.

For the ball-disc tribometer measurements, a glass-ceramic coating on steel, densified at 800°C under air, was investigated with stainless steel ball (100Cr6). The glass-ceramic coating withstands the stainless steel ball without damages. It was even superior to the ball, which gets abraded by itself. Overall, with the new coatings for metals, alloys, steels and glasses, an excellent combination of the very hard glass-like coating (with corrosion and scratch/wear protection) and the high temperature stable ceramics (with anti-adhesive properties and even flexibility) was synthesized.

KN-MCC3

Joining of ceramics by brazing alloys

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Interfacial interactions - wetting and reactions at metal/ceramic interfaces are of paramount importance in many fields of materials engineering such as joining of ceramics by brazing alloys, manufacturing of metal/ceramic composites, casting of metals, etc. The purpose of this presentation is to focus on the fundamental issues of metal/ceramic interfacial interactions and to analyse the main thermodynamic and kinetic factors governing these interactions. First, the main features of reactive wetting are described and illustrated. Then, after defining the two types of brazing used in practice - capillary and sandwich brazing, the thermodynamics and kinetics of capillary infiltration are presented. The different configurations expected to occur in sandwich brazing are also described and illustrated. Finally, some physicochemical aspects which can affect, or even control, the morphological evolution of the interfacial region and the properties of the joints are discussed by using and analysing different examples of interactions between oxide or non-oxide ceramics and reactive or non-reactive liquid alloys during joining of ceramics by brazing alloys.

KN-MCC4

Mechanical treatment of Me_IC- $Me_{II}B$-$Me_{III}O$ powders and sintered ceramic composites properties

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The effect of mechanical activation on the properties of hot pressed ZrO_2-ZrB_2-SiC ceramics was studied. It has been shown that material densification after mechanical treatment is finished on initial stages of sintering process. Addition of SiC leads to essentially increasing of sample density up to 99% of a theoretical one for powder with 20% SiC, as compared with ZrB_2 not higher when 76%. It has been shown that all defects which were accumulated during mechanical treatment are annealed during hot pressure process and there are no any changes of coherently diffracting domain values in sintered ceramics. The model was suggested to describe of three-layered porous composite synthesis at the conditions of hot isostatic pressing and investigate the porosity evolution during synthesis. It have been shown that addition of SiC leads to essentially increasing of sample density up to 99% of a theoretical one for sintered ceramics with 20% SiC, as compared with ZrB_2 not higher when 76%.

KN-REHA1
Circumstance, experiment and superstition: testing the notion of tradition in West Balkan pottery-making

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The West and Central Balkans host some of the oldest and most diverse ceramic traditions in Europe, amongst which the use of calcite as a component of pottery fabrics finds its roots in early prehistory. This paper attempts to highlight the complexity and diversity of recent pottery-making in the region by investigating possible reasons for the continued use of calcite, using a materials science approach combined with observations made during repeated visits to potters. It also invokes explanations given by the potters themselves to explore the nature of 'tradition' and how perceived behavioural or cultural distinctions in pottery-making contexts might be recognised archaeologically through corresponding material patterning. It suggests that while adherence to tradition need not always be determined by functional or material constraints, the use of calcite acts as a particularly powerful technological constraint in the dynamic equilibrium of successful pottery-making, considered in the context of appropriate technology. Finally, a plea is made for the recognition and preservation of this non-tangible heritage asset before it is entirely lost to the region.

KN-REHA2
Future lights in ceramics - a new award for European ceramists: expectations, experiences, results

Wilhelm Siemen

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

Since 2015 the „Future Lights award" aus part of a European project cofounder by the „Creative Europe" program is on the run. In a few months the „Ceramics and its Dimensions" team will launch the third call will be open. Themes were linked with industry as well as manufactury needs and opened new perspectives from art inspiring the designers to design focussing on social changes like migration as well as diversity and sustainability.

Two years of experience have passed by, corrections were made, young ceramists as well as young researchers from all over Europe applied, a few could be selected, gained expertise and new perspectives getting in touch with the ceramics branch and of cause the world of consumers.

KN-REHA3
A Review On The Selection of Anode Materials For Solid-Oxide Fuel Cells

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Solid-oxide fuel cells (SOFCs) are the most widely used fuel cells because they exhibit flexibility, power generation efficiency, and low pollutionformation.Research on SOFC anodes is a major and challenging task in the field of SOFCs.This review highlights the anode materials that may be used for SOFC applications.The use of cermet-based oxide materials as anodes for SOFCs is also discussed in detail. A literature survey conducted over the last 10 years shows that increased power generation efficiency may be attributed to anode materials used in such cells. Oxide-based anode materials with perovskite and several oxides with cubic fluorite structures are further described.Basedonthereviewconducted,we find thatcubic fluorite-structured compound s are the most promising anode materials reported thus far. Analyses of the structure and electrical performance of anode materials show as well that copper– gadolinium-doped cerium oxide(Cu–GDC) cubic fluorite-structured anodes exhibit higher electronic conductivity potential than yttria-stabilized zirconia-based anode materials.

KN-REHA4
Structural and Magnetic properties of magnetron sputtered Fe/Cu Nanoparticles thin films

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Structural, dc and ac properties of rf –sputtered Fe/Cu binary nanoparticles thin films have been fabricated by radio-frequency magnetron sputtering technique at different base pressures. The as made sputtere Cu/Fe granular nano-particles are found to be superparamagnetic in nature.The dc and ac magnetic properties are investigated as a function of applied field at different temperatures down to liquid helium temperature using a superconducting quantum interference device (SQUID). The room temperature Mössbauer spectroscopic studies shows a paramagnetic doublet. It is observed that the densely packed as cast nanoparticles system is an fcc-FeCu solid solution which goes through magnetic phase transition upon heat treatment with the inclusion of bcc-Fe. Nucleation of ferromagnetic Fe nanograins is observed upon annealing the sample at 400C for one hour in an argon atmosphere and is confirmed by the appearance of sextets in the Mössbauer spectrum. Also the as deposited Cu/Fe particle system with the predominance of fcc Cu is found to have high electrical conductivity and complete immiscibility and hence can be an ideal system for nano-device fabrication. Mössbauer spectrum of as made sample at room temperature shows paramagnetic doublet while a ferromagnetic sextet is observed for annealed samples

indicating the formation of ferromagnetic Fe nanoparticles in a predominant matrix of fcc-Cu. The Scanning Electron Microscopy (SEM) revealed a densely packed particles system with a wide range of particle size distribution. The Field cooled (FC) and Zero Field cooled (ZFC) curves have shown a peak temperature T_p around 45K. M-H hysteresis curve on as made and annealed samples at low temperature has shown magnetic softness while some measurable coercivity is developed upon heat treatment on this binary metallic particles system. The low field ac permeability measurements at constant applied field and different frequencies have shown a flip temperature around 45K.

INV-BMS1

Characterization of Au-mercaptotriazole crystals using the spectroscopy methods

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At the Institute of Mining and Metallurgy Bor a completely new electrolyte based on gold complex with mercaptotriazole was synthesized in a wide pH range from acid to alkaline media (pH=2–12). Synthesis of the electrolyte for hard and decorative plating was developed and tested. In this investigation detailed characterization of the complex in liquid and solid state in the whole range of its stability was performed.

It was shown that the new electrolyte can be successfully used in electrolytic baths for hard and decorative plating. Contrary to the previous organics complexes of gold, it retained a sufficient stability in a period of at least three months. Electrochemical characteristics of mercaptotriazole gold complex at pH value of two and nine remained unchanged for a period of one year. In that period any visual changes did not appear. Based on detailed experimental investigations, it was concluded that the quality of decorative gold plating, obtained from a gold complex based on mercaptotrizole, satisfies all requirements of decorative gold plating. The most important advantage of this electrolyte is ecological, as the gold could be regenerated by simply settling with hydrogen peroxide in which the sulfur is precipitated. Infrared (IR) and Raman spectroscopy were used for the characterization of the crystals of gold complexes based on mercaptotrazole obtained from solutions with different pH values (2, 4, 7, and 9). The most important finding of IC/Raman spectroscopy analysis is that the Raman spectroscopy has provided a definitive confirmation of bond established between metal ion and sulfur atom. Also, both techniques indicated that the nitrogen atom in the ring of obtained Au-MT compound, remains protonated at pH = 9, which does not support an assumption formulated from the analysis of UV-spectra, that MT molecules at this pH may interact with the metal ion not only through the sulfur, but also through the nitrogen atom.

INV-BMS2
Iron oxide functionalized wollastonite based adsorbents for oxyanions removal

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Iron oxide functionalized porous wollastonite (WL) was used as adsorbent for oxyanions (arsenic, chromate and phosphate ions) removal from natural water. Porous WL was fabricated from calcium carbonate and siloxane by a pressureless sintering process and by using low molecular weight nano-sized poly(methyl methacrylate) (PMMA) as pore forming agent. The precipitation of iron oxide nanoparticles was carried out directly by a polyol-medium solvothermal method using iron(III) chloride hexahydrate and via (3-aminopropyl)trimethoxysilane cross-linker by solvent/nonsolvent system method using iron(II) sulphate heptahydrate. The effectiveness of WL synthesis and modification was confirmed applying FTIR, Raman, XRD and SEM analysis. Comparative adsorption study, related to benefits of WL modification method for the iron oxide functionalized WL based adsorbent for oxyanion removal was conducted. In a batch test, the influence of modified WL mass and contact time on adsorption efficiency of arsenic, chromate and phosphate ions were studied.

INV-BMS3
Dilatometer as a scientific tool

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Dilatometry is defined as the dimensional change of a solid specimen recorded during temperature schedule. Set of data obtained in such a manner are known as dilatogram. Dilatograms for different sort of materials represent an important trace for deduction of other materials properties than volume. Property parameters directly appointable from the dilatogram graph are: thermal expansion coefficient for the temperature interval, glass transition temperature, phasetransition temperature, sintering shrinkage and sintering temperature for maximal shrinkage rate, crystallization point temperature for amorphous bulk metallic glasses, defect annealing temperature. From dilatometric data we can also calculate more complex values such as the sintering activation energy, deduce sintering kinetic

mechanisms, for the phase transition kinetic parameters and phase composition, defect concentration, materials thermal expansion coefficient at a particular temperature, solid state reaction kinetic parameters. Dilatometric devices regarding the construction are divided into contact and non contact ones, for they physically exert force on the specimen or not. Furthermore, contact dilatometric devices can be ascribed due to their construction as vertical and horizontal. This categorization leads to different and changeable contact force on the specimen. Vertical dilatometers usually use higher and temporarily changeable forces applied on the specimen. They can be, with suitable equipment, used for other mechanical properties determination than expansion, such as compressibility, tension or inflection. Non contact devices are divided into interferometric and optical. Interferometric ones use a two laser beams construction where for the length change measuring they count the number of wave lengths that are formed as a path difference between two beams. Optical devices, however, uses monochromatic light projected on the specimen that forms shadow recorded on an optical sensor. Obtained images are then analyzed for the specimen`s dimensional change.

INV-NOP1
Development of dense and controlled porous nano-structured biomaterials based on hydroxyapatite

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The human bones and teeth as natural composites contain nano-sized hydroxyapatite (HAp) forms as main inorganic phase which gives the sufficient mechanical properties to human hard tissue. The processing of nano-grained sintered HAp bioceramic forms and nano-structured controlled porous scaffolds based on HAp are two directions of development of biomaterials applicable in different regenerative purposes in dental, maxillofacial and orthopedic practice and also in the field of tissue engineering. The first part of the research was based on the investigation of possibilities for processing of nano-grained dense HAp, starting from nano-powder, using the different approaches for limiting of the grain size, different sintering techniques and different concept of temperature regimes. The presence of nano-sized grains in dense microstructure affected improvement in the mechanical properties and *in vitro* biocompatibility. *In vivo* investigations indicated that reducing of the grain size could improve the structure/quality of tissue-material interfaces and have potential to affect the osseointegration. It was also showed that nano-grains in full dense two-step microwave sintered HAp were not a guarantee, but in many cases are sufficient prerequisite for improvement of mechanical properties. The second part of the study was based on the improvement of the properties of composite scaffolds, with the amount of calcium phosphate phase similar to natural bone, by controlling of doping and shape of β-TCP bioactive particles.

INV-NOP2
New aspects in processing of hydroxyapatite ceramics

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Sintering of hydroxyapatite ceramics has been a challenging topic for decades since the material has good bioactivity, proven biocompatibility, low cost, and high availability. Besides its biomaterial applications, hydroxyapatite has been used so far as a catalyst support, sensor material, etc. For improvements in its functional properties, new synthesis and processing routes are certainly required.

This work will present current achievements in new processing routes of hydroxyapatite ceramics. In the first part, sintering of hydroxyapatite in the presence of lithium iron phosphate will be presented. Such composition induces formation of liquid phase during sintering and interaction between materials that provides decreasing of the processing temperature and formation of reinforcing Fe-rich phase located along the grain boundaries of the matrix material. Furthermore, an influence of heating rate on pure hydroxyapatite sintering will be presented showing that conventional processing with high heating rates can be beneficial for microstructural refinement without any drawbacks regarding the final density of sintered ceramics. This will be discussed regarding the chemical changes induced due to release of hydroxyapatite structural ionic species.

INV-NOP3
Self-assembly on surfaces and nanotechnology

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Tribology is a study of friction, lubrication and wear. The basic principles of friction have been described very well in an empirical way, but the molecular mechanisms underlying friction are still not understood. With the development of nanotechnology and the new experimental probes, scientists have been able to study the origins of friction on the atomic scale. Usually, there is a need to reduce the friction coefficient and the lubricants are normally employed. In this research special attention is dedicated to the boundary lubrication regime, when specific molecules form absorbed molecular film on the solid surfaces and dry contact is excluded. A good model for boundary lubrication are the self-assembled monolayers. Our aim was to produce homogeneous monolayers of surfactants on muscovite mica. We have chosen quaternary ammonium surfactants, to use the ion-exchange capabilities of the negatively charged mica substrate and positively charged head groups of the quaternary ammonium surfactants (primary cetyltrimethylammonium bromide). The adsorbed layers were characterized by contact angle measurements and atomic force microscopy imaging. It has been shown that the temperature during solution preparation can be potentially detrimental to surfactant adsorption on the solid surface from solution.

INV-EM1
Granular material transport and mixing - DEM/CFD numerical approach

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The quality mixing of powders, particles and/or granules obtain an engineering, energy, economic and ecological importance of various industries. The mixing efficiency, the design of equipment and mixing parameters exert a strong impact on the quality and the price of the intermediate or final product. The use of Discrete Element Method (DEM) is demonstrated in various applications, such as: modelling of granular flow in static mixer, revolving static mixer and modified screw conveyor. Computational Fluid Dynamics (CFD) is used for modelling of fluid flow through the Eulerian multiphase model. The coupling of DEM and CFD method could be used to predict the behaviour of particles during the transport / mixing process. If it is applicable, the model should undergo the verification step, during which the experimental results are compared to numerical data. Application of this modelling approach provides the possibility for optimization of the geometry and parameters of mixing systems and the improvements in granular material handling, taking into account the quality of the mixing process and the cost of the final product.

INV-EM2
Assessing electrical properties of ceramic samples

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We present an overview of electromagnetic numerical techniques and measurement apparatus that have been used for assessing electrical properties of ceramic samples. The complex permittivity of the ceramics is typically the first electromagnetic property of interest. In the measurement approach that we use, ceramic samples, in the shape of pills with metalized faces, are placed in either a proprietary coaxial chamber or in an open fixture. The scattering parameter (reflection coefficient) is measured using a network analyzer. For the deembedding of the complex permittivity of a sample one needs precise electromagnetic simulations, including detailed models of the chamber or the open fixture. For lower and intermediate frequencies we use a numerical technique for electrostatic analysis, based on the method of moments with Galerkin testing. We create a database that is used afterwards for evaluation of the complex permittivity practically in real time. For higher frequencies, a full electrodynamic model of the chamber is developed with WIPL-D software. For all our deembedding techniques, we have also developed a detailed model of losses in the SMA coaxial connectors, which is essential for a precise evaluation of the imaginary part of the

complex permittivity for low-loss dielectrics. We present results of several measurements in order to illustrate the used techniques.

INV-EM3
Electrocatalytic hydrogen production on a nickel electrode modified with V_2O_5+Co co-deposit: The synergetic electronic effect

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Considering a world wide need for renewable energy sources, much attention has been give to the hydrogen economy. Currently the production of hydrogen by alkaline water electrolysis is facing problem concerning high and ineffective energy consumption. Therefore, designing of a new cathodic materials, based on the concept of electrocatalytic synergism toward hydrogen production, are particularly of great importance. Accurate defined, electrocatalysis represents the effect of an electrode material on the rate of electrode reaction. This effect can be real (intrinsic), or apparent. Among various electrocatalystic systems, oxide electrodes have been shown to possess high catalytic activity for the hydrogen evolution reaction (HER). In this study, the galvanostatic co-deposition of V_2O_5 and Co particles onto the smooth Ni support has been carried out in an alkaline bath. Presence of V and Co species on the surface of Ni support was qualitatively confirmed by XRF spectroscopy. Electrocatalytic parameters of investigated electrodes toward HER, such as: the exchange current density, the current density at fixed overpotentil (-250 mV), the overpotential at fixed current density (300 mA cm^{-2}) have been evaluated. Comparative analysis of the electrocatalytic activities of: the V_2O_5+Co cathode (V_2O_5+Co/Ni), the Ni smooth electrode, the electrode obtained by electrodeposition of Co onto Ni smooth electrode (Co/Ni) and the *in situ* activated Ni smooth electrode with V_2O_5 (V_2O_5/Ni), has been carried out. Results are presented to show, that the enhanced electrocatalytic activity of the V_2O_5+Co/Ni electrode toward HER can be attributed to existence of a pronounced synergetic electronic effect.

INV-EM4
Kinetic investigation of various thermally-induced processes in ceramic materials

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In ceramic materials, various processes – physical or chemical – undergo; these are investigated through several thermoanalytical methods, thus by multiple techniques. Some of them, partially due to subtle changes that may not be monitored by all or most popular thermal techniques, have the disadvantage of being not completely studied or even wrongly understood. The kinetic studies of these transformations shall bring more insights to the overall understanding of these materials and point eventually to specific application deriving.

Sometimes, the kinetic methods are chosen to be employed in order to calculate the kinetic parameters without questioning their viability for the proposed topic. Nevertheless, the combination of chosen experimental techniques with the available kinetic methods are most of the time the weakest point: in this study, obvious aspects are shown in order to highlight dubious data which are although published in the literature and a strategy to follow for improving these aspects is proposed.

INV-MCC1
Influence of mechanical activation on the alternations in quality of raw materials for production of construction ceramics: chemometric approach

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The assessment of the activation process variables influence on the final quality of the product parameters was conveyed in order to optimize the mechanical treatments of the different raw materials (mica, talc, fly ash and alumina) used in the production of construction and high-temperature composites. The modification in the behavior of activated samples has been correlated to the particle size distribution effect produced by activation via ultra-centrifugal mill. The differences in the set of the process parameters determined before and after raw materials activation and their influence on the grain-size distribution related characteristics have been studied. The mechanical treatments are regarded as either energetically or economically unsustainable procedures, therefore the activations were optimized on basis of the assessment of the process variables (number of rotor revolutions, current intensity, activation period, circumferential rotor speed and mill capacity) effect on the final quality of product parameters (mesh sizes of the sieves, accumulated retained masses, average grain size, level of micronization kinetics, mesh size appropriate to 95 % of accumulated passing mass and specific surface area). The activated product parameters in all experimental sequences were obtained by the analytical procedure based on Rosin-Rammler-Sperling equation.

Response Surface Method, Standard Score Analysis and Principal Component Analysis were used as a means of the optimization. The established mathematical models were able to precisely predict the quality parameters in a broad range of processing parameters. Developed models showed r^2 values in the range of 0.714-0.988 for investigated raw materials. Standard Score Analysis highlighted that the optimal sample was obtained using the experimental sequence that corresponds to the set of processing parameters related to the 120 μm sieve mesh size. The acquired standard score values were: SS=0.74 for mica, SS=1.0 for talc, SS=0.93 for fly ash and SS=0.96 for alumina. Multiple comparison tests revealed that the optimal variation in the processing parameters could reduce the negative effect of raw materials inherent properties on the final score, which would improve energetic and economic sustainability of the activation applied to the processing of raw materials utilized in production of construction and high-temperature ceramics.

INV-MCC2

Wet-chemical approach for Ni deposition in BCY15 ceramic matrix: Structure and anode cermet activity in pSOFC

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Commonly, in proton conducting solid oxide fuel cells (pSOFC) metal Ni is incorporated in the proton conducting anode ceramic matrix as NiO to form the so called cermet, applying standard ceramic technology. However, the sintered powders are often with low homogeneity and uncontrolled particle size. Another complication is the eventual formation of parasitic phases with lower conductivity.

A wet-chemical approach for Ni introduction in the anode ceramic matrix of Y-doped barium cerate, $BaCe_{0.85}Y_{0.15}O_{2.925}$ (BCY15) was introduced as an alternative to the traditional ceramic route for Ni-based cermet preparation. BCY15/Ni powders, synthesized in aqueous, as well as in anhydrous medium, were examined by X-ray diffraction, N_2-physisorption and SEM techniques. The electrochemical properties of the produced BCY15/Ni anode cermet were determined by impedance spectroscopy after high-temperature sintering followed by reduction in hydrogen atmosphere.

It was found that the synthesis of BCY15/Ni solid in non-aqueous medium provides for the preservation of the matrix structure and enhances the electrochemical performance of the cermet. The wet-chemical reduction method ensures better conditions for Ni introduction in the ceramic matrix than the classical ceramic approach, offering a simple procedure to obtain promising high performance pSOFC anodes consisting of fine, well-dispersed and not agglomerated nano-scaled metal nickel crystallites distributed in the BCY15 matrix.

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INV-MCC3

Surface activity of ceramics/surfactants interface

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Surface activity of ceramics materials surface is of main importance in processes like wetting, cleaning and depositions of thin films.

Determination of contact angle and wetting properties as well as surface tension were done according to standard procedures at 25°C and 45°C. Contact angle was determined by tilting plate method, wetting time (wettability) was determined by immersion method and surface tension of surfactants mixtures was determined by using Traube stalagmometer. The used surfactant was anionic alkylpolyglucoside (APG) and nonionic alcohol etoxylate (AEO) and lauraminoxide (AO) in different ratios and total concentration form 0.05 to 0.30%

The properties of anionic surfactant APG was improved by adding of AEO and AO. It is clear that addition of nonionic ethoxylated alcohol and lauraminoxide surfactants caused a very pronounced synergism in mixed surfactant formulations. The changes in contact angle

and wettability on ceramic surface were in the function of surface tension of surfactants mixture. The lower contact angle and the best wettability were obtained with mixture APG/AEO/AO 10:2:1 and total concentration of 0.25% active surfactants mixture.

INV-MCC4
Monolith catalysts based on Mn oxides with additive (Cu, Ni, Co, Fe, La, Ce) for deep oxidation of hydrocarbons

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Decoration of honeycomb monoliths by nanoparticles allows to considerably expanding the range of functional capabilities of monoliths due to high chemical potential of nanoparticles and optimal design of supports. Current communication is devoted to development of a preparation-mode for nanoscale catalysts based on oxides of Mn with Cu, Ni, Co, Fe, La, Ce, which are deposited on monoliths.

The catalysts based on the individual and bicomponent Mn-Me oxides were prepared by impregnation of ceramic monoliths with a solution of suitable metal nitrates and studied by XRD, BET, TGA, TEM, SEM, H_2-TPR, differential dissolution.

Active component in the bicomponent catalysts was found to be nanoparticles of mixed Mn-Me oxides and composite oxides. Formation of composite Mn-Me oxides gives synergistic effect in activity of bicomponent catalysts compared with individual oxides.

INV-REHA1
The Inportance of Ethnoarchaeology in Ceramic Technology Research

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Ceramics is the oldest sintetic material of the humanity. From the Upper Paleolithic, until today, the ceramic technology has developed almost without interuption. Archaeological science still does not have the answers about all aspects of the ceramic production in the past, particularly the intangible ones. In the technological process of ceramic manufacturing there are certain rules that limit the number of possible variables in the operational chain, but on local level their combinations can be diverse and thay depends on the characteristics of the local raw materials in the first place. The hypothesis that material dictates a technique i.e. that a choice of clay and tempers are directly connected with the shaping technique and the function of the final product will be discussed in this paper. As well as the questions of technological universality and technological continuity in ceramic production.That is why getting familiar with curent traditional ceramic techniques and technologies, through the ethnoarchaeological research, is crucial for understanding of the ceramic phenomenon and its development through history. Ceramic ethnoarchaeology is a scientific field intensively

present in the world for several decades already. Nevertheless, in Serbia the discipline is just at the beginning of development. In this paper I'll try to explain the importance of the ethnoarchaeological research at local level and in wider, regional frames.

INV-REHA2
Fluorine doping of cathode materials for rechargeable batteries

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In the continuing search for alternative cathode materials for rechargeable batteries with improved electrochemical performances, there is a need for a versatile approach that will address concerns regarding low reversible capacity, poor capacity retention, low operating voltage and structural instability. So far, a lot of investigation was focused on cation doping. On the other hand, there is much less investigation on anion doping of cathode materials. Taking olivine-type $LiFePO_4$ and layered Na_xCoO_2 as example materials for lithium- and sodium- ion batteries, respectively, the influence of fluorine doping on both the structure and the electrochemical performances was examined. The crystal structure refinement revealed that fluorine incorporation preserves the parent structure. Furthermore, small oxygen replacement by fluorine ions changes electronic structure and consequently modifies electrical properties.

INV-REHA3
Spectroscopy study of $LiFePO_4$ catode materials for Li-ion battery prepared in the thermo-acoustic reactor

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$LiFePO_4$ is a potential cathode candidate for the next generation of secondary lithium batteries. The iron based olivine type cathodes (mainly lithium iron phosphate, $LiFePO_4$) are regarded as possible alternatives to cathodes based on rare metal composites. Industry uses mostly methods in solids and less hydrothermal synthesis. The pilot reactor was built according to the principles of the thermos-acustic burner. It consists of a burner on the basis of the Helmholtz resonator. The sample synthesized in incomplete combustion and resonance mode of reactor and calcined at 700°C. The obtained samples were characterized by X-ray diffraction, Raman and Mössbauer spectroscopy. The aim of this work is to show that is possible to achieve a desired crystal phase with only a proper mode of operation. The seemingly rapid transformation of amorphous into pure phase material was attributed to two mechanisms; increasing the number of particles due to the reduction in size and a larger number of collisions between particles due to the strong turbulent flow associated with explosive combustion.

OR-BMS1
Zinc oxide-based materials with enhanced sunlight-driven photo- and photo-electro-catalytic activity

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Current trend in photocatalysis is to develop efficient semiconductors which can be activated by absorbing sunlight. Which wavelength of sunlight will be absorbed depends on the semiconductor band gap; semiconductors with a wide band gap (> 3 eV) can absorb only UV light (5% of sunlight), while those with a narrow band gap (< 3 eV) can be activated by visible light (45% of sunlight).

Zinc oxide (ZnO) is promising semiconductor with band gap of 3.37 eV. Various approaches have been applied to modify its optical properties, for example: incorporation of different metal and nonmetal ions or defects into the crystal structure, particles' surface sensitization or hydrogenation. In this study, we examined the influence of different defects present in ZnO particles on their photo- and photo-electro-catalytic properties. Processing of ZnO particles were carried out in order to introduce: (1) lattice defects, through microwave procedure, (2) surface defects, through mechanical activation, and (3) surface defects, trough composite with polyethylene oxide. Synthesized particles were characterized by XRD, FE-SEM, laser diffraction particle size analyzer, Raman, UV-Vis diffuse reflectance and photoluminescence spectroscopy. The results of achieved photo- and photo-electro-catalytic tests indicate that both, structural and surface, defects enhanced sunlight-driven activity of ZnO particles.

OR-BMS2
Synthesis, characterization & bacterial activity of ZnO and Histidine incorporated ZnO

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Chemical route was adopted to synthesize both ZnO and amino acid (Histidine) incorporated ZnO. For synthesizing ZnO, which is used as reference, a solution (0.25M) Zn $(NO_3)_2$ was prepared in distilled water. NH_4OH was added drop wise till a white precipitate is observed. This solution was stirred continuously at 100^0C for 1 hr. The precipitate was then centrifuged & washed several times using distilled water, which was subsequently dried. The same procedure was carried out in the presence of Histidine for the synthesis of Histidine incorporated ZnO. Four different concentrations of Histidine were used, ranging from 0.1 mg/ml to 1mg/ml during the synthesis of Histidine incorporated ZnO.

Different techniques have been used for characterization of the synthesized powders. X-ray diffraction pattern shows the formation of single phase wurtzite ZnO. No other phases were observed. The average particle size of undoped ZnO & Histidine incorporated ZnO was estimated to be in the range of 40-60nm. Selected area diffraction pattern of Histidine incorporated ZnO indicates the observation of two hexagons titled to each other indicating the presence of strain in the synthesized ZnO powders. This tilt varied with the increase concentration of Histidine. The UV-visible spectrograph shows variation in band gap energy the Histidine incorporated ZnO. The undoped and Histidine incorporated ZnO were used for the bacterial activity test. While undoped ZnO, as expected, shows antibacterial activity, the Histidine incorporated ZnO shows, interestingly, pro-bacterial activity. Scanning electron microscopy supports the pro-bacterial activity of Histidine incorporated ZnO.

OR-NOP1
Synthesis of ZnO:Ag core-shell nanoparticles with enhanced photocatalytic properties by single - and two-steps USP

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Synthesis of **ZnO:Ag** core-shell nanoparticles were performed by ultrasonic spray pyrolysis (USP) from the corresponding nitrate solutions. Varying relative concentrations of Ag and ZnO precursors and two different equipment installation, allowing either common (single-step) or separate precipitation (two-steps) of Ag and ZnO, were examined in terms of their effect on final microstructure and photocatalytic properties using X-ray powder diffraction (XRPD), scanning and transmission electron microscopy (SEM, TEM, HRTEM), UV-Vis spectroscopy and photocatalytic tests. Formation of phase-pure **ZnO:Ag** core- shell like particles where ZnO secondary submicron sized particles formed by primary crystals with the size of 5-20 nm were confirmed by TEM analyses. Structural analyses revealed variations in silver distribution and morphology within ZnO core depending on experimental conditions. Samples with fine and uniform silver distribution on ZnO surface display a strong silver-induced enhancement of photocatalytic performance and exhibits a significantly improved photocatalytic activity in the degradation of methyl blue (MB) than that of other noble metal free ZnO systems. Photocatalytic analyses (all samples reached > 45% MB degradation) confirm the all synthesized **ZnO:Ag** USP systems viability for environmental applications. The best result (93% of dye elimination) is obtained for sample exhibiting maximum available surface, which strongly depends on particle morphology, size and distribution. Moreover, all samples synthesized by single-step USP revealed higher dye elimination with respect to ones with two- steps USP due to favored distribution of silver in microstructure.

OR-NOP2
In-vitro visualization of primary tumor cells using up-conversion nanophosphors

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Due to their unique luminescent features, lanthanide doped up-converting nanoparticles (Ln-UCNPs) have an important role in biomedical use, particularly in the area of NIR-excited fluorescent cell imaging. For such purpose, Ln-UCNPs should have specific morphological characteristics and efficient luminescence response. In this work, a biocompatible and water dispersible $NaYF_4$:Yb,Er@PLGA nanoparticles synthesized using a one-step hydrothermal synthesis were tested as fluorescent bio-labels of primary cell cultures obtained after passage of head and neck squamous carcinoma cells (HNSCC). Structural, morphological and optical properties of particles were obtained using X-ray powder diffraction (XRPD), field emission scanning and transmission electron microscopy (FESEM/TEM), energy dispersive X-ray (EDX), Fourier transform infrared (FTIR) and photoluminescence (PL) spectroscopy. The results revealed coexistence of the cubic (*Fm-3m*) and hexagonal ($P6_3/m$) phase in spherical and irregularly shaped nanoparticles, respectively. Moreover, preservation of the PLGA ligands at the particles surface facilitates their interactions with the cell membrane and provides permeation into cells. To asses a biological safety of their use, viability of human gingival fibroblasts (HFG) was additionally evaluated by a colorimetric MTT assay.

OR-EM1
Effect of annealing temperature on structural and surface morphology of ceramic electrolyte for IT-SOFC applications

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In the present work the powder of $Gd_{0.1}Ce_{0.9}O_{1.95}$ Gadolinium-doped ceria (10GDC) is procured from Sigma Aldrich with 99.9% purity. Using powder 10GDC the electrolyte material in pellets form were sintered at different temperature of 800, 900, 1100 and 1200 ^oC for 4 hr in microwave high temperature furnace to investigate the effect of sintering temperature on density, structural and morphological properties of 10GDC. Density was measured using the Archimedes's method.

The crystallite size was estimated from the obtained XRD data with the help of X'pert High Score software. The average crystallite size, as estimated from the x-ray diffraction data, was found to be in nanosize for all samples sintered in the above mentioned temperature range. The crystallite size and particle size (as observed from FESEM) for10GDC sintered from 800 to1200^{o}C was found to be in the range of 54.73-85.23 nm respectively The lattice parameter and lattice cell volume were measured using Cell Refine software.

It is observed that the sintering temperature has significant effect on the surface morphology and crystallite size. The surface morphology of all the microwave sintered samples were recorded using Field Emission Scanning Electron Microscopy (FE-SEM). Denser nanostructures were observed in case of 10GDC samples sintered at 800^{o}C, when compared those sintered at higher tempertaures. Further, the density of the pellets goes on decreasing with the increase in sintering temperature, which is in good agreement with the reported data. The density varied in the range between 7.49 to 6.89 g/cm^3.

OR-EM2
Fractal nature Heywang model correction and Brownian motions

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Ceramics grains contacts are essential for understanding complex dielectric properties of electronic ceramics materials. Since the actual contact surface is an irregular object, the theory of fractal sets is applied. Also, the Heywang model of intergranular capacity are introduced as a basic idea for relations with fractal structure. The $BaTiO_3$-ceramics has fractal form in, at least, two levels: shapes and distributions of grains and intergranular contacts. Using fractal modeling approach, reconstruction of microstructure, like shapes of grains or intergranular contacts can be successfully done. Furthermore, the area of grains surface is calculated by using fractal correction that expresses the irregularity of grains surface through fractal dimension. It is known that $BaTiO_3$ and similar ceramics have fractal nature based on three different phenomena. First, there is process of Brownian-fractal motions inside the material during sintering in the form of flowing micro-particles –ions, atoms, electrons which is an essentially fractal phenomena. This motion has fractal structure and can be undergo the process of fractal modification. Second, there are so called "negative space" made of pores and intergranular space. Being extremely complex, the pore space plays an important role in microelectronic, PTC and other phenomena. Third, ceramic grains have fractal shape seeing as a contour in cross section or as grain's surface. These triple factors, in combination, make the microelectronic environment of very peculiar electro-static and dynamics microelectronic environment.

In order to obtain an equivalent circuit model, which provides a more realistic representation of the electronic materials electrical properties, in this article an intergranular contacts model for the $BaTiO_3$ electrical properties characterization were determined and implemented. Considering obtained results, the directions of possible $BaTiO_3$-ceramics materials properties prognosis are determined according to the correlations synthesis-structure-properties.

OR-EM3
Reusable thermal heat pillow based on clay and phase change materials for human use

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Thermotherapy as an external effect of warming the body was used in medical and recreational and preventive purposes. The subject of our work is thixotropic dense gel based on clay and phase change materials. It must have a flexibility surface form of the joints, spine and others body parts. In addition, it should have a heat transfer coefficient which will enable the acceleration of the blood, the reduction of viscosity of physiological fluids, in particular lymph, thus providing a blood circulation in the treated body part. The viscoelastic thixotropic gel responds to temperature changes with body and makes custom shape of the pillow to conform to the curves of a body for comfort and support. This allows the shape of the pillow to follow more closely the contours of the body and to promote an improved alignment of the neck and spine when a person is in a supine or side-lying position. The product should have characteristically reusable with the same properties. This means that the heterogeneous gel based on clay, salts, wax or stearic acid, is to retain the homogeneous structure reusable after heating. The best heating is achieved by microwaves. Packaging the gel should be easily adaptable to the body, that has thermal stability up to 150°C, which ensures the functionality of the application. In addition to all the product must be easy to heat and easy to apply at any position of the body with a corresponding Velcro strip. The heat capacity of the gel by adding the clay and the water for mass of 1 kg is about 500 kJ. Elastic and easily customizable body shape pillow filled with all-natural, clay-based materials. It is non-toxic, biodegradable and environmentally safe. Recommended for home treatments. Use radiant energy to provide soothing relief from: arthritis, sports injuries, muscle pain, joint stiffness, fibromyalgia, menstrual cramps, chronic back pain, sinus/stress headaches, post-surgery pain and others. Maintains optimum temperatures longer. Retains peak therapeutic temperatures better than simple gels.

OR-MCC1
“Bone Ash Reinforced Geopolymer using Metakaolin from Metamax(MT), Mymensingh Clay(MW) and Synthetic Mymensingh Clay(MW-SYN)”

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Calcined natural bone ash of hydroxyapatite (HA) and dicalcium phosphate (DCP) has been investigated for the reinforcement of potassium geopolymer (KGP). The particulate reinforcements of 5, 10 and 15 wt % each of hydroxyapatite and dicalcium phosphate were added to potassium geopolymer to compare with potassium geopolymer using Metamax (KGP-MT), potassium geopolymer with Mymensingh clay metakaolin (KGP-MW) and

potassium geopolymer using synthetic Mymensingh clay metakaolin (KGP-MW-SYN). Both the room temperature and high temperature properties in SEM, XRD and Instron were investigated for the tested geopolymer samples. X-ray diffraction confirmed the formation of geopolymer analogue with amorphous hump at 28^0 2θ in all the tested samples at room temperature. In addition, crystalline peaks were observed in KGP (MW) as well as in KGP (MT) reinforced with HA and DCP. Thermally treated geopolymer at 1150^0C also showed crystalline peaks of leucite, kalsilite, monetite and quartz confirming the signature of geopolymer ceramics at elevated temperature. Scanning electron microscopy (SEM) revealed fully reacted and homogenous aluminosilicate matrix in the geopolymer samples cured at room temperature for 7 days. Geopolymers composites KGP (MT)-15 DCP, KGP(MW)-15DCP and KGP(MW-SYN)-15DCP when thermally treated at 1150^0C revealed microstructural integrity with the formation of phosphate glass, while in KGP (MW), a self-glazed surface was developed after being heated at 1125 ^{0}C. Even though the room temperature compressive strength decreased in the reinforced geopolymer compared to pure geopolymer, the room temperature flexure strength increased to 18.3 MPa in KGP (MW), 11.0 MPa in KGP (MT)-15HA and 11.1 MPa in KGP (MT)-15DCP, 14.74 MPa in KGP(MW-SYN) and 14.5 MPa in KGP(MW-SYN)-5DCP compared to that in pure potassium geopolymer KGP (MT), 8.4 Mpa. The high temperature flexure strength after heat treatment at 1150^0C for 1 hr. also increased to 28.56 Mpa in KGP(MW-SYN)-5DCP and 31.97 Mpa in KGP(MW-SYN)-10DCP and but decreased to 20.3 MPa in KGP (MW-SYN)-15DCP. The increment of flexure strength attributes to the crystalline reinforcement phases in pure geopolymer matrix.

OR-MCC2
Novel sintered clay ceramics with combined utilization of steel mill scale waste and municipal sewage sludge

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Safe management of industrial and municipal wastes with their beneficial utilization in new ecofriendly applications is imperative nowadays. Mill scale waste (MS) in particular, is the flaky surface of hot-rolled steel, a porous, hard and brittle coating of several distinct layers of iron oxides (predominantly FeO and Fe3O4). It is formed in large quantities in steel industry during the milling process from the rapid oxidization of the hot iron products. On the other side, huge amounts of municipal sewage sludge (MSS) are daily produced. In the present research, the incorporation of MS (6%) and MSS (3% and 6%) as admixtures into clay-based ceramic manufacturing by applying extrusion and sintering (950o C) processes is investigated. For, that purpose, clay brick specimens were produced and their physical and mechanical properties were determined and studied as a function of the % MS and MSS content, while emissions during firing and leachability of the materials obtained were also evaluated. The experimental results show that the incorporation of MSS into clay-based

bricks containing MS is feasible. In fact, ceramic thermal insulation is slightly improved whereas the mechanical performance only slightly deteriorates. It should be emphasized that a specific experimental study carried out during sintering showed zero emission of dangerous pollutants. Moreover, standard leaching tests conducted predicted negligible quantities of dangerous leachate elements, indicating the effective encapsulation of heavy metals in the ceramic matrix, towards environmentally friendly ceramic materials.

OR-REHA1
Copmarative analysis of mortars from the archeological sites Gamzigrad (Romuliana) and Caričin Grad for the purpose of making compatible repair mortars

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The paper presents a comparative analysis of mortars found at two significant archeological sites in Serbia. Specifically, those are Gamzigrad (Romuliana) near Zajecar and the archeological site Caricin Grad near Leskovac. In the previous papers, we dealst with the characterization of mortars from both sites. It was the first examination of mortars from both locations. The comparative analysis of mortars was performed based on the data obtained by testing physical-mechanical properties such as: water absorption, porosity, gravity and specific mass. Mineralogical composition (both quantitative and qualitative) was obtained based on XRD / XRF and SEM/EDS analyses. The comparative analyses of the mortar obtained from the mentioned archeological sites indicated that mortars from both locations contained grains of river aggregate, crushed limestone aggregate and crushed masonry bricks. The share percentage varied. Regarding the binder, the mortar from the Gamzigrad (Romuliana) site had limestone used for the binder, while the mortar from the Caricin Grad site had clay and powdered masonry bricks. The obtained results of mortar analysis pave the way for further research with an aim of making repair mortars.

P1
The use of the nanomaterials and nanotechnology in forensic science

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Nanotechnology is beginning to have an impact on the handling of evidence at crime scenes, its analysis in the laboratory and its presentation in the court room. This article aims to highlight some of the major advances in Forensic Science brought about by Nanotechnology but is not exhaustive of the subject matter. Nano forensics is a new discipline that is related to the development of nanosensors as well as the monitoring of terrorist activities, where it is necessary to detect the presence of explosive gas, biological or chemical reagents. In this paper, based the literature data, are presented the most recent research in the field of nanotechnology, as well as the application of nanomaterials in criminology. Their use has yielded very positive results in the processes of identification and characterization of different materials, from the places of crime.

P2
The determination of microstructural parameters of Ba/Ca-, Pb- and Sr-feldspar by using the X-ray powder diffraction analysis

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In the process of the characterization of ceramic materials, very important part is the determination of microstructural parameters. For determination are used the different method: the powder X-ray diffraction on polycrystalline sample, the single crystal X-ray diffraction method, SEM (scanning electron microscope), TEM method-a (transmiosioni electron microscope). In this paper are presented the results of microstructural analysis, obtained by X-ray diffraction on polycrystalline sample and using the crystallographic software FullProf. The microstructural parameters are determined on the basis of refined structures of Ba/Ca feldspar, Pb-feldspar and Sr feldspar.

P3
Crystal of SR-Feldspar obtained by Rirtveld analysis

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Monoclinic Sr feldspar has been prepared from Sr-LTA zeolite precursor.The crystal structures of Sr-feldspar are solved and refined using X-ray powder diffraction (XRPD) data by Rietveld method. The crystal structure of Sr-feldspar is refined in the space group *I*2/*c* and results indicate ordering distribution of Si and Al (unit cell parameters is *a* = 8.365, b = 12.944 *c*=14.229 Å and agreement factors: R_{exp}= 15.3 R_p=19.9, R_{wp}=19.0, R_B=15.0 R_F=4.08). The microsturcural parameters size and strain, are determine with two crystalographic program Breadth and Fullprof.

P4
Characterization of optical polymer composites based on single crystals

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In this work the possibility of synthesis of optical active composites with improved mechanical, thermal properties and functionality was investigated. Composites with a polymer matrix based on single crystals have great potential in the field of optical communication systems where active micro to nano crystals dispersed in an optically transparent matrix. Synthesis and characterization of nano to micro modified polymer composites on the basis of single crystal are performed. CaF_2 single crystals in diameter of 20 mm are obtained by the vertical Bridgman method in vacuum. Composite films PMMA-CaF_2 was obtained with preserved optical properties of single crystals, whereas the thermal and mechanical properties improved. Composite films PMMA-CaF_2 was obtained with preserved optical properties of single crystals, whereas the thermal and mechanical properties improved. For characterization composite films were used the following methods: DSC, Raman spectroscopy, FTIR and nanoindentation test. Results od DSC analysis for composite films PMMA-CaF_2 revealed that the thermal propertis od polymer was improved by embeding inorganic particles. T_g for composit was higher the for pure polymer. FTIR spectrum of composites there are well defined peaks for PMMA and some of the vibration modes of Ca–F bond at 671 cm^{-1}. This means that CaF_2 crystals in the composite have been identified and that no other bounds with PMMA were created during the processing. The Raman spectra of CaF_2 single crystal, PMMA and the composites revelaed all modes found are well matched with literatures. By addition of 1% and 2% CaF_2 crystals can be seen the peaks are the same as in the spectrum of PMMA. The intensity of these peaks in the composite is about 364, 481,

600, 812 and 964 cm^{-1}. It was also noted a sharp peak at 323 cm^{-1} which is characteristic of CaF_2. A weak band near 400 cm^{-1} in possibly be δ(C—O—C) in spectrum of the PMMA and the composites 1% and 2% CaF_2 with PMMA.

P5

Electrical properties of doped $BaTiO_3$ Ceramics

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The electrical resistivity (ρ) and PTCR (Positive Temperature Coefficient of Resistivity) effect doped $BaTiO_3$ ceramics with different dopant were investigated in this paper, The content of additive in doped samples were ranged from 0.01 to 1.0 at% Er/Yb. The samples were prepared by a conventional solid state sintering procedure and sintered at 1320° for 4 hours. For samples doped with Er_2O_3 (0.01 at% Er/Yb), SEM analysis shows abnormal grain growth with the average size range between 20 μm - 40 μm. For samples doped with Yb_2O_3 the average size was from 30 μm - 50 μm. With increase of dopants concentration the average grain size decreases, and for samples doped with 1.0 at% Er/Yb, grain size range between 3 μm - 20 μm for samples doped with Er and between 1 μm - 10 μm for samples doped with Yb_2O_3. The specific electrical resistance were measured in temperature range from 25°C to 170°C at different frequencies, ranged from 100Hz to 1MHz. To a temperature of 120°C, resistance has a slight increase with increasing of temperature, but above this temperature the resistance rapidly increasing. The value of the specific electrical resistance decreases with increasing concentration of Er/Yb, reached the minimum at certain dopant content (0.5 at% Er/Yb), then increased rapidly with dopant content in high doping level.

P6

Application of Curcumin in Dye-Sensitized Solar Cells

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Dye-sensitized solar cells are the closest mankind has come to replicating nature's photosynthesis. The type of a dye influence the efficiency of these cells. In this paper we studied curcumin dye as sensitizer in dye-sensitized solar cells and compared him with mostly used cyanidin. The results have shown that curcumin has higher efficiency and higher absorption in the visible part of the spectrum compared to cyanidin. Model dye molecules, curcumin and cyanidin, are deprotonated upon adsorption on the titanium dioxide surface. The energy levels obtained from the calculation indicate a higher probability of electron transition from molecule to titanium dioxide surface in the case of curcumin than in the case of cyanidin. Based on these results, we concluded that curcumin dye has better properties as sensitizer in dye-sensitized solar cells.

P7
Facile synthesis of hydrophilic polymer-capped upconverting $NaYF_4$: Yb,Er particles

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Over the last decade, solvothermal decomposition of organometallic compounds has been indicated as one of the most convenient method for the synthesis of monodisperse lanthanide doped upconverting fluorides. Due to their hydrophobic nature such particles could not be used for a conjugation of the molecular targeting agents which is necessary for optical imaging of biological tissues. In this work, hydrophilic $NaYF_4$:Yb,Er (17 mol% Yb; 3 mol% Er) nanoparticles were synthesized by facile one-pot hydrothermal synthesis performed with a help of chitosan (CS) and poly(acrylic acid) (PAA). Obtained powders were analyzed by X-ray powder diffraction (XRPD), field emission scanning electron microscopy (FE-SEM), Fourier transform infrared (FTIR) and photoluminescence (PL) spectroscopy. The obtained results implied that particle size, shape and surface characteristics are dependent on the polymer choice. Although both powders crystallize in the same crystal arrangement (cubic, *Fm-3m*) more intense red emission, assigned to the Er^{3+} $^4F_{9/2} \rightarrow {}^4I_{15/2}$ electronic transitions, characterize spherical $NaYF_4$:Yb,Er@CS particles. To asses a biological safety of their use, viability of the human gingival fibroblasts (HFG) was additionally tested by a colorimetric MTT assay.

P8
Al,Fe,Ni-pillared bentonite in catalytic wet peroxide oxidation of textile dye Acid Yellow 99

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In this work catalytic performance of Al,Fe and Al,Fe,Ni-pillared bentonite was studied in the heterogeneous catalytic wet peroxide oxidation (CWPO) of textile dye Acid Yellow 99 used as a model compound. Pillared bentonites were synthesized using the bentonite from Mečji Do, Serbia and the pillaring solutions contained the different molar ratios of Al^{3+}, Fe^{3+} and Ni^{2+} cations: a) 90 % Al, 10% Fe (AlFe10-PILC), b) 85% Al, 10% Fe,

5% Ni (AlFe10Ni5-PILC), and c) 90 % Al, 5% Fe, 5% Ni (AlFe5Ni5-PILC). The XRD, chemical and FTIR analysis and nitrogen physisorption at -196ºC were used for the characterization of the obtained samples. All results of the characterization confirmed successful pillaring. Degree of decolorization of dye containing aqueous solution was monitored using UV-Vis spectroscopy. The experiments were performed using solution with initial concentration of 50 mg dm^{-3} at 60 °C with respect to the catalyst and H_2O_2 amount. The catalytic degradation for all investigated catalysts followed the first order kinetics. Among the investigated materials AlFe10Ni5-PILC was found to be the most promising one for CWPO of AY99. These investigation are proof of concept that Al,Fe,Ni-pillared bentonite are applicable in CWPO.

P9
Radioadaptive irradiation combined with radiosensitising effects of gold nanoparticles on the healthy and cancer human lung cell lines

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Many substances and materials have been reported to be radiosensitizers, some of which are gold nanoparticles GNP, too. Studies have shown that the presence of GNP increases the production of electrons and free radicals. Generally, radiosensitising with GNP depends on the nanoparticles' size, shape, ζ potential, and coating. The aim of this study was to investigate the optimal combination of radioadaptive irradiation with GNP on the healthy human lung fibroblast cell lines (MRC5) and human lung adenocarcinoma cells (A542). Also we examined potential synergistic effects between coating of GNP with β-cyclodextrine (βCD) and designed modality of irradiation. Gold nanoparticles and gold nanoparticles-βCD were measured in order to determine their size distribution and ζ-potential. The influence of different irradiation regimes on the survival of cells (viability) was determined using MTT assay.

P10
Hybrid macroporous polymer/clay nanocomposites

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Hybrid polymer/nanocomposites are a new class of materials that consist of polymer matrix and clay nanoparticles as the dispersed phase. The aim of this work was to obtain macroporous poly(glycidyl methacrylate-*co*-ethylene glycol dimethacrylate)/clay nanocomposites *p*(GEM-NC) with different porosity and morphology.

Macroporous *p*(GEM) copolymer and two nanocomposite *p*(GEM-NC) samples with different clay content (2 and 5 wt.%) were synthesized by *in situ* suspension copolymerization. Nanocomposite samples were reinforced with organomodified montmorillonite clay Cloisite 30B® (C30B). Structure, porosity and surface chemistry of the *p*(GEM) and *p*(GEM-NC) samples were evaluated by Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy with energy dispersive x-ray spectroscopy (SEM/EDS) and mercury porosity.

The results show the synthesized *p*(GEM-NC) have improved textural, structural and morphological properties in comparison with pure macroporous *p*(GEM) copolymer. The incorporation of C30B in *p*(GEM) was confirmed by FTIR and SEM/EDS analysis. Also, it was shown that the higher clay content significantly influences the *p*(GEM-NC) porosity parameters (i.e. specific surface area, specific volume and pore diameter).

P11
Surface properties of Ni/BCY15 cermet anodes obtained by deposition wet-reduction

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ABO3 perovskite structured materials as Y-doped barium cerate ($BaCe_{1-x}Y_xO_{3-\delta}$), are of particular interest because of their high proton conductivity and excellent chemical stability under reduced fuel cell environment in conducting solid oxide fuel cells (pSOFC). Metallic Ni has been extensively used to improve the electrocatalytic properties of pSOFC cermet anode and to ensure the necessary electronic conductivity.

Metallic Ni nanoparticles are added to $BaCe_{0.85}Y_{0.15}O_{2.925}$ (BCY15) ceramic matrix by deposition wet-reduction approach in aqueous and non-aqueous medium. Strong interaction between support (BCY15 electrolyte) and metallic Ni is expected. The surface properties are examined applying N_2 sorption and X–ray photoelectron spectroscopy (XPS) techniques.

N_2-physisorption analysis unveils preservation of the ceramic BCY15 matrix after incorporation of nickel and filling of the support pores by creation of the new mesopore system. The transition-metal Ni in the Ni/BCY15 cermet is doped on the Ce-sites confirmed by XPS data.

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P12
Synthesis of hierarchically structured $Y_2O_3:Eu^{3*}$@ Ag nanocomposites with plasmon enhanced luminesencence *via* ultrasonic spray pyrolysis

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$Y_2O_3:Eu^{3+}$@Ag nanocomposites have been successfully synthesized by ultrasonic spray pyrolysis (USP) and examined to reveal effects of surface plasmon resonance, associated to silver nanoparticles, to the luminescence efficiency of Y_2O_3: Eu^{3+} red-emitting phosphors. Various Ag concentrations (1, 2.5 and 5 wt. %) and heat-treatment regimes (as prepared, 2h, 12h) were applied to understand how size and distribution of the Ag nanoparticles affect the luminescence efficiency. Samples were characterized by TEM, XRPD and STEM to evaluate crystal structure and distribution of Eu^{3+} in Y_2O_3 matrix. In terms of Y, O and Eu ions, uniform distribution was observed in the particles interior, while the Ag is present at the particles surface showing that USP is feasible for synthesis of hierarchically organized $Y_2O_3:Eu^{3+}$@Ag. In the case of higher Ag concentration, a deviation from uniform and finely distributed Ag nanoparticles on $Y_2O_3:Eu^{3+}$ surface was detected having detrimental effect to the plasmon enhanced luminescence. Regardless from silver concentrations, all heat treated samples exhibited superior luminescence with respect to as-prepared ones, while decrease of luminescence efficiency was detected with the increase of Ag concentration. The most intense red luminescence at 612 nm which is due Eu^{3+} $^5D_0 \rightarrow {}^7F_2$ transition was observed in $Y_2O_3:Eu^{3+}$@Ag system for sample with 1wt% Ag, annealed for 12 hours.

P13
Microwave assisted synthesis of onion-like carbon

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Onion-like carbon (OLC) is specific allotropic form of carbon which is expected to achieve wide application in many fields such as solid lubricant materials, electron sources, electromagnetic shields, catalysts in fuel cells, lithium ion batteries, etc. Until now, OLC were prepared using chemical vapour deposition (CVD), arc discharge, laser ablation, etc. A novel procedure for OLC synthesis is developed which is based on solid-phase interaction of the carbohydrate precursor and susceptor of microwave energy. The effects of the type and quantity of precursor and susceptor in reaction mixture, reaction mixture weight, power of microwave field and interaction time on the yield of OLC are investigated. Characterization of the resultant product was done by ordinary used techniques such as X-ray diffractometry,

FTIR and Raman spectroscopy, thermogravimetry, scanning electron microscopy. Based on the obtained results it was concluded that: i) Microwave assisted synthesis is effective and fast method for OLC production and ii) the optimal syntheses conditions are found to be: carbohydrate precursor is naphthalene, susceptor of microwave energy is carbon molecular sieve, weight ratio precursor to susceptor is 1 to 2, microwave power 300 W, reaction time 3 minutes.

P14
Preparation of cordierite-based adsorbents for water purification

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In this study, porous cordierite-based ceramics was synthesized. In the first step, MgO, Al_2O_3, and SiO_2 (all Aldrich, p.a.) were used. MgO and Al_2O_3 powders were calcined at 1000 ^oC for 2 h, in order to avoid hydroxides. They were mixed in 2:2:5 molar ratio, in order to form cordierite, $Mg_2Al_4Si_5O_{18}$. Ethanol was added to the mixture, and then milled in a Fritsch Pulverisette planetary mill, with 300 rpm, in air atmosfere. Times of activation were 0, 10, 40, and 80 min, while balls and vessels were made from ZrO_2, and powder to balls mass ratio was 40:1. After milling, powders were dried, and then pressed under 3 t/cm^2. Pallets with 8 mm radius were sintered in air at 1350 ^oC, for 2 h, heating rate was 20 ^oC/min. Sintered samples were crashed and sieved.

In the secons step, the as-prepared cordierite was mixed with 20 wt.% yeast (0.1 g yeast + 0.4 g cordierite per sample). The other mixture was with 20 wt.% nanocellulose (0.1 g NC + 0.4 g cordierite per sample). Both mixtures were pressed into pallets under 5 t/cm^2 and sintered at 700 ^oC, with 5 ^oC/min heating rate, in air atmosfere.

During the second sintering regime, porous cordierite-based ceramics was obtained. The phase composition of the sintered samples as well as microstructures was analyzed by the means of X-ray diffraction method and SEM. Cordierite was the most abundant phase in all sintered samples. It was observed that addition of different pore-forming agent resulted in significantly different microstructures.

P15
Tartrazine azo-dye degradation using Co-impregnated Al-pillared clay and Oxone: influence of temperature

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Heterogneous Fenton-like reaction is one of the most efficient solutions for the degradation of organic pollutants in water. A variant of this reaction involves the application of Oxone reagent, based on potassium peroxymonosulfate. Oxone, in conjunction with cobalt, is the source of sulfate radicals. These radicals are very efficient oxidants because of their high standard reduction potential at neutral pH.

In this work Co-impregnated Al-pillared clay (CoAP2) was used as heterogeneous catalyst in the degradation of Tartrazine azo-dye in aqueous solutions. For this purpose, Na-montmorillonite source clay from Wyoming, USA, with particle diameters of up to 2×10^{-6} m was submitted to pillaring with aluminium (Keggin ions) and subsequent impregnation with $Co(NO_3)_2$ followed by calcination. Morphological and textural characterization as well as phase and chemical characterization were performed on the obtained material.

Catalytic degadation of Tartrazine using CoAP2 and Oxone was investigated with respect to reaction temperature in the range from 30–70 °C and monitored using UV-Vis spectroscopy. The obtained spectra indicated that solution decolorization was efficient. Increasing temperature increased decolorization efficiency, and led to the degradation of the dye, the formation and subsequent disappearance of different reaction products. The catalyst showed to be stable under investigated conditions.

P16
Bioactive scaffolds based on doped hydroxyapatite powders

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Modified hydroxyapatite (HAp) with desirable antibacterial properties and high biocompatibility is of great interest in many biomedical applications. Four different HAp powders were hydrothermally obtained by adding of Si^{4+}, Ag^{+}, Cu^{2+} and Zn^{2+} ions at 160 °C, and labeled as HAp, Si-HAp, AgCuSi-HAp and AgZnSi-HAp. The powders were additionally calcinated at 1100 and 1150 °C and further used in synthesis of scaffolds by replica foam technic. The scaffolds sintered at 1300 and 1400 °C were placed in SBF for 14 days and then characterized by powder X-ray diffraction, field emission scanning electron

microscopy (FESEM) and Fourier transform infrared spectroscopy (FTIR). The analyses confirmed the presence of new, well developed HAp crystals on the surface of scaffolds after incubation in SBF as a proof of their excellent bioactivity. The mechanical properties of scaffolds and their antimicrobial activities against *Escherichia coli* and *Staphylococcus aureus* were also investigated. In spite of less satisfactory results of mechanical testing, the antimicrobial activity was significant, especially in the case of scaffold obtained from AgCuSi-HAp powder.

P17
Synthesis of $BaFe_{12}O_{19}$-$BaTiO_3$ multiferroics by mechanical activation

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A mixture of polycrystalline powders of Fe (70 % wt.) and $BaTiO_3$ (30 % wt.) was ball-milled in a planetary mill under air atmosphere, for different time intervals: 60, 120, 180, 240, 300 and 360 min. During the mechanical activation, the powder was exposed to oxygen from the air, resulting in formation of iron oxides: FeO and then Fe_2O_3 and Fe_3O_4.

XRD and SEM analyses of the activated powders revealed that the weight fraction of the iron oxides in the mixture and microcrystal size depend on the activation time. For the powders activated for different time intervals, average crystallite size (D_{hkl}), dislocation density (ρ_n) and average microcrystal size of $BaTiO_3$ and Fe were determined. In order to investigate the influence of thermally induced structural changes on magnetic properties, the change of magnetic properties of the pressed activated powders during multiple heating in a magnetic field of 10KA/m was measured. Maximum magnetization of the samples was reached after heating at 620 K.

Pressed powder samples were sintered at temperatures of 1100 ^oC and 1200 ^oC for 2h giving the different phase diagrams. The samples sintered at 1100 ^oC include $BaTiO_3$, $BaFe_{12}O_{19}$ and $BaFeO_{2,67}$ as the dominant components. The samples sintered at 1200 ^oC containing only two components, $BaTiO_3$ and $BaFe_{12}O_{19}$, exhibited pronounced ferromagnetic and ferroelectric properties.

P18
Influence of synthesis parameters and thermal treatment on functional properties of Fe_3O_4-$BaTiO_3$ multiferroics obtained by mechanical activation

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Mechanical activation of a mixture of polycrystalline powders Fe_3O_4 (50% wt.) and $BaTiO_3$ (50% wt.) was performed in a planetary ball-mill, with different milling times (3 h, 6 h and 12 h). Average crystallite size determined by XRD analysis ranges from 12 to 30 nm, depending on the milling time.

The activated powders were pressed into disc-shaped samples, 8 mm in diameter and 1.5 mm thick, applying the pressure of 500 MPa,. Thermoelectric measurements conducted in the temperature range from room temperature to 350 ^oC revealed that the electrical resistivity of the sample depends on temperature and activation time. At room temperature, the maximum value of specific electrical resistivity (ρ_0 = 1 MΩm) was observed for the sample obtained by pressing the powder activated for 6 h.

Magnetic properties of pressed powder samples were studied using a modified Faraday method. At room temperature, the pressed powder activated for 3 h exhibited the maximum value of magnetization, M_0= 0.86 Am^2/kg. Multiple heating of the pressed samples, for 10 min, was performed in a magnetic field of 20 KA/m. After cooling, the highest magnetization values were observed for the samples previously heated at 380 ^oC, while the maximum one ($M^{'}$ = 1.04 Am^2/kg) corresponds to the sample activated for 3 h.

P19
PHYSICAL AND MECHANICAL PROPERTIES OF CEMENT COMPOSITES MADE WITH EXPANDED CLAY AND EXPANDED GLASS

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The results of experimental tests, conducted on Self-compacting concrete (SCC) made with lightweight aggregate and fly ash, will be presented in this paper. Two types of lightweight aggregate were used, namely expanded clay and expanded glass (also known as "poraver"). These series were made with the quantity of cement ranging from 421 kg/m^3 up to 550 kg/m^3. Three series of samples with expanded clay were made, with the constant quantity

of cement (m_c = 550 kg/m^3), and different contents of fly ash (40% to 65% relative to the weight of cement). Expanded clay was separated into two fractions (0/5 and 5/10 mm). Furthermore, three series of SCC with expanded glass were made, with various replacement amounts of cement with fly ash (from 30% to 52 % of the cement mass). The used "poraver" was separated into four sub-fractions (0/0.04, 0.2/0.7, 0.1/0.3, 2/4 mm), and it served as a partial replacement of the river aggregate of the same grain size. Test results showed that SCC concrete with lightweight aggregate have all properties of self-compactibility (slump flow app. 750 mm) and bulk density lower than 1650 kg/m^3. The presented composites showed a satisfactory compressive strength (app. 30 MPa) and durability proven by water permeability.

P20
The influence of the nano-TiO_2 addition on the process of sintering magnesium oxide obtained from seawater at a temperature of 1500 ^oC

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This study has examined the process of sintering of MgO samples (80 % precipitation) obtained from seawater at a temperature of 1500 ºC in order to determine the influence of nano-TiO_2 on their properties (density, porosity), chemical composition and microstructural characteristics after sintering. The magnesium oxide samples were prepared by rinsing of the Mg(OH)2 precipitate with the combined rinsing method (2+3) (rinsing 2 times with distilled water of pH of 5.88 and 3 times with alkalized distilled water of pH of 12.50) in the process of decantation, and 5 times with fresh distilled water of pH of 5.88 on filter paper. The results indicate that the method of rinsing of the magnesium hydroxide precipitate significantly affect the chemical composition of samples, primarily with regard to the CaO and B_2O_3 content. Further, the process of sintering of magnesium oxide and the influence of the nano-TiO_2 addition (ω = 1, 2 and 5%) on its properties and microstructure at sintering temperatures of 1500 (1 h) was examined. SEM/EDS analysis confirmed the formation of periclase grain and its direct bonding. $CaTiO_3$ and $MgTiO_4$ are separated in the form of a thin layer over the periclase grain boundary surface during cooling. Microstructure of the MgO samples with the addition of nano-TiO_2 becomes more compact which have positive influence on porosity and density of the samples.

P21
Optical properties of the mechanochemically synthesized Cu2FeSnS4 (stannite) nanocrystals

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The Cu2FeSnS4 stannite nanocrystals were synthesized mechanochemically from elemental precursors Cu, Fe, Sn, and S. Milling time was 45, 60, 90 and 120 min. The milling time influence on synthesis stannite Cu2FeSnS4 was observed. We used X-ray diffraction (XRD), Raman and far-infrared spectroscopy to characterize the crystal structure and compositional purity of Cu2FeSnS4 nanoparticles. The detailed analysis of the experimental spectra has allowed us to determine the frequency and symmetry assignment of the main and weaker peaks. Among the peaks that are characteristic for the stannite Cu2FeSnS4, we registered the modes of binary phases of FeS and SnS. Intensities of FeS and SnS modes decreases while the milling time increase. The total disappearance of the mode originated from SnS binary phase is observed after 60 min milling time, and FeS modes when the milling time is longer than 90 min. Absence of those modes excluded the presence of FeS and SnS binary phases, which indicates that after 90 minutes milling time pure stannite Cu2FeSnS4 is synthesized. Contrary the modes originated from the binary phases FeS and SnS, intensities of the modes originated from Cu2FeSnS4 increases while milling time increases.

P22
A rapid method for preliminary evaluation of nitrate content during desalination of building materials

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Currently available methods for measurement of nitrate (NO_3^-) content are either time consuming or require specific equipment. The idea of our work was to use infrared spectroscopy with Fourier transformation (FTIR technique) for a preliminary assessment of nitrate content. This technique includes direct testing of powders from masonry structures without any special preparation with the duration of measurement of 1.5 min per sample.

The FTIR technique was successfully applied during the development of biocleaning poultices for nitrate reduction in the affected cultural heritage objects. A large number of samples (at different heights and depths of the brick models and masonry structure) was needed. The implementation of a rapid screening method for measuring the nitrate content (i.e. FTIR) presented an important step. The gained spectra recorded in ATR mode were

mathematically processed by integration of the peak area characteristic for nitrates and by measuring the ratio of intensity of the characteristic peaks.

The results from the fast FTIR technique and those obtained by a slow and demanding UV-Vis spectrophotometric technique were compared. This showed that the proposed mathematical analysis of the FTIR spectra gave the same trend of quantitative results as the UV-Vis results, promising to be a useful tool for preliminary investigation of nitrate content in powdered materials.

P23

Synthesis and Characterization of Multifferoics $16\%(Fe_2O_3)4\%(BaCO_3)80\%(BaTiO_3)$

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The initial powder (16 % Fe_2O_3, 4 % $BaCO_3$, 80 % $BaTiO_3$) was mechanically activated in a planetary mill for 20, 80, 120, 160, 200 and 220 minutes in air. Modified Faraday method was used to perform magnetization measurements of compressed activated powder. The value of magnetization of these samples increases with increase in time of activation from 0.77 Am^2kg^{-1} to 1.74 Am^2kg^{-1}. Thermomagnetic measurements in 20-600 ^oC temperature interval was used to investigate the dependence of magnetization on temperature. Multiple heating cycles of the sample activated for 120 min shows that after heating to 540 ^oC and 600 ^oC the value of magnetization increases 17 % and 62 %, respectively. Compressed powder samples were sintered for 2 hours at 1200 ^oC, leading to an increase in magnetization of 81 to 123 %. Thermomagnetic measurements of sintered samples in 20-450 ^oC temperature interval shows that sintered samples possess both ferromagnetic and ferroelectric properties. The relative dielectric constant of sintered samples at room temperature is around 8x104, depending on mechanical activation time.

P24

Tetramethylammonium-smectites as nicotine adsorbents

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Nicotine i.e. (S)-3-(1-methylpyrrolidin-2-yl) pyridine is an alkaloid present mostly in tobacco, used for cigarette production and consequently in wastewaters obtained during tobacco manufacturing. The adsorption, as wastewater purification method, is among widely

used methods. New class of hybrid nanomaterials based obtained of intercalation of tetramethylammonium (TMA) cations into clay minerals, i.e. smectite, potentially could be effective adsorbents due to their organic-inorganic interfaces. Therefore the influence of TMA loading on adsorption properties of nanocomposite toward nicotine was investigated. The series of nanocomposites with different TMA:smectite ratios was synthesized and characterized by XRD and low temperature nitrogen physisorption. The nanocomposites with intercalated TMA into smectite in pillared arrangements with highly developed porous structure were found to be the most efficient adsorbents. The adsorption isotherms of nicotine were fitted with different models and the Langmuir isotherm model showed the best agreement with experimental data.

P25
Synthesis and characterization of $SrY_2O_4:Eu^{3+}$ nanoparticles for potential application in solar cells

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Here in this work, SrY_2O_4 with different concentration of Eu^{3+} nanoparticles (0.25, 0.5, 1, 2, 4 and 8 at%) were investigated for the purpose of application in solar cells. Nanoparticles were obtained with citrate sol-gel method using glycine as a fuel. The samples was burned in the furnace at 500 °C for 1.5h and then finally calcined for 2.5h at 1000 °C. Solar cell was made using ITO conductive glass; composite film that consisted of $SrGd_2O_4:Eu^{3+}$ nanoparticles and hypericine as a natural dye, electrolyte (0.5M KI + 0.05M I_2) and aluminum as a counter electrode. Layer was deposited by spraying technique and had a thickness of 1μm. Characterization was performed by X-ray diffraction (XRD), Scanning electron microscopy (SEM), Photoluminescent measurements (PL) and Current-Voltage (I-V) measurements. The solar cell was investigated at very low light (5% of sun), low light (35% of sun) and at Standard test conditions (1 sun) with different light distribution. Whole cell surface was 7.5 cm^2 while illuminated part was 3 cm^2.

P26
Determination of pigments using the SEM-EDS method for the restoration and conservation of art painting

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The aim of this paper is to identify the pigments present in the samples of painting colors that were applied in the production of a certain artistic painting.

Characterization, control and analysis of various materials (metals, ceramics, semiconductors, polymers, etc.) can't be imagined without knowing their microstructure and microstructural constituents. Therefore, the techniques and methods for analyzing the

microstructural characteristics of these materials are of exceptional importance. For such a research, electronic methods are particularly present, and scanning electron microscopy (SEM) and energy dispersion electroscopy (EDS) are distinguished. Pigments are particles that give opacity and color to the material in which they are dispersed. The structure and shape of the particles strongly depend on the crystallinity of the pigment. The process of sample preparation consisted of a thin film of gold depositing on a single surface of the sample to make the sample transparent to the electron beam.

Elemental SEM-EDS analysis showed that oxide pigments (titanium oxides, iron, aluminum, potassium, etc.) are predominantly represented in paint samples, which are included in alumosilicate and sulfide pigments (sulfides of cadmium and arsenic). By knowing these results, adequate restoration and further conservation of the artwork can be carried out.

P27
Application of FTIR spectral analysis and SEM analysis for characterization of clay modified with acid

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The aim of this study is to test acid-activated clay modified with NaCMC. The reason for this testing is possibility of application this material for the purpose of removing heavy metals that are highly toxic and contaminate watercourses.

Acid activated clay was prepared by the treatment of crude clay with concentrated HCl. 15 g bentonite clay was suspended in the beaker with 300 mL deionized water. Afterwards NACMC was added in the quantity of 1 % of clay mass (0.15 g) (modified clay GI), 3 % (GII) and 5 % (GIII) and then heating at 90 °C and mixing on rotary mixer (1-2 h). 5 mL of conc HCl was added dropwise. The probe was left overnight, and then filtered through Buchner funnel on vacuum pump and rinsed with plenty of deionized water until the negative reaction on chlorides. Modified clay was dried in the hothouse at 110 °C[6] to constant weight, left overnight and then smashed in the mortar. Before the addition of NaCMC pH was 9.2±0.1, while pH after the addition of NaCMC and HCl was 1.35±0.1.

Samples of carboxymethyl cellulose, modified clays (GI, GII, GIII) and unmodified clay (G0) were recorded on FTIR spectrometer. Scanning was performed in the range of wavelengths from 4000-400 cm^{-1} with the resolution 4 cm^{-1}. SEM analysis of surface samples was performed by scanning electron microscope JEOL JSM-5300, which is operated at a working potential of 30 kV, and the depth of penetration of electron beam was 10 pm. Characteristics of surface samples are observed at different magnifications (1000×, 2000×, 5000×). SEM-EDS analysis was performed using the same scanning microscope, but with the detector (probe) Linx Analytical QX 2000b.

In FTIR spectra it is clearly visible the intensive band coming from deformational vibration of Si-O bond, with maximums at 1033.27 cm^{-1}, 1028.52 cm^{-1}, 1037.13 cm^{-1} and 1019.46 cm^{-1} (characteristic for alumosilicates present in the clay). In spectra of GII and GIII,

these bands are less pronounced, which means that sample GI contains mostly unmodified carboxymethyl cellulose, although in the process of the preparation the least quantity of this organic compound as a modifier of the surface and adsorption characteristics of clay was used. SEM analysis of unmodified clay (5000× magnification) shows characteristic morphology of clay minerals, i.e. platelet particles of different sizes. SEM analysis of GI sample indicates lamellar particles with dominant fraction of 5-10 μm in diameter. Microphotographs of GII sample show polyhedral crystals, which are more evident on SEM analysis of GIII sample. We assumed these crystals originated from NaCl formed in the reactions of HCl and sodium from NaCMC.

P28
Analytical method for hysteresis modelling of magnetic materials applying labview software package

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This study presents the realization of a new analytical model for major and minor hysteresis loops of magnetic materials under LabVIEW software package.

In order to achieve better accuracy of the model, hysteresis loop was decomposed into two segments. Each of segments was modeled by the corresponding analytical expression. The advantage of the proposed model is small number of input parameters required to obtain a very well agreement between measured and modelled hysteresis loops. Therefore, this model is very comfortable for programming.

The LabVIEW realization was applied to simulate minor curves as well as major hystersis curve of FeCo-2V alloy samples sintered in the range from 1300 °C to 1460 °C, 3.5 h in an protective atmosphere. Devices prepared from FeCo-2V alloy are usually exploited under extreme conditions. Therefore, magnetic measurements and appropriate modelling were performed in the operating frequency range from 5 Hz to 60 Hz. Common shapes as well as anomalous shapes of these dynamic loops were successfully modelled.

P29
Fractals and ceramics materials characterization

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Large part of powder based materials; especially ceramics are porous in more or less percentage. For such materials, two separated spaces are present. The “positive” space is made by grains or particles, while the “negative” space is “reserved” for pores. Formally speaking, the bulk of material space, *V* can be written as an union of “positive” and “negative” space which otherwise have no common points. Pores and grains share same

surfaces, and since grains have fractal nature, with fractal interior and fractal boundary surfaces, the pores also have fractal "walls". This implies two conclusions: the pores should be treated as the *fractal* objects, i.e., the objects having non-fractal interior, and fractal surface with dimension equal to grain's fractal dimension. Suppose that the morphology of materials changes through time for the consideration process. By box counting methods fractal dimension definition, it follows that three sintering phase formulae based on the union described above, the sintering initial phase, the Frenkel formula takes corrected form including fractal dimension value.

In this paper we applied four methods: Cube counting, Triangulation, Variance and Power spectrum method. All of these are very important and quite a different then the other, Ceramic Characterization Classic methods, what is opening new frontiers in material science characterization.

P30

Ceramics in modern concept of national security

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Recent decades have brought new threats a change in national security concerns. Their emergence imposed a need for new approaches in terms of adequate new tools and methods to detect, identify, and neutralise them and also to provide the performance of the existing components of national security system. The effective management and handling requires new tools and methods to be smaller, highly integrated and ever more complex (National Materials Advisory Board, 1999: 35-36). Today, the use of ceramics appears to be critical for these tasks.

Characteristics such as light weight, low density, hardness, undetectability on metal detectors make ceramics suitable for terrorist and surprise tactics. A ceramic layer in the body armour is, theoretically, supposed to break up the bullet and a composite layer of fabrics, to catch the bullet (Bengisu, 2001: 415). Its light weight makes it easy to wear and carry. A ceramic knife, most often made of zirconium dioxide, is very hard and tough (Danzer et al., 2013: 614), thus suitable for serious attacks.

Ceramic projectiles with coat of light metal disintegrate into particles upon impacting a target which minimises their penetration capacity. Thus, they are not yet suitable for combat bullets, but are suitable for crowd control. But, experiments indicate that composite ceramic bullet can damage soft tissue after travelling over a 100 yards (Brogdon; Messmer, 2011: 216-217), and even ceramic targets (Yi et al., 2017: 298). What makes them a security risk is that they are untraceable.

As far as firearms are concerned, the US Undetectable Firearms Act of 1988 makes it illegal to manufacture, import, sell, ship, deliver, possess, transfer, or receive any firearm that is not as detectable by walk-through metal detection as a security exemplar containing 105 g of steel, or any firearm with major components that do not generate an accurate image before standard airport imaging technology.

From the aspect of requirements for contemporary national security concepts, ceramics, generally, offer at least three strategic comparative advantages: much lower density than the super alloys, operate uncooled at extreme temperatures and higher resistance to wear

and corrosion (Ashby, 2011) They thus offer significant weight savings, improved metallic disk life, faster rotor response, and reduced containment requirements.
Ceramics function at 2400°C, with a melting point over 2500°C (Low; Sakka; Hu, 2013: 83). This leads to increased power and lower specific fuel consumption, as well as lower emissions.

Today's ceramics are characterised by in-situ reinforced microstructure, giving high strength, high fracture toughness, and high thermal shock resistance (Kita et al., 2013:256-257). Their high Weibull modulus gives low variability and high predictability. Such ceramics enable combination of miniature mechanical structures, microelectronics, and massive parallel architectures, like in the case microelectromechanical systems of an integrated chip or single substrate (Maluf; Williams, 2002: 233-235). These allow merging of sensing, computation, actuation and control in a single device.

From the aspect of vital values, modern national security concepts rely on the effects of implementation of some advantages offered by modern ceramics: increased strength and stiffness and reduced weight of composites; alloys for better quality and less expensive equipment, small, thin and light products that operate under low voltage; high thermal insulation and wear-resistant properties.

Firstly, these characteristics find their application in semiconductor gas sensors; bulletproof vests and infrared night vision devices; packaging functions: distribution of power in and out of device; communicate signals through and outside the device; dissipation of heat; to protect from heat, moisture and radiation.

Secondly, ceramics improve energy economy and reduction of emissions, consequently, increasing power capabilities and reducing logistical support, which contributes to environmental security.

Thirdly, ceramics offer possibilities which enable advances in tools and procedures applied in the field of renewable energy, tools for sensing environment.

These aspects of exploiting the possibilities of ceramics offer commercial prospects, but their significance for vital national values indicates a need for developments in ceramics on the coordinated national level.

P31
The activation time and heat impact on the magnetic properties of nanostructural powder 85,8%Ni 10,6%Fe 2,2%Cu 1,4%W

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The mechanical activation of the mixture of polycrystal powders 85,8% Ni, 10,6% Fe, 2,2% Cu and 1,4% W in the time intervals of 30, 60, 90, 120, 150, 180 and 210 minutes resulted in the formation of nanocrystal powder of the same content. XRD analysis determined the dimensions of the crystalite, the size of microstrains and minimum density of dislocations for the Ni phase of activated powders. It has been shown that with the increase in the activation time the dimensions of the crystalites decrease, whereas the size of microstrains and minimum density of dislocations rise. DSC method was used to test the thermal stability of the powder in the temperature interval

from room temperature up to 350^0C. It has been shown that in the temperature interval from 240^0C to 300^0C all samples display exo-peak. Enthalpy of these exothermal processes range from 1,47 J/g to 5,15 J/g depending on the activation time. Magnetization of the samples obtained by pressing activated powders has been measured by modified Faraday method in the applied magnetc field of 40 kA/m. It has been shown that the maximum magnetization before and after the annealing at 420^0C has the sample obtained by pressing the powder activated for 120 minutes, and it is M_0 = 31,67 Am^2/kg before and M' = 36,88 Am^2/kg after the annealing.

P32
Modeling of synthesis parameters and their influence on electrical and magnetic properties of Fe_xO_y - $BaTiO_3$ as a multiferroic

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The mechanical mixture of polycrystalline powders of 60% Fe and 40% $BaTiO_3$ was activated in the planetary ball mill for 20, 40, 60, 80, 100, 120, 150, 180, 210 and 240 minutes in the air atmosphere. During the activation, the iron powder transits into iron oxides FeO, Fe_2O_3 and Fe_3O_4. Depending on the activation time, the mass percentages of the components in the mixture are changed, as well as the size of the nanocrystallites. The characterization of activated powders and pressed samples sintered at 1100 ^{0}C and 1200 ^{0}C in the time interval of two hours was achieved by XRD, SEM and TEM analysis.

The thermoelectric measurements have shown that specific electrical resistance and dielectric constant of the pressed samples of the activated powder before and during heating and after the sintering depend on the activation time and temperature. It is experimentally shown that the best electrical properties before and after the sintering at the temperature of 1200 ^{0}C during two hours has the sample obtained by pressing the powder activated for 120 minutes. Dielectric constant for this sample at the frequency range of 50 Hz up to 100 MHz is $\varepsilon_r = 8 \cdot 10^4$.

The thermomagnetic measurements have shown that the sample obtained by pressing the powder activated for 120 minutes and sintered at the temperature of 1200 ^{0}C during two hours have ferroelectric transition at the temperature of 120 ^{0}C. It is shown that this sample has the magnetization of M = 2,9 Am^2/kg after the sintering. By heating this sample to the Currie temperature (420 ^{0}C) and by cooling the sample in the applied magnetic field, the magnetization of the sample is increased by almost four times and has the value of M' = 11,6 Am^2/kg, while the sample remains permanently magnetized. The strength of the applied magnetic field during all magnetic measurements was H = 20 kA/m.

Based on the experimental results of the measurements, the modeling of magnetization dependence on the activation time and temperature was performed.

P33
Archeological site Felix Romulijana – Research in time

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Gamzigrad is an archeological site in the vicinity of Zaječar, in east Serbia. It is an imperial palace built at the request of Gaius Valerius Galerius Maximianus, in III and IV centuries AD. Galerius had the palace built for himself and his mother Romula, and for this reason it bears the name Felix Romuliana. It belongs to the category of Roman court architecture in the Tetrarchy period.

The palace is enclosed within a double fortification system with extremely massive walls and towers. The northern part of the complex is occupied by a part of the palace intended for the emperor with a small temple and the sacrificial altar, while the southern part is occupied by the public buildings and buildings intended for serving the palace.

Felix Romuliana has an outstanding historical and cultural value. This site has been under protection since 1948. In 1979 it was categorized as an immovable cultural property of outstanding importance of the Republic of Serbia. The value of this archeological site is recognized by the global experts in this field, so since 2007 it is included in the UNESCO cultural heritage list. Up to 40 000 tourists a year visit this site.

Even though there were mentions of the site in the literature since 1864, the archeological research started in 1953. The works on the site and the nearby sacral complex on Magura have been underway. The discovered structures have been continuously conserved. A large number of experts in various fields found an inspiration and research material on the site. The paper provides a historical review of research on this archeological site, in order to emphasize its great importance and popularize it further.

P34
Archeological site Caričin Grad – Research in time

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Caričin Grad is and early Byzantine archeological site in Serbia. It is located in the south of Serbia, 28 kilometers west from Leskovac, around 7 kilometers north-east from the present-day Lebane town. The town extends in a north-west – south-east direction for over 500 meters, on an elevated and elongated plateau above the confluence of two streams, the Svinjarička stream in the west and the Caričinska stream in the east.

The town was built by the Byzantine emperor Justinian I (527-565), in order to mark his birth place. It was built on a site showing no traces of previous construction layers. The

town existed for a very short time. By the beginning of VII century, it perished in a large conflagration, after which it was not rebuilt.

This archeological site has an outstanding cultural and historical value. Caričin Grad, after a decision of the Assembly of the no. 29 of 29th March 1979 was categorized as an immovable cultural property of outstanding importance for the Republic of Serbia. In 2010, it was preliminary listed among the cultural properties which will be nominated for the UNESCO cultural heritage list (Tentative List). The site has been under intensive restoration, in order to restore it to a certain condition, after which a nomination portfolio for inclusion in the UNESCO cultural heritage list will be prepared. During the month of August of 2017 the first action camp World Heritage Volunteers Initiative, WHV-Heritage in our Hands Decorated Stone Elements Rescue and Conservation under the auspices of the UNESCO was held.

The works in Caričin Grad have been going on, at different intensity, since 1912 until the present day. The site, over the course of a century attracted a number of eminent researchers of different professions. Archeologists, conservation architects, art historians, mosaic restorers all contributed to the research. The paper presents the historical review of the research on this very important archeological site, in order to once again emphasize the significance of this site, which will, we believe, soon attain a global reputation it deserves.

P35
Generalized Lorentz model description of electrical, dielectric, conductive and magnetic processes two-time relaxations in $BaTiO_3$ ceramics with constitutive relations

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In this study, generalized Lorentz model is considered in the framework of dielectric, conductive and/or magnetic responses of materials. Beside positive temperature coefficient of resistivity (PTCR) materials (current stabilizers, time delay circuits and current limiters for overvoltage or overcurrent protection, temperature sensors, self-heating, …), magnetic properties indicate to multifunctional or specific applications (for example, nanocubic technologies).

AC conductivity studies of various $BaTiO_3$ ceramics or similar ceramics produced equivalent circuits with impedance spectra, usually within the framework of RCPE elements serial connection (CPE - constant phase element) or Cole element. One of the first models that explains PTC effect is the Heywang model, in terms of grain boundaries potential barriers of the Shottky type. Dielectric frequency spectra can be described in similar relationships. However, magnetic features of BaTiO3 ceramics are not well described.

In this presentation all three behaviors (dielectric, conductive and magnetic) of materials and their relationships are considered in the case of electric or magnetic alternate fields, which are the basis for experimental measurements.

P36

Fractal Simulator and Ceramics Technology for New Tesla's Fountain

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In this study, we present new Tesla's Fountain model in ceramics technology. It is reconstructed from basic 3D model. The model is designed based on Tesla's original US patent no. 1,113,716, granted on October, 13 (1914). The complete model includes the engine (rotating water pump), colored lights and fluids. This part of the paper is based on research within the project entitled "Computer Simulation and Modeling of the Original Patents of Nikola Tesla" and approved by the Ministry of Education, Science and Technological Development of the Republic of Serbia. The first Tesla's patent that was under our attention in this project was Tesla's Fountain that is presented in this paper.

It is well known that first Tesla's experiments on Fountain have been realized in materials like bronze-metal. Nevertheless, we used new approach and applied ceramics materials technologies in combination of casting and sintering. We used our original fractal simulator to observe and simulate micro particles movements in Fountain model

Finally, we used smoothed-particle hydrodynamics (SPH) as a method of computation and simulating the dynamics of continuum media, like the flow of fluids. The method was developed by Gingold, Monaghan and Lucy in 1977, initially for astrophysical problems. It is also used in astrophysics, ballistics, volcano logy, and oceanography but we find new appliance in our Fountain model. We combine a mesh-free Lagrange method (coordinates move with the fluid) to easily adjust resolution of the simulation with respect to all variables (like the density).

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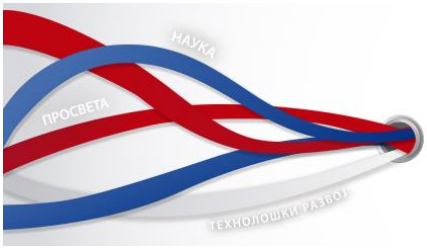

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