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

Serbian Ceramic Society
Institute for Testing of Materials
Institute of Chemistry Technology and Metallurgy
Institute for Technology of Nuclear and Other Raw Mineral Materials
School of Electrical Engineering and Computer Science of Applied Studies

PROGRAM AND THE BOOK OF ABSTRACTS

Serbian Academy of Sciences and Arts, Knez Mihailova 35
Serbia, Belgrade, 21-23. September 2015

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Book title: Serbian Ceramic Society Conference - ADVANCED CERAMICS AND APPLICATION IV: Program and the Book of Abstracts

Publisher:
Serbian Ceramic Society

Editors:
Prof.dr Vojislav Mitić
Prof.dr.Olivera Milošević
Dr Lidija Mančić
Dr Nina Obradović

Technical Editors:
Dr Lidija Mančić
Dr Nina Obradović

Printing:
Serbian Academy of Sciences and Arts,
Knez Mihailova 35, Belgrade

Edition:
140 copies

Photos : Jewelry - Zvonko Petković
Sculptures - Dragan Radenović
Ceramics - Ruža Nikolić

CIP - Каталогизација у публикацији -
Народна библиотека Србије, Београд

666.3/.7(048)
66.017/.018(048)

SERBIAN Ceramic Society Conference - Advanced Ceramics and Application (4; 2015 ; Beograd) Advanced Ceramics and Application : new frontiers in multifunctional material science and processing : program and the book of abstracts / IV Serbian Ceramic Society Conference, Belgrade, 21-23. September 2015. ; [organized by] Serbian Ceramic Society ... [et al.] ; [editors Vojislav Mitić ... et al.]. - Belgrade : Serbian Ceramic Society, 2015 (Belgrade Serbian Academy of Sciences and Arts). - 106 str. ; 30 cm Tiraž 140.

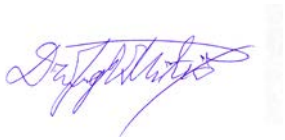
ISBN 978-86-915627-3-1
a) Керамика - Апстракти b) Наука о материјалима - Апстракти c) Наноматеријали - Апстракти
COBISS.SR-ID 217500428

Dear Colleagues, Dear Friends,

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

Advanced Ceramics play an important role in the European Union's prioritized materials to enable the transition towards to a knowledge-based efficient societies. The chosen Conference topics cover fundamental theoretical research in advanced ceramics, modeling and simulation of technological processes, controlled synthesis of nanomaterials, developing of new composite and hybrid structures which should provide practical realization of the new ideas and brings new quality in everyday life. ACA IV Conference gathers the researchers, engineers, academy staff, artist, specialist and PhD students trying to emphasizes the key innovation activities toward developing the next generation of advanced ceramics products for industry of high-technology, renewable energy sources, 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.



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

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

General Conference Topics

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

Conference Co-chairmen:
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. Lidija Mančić SRB

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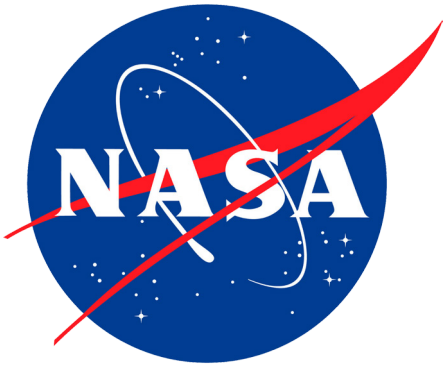
Acknowledgements:

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, Technical High School Niš, High School-Academy for Arts and Conservation, Serbian Orthodox Church. We are also grateful to the Dunav Insurance Co, FORMAT doo, and others who support the conference.

Conference Program and Abstracts

ENDORSMENTS



Program and Abstract's Contents

Conference Information:

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

Conference fee: Standard fee for foreign participants: 100 EUR; Standard fee for domestic participants: 50 EUR, Members of SCS and PhD Students: 30 EUR, last year winners for oral and poster presentations: free of charge.

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

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

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

Additional Conference information
Phone: +381-11-2027247 or 2185-437 or 2637-239, e-mail: nina.obradovic@itn.sanu.ac.rs
http://www.serbianceramicsociety.rs/about.htm

Program Overview

Date	Time	Programme	Floor, Room
September, 21, 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	1st Floor, Club SASA, Mezzanine
	15.00-17.30	Plenary Session 3	2nd Floor, Great Hall
	17.00-17.30	Coffee Break	2nd Floor, Hall
	17.30-18.30	Plenary Session 4	2nd Floor, Great Hall
	20.00	Conference Dinner (with invitation only)	Restaurant Peking Vuka Karadžića 2
September, 22, Tuesday	08.00-09.00	Registration Poster and Exhibition Installation	1st Floor, Hall
	09.00-10.30	Plenary Session 5	1st Floor, Blue Hall 1
	10.30–11.00	Coffee Break	1st Floor, Hall
	11.00-12.30	Plenary Session 6	1st Floor, Blue Hall 1
	12.30-13.30	Buffet Lunch	1st Floor, Club SASA Mezzanine
	13.30-18.25	13.30-15.15: 1st Session Basic & Sintering Blue Hall 2 / 3rd Session Electro & Multifunctional Red Hall 1	1st Floor
		15.15-15.45: Coffee Break	
		15.45-18.25: 2nd Session Nanostructured, Opto & Bio Blue Hall 2 / 4th Session Electro & Multifunctional Red Hall 1	
September, 23, Wednesday	09.30-11.30	5th Session: Constructional & Composite	1st Floor, Blue Hall 2
	11.30-12.00	Coffee Break and Buffet	
	12.00-13.55	6th Session: Magnetic & Amorphous	
	13.55-14.15	Closing Ceremony	

Monday, September 21st, 2015

Hall, 2nd Floor

08.00–09.00 **Registration**

Great Hall, 2nd Floor

09.00–09.30 **Opening Ceremony of the Fourth Serbian Ceramic Society Conference: Advanced Ceramics and Application**
Prof. dr Vojislav Mitić SCS, Dr. Olivera Milošević, Dr. Nebojša Nešković, Dr. Richard Todd, Hua-Tay Lin, Academician Ninoslav Stojadinović, RS President, High-representative of Government

09.30–09.40 **Short break**

Great Hall, 2nd Floor

09.40–11.40 **Plenary Session 1**
Chairpersons: Marcel van de Voorde, Vladimir Pavlović

09.40–10.10 **PL1 Chemically Processed Functional Nanostructures for Energy and Health Application**
Sanjay Mathur
Chair, Inorganic and Materials Chemistry University of Cologne, Greinstrasse 6, D-50939 Cologne, Germany

10.10–10.40 **PL2 Advanced Ceramics for Energy and Environmental Technology**
Alexander Michaelis
Fraunhofer Institute of Ceramic Technologies and Systems, IKTS, Dresden,-Germany

10.40–11.10 **PL3 Advanced Ceramics for Clean and Efficient Energy Technologies**
Hua-Tay Lin
Guangdong University of Technology, Guangzhou, 510006 Guangdong

11.10–11.40 **PL4 Ceramics and coatings for biomedical applications – from prosthetic devices to deep brain stimulation systems**
Rainer Gadow, F. Kern, A. Killinger
Institute for Manufacturing Technologies of Ceramic Components and Composites, IMTCCC, University of Stuttgart, Stuttgart, Germany

11.40–12.00 **Coffee Break and Photo Session** **Hall, 2nd Floor**

Great Hall, 2nd Floor

12.00–14.00 **Plenary Session 2**
Chairpersons: Rainer Gadow, Alexander Michaelis

12.00–12.30 **PL5 Flash sintering of ceramics: thermal runaway and ultra-fast firing**
Richard I. Todd[1], M. Yoshida[2], E Zapata-Solvas[1,3], RS Bonilla[1], JC Xu[4], JY Zhang[4], ZY Fu[4]
[1]Department of Materials, University of Oxford, UK
[2]Department of Materials Science and Technology, Gifu University, Japan
[3]Instituto de Ciencia de Materiales, CSIC-Universidad de Sevilla, Spain
[4]State Key Lab of Advanced Technology for Material Synthesis and Processing, Wuhan University of Technology, P.R. China

12.30–13.00 **PL6 Synthesis, Properties and Applications of Ultrananocrystalline Diamond Layers and Engineered Diamond Microparts**
Hans-J. Fecht
University of Ulm, Ulm, Germany

13.00–13.30 PL7 Development of ultra high temperature ceramics (UHTCs) for aerospace applications
Doni D. Jayaseelan[1], W.E. Lee[1,2]
[1] Centre for Advanced Structural Ceramics, Dept of Materials, Imperial College, London, SW7 2AZ, United Kingdom
[2] Centre for Nuclear Engineering, Dept of Materials, Imperial College, London, SW7 2AZ, United Kingdom

13.30–14.00 **PL8 Effects of Solid Loading and Sintering Additives Content on Microstructure and Mechanical Properties of Porous Silicon Nitride Ceramics Fabricated by Gel Castin**
Farhad Golestanifard
School of Metallurgy and Materials Engineering, Iran University of Science and Technology, Tehran, Iran

14.00–15.00 **Buffet Lunch** **Club SASA, Mezzanine Hall, 1st floor**

Great Hall, 2nd Floor

15.00–17.00 **Plenary Session 3**
Chairpersons: Richard Todd, Dušan Jovanović

15.00–15.30 **PL9 Developments of New Thermal Barrier Coatings: Design, Synthesis and Properties**
Wei Pan, Chunlei Wan, Xiaorui Ren, Meng Zhao, Kai Wang
State Key Lab of New Ceramics and Fine Processing, School of Materials Science and Engineering, Tsinghua University, Beijing, P. R. China, 100084

15.30–16.00 **PL10 Application of Rare-Earth Doped Ceramic Nanophosphors for Near Infrared Biophotonics**
Kohei Soga
Department of Materials Science and Technology, Tokyo University of Science, 6-3-1 Niijuku, Katsushika, Tokyo 125-8585, Japan

16.00–16.30 **PL11 Geopolymers as Sustainable Construction Materials**
Waltraud M. Kriven
Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, IL

16.30–17.00 **PL12 Synthesis of Nanocarbons and Nano-Ilmenites using Super-High-Energy Ball Milling**
Satoshi Ohara
Joining and Welding Research Institute, Osaka University,11-1 Mihogaoka, Ibaraki, Osaka 567-0047 Japan

17.00–17.30 **Coffee Break** **Hall, 2nd Floor**

Great Hall, 2nd Floor

17.30–19.30 **Plenary Session 4**
Chairpersons: Kohei Soga, Hua-Tay Lin

17.30–18.00 **PL13 Heart Transplantation and Left Ventricular Assist Device in Serbia**
Mijlko Ristic[1], Emilija Nestorovic[2]
[1]Clinical for Cardiac Surgery, Clinical Center of Serbia
[2]Department for Heart Transplant, LVAD and ECMO, Clinical for Cardiac surgery, Clinical Center of Serbia

18.00–18.30 **PL14 Pumps to save life in cardiac failure**
Christof Schmid
Dept. Cardiothoracic Surgery, University Medical Center Regensburg, Germany

18.30–19.00 **Sponsor-Berlin Heart**
Pal Soos

20.00 **Conference Dinner (with invitations)** **Restaurant Peking**

Tuesday, September 22nd, 2015

Hall, 1st floor

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

Blue Hall 2, 1st floor

09.00–10.30 **Plenary Session 5**
Chairpersons: Nebojša Nešković, Hans Fecht

09.00–09.30 **PL15 Ceramic Materials in Ozone Generators Production**
Slavcho Rakovsky[1], V. Mitic[2], D. Jovanovic[3]
[1]Institute of Catalysis, Bulgaria, Bulgarian Academy of Sciences, Bulgaria
[2]Serbian Ceramic Society President, Member of European Academy of Sciences and Arts, Serbia
[3]University of Belgrade, Institute of Chemistry, Technology and Metallurgy (I.Ch.T.M.), Center of Catalysis and Chemical Engineering, Serbia

09.30–10.00 **PL16 Spectral Properties and Tunneling in Systems of Weakly Coupled Nanoparticles**
Branislav Vlahović, I. Filikhin
North Carolina Central University, 1801 Fayetteville St. Durham, NC 27707, USA

10.00–10.30 **PL17 Transparent Fabrication and Electron-Optic Properties of Relaxor PMN-PT Ferroelectric Ceramics**
Wei Ruan[1], Jiangtao Zeng[1], Wei Zhao[1], Yibo Zhou[1], Kunyu Zhao[1], Liaoying Zheng, Huarong Zeng, Guorong Li[1], L.S. Kamzina[2]
[1] Key Laboratory of Inorganic Functional Materials and Devices, Shanghai Institute of Ceramics, Chinese Academy of Sciences, 1295 Dingxi Road, Shanghai 200050, CHINA,
[2] Ioffe Physical Technical Institute, Russian Academy of Sciences, Politekhnicheskaya ul. 26, St. Petersburg, 194021 Russia

10.30–11.00 **Coffee Break** **Hall, 1st floor**

Blue Hall 2, 1st floor

11.00–12.30 **Plenary Session 6**
Chairpersons: Slavcho Rakovsky, Lidija Mančić

11.00–11.30 **PL18 Synthesis of macro-porous ceramic (carbon foam) derived from phenolic resin using polyurethane foam as template**
Noaman Ul-Haq[1], Faisal Naseem Siddiqui[1], Shameel Farhan[1]
[1] Department of Chemical Engineering, COMSATS Institute of Information Technology, Lahore-54000, Pakistan

11.30–12.00 **PL19 Quantum rainbows in positron channeling in carbon nanotubes**
Nebojša Nešković
Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia

12.00–12.30 **PL20 Non-Brittle Ceramic Matrix Composites**
Walter Krenkel
Ceramic Materials Engineering, University of Bayreuth, Germany

12.30–13.30 **Buffet Lunch** **Club SASA, Mezzanine**

Blue Hall 2, 1st floor

13.30–15.15 **1st Session – Basic & Sintering**
Chairpersons: Nina Obradović, Suzana Filipović

13.30–13.55 **KN1 Computer Simulation of Liquid Redistribution induced by Rearrangement during Liquid Phase Sintering**
Zoran S. Nikolic
University of Niš, Faculty of Electronic Engineering, Department of Microelectronics, 18000 Niš, Aleksandra Medvedeva 14, P.O. Box 73, Serbia

13.55–14.15 **INV1 Electrical and Dielectric Characterization of ZnxNi1-xFe2O4 Ferrite Ceramics Prepared by Sintering of Nanopowders**
Dalibor L. Sekulić[1], Z. Ž. Lazarević[2], Č. Jovalekić[3], N. Ž. Romčević[2]
[1] Faculty of Technical Sciences, University of Novi Sad, Serbia
[2] Institute of Physics, University of Belgrade, Belgrade, Serbia
[3] The Institute for Multidisciplinary Research, University of Belgrade, Serbia

14.15–14.30 **OR1 The effect of Hot Isostatic Pressing on the MT sample densities**
Suzana Filipovic[1], N. Obradovic[1], V. B. Pavlovic[1], D. Kosanovic[1], M. Mitric[2], V. Paunovic[3], V. Pouchly[4], M. Kachlik[4], K. Maca[4]
[1] Institute of Technical Science of SASA, 11000 Belgrade, Serbia
[2] Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade
[3] Faculty for Electronics, University of Nis, 18000 Nis, Serbia,
[4] CEITEC BUT, Brno University of Technology, Brno, Czech Republic

14.30–14.45 **OR2 Nb/Mn Codoped $BaTiO_3$ Ceramics-Microstructure and Dielectric properties**
Vesna Paunović[1], Vojislav V.Mitić[1,2], Ljubiša Kocić[1], Ljiljana Živković[1]
[1]University of Niš, Faculty of Electronic Engineering, Nis, Serbia
[2]Institute of Technical Sciences of SASA, Belgrade, Serbia

14. 45–15.00 **OR3 BaTiO3-Ceramics Microstructure Fractal Nature Influence on Solar Energy Sources**
Filip Bastić[1,2], D. Sirmić[1], V. V. Mitić[1,2], Lj. Kocić[1], V. Paunović[1]
[1]Faculty of Electronic Engineering, University of Niš, Serbia
[2]Institute of Technical Sciences of SASA, Belgrade, Serbia

15.00–15.15 **OR4 Low temperature co-fired-ceramics device for electromagnetic fields detection emitted by wind turbines**
Dalibor Petković[1], Vojislav Mitić[2], Ljubiša Kocić[3]
[1]University of Niš, Faculty of Mechanical Engineering, Department for Mechatronics and Control, Aleksandra Medvedeva 14, 18000 Niš, Serbia
[2]Institute of Technical Sciences, SASA, Belgrade, Serbia
[3]University of Nis, Faculty of Electronic Engineering, Nis, Serbia

15.15–15.45 **Coffee Break** **Hall, 1st floor**

Blue Hall 2, 1st floor

15.45–18.25 **2nd Session – Nanostructured, Opto & Bio**
Chairpersons: Satoshi Ohara, Olivera Milosević

15.45–16.10 **KN2 ZnO&Ag and ZnO&Pt system: synthesis and structural, morphological and functional characterization**
Lidia Muñoz[1], Aranzazu Sierra-Fernández[1,2],Gregorio Flores-Carrasco[3], Luz Gómez-Villalba[2], Olivera Milosevic[4], Maria Eugenia Rabanal[1]
[1] Materials Science Department and Chemical Engineering, Universidad Carlos III de Madrid&IAAB, Madrid, Spain.
[2] Instituto de Geociencias (CSIC, UCM), Madrid, Spain.
[3] CIDS-ICUAP Benemérita Universidad Autónoma de Puebla, México.
[4] Institute of Technical Sciences of the SASA, Belgrade, Serbia.

16.10-16.35 **KN3 Transport properties of graphene modified with different atoms**
Dragoljub Mirjanić[1], Stevan Armaković[2], Sanja J. Armaković[3], Svetlana S. Pelemiš[4]
[1]University of Banja Luka, Medical Faculty,
78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina
[2]University of Novi Sad, Faculty of Sciences, Department of Physics,
Trg Dositeja Obradovića 4, 21000, Novi Sad, Serbia
[3]University of Novi Sad, Faculty of Sciences, Department of Chemistry,
Biochemistry and Environmental Protection, Trg DositejaObradovića 3, Serbia
[4]University of East Sarajevo, Faculty of Technology, Zvornik, Karakaj bb, 75400 Zvornik, Republic of Srpska, Bosnia and Herzegovina

16.35–17.00 **KN4 Simultaneous Thermal Analysis used as Objective Diagnosis Method in Osteosarcoma Early Detection**
M. Vasile[1], F. Lamonaca[2], Alfonso Nastro[3]
[1]School of Medicine, University Ovidius of Constanta, Bd. Mamaia 124, 900527 - Constanta, Romania,
[2]Dept. D.I.M.E.S. Univ. of Calabria, Arcavacata di Rende, 87036 - Rende (CS), Italy
[3]Dept. C.T.C. Univ. of Calabria, Arcavacata di Rende, 87036 - Rende (CS), Italy

17.00-17.20 **INV2 Study of Nanodimensional Spinel $Ni_{0.5}Zn_{0.5}Fe_2O_4$ Ferrite Prepared by Mechanochemical Synthesis**
Zorica Lazarević
Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Serbia

17.20-17.40 **INV3 EPMA, BIB-SEM and FIB-SEM Investigations on Gas Shales from the Dniepr Donets Basin (Ukraine): Evolution of Micro- and Nanoscale Porosity during Thermal Maturation**
David Misch[1], F. Mendez-Martin[2], J. Klaver[3], D. Gross[1], G. Hawranek[2], J. Schmatz[3], R.F. Sachsenhofer[1]
[1]Chair of Petroleum Geology, Montanuniversitaet Leoben, Peter-Tunner-Straße 5, 8700 Leoben, Austria
[2]Chair of Physical Metallurgy and Metallic Materials, Montanuniversitaet Leoben, Leoben, Austria
[3]Structural Geology, Tectonics and Geomechanics, Energy and Mineral Resources Group (EMR), RWTH Aachen University, Lochnerstrasse 4-20, 52056 Aachen, Germany

17.40-17.55 **OR5 Application of surface modified titanate nanotubes in reinforcing of polyamide 11**
Lidija Mancic[1,2], R.F.M. Osman[2], B.A. Marinkovic[2], F.C. Rizzo[2]
[1]Institute of Technical Sciences of SASA, Knez Mihailova 35, Belgrade, Serbia
[2]Department of Chemical and Materials Engineering, Pontifical Catholic University of Rio de Janeiro, RJ, Brazil

17.55-18.10 **OR6 Nanocomposite photocatalyst based on layered double hydroxides (LDHs)/ kaolin clay associated with** TiO_2
Jonjaua Ranogajec[1], Andrijana Sever-Skapin[2], Snežana Pašalić[3], Ognjen Rudic[1], Snežana Vucetić[1]
[1]University of Novi Sad, Faculty of Technology, Novi Sad, Serbia
[2]Slovenian National Building and Civil Engineering Institute, Dimiceva12, Ljubljana, Slovenia
[3] Ministry of Education, Science and Technological Development of the Republic of Serbia, Serbia

18.10-18.25 **OR7 High efficiency Sb2S3-based hybrid solar cell at low light intensity: cell made of synthesized Cu and Se doped Sb2S3**
Valentina Janošević, Miodrag Mitrić, Ivana Lj. Validžić
Vinča Institute of Nuclear Sciences, P.O. Box 522, 11001 Belgrade, Serbia

18.25-19.30 **Coffee Break and Poster Session** **Hall, 1st floor**

Red Hall 1, 1st floor

13.30-15.05 **3rd Session – Electro & Multifunctional**
Chairpersons: Dumitru Nedelcu, Maria Eugenia Rabanal

13.30-13.55 **KN5 Fractality aspects in ceramics technologies**
Ljubiša M. Kocić[1], Vojislav V. Mitić[2]
[1]University of Niš, Faculty of Electronic Engineering, Niš, Serbia
[2] Institute of Technical Sciences of SASA, Belgrade, Serbia

13.55-14.20 **INV4 Interaction of UV irradiation with thin films of organic molecules**
Aleksandar Tomović, V. Jovanović, R. Žikić
Institute for Multidisciplinary Research, University of Belgrade, Kneza Višeslava 1, 11030 Belgrade, Serbia

14.20-14.35 **OR8 Thermal treatment of oxides in different atmospheres**
Nebojša Labus[1], Zorka Z. Vasiljevic[1], Slavko Mentus[2,3], Vladimir B. Pavlović[1], Miloljub Luković[4], Maria Vesna Nikolić[4]
[1]Institute of Technical Sciences of SASA, Knez Mihailova 35, 11000 Belgrade, Serbia
[2]Faculty of Physical Chemistry, Studenski trg 12-16, 11158 Belgrade, University of Belgrade, Serbia
[3]Serbian Academy of Sciences and Arts, Knez Mihailova 35, 11000 Belgrade, Serbia
[4]Institute for Multidisciplinary Research, Kneza Višeslava 1, 11000 Belgrade, University of Belgrade, Serbia

14.35-14.50 **OR9 Quantum Dot Integration Into A Hybrid Polymer System: A DFT Study**
Vladimir Blagojević
Institute of Technical Sciences of the Serbian Academy of Arts and Sciences

14.50-15.05 **OR10 Marine pollution from TBT-based antifouling paints**
Martina Furdek, Nevenka Mikac, Goran Kniewald
Ruđer Bokovic Institut, Division for Marine and Environmental Research, Zagreb, Croatia

15.05-15.20 **OR11 Nanoindentation of „Liquid wood“ Samples**
Dumitru Nedelcu[1], Esteban Broitman[2], and Simona Plavanescu (Mazurchevici)[1]
[1] “Gheorghe Asachi” Technical University of Iasi, Department of Machine Manufacturing and Industrial Management, Blvd. Mangeron, No. 59A, 700050 Iasi, Romania
[2] Thin Film Physics Division, IFM, Linkoping University, SE581 83 Linkoping, Sweden

15.20–15.45 **Coffee Break** **Hall 1, 1st floor**

Red Hall 1, 1st floor

15.45-18.25 **4rd Session – Electro & Multifunctional**
Chairpersons: Trudy Kriven, Dalibor Sekulić

15.45-16.05 **INV5 Preparation of Silica Microcpasules by Non-Aqueous Sol-Gel Chemistry and Their Applications**
Raed Abu-Reziq
Institute of Chemistry, Casali Center for Applied Chemistry, Center for Nanoscience and Nanotechnology The Hebrew University of Jerusalem, Israel

16.05-16.25 **INV6 Local Magnetic and Electronic Structure of Selective and Sensitive Iron Oxide Nanoparticles as Magnetic Resonance Imaging (MRI) Contrast Enhancers**
Christina Graf[1], Christian Goroncy[1], Patrick Stumpf[1], Madlen Schmudde[1], Mathias Gruner[1] Daniel Nordmeyer[1], Christine Boeglin[2], Eckart Rühl[1]
[1]Institut für Chemie und Biochemie - Physikalische und Theoretische Chemie, Freie Universität Berlin, Berlin, Germany
[2]Institut de Physique et de Chimie de Strasbourg Département Surfaces-Interfaces, Strasbourg, France

16.25-16.45 INV7 The Pores Fractal Nature Influence on Integral Capacity
Vojislav V. Mitić[1,2], Ljubiša M. Kocić[1], Zoran Nikolić[1]
[1]University of Niš, Faculty of Electronic Engineering, Niš, Serbia
[2] Institute of Technical Sciences of SASA, Belgrade, Serbia

16.45-17.05 **INV8 Application of bentonite clay to human use**
Staniša Stojiljković
Faculty of Technology Leskovac,University of Niš, Serbia

17.05-17.25 **INV9 "Similarly attracts Like" in the Theory of Sintering**
Dimitrije Č. Stefanović[1], Dejan R. Blagojević[2]
[1]Electronic Faculty of Niš,
[2]Technical High School, Niš.

17.25-17.40 **OR12 Lead-free piezoelectric ceramics selection by using MADM approach**
Dušan Petković[1], Miloš Madić[1], Goran Radenković[1]
[1]Faculty of Mechanical Engineering University of Niš

17. 40-17.55 **OR13 Impact of crushed mineral aggregate on the pumpability of concrete during transported and placement**
Gordana Topličić-Ćurčić[1], Nenad Ristić[1], Zoran Grdić[2], Vojislav V Mitić[3], Dušan Grdić[1]
[1]University of Nis, The Faculty of Civil Engineering and Architecture, Aleksandra Medvedeva 14 street, 18000 Nis, Serbia,
[2]University of Nis, The Faculty of Civil Engineering and Architecture, Aleksandra Medvedeva 14 street, 18000 Nis, Serbia,
[3]University of Nis, Faculty of Electronic `Engineering, 18000 Nis, Serbia

17.55-18.10 OR14 Integral characteristics of entropy and Planck's law of radiation
Dejan R. Blagojević[1], Stanislav D. Veljković[1], Dimitrije Č. Stefanović[2]
[1]Technical High School, Niš
[2]Electronic Faculty of Niš

18.10-18.25 **OR15 Timacum Maius: Roman Bricks as a Significant Historical Source**
Vladimir P. Petrović[1], Vojislav Filipović[2]
[1]Institute for Balkan Studies of SASA
[2]Archaeological institute, Belgrade

18.25-19.30 **Coffee Break and Poster Session** **Hall, 1st floor**

Wednesday, September, 23rd, 2015

Blue Hall 2, 1st floor

5th Session: Constructional & Composite
Chairpersons: Goran Rašić, Vladimir Blagojević

09.30-10.00 **PL21 Novel ceramic nanocomposites as bioimplant materials**
Csaba Balázsi
Advanced Materials Department, Engineering Division, Bay Zoltán Nonprofit Ltd for Applied Research, Fehérvári u. 10, 1116 Budapest, Hungary

10.00-10.25 **KN6 Ceramic pigments based on $NiAl_2O_4$ and $CoAl_2O_4$ spinels**
Margarita Gabrovska[1], Dorel Crişan[2], Dimitrinka Nikolova[1], Maya Shopska[1], Lyubima Bilyarska[1], Maria Crişan[2], Rumeana Edreva-Kardjieva[1]
[1]Institute of Catalysis, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. Bl. 11, 1113 Sofia, Bulgaria
[2]"Ilie Murgulescu" Institute of Physical Chemistry, Romanian Academy, Bucharest, Romania

10.25-10.45 **KN7 Contemporary Political and Religious Extremists as Destroyers of Ancient Artistic Heritage**
Dragan Simeunović
Academy of National Security, Serbia

10.45-11.00 **KN8 Contemporary aspects of joint arthroplasty-role of ceramic implants**
Zoran Popović, Aleksandar Radunović
Military Medical Academy, Belgrade, Serbia

11.00-11.15 **KN9 Clay modelling as eternal cultural heritage of Creativity**
Dragan Radenović, sculptor

11.15-11.30 **OR16 Effect of Dispersant in Engineering of Particle Interaction in Wet Ceramic Processing of Alumina Ceramics**
Asad U. Khan, Murid Hussain, Noaman Ul-Haq
Department of Chemical Engineering, COMSATS Institute of Information Technology, Lahore-54000, Pakistan.

11.30-12.00 **Coffee Break and Buffet** **Hall, 1st floor**

Blue Hall 2, 1st floor

12.00-14.00 **6th Session: Magnetic & Amorphous**
Chairpersons: Margarita Gabrovska, Csaba Balazsi

12.00-12.20 **INV10 Reducing Losses in Magnetic Thin Films Through Nanoscale Surface Patterning**
Goran Rasic[1], Justin Schwartz[2]
[1]Department of Physics, North Carolina Central University, Durham, NC 27707 USA
[2]Department of Materials Science and Engineering, North Carolina State University, Raleigh, NC 27606 USA

12.20- 12.40 **INV11 Preparation and characterisation of iron based bulk metallic glasses**
Nebojša Mitrović[1], Jarmila Degmova[2], Mihai Stoica[3]
[1]Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia
[2]Faculty of Electrical Information and Technology, Slovak University of Technology, Bratislava, Slovac Republic 3IFW Dresden, Institute for Complex Materials, Dresden, Germany

12.40-12.55 **OR17 Biomaterials in hernia surgery – a surgeons view**
Marinko Žuvela, Danijel Galun, Zoran Krivokapić, Miroslav Milićević
First Surgical Clinic, Clinical Center of Serbia, Faculty of Medicine, University of Belgrade

12.55-13.10 **OR18 Aerolam honeycomb as a carrier in mosaic conservation**
Marijana Protić, Nemanja Smičiklas, Branko Radović
Republical institution for protection of cultural monuments Belgrade

13.10-13.25 **OR19 Thermal properties and resistance to fire-standing sandwich panels with "PUR" and "APN" fill**
Edin Garaplija[1], Sanin Džidić[2]
[1]Institute for risk managment INZA, Sarajevo, Bosnia and Herzegovina
[2]International BURCH University of Sarajevo, Bosnia and Herzegovina

13.25-13.40 **OR21 The in-situ challenge of better understanding Structure-Properties relationship in nanomaterials : Possible solutions and illustrations**
Dušan Popović
Analysis, Belgrade, Serbia

13.40-13.55 **OR 22 SEM- Digital**
Jernej Žižek
Scan- Jeol, Slovenia

13.55-14.15 **Closing Ceremony**

Belgrade sightseeing

Book of Abstracts

Chemically Processed Functional Nanostructures for Energy and Health Application

Sanjay Mathur

Chair, Inorganic and Materials Chemistry University of Cologne, Greinstrasse 6, D-50939 Cologne, Germany

Chemical nanotechnologies have played, in the past few decades a major role in the convergence of life, physical and engineering science leading not only to simple collaboration among the disciplines but to a paradigm shift based on true disciplinary integration. The successful synthesis, modification and assembly of nanobuilding unites such as nanocrystals and wires of different materials have demonstrated the importance of chemical influence in materials synthesis, and have generated great expectations for the future. Implications of chemistry as an innovation motor are now visible for knowledge leap forward in various sectors such as materials engineering for energy, health and security. Materials chemistry mostly housed at the universities and academic research institutions has delivered tremendous knowledge leap in the domain of functional materials but in the absence of proper validation of few materials for possible device application their commercial uptake is severely limited.

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

PL|02

Advanced Ceramics for Energy and Environmental Technology

Alexander Michaelis

Fraunhofer Institute of Ceramic Technologies and Systems, IKTS, Dresden, Germany

Advanced ceramic materials offer enormous potential for innovations in the fields of efficient energy conversion and storage as well as environmental technology. The joint application of structural and functional ceramic technology allows for unique combination of electronic, ionic (electrochemical) and mechanical properties enabling the development of new, highly integrated systems. In the field of energy technology we present specific examples for Fuel Cell, Li-Ion and high temperature Na-metal batteries development. The production of such systems requires high reliability of ceramic materials, components and systems. For this, new NDE (non destructive evaluation) methods have been developed.

For illustration of the potential of advanced ceramic materials in environmental technology, ceramic membrane systems are discussed. Ceramic membranes can be used for micro-, ultra- or nano- filtration of liquids. Further innovations require an improved control and reduction of pore size. This allows for new applications in gas separation and pervaporation systems. For this, pores sizes below 1nm have to be generated using specific structural features of selected materials.

PL|03

Advanced Ceramics for Clean and Efficient Energy Technologies

Hua-Tay Lin

Guangdong University of Technology, Guangzhou, 510006 Guangdong

It is forecasted that the total global energy consumption will increase 49% from 2007 to 2035 based on the data published by Energy Information Administration of US Department of Energy. The key diving forces pushing the increase in worldwide demand are mainly due to 1) industrialization in emerging markets, 2) strong economic growth in emerging market, especially in China and India, 3) globalization, and 4) concerns over energy security. It is realized that the use of natural gas and coal will continue to grow, but there is an imminent need for alternative energy resources to meet the fastest growing demand such as renewable energy as well as other potential resources. This need has now created tremendous new markets. Technologies developed for solar panels, wind turbine, and energy storage are now well established, but others, such as energy harvesting, remain niche while the technology is still being developed. All offer significant business opportunities: energy harvesting, for example, is forecast to be worth $4.4 billion by 2020. However, most renewable energy technologies cannot compete economically with fossil fuels. This lecture will review how emerging ceramic technologies would help to improve manufacturing and energy generation efficiency and bring renewable energy production closer to reality. In addition, the employment of advanced ceramics to improve the gas turbine efficiency as well as for next generation nuclear reactors will be reviewed and discussed in this lecture as well.

Ceramics and coatings for biomedical applications - from prosthetic devices to deep brain stimulation systems

Rainer Gadow, F. Kern, A. Killinger

Institute for Manufacturing Technologies of Ceramic Components and Composites, IMTCCC, University of Stuttgart, Stuttgart, Germany

Bioceramics are bulk, coating and composite materials for medical applications, especially for human health care. An important field of application are temporary or permanent implants with mechanical functionality and with tailored or designed surfaces and optimized interfaces to enable the required biocompatibility.

The novel, supersonic fast, high velocity suspension flame spray technique (HVSFS) enables direct processing of submicron and nano sized particle suspensions as liquid feedstock, without spray drying process to form appropriate grain sized spray powders as required for conventional APS coatings. This workplace and health risk safe processing of nano powders in suspension opens an entirely new field of spray materials for the production of nano coatings (e.g. mixed phase ceramic powders, cermet materials and bioglasses). Due to the very high particle velocity and kinetic impact the deposition of very dense coatings is possible. The traditional gap between conventional thermal spray coatings and thin solid films deposition can be closed, regarding coating thickness (10 – 50 µm) in industrial manufacturing.

In recent years new material concepts have been developed for ceramic cell carriers in vitro and even in vivo for the selective formation and growth of special cell cultures with various applications in tissue engineering up to complete substitutes for human organs. Not only the intrinsic material properties in bulk or volume play an important role in these applications but the surface structure, composition and morphology are even more important because of the chemical reactions at the ceramic interface.

Bioresorbable polymer implants are a promising concept in maxillofacial surgery, e.g. bone fracture repairing or bone defects replacement by PDLLA, since their use eliminates the need for a secondary operation to remove metal implants. Mechanical properties and biocompatibility of these poly lactide implants require new composite devices. Thermally sprayed osteoconductive bioceramic coatings like tricalcium phosphate (TCP) can significantly increase the biocompatibility of these polymer implants and contribute to match the resorption rate of the device with the bone healing rate, leading to a correct mechanical stress transfer implant/tissue and therefore to successful fracture fixation even in load conditions.

Deep brain stimulation (DBS) is used as a modern therapy for the treatment of neurological issues such as Parkinson's disease or tremor. The development of MRI compatible non-metallic probes as stimulating electrode, based on specially stabilized zirconia micro tubes and rods with a functionalized surface is essential for a new concept for intelligent neuro-implantation with high precision and reduced stress for the patient.

PL|05

Flash sintering of ceramics: thermal runaway and ultra-fast firing

Richard I. Todd[1], M. Yoshida[2], E. Zapata-Solvas[1,3], R. S. Bonilla[1], J. C. Xu[4], J. Y. Zhang[4], Z. Y. Fu[4]

[1]Department of Materials, University of Oxford, UK,
[2]Department of Materials Science and Technology, Gifu University, Japan,
[3]Instituto de Ciencia de Materiales , CSIC-Universidad de Sevilla, Spain,
[4]State Key Lab of Advanced Technology for Material Synthesis and Processing, Wuhan University of Technology, P.R. China

"Flash sintering" occurs when an electrical potential difference is applied across a ceramic powder compact and is characterised by an electrical power surge at a specific temperature, accompanied by extremely rapid densification. The phenomenon is easy to reproduce but the mechanisms responsible remain controversial. This presentation examines separately the thermoelectrical response and densification at high heating rates of 3YSZ. Measurements of the resistivity vs. temperature relationship during flash sintering are used as the basis of a dynamic model for Joule heating under conditions of non-uniform temperature. Comparison of the model predictions and experimental results showed that the flash event can be quantitatively explained by classical thermal runaway resulting from the negative temperature coefficient of resistivity observed. Experimentally observed localisation of heating and densification is also predicted correctly. The sintering response and grain size of flash sintered specimens are compared with those of specimens taken from identical powder compacts and heated at similar rates but without the application of an electric field. High densities and similar grain structures to the flash sintered specimens are found to be achievable in the absence of an electric field. The mechanisms responsible are discussed and areas requiring further investigation are highlighted.

Synthesis, Properties and Applications of Ultrananocrystalline Diamond Layers and Engineered Diamond Microparts

Hans-J. Fecht
University of Ulm, Ulm, Germany

Nanocrystalline diamond layers combine the remarkable properties of conventional diamond, such as extreme hardness and wear resistance with low internal stresses, minimum surface roughness 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 UNCD layers. Nanocrystalline diamond layers with thickness varied between 0.5 and 150 micrometers have been grown on single crystalline Si wafers up to six inches in diameter by hot-filament chemical vapour deposition. The UNCD films consist of ultra small equiaxed grains resulting in ultra smooth surfaces and transparent appearance. Investigation of the microstructure with HRTEM (FIE-Titan 300 kV) and XRD yield a mean grain size of typically 10 nm as described in ref. [1].

The chemical composition was investigated by XANES, RBS and ERD indicating a high phase and elemental purity of 99%. Elastic properties have been investigated by LSAW, showing a declining Young's modulus from 1010 to 720 GPa, consistent with decreasing grain size and increasing sp^3/sp^2 ratio. By a sophisticated combination of photolithographic techniques and efficient RIE etching processes complex shaped microparts can be designed and fabricated. A number of different current applications will be discussed, such as lubrication-free wear-resistant diamond based microparts and hybrids for high-precision mechanical devices (see Fig. 1), sensors for harsh environments and bio-applications.

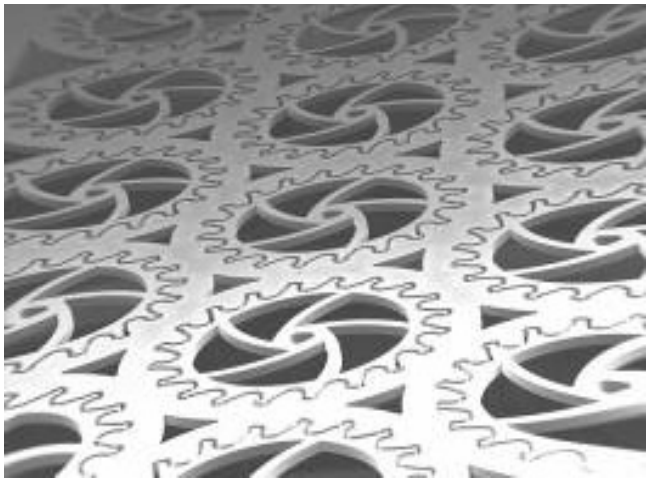


Fig. 1. Micro-components made of ultrasmooth nanocrystalline diamond

PL|07

Development of ultra high temperature ceramics (UHTCs) for aerospace applications

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[2] Centre for Nuclear Engineering, Dept of Materials, Imperial College, London, UK

Ultra high temperature ceramics (UHTCs) are having increasing interest for use in severe environments owing to their high melting points, high mechanical properties at elevated temperatures, chemical stability and etc. A series of ZrB_2, HfB_2 and TaC based ultra high temperature ceramic (UHTC) composites were fabricated by spark plasma sintering (SPS) technique looking at materials for future hypersonic vehicle leading edge applications in which temperatures exceed 2000°C and they were characterised by different techniques.

The overall view of the process development of a series of UHTCs but mainly based on Zr- and Hf-based ceramic composites will be addressed. Thermal and mechanical properties of UHTCS at high temperatures will be discussed. Oxidation studies were carried out for UHTC samples using different techniques such as conventional laboratory based $MoSi_2$ furnace, defocused laser beam testing and arc-jet testing and the results will be discussed based on the microstructural evolution. New ways to improve the oxidation resistance of UHTC materials at intermediate temperature regims (1400 – 1600°C) will also be addressed.

PL|08

Effects of Solid Loading and Sintering Additives Content on Microstructure and Mechanical Properties of Porous Silicon Nitride Ceramics Fabricated by Gel Castin

Farhad Golestanifard

School of Metallurgy and Materials Engineering, Iran University of Science and Technology

In this work, the possibility of producing porous silicon nitride ceramics by adjusting the amounts of solid loading and sintering additives in aqueous gel casting method have been investigated. The effects of solid loading and sintering additives content on the silicon nitride suspension were investigated systematically via observation of the rheological behavior. The effects of solid loading and sintering additives content on the phase composition, microstructure, density, porosity and mechanical properties of the prepared porous Si_3N_4 ceramics were investigated. It can be seen that all suspensions (30-40 vol. % solid loading) exhibited a shear-thinning behavior and relatively low viscosity, which was suitable for casting. The viscosity increased with increasing volume fraction of solid. Increased sintering additives content enhanced densification via particle rearrangement. Also $\alpha \rightarrow \beta$ phase transformation increases with increasing sintering additives content. The flexural strength of porous Si3N4 ceramics was up to 144–242 MPa with porosity of 32–39%.

The Vickers microhardness of porous Si3N4ceramics ranged between 1.56 and 2.99 GPa, and depends on the volume fraction of porosity.

Development of New Thermal Barrier Coatings: Design, Synthesis and Properties

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[1]State Key Lab of New Ceramics and Fine Processing, School of Materials Science and Engineering, Tsinghua University, Beijing, P. R. China, 100084

There are many applications of the low thermal conductivity ceramics in industries, for the heat insulations and protection of metallic parts of the high temperature instruments. In gas turbine and jet engine, low thermal conductivity ceramics usually used as coating materials, which is called thermal barrier coatings, (TBC). Increasing thermal efficiency and lower emissions require gas turbine designers to further increase the combustion temperature that leads to the high temperature components such as combustion chambers, blade and vanes surfaces face more rigorous conditions. Therefore, there is urgent demand to develop new ceramic coatings with even lower thermal conductivity, higher stability and durability than currently used thermal barrier coatings coating (7wt% YSZ) on the surface of high temperature alloy components.

In this presentation, we introduce the new class of refractory ceramics as candidate materials for thermal barrier coatings, including the structure design, the rule of introducing defects in the crystal structure to further decrease the thermal conductivity, and the way to increase the structure stability at high temperature; the idea for suppress of heat transfer at the high temperature by irradiation; the synthesis process and thermal properties. The mechanical properties at ambient and elevated temperature are also reported.

Application of Rare-Earth Doped Ceramic Nanophosphors for Near Infrared Biophotonics

Kohei Soga

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Rare-earth doped ceramics, such as Nd:YAG or Er-doped silica fibers has been used for optical devices such as lasers or optical amplifiers. Another interesting application is infrared-to-visible upconversion with visible fluorescence under near infrared excitation. Common features of them is the infrared excitation for emitting visible or near infrared lights. On the other hand, fluorescence bioimging is an inevitable techniques for biologists and medical doctors to clarify the biological phenomena. The observation depth for the fluorescence bioimging has been limited normally to be several mm due to scattering loss. However, by shifting the wavelength in to the near infrared range over 1000 nm, the observation depth with several cm has been achieved. By fabricating the rare-earth doped ceramics phosphors to be in nano size, the author's group has been developing the bioimaging probes for the near infrared fluorescence bioimaging. The paper will discuss the potential use of the rare-earth doped ceramics nanophosphors for biophotonics, including a candidate fluorescent agent for nano thermometry.

PL|11

Geopolymers as Sustainable Construction Materials

Waltraud M. Kriven

Department of Materials Science and Engineering, University of Illinois IL

"Geopolymer" is a charge balanced, aluminosilicate, ceramic-like gel made by from a liquid suspension undergoing dissolution, polycondensation or precipitation under ambient conditions. It has a nominal chemical composition of $M_2O{\bullet}Al_2O_3{\bullet}4SiO_2{\bullet}11H_2O$ where M could be Group I elements of Li, Na, K, Rb or Cs. The water content may be varied, depending on particle size, and specific surface area of the starting powder, such as metakaolin. The inorganic polysialate polymer is made by mixing metakaolin ($Al_2O_3{\bullet}2SiO_2$) with waterglass (an alkali metasilicate solution). The resulting microstructure is impervious, nanoporous (of diameter~6.8 nm), contains 40% porosity by volume, and is nanoparticulate (10-40 nm diameter).

Alternative aluminosilicate sources are waste materials such as fly ash, slag, red mud, or other minerals such as kaolinite, halloysite or bentonite. The cross-linked product shares the brittle nature of ceramics, but can be reinforced with platelets, particulates, chopped fibers, uniaxial fibers, or fiber weaves yielding a strong and touch composite, which has additional properties of fire and corrosion resistance. Geopolymers also have refractory adhesive properties up to 1,000°C whereupon they crystallize into a ceramic.

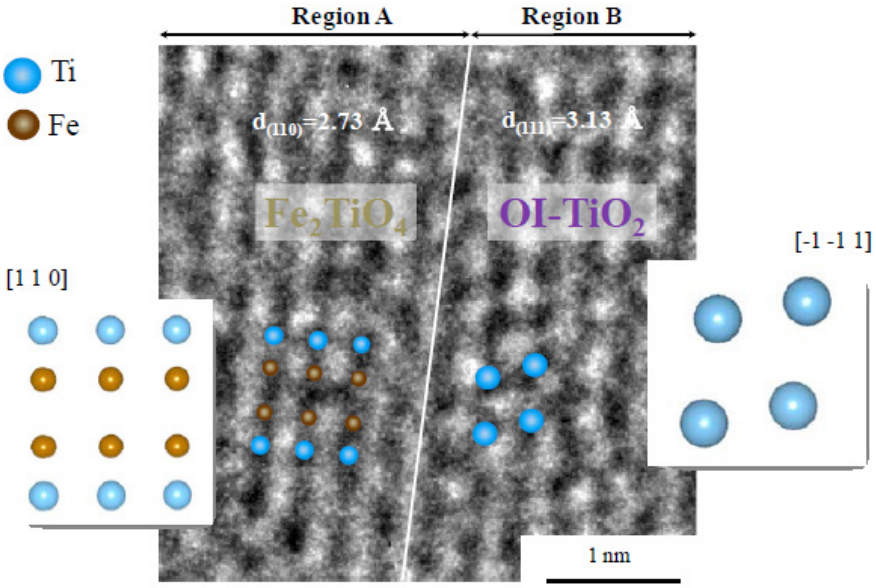
Geopolymer composites have been make with chopped graphite fibers (60 mm and 100 mm in length); carbon nanoplatelets; chopped Saffil alumina; basalt (1/2 inches) or polypropylene fibers (0.5", 1", 1.5"); alumina platelets; uniaxial fibers of carbon, corn husks; and weaves of Nextel 610 alumina and Nextel 720 mullite plus alumina as well as natural fibers of corn husks, jute, Colombian fique and Amazonian malva. The mechanical properties of various ceramic particulate, chopped fiber and fiber-reinforced composites are summarized as a function of temperature, both post-heat treatment, or in situ at high temperatures to 1400 °C. While the manufacture of one ton of Portland cement releases ~0.95 tons of carbon dioxide into the atmosphere, the synthesis of geopolymer liberates only 0.25 tons of carbon dioxide. The mechanical properties of geopolymer concretes are about twice the compressive strength and three times the flexural strength of cement concretes. Geopolymers have a density of ~1.4 g/cc which is approximately half that of Portland cement, and set in 1-2 days as compared to 28 days for Portland cement. With the use of waste produces such as fly ash and slag, geopolymers present a viable pathway to retard the effects of global warming. Thus geopolymer composites expand the field of sustainable construction materials.

Synthesis of Nanocarbons and Nano-Ilmenites using Super-High-Energy Ball Milling

Satoshi Ohara

Joining and Welding Research Institute, Osaka University, Japan

The ball milling process is common in grinding machines as well as in reactors where various functional materials can be created by mechanochemical synthesis. A simple milling process reduces both CO_2 generation and energy consumption during materials production. Herein a unique ball milling approach to produce sophisticated nanocarbons is reported. It is demonstrated that unique carbon nanostructures, including carbon nanotubes, carbon onions, and new carbon nanorings are synthesized by super-high-energy ball milling of steel balls. This paper also shows the synthesis of ilmenite nanoparticles and quenching ilmenite with a high-temperature and high-pressure phase (see Fig.1) using super-high-energy ball milling.



High-resolution TEM image of ilmenite with a high-temperature and high-pressure phase

PL|13

Heart Transplantation and Left Ventricular Assist Device in Serbia

Mijlko Ristic[1], Emilija Nestorovic[2]

[1] Clinical for Cardiac Surgery, Clinical Center of Serbia
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Heart transplantation (HTX) remains the gold standard in cardiac replacement therapy for patients with end - stage heart failure. Due to the insufficient availability of donor hearts, left ventricular assist device (LVAD) is often used to support patients with advanced heart failure awaiting cardiac transplantation or as destination therapy. The newer generation of continuous flow LVAD, have helped to reduce mortality in patients awaiting transplant, and have become the standard of care as a bridge to transplantation. Clinical center of Serbia has been started and developed successful LVAD and HTX program, including 15 HTX, 33 LVAD and 18 extra-corporeal membrane oxygenation (ECMO) and therefore opened a new era in the treatment of terminal heart failure in Serbia.

Pumps to save life in cardiac failure

Christof Schmid

Dept. Cardiothoracic Surgery, University Medical Center Regensburg, Germany

Heart failure is a leading problem in our health care systems with a prognosis which is worse than that of cancer. Ideally, all terminally ill patients with severe heart failure should undergo heart transplantation. However, due to an extreme scarcity of donor organs this remains an illusion. Accordingly, the current strategy is to resolve the problem by implanting blood pumps. The development of blood pumps started long time ago and finally lead to the first clinical application of a heart lung machine in 1953 to close a congenital heart defect. Nowadays, heart lung machines are ubiquitous in cardiac surgery but not suitable for longer-term support. Slimming these machines from all superfluous components resulted in miniaturized heart lung machines which allow cardiopulmonary short-term support as so-called ECMO or ECLS systems. Cannulas are predominantly placed into arterial and venous femoral vessels via percutaneous access to establish cardiopulmonary support, also during ongoing resuscitation. After hemodynamic stabilization, transportable equipment enables intensive care staff to safely transfer patients by ambulance car or helicopter from distant hospitals to experienced heart centers. Even ECMO placement outside of hospital is possible – accepting the associated risks.

If the heart do not recover, pumps for long-term use of as definite solution are mandatory. As an alternative to heart transplantation, left ventricular assist devices (LVAD) have been established over the past 2 decades. LVADs are electrically driven axial or centrifugal pumps which drain blood from the left ventricular cavity and eject into the aorta, as the native left ventricle does. The pumps are implanted into the chest, a percutaneous drive lines exits the abdominal wall and connects to a controller and to batteries. Despite high implant numbers, the technology is far from being perfect and complications may occur. Small diameters inside the pump lead to shear stress and cell activation. Artificial surfaces and blood stasis promote thrombus formation with poses the threat of acute pump failure. Hemodynamic optimization maximizes the clinical benefit and minimizes a dangerous blood stasis in the pump housing. Several technical refinements have been devised to further reduce the risk of pump malfunction. The ultimate goal of a total artificial heart replacing both, the left and right ventricle has not yet been satisfactorily reached. In the clinical practice, there is only rather old pneumatic technology. Electric artificial hearts are still under development.

In conclusion, pump technology saves many lives of patients with critical heart failure. Even if left ventricular assist devices have largely replaced heart transplantation, there is still a long way to go before perfect artificial hearts can be offered to the patients.

PL|15

Ceramic Materials in Ozone Generators Production

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At present, in many cases ozone is an oxidizing agent in organic synthesis, has been widely used in sterilization, disinfection, deodorization, deodorization, discoloration, purification of water and other aspects, ozone in the preparation process is convenient, is inexpensive, is required key consideration. Conventional ozone generators use glass, quartz, or ceramic dielectrics. According to that study, a dielectric is provided for an ozone generator, which has a high dielectric constant, high dielectric strength, and low enough piezoelectric properties so that the dielectric will not ablate, crack, or otherwise suffer damage because of high voltage application. The dielectrics may have dielectric constants of greater than 1,000, like barium titanates, yet do not have the adverse piezoelectric properties thereof. The dielectrics preferably employed according to the present study are known as PLZT mixed oxide ceramics, the designation "PLZT" referring to lead, lanthanum, zirconium and titanate. The concentration of individual components of such a mixed oxide ceramic affects the crystalline structure of the product as well as its electrical properties, and by varying, the composition of the PLZT mixed oxide it is possible to make a material with a very high dielectric constant, high dielectric strength, and low piezoelectric activity. According to one aspect of the present study, an ozone generator is provided comprising: First and second electrodes. Means for mounting the electrodes to define a flow path for oxygen containing gas between them. Means for applying an electrical potential to the electrodes sufficient to generate ozone from oxygen containing gas flowing in the flow path. The dielectric between the electrodes and the flow path, comprising a mixed oxide composition having a dielectric constant of at least 200, a dielectric strength of at least about 800 volts/mil, and a low enough level of piezoelectric activity. That gives possibility to use alternating current greater than 10,000 volts at a frequency of about 500 hertz. The dielectric coating will not ablate, crack, or otherwise suffer damage because of such high voltage. The preferred dielectric coating, for use on the electrode generator, on a metal surface thereof, has a composition comprising: about 30-70% lead oxide, about 2-8% barium oxide, about 2-12% lanthanum oxide, about 3-18% titanium dioxide, about 12-40% zirconium dioxide, and trace materials. The trace materials include silver, bismuth oxide, CdO, or combinations thereof. Dielectric constants of greater than 1,000 are relatively simple to obtain; in fact, dielectric constants of well over 2,000 are practical.

Spectral Properties and Tunneling in Systems of Weakly Coupled Nanoparticles

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We study electron localization, tunneling and energy spectra for systems of weakly coupled nanoparticles. The ceramic nanoparticles are modeled using single sub-band effective mass approach, with the band gap energy chosen to be ~ 3 eV. The initial model for Si/SiO2 quantum dots reproduces well optical experimental data. Considered is violation of the symmetry in quantum systems (double nanostructures, array of nanoparticles) as one of conditions for chaotic behavior. Tunneling of single electron in double nanoparticle system is studied by varying the inter-dot distances. The effects of particles overlapping and adding a third particle to a nanoparticle pair are investigated.

Tunneling rates for different shapes of the double nanoparticle system are considered in relation to the symmetry violation. Localization of electron is calculated for each level of the whole spectrum of the double system. We show that violation of symmetry of the double and triple nanoparticle systems geometry reduces the tunneling. Chaotic behavior of the spectrum is demonstrated for different imperfectness of the shape of double particles system. Extension of the model for larger band gap (>4eV) is used to describe electronic properties of semiconductor and ceramic nanoparticle systems.

Transparent Fabrication and Electron-Optic Properties of Relaxor PMNPT Ferroelectric Ceramics

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The transparent ferroelectric ceramics have been of great interest for their high electro-optic (EO) property and low production cost, and utilized in various electron-optic applications. The relaxor ferroelectrics (1-x)Pb($Mg_{1/3}Nb_{2/3}$)O_3-x$PbTiO_3$ (PMN-PT) materials are known for their peculiar properties characterized by a broad and frequency-dependent peak in the dielectric response due to the polar nano-regions (PNRs). In this work, we use the two-stage sintering method to fabricate the PMN-PT transparent ceramics which shows an excellent transparency and typical relaxor behaviors. The grain size and grain-boundary are shown uniform and clear grain-boundaries. The domain observation using piezoresponse force microscopy (PFM) is performed which shows a domain structure dependent transparency that the smaller the domain size, the better the transparency, or vice versa. The optical properties of the PMN-PZT transparent ceramics are measured under different external electric fields, DC bias and strong AC field, which shows two distinct behaviors. The dielectric and Raman studies are performed to investigate the different EO properties of the PMN-PZT transparent ceramics, which provides further understanding on the EO properties of the relaxor ferroelectrics materials.

PL|18

Synthesis of macro-porous ceramic (carbon foam) derived from phenolic resin using polyurethane foam as template

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Thermally stable ceramic carbon foam has been synthesized using polyurethane (PU) foam, phenolic resin, and coal tar pitch. The impregnation of the PU foam with a mixture of dilute phenolic resin and coal tar pitch was carried out 3 to 5 times. After impregnation, the foam was placed in forced air circulation oven at 50°C for 24 hours. Pressing of impregnated foam was carried out by placing the semi-dried sample in a metallic mold whose size was 10% smaller than the size of the foam. Finally slow curing of the resin was carried out at 100, 250 and 2000°C and carbonization was carried out at 800 °C. The density of the resulting carbon foam was measured using a helium gas displacement pycnometer. Apparent density and true density of the carbon foams were 0.49 g/cm^3, 0.54 g/cm^3, and 0.60 g/cm^3; and 1.48 g/cm^3, 1.44 g/cm^3, and 1.42 g/cm^3 respectively for IS cycles of three, four and five. The respective porosity of the foams was 65 %, 62 %, and 56 %.The final density and porosity of the carbon foam depends upon the repetition of impregnations. The morphology of the carbon foam was observed using scanning electron microscopy and the thermal studies of raw material and final product (isothermally and non-isothermally) were carried out using thermo gravimetric analysis in an inert and oxidizing environment.

PL|19

Quantum rainbows in positron channeling in carbon nanotubes

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Carbon nanotubes are the sheets of carbon atoms rolled up into cylinders with the atoms lying at the hexagonal crystal lattice sites. It has been predicted that they can be used to channel positively charged particles. This means that nanotubes could be used for guiding such beams. It has been also shown that the rainbow effect plays an important role in proton and positron channeling in nanotubes. This plenary speech is devoted to channeling of positrons of kinetic energy of 1 MeV in (11, 9) chiral single-wall carbon nanotubes of lengths between 50 and 200 nm. We present the classical and quantum spatial and angular distributions of transmitted positrons. In the classical calculations, the approach is via the equations of motion, and in the quantum calculations, the time-dependent Schrödinger equations is solved. The solutions of these quations are obtained numerically. In the quantum calculations, the initial beam is taken to be an ensemble on noninteracting Gaussian wave packets. The spatial and angular distributions are generated using the computer simulation method. The analysis is concentrated on the rainbow effects, which is clearly seen in the spatial and angular distributions. The obtained classical and quantum rainbows are analyzed in detail and compared with each other. We give a full quantum mechanical explanation of the quantum rainbows.

Non-Brittle Ceramic Matrix Composites

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Ceramic Matrix Composites (CMC) had originally been developed for limited-life structures in aerospace industry as a lightweight and heat-resistant alternative to metal-based materials. Today, they can be tailored for various customized purposes, and therefore offer a wide range of applications, e.g. in transportation systems, gas turbines and in structural components for the combustion environment. These safety-critical components have to withstand harsh conditions in terms of temperature and corrosion for long times. Oxide as well as non-oxide CMCs are under development with the main constituent silicon carbide or alumina for fibers as well as matrices. Liquid phase routes like polymer impregnation and pyrolysis (PIP), melt infiltration (MI) and slurry impregnation or combinations thereof are promising manufacture routes to overcome the still high processing costs of this class of materials. Different approaches are on the way to develop new CMC processes on the basis of prepregs and preforms with chopped or continuous fibers. The paper reports about the current status of oxide and non-oxide composites, their applications and perspectives.

PL|21

Novel ceramic nanocomposites as bioimplant materials

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There are more than 400 000 artificial hip joint operations made every year in the word and there are some 25 000 000 people who have either a partial or a total hip replacement. It has been estimated that the aged people population has increased tremendously in recent past and there will be seven times increase. Because the human body is at the same time both a very hostile and sensitive environment for foreign objects, the life span of a hip implant is limited. Whit time, the wear and risk of the implant loosening increases so that after 10 years 10-20% of the implants have to be renewed. Biomaterials used for implant should posses some important properties in order to long-term usage in the body without rejection. One of most important properties is a biocompatibility. The biomaterial is „any substance, synthetic or natural in origin, which can be used for any period of time, as a whole a part of a system which treats, augments or replaces any tissue, organ or function of the body". Biomaterials are used in different parts of the human body as artificial valves in the heart, stensts in blood vessels, replacement implant in shoulders, knees, hips and orodental structures. Materials used as different biomaterials should be made with certain properties. The materials used for orthopedic inplants should possess excellent biocompatibility, superior corrosion resistance in body environment, excellent combination of high strength and low modulus, high ductility and be without toxicity. The materials currently used for implants include hydroxyapatite, 316L stainless steel, cobalt-cromium alloys and pure titanium or its alloys. Elements such as Ni, Cr and Co are found to be released from the stainless steel and cobalt chromium alloys due to the corrosion in the body environment. The toxic effects of metals, Ni, Co and Cr released from prosthetic implant are known. Skin related diseases such as dermatitis due to Ni toxicity have been reported and numerous animal studies have shown carcinogenicity due to the presence of Co. From this point of view, the development of novel nanocomposite biocompatible materials in bulk and layer form is highly needed. The presentation will give a review of novel biogenic and nanocomposite ceramics used as implants materials.

Computer Simulation of Liquid Redistribution induced by Rearrangement during Liquid Phase Sintering

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Initial stage of liquid phase sintering is characterized by three possible states of liquid bridges between contacting particles: pendular, funicular, and capillary states that, in order, can be observed for increasing degrees of saturation in a system of many solid particles with interstitial liquid phase. For low saturation of the void space, small quantity of liquid is distributed as individual (pendular) liquid bridges between particles forming the cluster of connected particles. By increasing the amount of the liquid, the funicular state is obtained where both liquid bridges as well as some of the pores filled with liquid are present. The capillary state is reached when all voids are completely filled. As a matter of fact, the funicular state characterized by the co-existence of liquid bridges and liquid-filled pores can be treated as the transition state to the capillary state. For computer simulation at least three particles are necessary for the presence of funicular or capillary liquid bridges.

It is well established that the capillary forces resulting from the formation of liquid bridges between solid particles are important in controlling the mechanisms and kinetics of rearrangement process. Even more, the capillary forces generated by the presence of liquid bridges between solid particles and determined by the geometric configuration and the physical–chemical nature of the particulate system have a strong effects to redistribution of wetting fluids.

In this study, two-dimensional mathematical approach for simulation of the primary particle rearrangement that involves the individual liquid bridges' connected particles will be simulated. Our simulation model will be based on the assumption that during the initial stage the solid particles often preserve their initial size and shape while undergoing rearrangement without dissolution of the solid in the liquid. Under conditions of low inter-particle friction (smooth particles) and the action of the total driving force, the particles will repack causing uniform shrinkage and liquid redistribution. Due to the elimination of porosity, eventually neighboring liquid bridges can impinge and merge. The end of rearrangement will be determined by some zero inter-particle distances (solid-to-solid point contacts) and an equilibrium configuration of a two-dimensional network of solid particles and liquid bridges.

ZnO&Ag and ZnO&Pt system: synthesis and structural, morphological and functional characterization

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In the area of nanotechnology, which is one of the most active research fields, well-known functional material (ZnO) generates enormous scientific interest owing to its extraordinary properties and so, its novel applications at the nanometric scale. Besides the ZnO properties and its applications, its photocatalytic behavior has been widely studied. Currently, many works are focused on developing of hybrid materials of noble metal-doped ZnO to improve its catalytic activity. With this aim, using silver or platinum nanoparticles on the surface of nanoparticles could be a suitable option.

So, in our study, synthesis (by solvothermal method) and characterization (structural, chemical, morphological among others) of ZnO nanostructured particles with silver or platinum nanoparticles (ZnO&Ag/Pt) have been developed. Afterward, the photocatalytic behavior has been evaluated. The best photocatalytic results (>60 % pollutant removal) demonstrate the viability for its application in the degradation of contaminants in water and, so, prove that the system morphology is critical to the properties of the obtained material.

Transport properties of graphene modified with different atoms

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Graphene possesses a set of outstanding properties thanks to which it has great potential for practical applications. Many theoretical and experimental studies clearly indicate for graphene that it is expected to be the basis of modern nanoelectronic devices. One of the most striking properties of graphene is the fact that its electrons behave like massless relativistic fermions, because of which they can move through the lattice many times faster than in present day silicon devices. This has led to the fabrication of single field effect transistors.

However, further improvements of physical and chemical properties of graphene are possible thanks to different physical and chemical methods. Significant changes in electronic structure of graphene can be induced through modifications of the covalent bonds in graphene. This can be achieved either by chemical functionalization or by introducing different atoms in the graphene framework. Different approaches open the band gap of graphene, improve its reactive properties and enables interaction with various structures. In the same time, mentioned modifications induce changes in transport properties of graphene as well. Therefore, in this work we present results of the comprehensive study in which effects of various substituted atoms to transport properties of graphene are investigated by means of NEGF method and DFT computations.

Simultaneous Thermal Analysis used as Objective Diagnosis Method in Osteosarcoma Early Detection

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Osteosarcoma, is an aggressive malignant neoplasm that arises from primitive transformed cells of mesenchymal origin and that exhibits osteoblastic differentiation and produces malignant osteoid. From histological point of view, osteosarcoma is the eight-most common cancer for child's and young adults. With respect to the available clinical diagnosis we propose a measurement method for the accurate detection of the osteosarcoma and then the exact point for the amputation point. Indeed, imaging investigations which uses X-rays (radiography and CT-Computerized Tomography), magnetic fields (MRI-Magnetic Resonance Imaging) or radioactive substances (PET- Positron Emission Tomography) are able to detect the presence of the diseases but with a coarse accuracy as regards its extension. Actually the detection of the position is performed during the surgical operation by biopsy performed under general anesthesia. Biopsy samples are examined by pathologist under microscopes or tests concerning chromosome or gene changes can be performed in order to have a diagnosis, prolonging the duration of the surgical operation. The early diagnosis is very important in this disease. This paper propose a measurement method for early detection of osteosarcoma and to speed up the process of the surgical amputation by permitting the accurate localization of the amputation point just with a pic performed in ambulatory before the operation. The proposed measurement method is based on thermogravimetric analysis that is a typical measurement technique for material science. The optimization of the warming protocol has permitted to define the ratio between hydroxyapatite and collagen (HAP/Coll) which can be connected to the pathological status degree. The analysis is performed on a sample of 20 mg of bone tissue cropped from the patient by needle biopsy performed even in ambulatory condition under local anesthesia. The measurement result is ready after 15 minutes. To validate the elemental composition of materials Energy -Dispersive Analysis with X-ray spectroscopy (EDAX) has been performed.

Fractality aspects in ceramics technologies

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The recent literature as well as experimental results offer a generous material for investigating ceramics materials from the point of view of micro-morphology parameters that represent irregularity and non-Euclidean geometry appearance on the measurement level ranged from 10^{-9} to 10^{-4} meters, upon different magnitude of magnification. Such irregularity can be quantified using the concept of fractals and fractal dimension. There are different "sources" of fractality in such materials, known by their complex physicochemical structure which includes different ceramics, especially electronics ceramics materials, semiconductors, electromagnetics, ferroelectrics, multiferroics, thin films, diamond films etc. Once establishing the existence of fractal nature, it is possible to propose suitable correction factors that, being incorporated in already known formulas and important physical laws may contribute in better understanding of these materials properties such as microstructural relationship to microelectronic phenomena. Especially, these fractal nature analytic approaches open a new perspective for deeper and higher level electronics integrations within the new fractal electronics ideas.

Ceramic pigments based on $NiAl_2O_4$ and $CoAl_2O_4$ spinels

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$NiAl_2O_4$ and $CoAl_2O_4$ spinels have been prepared by thermal treatment of non-stoichiometric Ni-Al and Co-Al layered double hydroxides. The layered precursors have been synthesized with a molar ratio of $Ni^{2+}(Co^{2+})/Al^{3+} = 0.5$ by co-precipitation of mixed Ni(Co)-Al solution with alkaline agent. The influence of the decomposition temperature on the phase composition and color of the solids were investigated using specific surface area measurements, thermal analysis, powder X-ray diffraction, scanning electron microscopy, infrared and diffuse reflectance spectroscopy techniques. It was found that the phase crystallization degree corresponds to the crystallite size increase accompanied by specific surface area decrease with the enhancement of the decomposition temperature.

The comparative study show that different coordination of nickel and cobalt ions in the spinel lattice causes obtaining of materials with various shades of blue color depending on the calcination temperature of the layered precursors. Like a bright blue $CoAl_2O_4$ spinel, $NiAl_2O_4$ one is a suitable candidate for creation of less-expensive, softly and downy cyan or pale blue colored pigments. The nano-scaled fine-grained $NiAl_2O_4$ crystallite particles provide for obtaining of high quality pigments with wide applications in ceramic, glass, plastics, rubber and paint industry.

KN|07

Contemporary Political and Religious Extremists as Destroyers of Ancient Artistic Heritage

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During numerous wars throughout history, warring parties aimed to destroy cultural and religious treasures of the enemy. Modern age had brought us consciousness that such endeavors are harmful. Moral and legal prohibitions are created on international level in order to preserve cultural heritage. Yet, we are witnessing that in this age these norms not always respected. Political and religious extremists are especially prone to systematically destroy ancient artistic heritage and steal and re-sell valuable artefacts, in order to finance their terrorist activities. This paper is focused on such destructive acts perpetrated by members of terrorist organization Islamic state of Iraq and Levant, who are currently in control of a territory where 4.000 very valuable archeological sites are located. Following their political and religious principles, they had destroyed a number of precious, thousands of years old archeological monuments, demolished not only churches but also mosques of their enemies, burned down numerous archives of priceless historical value. Thereby, smaller ceramic artifacts are usually stolen and resold, while the larger ones were destroyed.

KN|08

Contemporary aspects of joint arthroplasty-role of ceramic implants

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Field of big joints arthroplasties is one of medical areas with most dynamic changes.Increased number of patients in need for this surgery as enlarged expectations they have , demands from surgeon good knowledge and follow up of implant characteristics and materials used in their production. At this moment dynamic is most noticeable in the materials used for acetabular inserts and femoral head fabrication. Endoprosthesis components are crafted from metals and its alloys, poliethylene and ceramics. Properties that favorize ceramics are high biocompatibility and wear resistance while most significant negative feature of ceramics is inabillity for plastic deformation so the smalles crack can lead to catastrofic implant failure. Continuos improvement of ceramic implants composition made them of more important role in contemporary joint arthroplasty surgery.

Clay modelling as eternal cultural heritage of creativity

Dragan Radenović

sculptor

"Once I am gone, you will make me out of mud." This is often a comment old people make here when they are disappointed by the disobedience and mischief of the youngsters.

At the beginning of the history, when Earth was an amorphous mass of mud and water, God is flying over the surface, he sees his own reflection in the water and he sculpts the man by reproducing his own image. God bestows soul to the clay figure of our ancestor, by touching the tip of its index finger with his own index finger. (This was painted by the great Renaissance artist Michelangelo Buonarroti on the fresco of the Sistine Chapel cupola in Vatican). The single witness of the God's creation of the world was *corvus*-being Ananda, who tells his account of the experience in the Indian philosophy and religion. His closest relative Buddha conveys these accounts in his speeches.

Mud or clay is an important and necessary layer under the cultivated surface of the land. This layer keeps the water thus enabling the growth of the entire biological world on the surface. The foundations of the culture known to the humankind and the beginnings of the civilization appear in the age of Neolith. At the time, clay, which was used to make everyday objects and objects of art produced out of the urge of the soul, was the principal material. The forms made in clay were baked thus enabling their long lasting. We can find the evidence of such creations to this day at archeological excavations.

I am a sculptor. The historians and art theoreticians call my work "the high moderne", defining it as a sculpture of an authentic visual expression, which speaks about the reality in the language of contemporary visual communications. I sculpt the forms in clay, the traditional sculptor's method, so that the final result, following the process of casting the negative and then the positive in plaster, the preparations and the bronze casting, is a sculpture bearing all the marks of the fingers and tools which were made during work. The aim is for each material detail of the game of nerves to be visible in the final work. Rough marks of the unpolished clay remind of fractals – the recently discovered particles in the micro world, or the way I imagine that world.

The artistic beauty expressed in the sculptor's work is still present in the contemporary reality. CERAMICS – the products made in clay or works made by using this plastic material are a bridge in time between the past and the future and an optimistic alternative to globalism, in the depressive persistent final phase of constructing a postmodern world empire.

INV|01

Electrical and Dielectric Characterization of $Zn_xNi_{1-x}Fe_2O_4$ Ferrite Ceramics Prepared by Sintering of Nanopowders

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Nanostructured $Zn_xNi_{1-x}Fe_2O_4$ (x= 0.0, 0.5 and 1) ferrite ceramics were successfully prepared by a conventional sintering of nanosized powders (10–25 nm), synthesized by soft mechanochemical treatment of high–purity Ni(II), Zn(II) and Fe(III) hydroxides as precursors. Electrical properties, such as DC resistivity as a function of temperature and AC conductivity as a function of frequency and temperature, were examined. The variation of DC resistivity with temperature well obeys the Arrhenius law, indicating semiconductor–like behavior of the prepared ferrites. The drift mobility was estimated from the DC resistivity data and found to increase with increasing temperature from ambient to 200°C. The experimental results reveal that AC electrical conductivity of all three samples increases with increasing frequency of the applied field from 100 Hz to 10 MHz. Analysis of the AC conductivity data by means of Jonscher's universal power law shows that correlated barrier hopping mechanism is the most probable mechanism of electrical conduction for $Zn_xNi_{1-x}Fe_2O_4$ ferrites. As part of a systematic study, dielectric constant and dielectric loss (tanδ) are also studied as a function of frequency and temperature. The dielectric behavior of ferrite ceramics can be explained by using the mechanism of polarization process, which is correlated to hopping of charge between Fe^{2+} and Fe^{3+} ions at octahedral sites of the spinel lattice.

INV|02

Study of Nanodimensional Spinel $Ni_{0.5}Zn_{0.5}Fe_2O_4$ Ferrite Prepared by Mechanochemical Synthesis

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The nanodimensional $Ni_{0.5}Zn_{0.5}Fe_2O_4$ ferrites were prepared from mixture of NiO/ZnO/α-Fe_2O_3 and $Ni(OH)_2/Zn(OH)_2/Fe(OH)_3$ powders by (soft) mechanochemical synthesis after 5 and 10 h of milling time. The XRD of the sample obtained after 10 h milling time shows single phase cubic spinel structure. TEM analysis revealed that all samples are composed of more or less agglomerated nanosize particles. The average size of nano crystallites is ~20 nm. The degree of the cation inversion of NZF is estimated for spinel fraction in all samples by Rietveld analysis. In the Raman and IR spectra are observed all of first-order active modes. In the spectra of the single phase "hydroxide" samples it is visible that the energy position and intensity of modes is dependent on the composition and cation distribution. It was shown that the modes in Raman spectra of nickel-zinc ferrite that originate from vibrating of different cations could be clearly distinguished. From the ratio of intensities of the A_{1g} -type Raman modes, it is possible to estimate the inversion of cations. The Mössbauer spectra were fitted by several subspectra and according to known subspectral areas of both iron sites the degree of inversion was calculated, also. The cation inversion is $\delta = 0.36(3)$ for ferrite sample obtained from the mixture of appropriate hydroxide for 10 h milling.

EPMA, BIB-SEM and FIB-SEM Investigations on Gas Shales from the Dniepr Donets Basin (Ukraine): Evolution of Micro- and Nanoscale Porosity during Thermal Maturation

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Porosity and permeability are essential parameters for reservoir rocks. As these parameters are directly related to the rock fabric, high resolution techniques are increasingly used to determine reservoir quality of shale gas plays. Techniques developed for conventional reservoir rocks, characterized by large (>10 µm) pores, cannot fully be applied to study gas shales.

The Dniepr Donets Basin (DDB) is a Devonian rift-structure located within the East European Craton. It is filled with Devonian syn-rift sediments and a thick Carboniferous to Mesozoic post-rift succession. The basin hosts more than 200 conventional oil and gas fields. Apart from that, recent investigations focus on the potential for unconventional hydrocarbon production (shale gas). Because of their high average content of total organic carbon (5-6 %), Upper Visean Rudov Beds are one of the main target horizons for shale gas exploration within the DDB. The organic rich black shales can be subdivided into different facies zones according to their mineralogical composition. Those facies zones, predefined by x-ray diffraction measurements on core samples, have been visualized in detail using SEM imaging of fresh broken surfaces, allowing a rapid assessment of mineral distribution and rock fabric. Changing permeability and fraccability, which are essential for reservoir characterization, are directly related to microscale changes in rock texture and mineralogical composition. In case of Rudov Beds, a basin-centered, brittle siliceous facies is most likely referred to a high contribution from deep water radiolaria and is separated from a transitional clayey and a marginal carbonate rich facies. In contrast, a higher abundance of coaly layers as well as inertinite macerals, derived from syn-depositional wildfires, reflects increased terrestrial influence in the marginal areas of the basin.

Another major issue in terms of reservoir quality is represented by type and distribution of organic matter (OM) within the inorganic mineral matrix. Combined SEM imaging, EDX and WDX element mapping on polished sections help visualizing the complex distribution of organic particles within the fine-grained matrix as well as interactions of OM and inorganic phases like clay minerals. Light element mapping of finely dispersed OM, as usually present in gas shales, revealed compositional differences between primary and secondary OM. However, a quantitative approach is still problematic for small particle sizes.

To evaluate the suitability of electron probe microanalysis (EPMA) for (semi-)quantitative determination of light element contents (C, N, O, S) within OM, EPMA was performed on macerals from coaly samples. Results show that C and O contents not only follow maturity trends, but also maceral-specific variations. In general, C and O contents show a negative correlation within all measured samples, with the highest measured C contents within macerals of the inertinite group. In contrast, N abundance cannot be assigned to a distinct maceral group

based on the obtained results. However, S contents are generally lower in interinite macerals compared to vitrinite and liptinite (sporinite). Differences between vitrinite and sporinite are too small for quantification via EPMA – analysis of relatively small spores in detrital OM accumulations might be biased by the excitation of surrounding vitrinite. Instead, varying contents of organic matter-hosted S in vitrinite and sporinite were observed for samples from different seams, probably reflecting changes in the depositional environment. The general trend exceeds the variations in S content between the maceral groups themselves.

Generally, a precise quantification of maceral-specific light element contents by EPMA is problematic due to highly variable measured compositions within the distinct maceral groups and due to varying and generally low totals, most probably referred to changing contribution of H that cannot be detected directly by EPMA. Totals are especially low for components identified as liptinite in the optical microscope, suggested to be a consequence of high H content in such macerals. However, WDX mapping of sporinite shows comparably high C and slightly lower O contents in relation to surrounding vitrinite, whereas macerals cannot be resolved clearly by element mapping of N and S, due to small compositional differences between the liptinite and vitrinite group within the investigated coals.

A trend of increasing C and decreasing O contents was observed for vitrinite macerals within a maturity range from 0.5 to 1.4 %Rr, reflecting a decrease in volatile compounds during thermal maturation. Accordingly, C and O contents of vitrinites within high rank coals show decreased scattering, compared to their low rank counterparts. In contrast, N and S contents do not correlate with increasing rank of coals within the investigated maturity range (0.5–1.4 %Rr).

Apart from geochemical analysis by microbeam techniques, combined BIB/FIB-SEM allows both high-resolution mapping of representative areas (~2000x500 μm) and imaging of cross-sections within a particular maceral or bituminous pore filling of interest. Using this approach, nanopores down to 5-10 nm of equivalent diameter can be resolved and total porosity as well as its distribution within the different organic and inorganic phases can be estimated. Nanopores within OM are suggested to host the main storage potential for gaseous hydrocarbons within gas shales, as most clay minerals are often considered to be water wet (e.g. illite). However, it is not yet clear, whether the nanopores partly develop in primary macerals (e.g. vitrinite) or exclusively in secondary organic matter (bitumen) formed at oil window and higher maturity. Therefore, a differentiation of primary macerals and secondary OM, based on high resolution imaging, is crucial for the understanding of source rock evolution during thermal maturation.

Nanopores have rarely been detected in primary or secondary OM to depths of 5500 m (~1.4% Rr) within the NW DDB. Probably, main generation of nanopores takes place at higher maturity which may be reached in the deeper southeastern part of the basin. Within the investigated shales, abundance of clay matrix hosted sub-micrometer- to nanopores decreases with burial depth, whereas organic matter-hosted pores generally are more abundant and increase in size within samples of higher maturity (1.8 – 2.1 %Rr). However, lack of nanopores in bitumen within mainly gas-prone samples at 1.4 - 1.8 %Rr as well as its abundance in an oil-prone sample at ~0.8 %Rr points out that varying kerogen composition might be an equally important influencing factor as thermal maturation of OM. To which extent composition of mineral matrix and burial history affect the generation or preservation of nanopores within bitumen, remains an unresolved issue.

Interaction of UV irradiation with thin films of organic molecules

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There is an ongoing interest in organic materials due to their application in various organic electronic devices. However stability of organic materials limits their potential use. They are prone to degradation both during the working life and storage. One of the main causes is extrinsic degradation, under the influence of oxygen and moisture. This problem can be solved by encapsulation of devices. However no encapsulation is perfect.

In the first part of this work a study of degradation of thin films of N,N′-bis(3-methylphenyl)-N,N′-bis(phenyl)benzidine (TPD) and 4,4′-bis(2,2-diphenylvinyl)-1,1′-biphenyl (DPVBi) under UV irradiation in air is given. Films of both materials are stable in vacuum, but readily degrade in the presence of oxygen. Thus, the necessary condition for degradation is the simultaneous presence of UV light and oxygen. Chemical analysis of irradiated films by NMR, mass and infrared spectroscopy revealed presence of oxidized species (impurities). These impurities are responsible for increased morphological stability of irradiated films and quenching of photoluminescence. Only small amount of impurities, 0.4 % (0.2 %) for TPD (DPVBi), causes 50 % decrease of photoluminescence. This implies a non-trivial mechanism of quenching. For both molecules it was found that distance between impurities is smaller or equal to exciton diffusion length, which is the necessary condition for quenching. Following mechanism of quenching is proposed: exciton diffuses by hopping form one DPVBi (TPD) to another through FRET in a random walk manner. If, during its lifetime, it comes to proximity of an impurity, a Dexter-type energy transfer occurs and PL is quenched.

Findings of DPVBi study are important because they show that even a small amount of oxygen that penetrates a DPVBi layer would impair luminescence efficiency of a device. Moreover, the absorption of own radiation (for DPVBi and TPD both) would additionally contribute to the rate of degradation of a device. It is reasonable to expect that transport properties would also be affected when materials are used as a hole-transporting layer in OLEDs.

Preparation of Silica Microcpasules by Non-Aqueous Sol-Gel Chemistry and Their Applications

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Microcapsules have taken an important role in controlled release of active agents, such as drugs and agrochemicals, and enable a microenvironment for catalytic reaction. [1-2] One known encapsulation process is based on silica microcapsules prepared by the sol-gel method. Sol-gel microcapsules are known to be inert, biocompatible and flexible; therefore they are commonly used in pharmaceutics and cosmetics. Many of this ingredient are water- sensitive, thus a new method for preparing a silica microcapsules is required.

In our research, we focus on preparing a silica microcapsules by non-aqueous and non-hydrolytic sol-gel chemistry. In order to achieve that, non-aqueous emulsions are prepared using polar and non-polar organic solvent and a silane precursors that can polymerize and produce silica at the interface of the emulsion, without a hydrolysis step. The polar solvent that was chosen is ionic liquids and the silica was formed by the reaction of tetrachlorosilane with dimethylsulfoxide (DMSO) or benzyl alcohol. Ionic liquids are thermally and chemically stable, not volatility and they are liquids over a wide range of temperatures and pressures. These properties make them good solvent for a broad spectrum of materials and catalytic reactions. The preparation of the silica microcapsules by non-aqueous sol-gel method, their characterization and applications will be presented.

Local Magnetic and Electronic Structure of Selective and Sensitive Iron Oxide Nanoparticles as Magnetic Resonance Imaging (MRI) Contrast Enhancers

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Iron oxide nanoparticles (FeO_x NP) are applied as T_2-contrast agents in MRI. A control of their magnetic properties is essential for these applications. Magnetic properties of FeO_x NP strongly depend on their size, shape, and surface functionalization. Especially, structural and magnetic disorder in the surface region lead usually to a reduced magnetization. Modern applications require NP which do not only provide a high T_2-contrast but also allow for specific targeting and multimodal imaging. The aim of the present study is to obtain NP with optimized magnetic properties as well as a high stability in biological media and selective targeting. Monodisperse, spherical Fe_3O_4/γ-Fe_2O_3 NP are prepared from iron oleate. X-Ray Magnetic Circular Dichroism (XMCD) is used to investigate local magnetic and electronic properties of the surface region of these NP after controlled oxidation, surface functionalization as well as doping with Gd which may increase both the T_1 and the T_2 contrast of FeO_x NP. XMCD reveals that after post-synthetic oxidation the magnetization of the NP surface region as well as their γ-Fe_2O_3-to-Fe_3O_4 ratio are strongly increased, and that surface spin canting is strongly reduced. The NP are functionalized with various ligands including dendritic polyglycerol sulfate, which allows for specific targeting. Functionalization of the NP with ligands like bisphosphonate can have a similar effect as oxidation on the local magnetic properties. Transfer of the NP into aqueous media intensifies these processes. XMCD reveals that nitration of catechol anchor groups can prevent oxidation during transfer in water. Finally, different types of Gd-doped FeO_x NP are prepared. XMCD suggests that Gd-clusters have a preference for octahedral positions in FeO_x lattices and that moderate Gd doping increases the magnetization of NP.

The pores fractal nature influence on integral capacity

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The recent literature as well as experimental results offers a generous material for investigating ceramics materials from the point of view of micro-morphology parameters that represent irregularity and non-Euclidean geometry appearance on the measurement level ranged from 10^{-9} to 10^{-4} meters, upon different magnitude of magnification. Such irregularity can be quantified using the concept of fractals and fractal dimension. There are different "sources" of fractality in such materials, known by their complex physicochemical structure which includes different ceramics, especially electronics ceramics materials, ferroelectrics, multiferroics, semiconductors, electromagnetics, thin films, diamond films etc. One of the substantial sources of fractality is the space of pores. Comparing to the collection of grains, the set of pores constitutes a "negative space" which influence is kind of opposite regarding the influence of grains. Once establishing the existence of fractal nature it is possible to propose suitable correction factors having its base on pores. It may be incorporated in already known formulas and important physical laws may contribute in better understanding of these materials properties such as microstructural relationship to microelectronic phenomena. Especially, these fractal nature analytic approaches open a new perspective for deeper and higher level electronics integrations within the new fractal electronics ideas.

Application of bentonite clay to human use

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In addition to inorganic minerals and prehistoric remains of unicellular organisms, bentonite clay is one of a few natural materials. One of a few natural materials that contains in addition to inorganic minerals and prehistoric remains of unicellular organisms is bentonite clay. The composition is not the only indicator of effects. The energy, that is received and transmitted as a composite within all the forms od heat, magnetism, chemistry and biology, is actually something that today seems unfathomable. The energy that this time as composite received and transmitted, all forms of heat, magnetism, chemistry, biology is actually something that today seems unfathomable. It was used in all civilizations, on all continents and repeatedly mentioned in the Bible. Modern instrumental techniques in recent decades increasingly discovering the benefits of bentonite clay, which only confirms the application of composites in all phases of the development of civilization. Bentonite clay is used not only for drinking in order to eliminate some toxins or reimbursement of certain minerals but for lubricating and healing many skin diseases as well. Very easy to adjust as ion exchanger, emulsifier, detoxifier, moisturizer, etc., it is particularly significant for the dumping of bodies in solution with water and sea salt not only for the cleaning of some toxins, but also for energy, an intermediary for the delivery of gas, oxygen or carbon dioxide, supplies the body through the skin with (to) some trace elements and minerals. The heterogeneous liquid clay, extracts of herbs and sea salt can be symbolically compared with the fetus's Guide. Contemporary nano clay are biopolymers, which are compatible with this tissue. Bentonite clay, one of a (the) few minerals that are naturally found in nano form. Its physical and chemical properties are so extensive. Emphases, ion exchange, electromagnetic, bioactive, emulsion, dispersion and others. Bentonite clay is used in hundreds of products for oral use, cosmetics, pharmacy or hygiene of the body. We can claim for sure that bentonite clay is a natural protector of the human species. We can safely say that the bentonite clay natural protector of the human species.

"Similarly attracts Like" in the Theory of Sintering

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Much has been said about the significance of changes in the density of sintered material and usually these changes represent an initial research phase of sintering process. Whether it is about the process of pressing and common sintering, whether it's a cold sintering or sintering under high pressures, these changes are very important for the further research of changes of certain levels of the sub-structure, starting from the macro and microstructure, to electronic structure.

On the other hand, the most recent tendencies towards defining the system units through natural constants place in a focus a new definition of mass as physical quantity, which is in its turn inseparable in relation to the gravitational constant.

In this sense, in this work, starting from the ancient theory of elements, an attempt will be made that from ancient Anaksagoras and Empedocles theory, according which "like attracts like", will be achieved the relation of theory of gravitational attraction with other entities of structure, using characteristics of enthropy, i.e. following the genesis of these characteristics. This leads to a model of affinity at the level of microstructure and its sub-structure, and therefore the most appropriate model of sintering, which would still be able to improve existing models. There will also be traced one of the possible paths towards metrology definitions of mass and gravitational constant, in compliance with all existing theories – from classical to the general theory of relativity and atomic–molecular structure of the materials.

Finally, through the integral characteristics of the function of probability or entropy as its representative, and in a relatively simple way the theory of materials to high pressures Savić–Kašanin[4] can be justified, as well as its application in the science of sintering. By comparing the results obtained with the settings of the theory, primarily with changes in the density of celestial bodies that are changed by law 2^{φ}, comes to the conclusion that the results agree with all the settings, and experiments in the field of sintering.

Reducing Losses In Magnetic Thin Films Through Nanoscale Surface Patterning

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The combination of high electrical resistivity and ferrimagnetism makes ferrites one of the technologically most important magnetic materials. They are particularly interesting in high-frequency applications due to their low electrical power losses. Magnetic hysteresis losses, however, are intrinsic to the material and harder to deal with. We report on a novel method of reducing losses in magnetic thin films through surface patterning.

Textured nickel ferrite ($NiFe_2O_4$) thin films were deposited onto a c-plane sapphire substrate using chemical solution deposition. Surface of the films was patterned with a polydimethylsiloxane (PDMS) stamp using nanoimprint lithography technique. A series of pattern masters with periods ranging from 500 nm to 1500 nm was used for patterning. In addition, sample with different thicknesses were prepared. Atomic force microscopy demonstrated the pattern was faithfully copied from the pattern masters to the thin films. X-Ray diffraction revealed all samples to be textured single phase inverse spinel nickel ferrite. Magnetic measurement showed substantial coercivity reduction in all patterned samples. Magnetic force microscopy was used for direct observation of the magnetic domain structure. Combined with theoretical investigations it confirmed the origin of the coercivity reduction to be a direct consequence of altered surface topography.

Preparation and characterisation of iron based bulk metallic glasses

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Iron-based bulk metallic glasses (BMG) are advanced soft magnetic alloys with high glass forming ability (GFA) and attracted attention due to the novel fundamentals in science of metastable alloys and high technological potential.

Multicomponent Fe-based alloys of complex chemical compositions:

A1/**A2**: $Fe_{72-x}Nb_xAl_5Ga_2P_{11}C_6B_4$ (x=0, 2),
A3: $Fe_{77}Al_{2.14}Ga_{0.86}P_{8.4}C_5B_4Si_{2.6}$,
B1/**B2**/**B3**: $Fe_{62-x}Cu_xCo_8Ni_6Zr_8Nb_2B_{14}$ (x=0, 0.5 and 1) and
C1: $Fe_{65.5}Cr_4Mo_4Ga_4P_{12}Cr_5B_{5.5}$ were prepared by different processing:

(a) ribbons that are about d=30 mm thick and w=2 mm wide were produced by rapidly quenching using a single-roller technique in a vacuum chamber,
(b) rod form samples were prepared by injection (or suction) cooper mold casting in a vacuum chamber,
(c) hot compaction of amorphous powders prepared by ball milling of as-spun ribbons.

Thermal and microstructure characterization (performed by DSC, XRD and Mössbauer spectroscopy) was used to correlate glass forming ability, microstructure and thermo/thermo-magnetic treatments which resulted in excellent functional properties: optimum soft magnetic properties and improved mechanical properties.

The effect of Hot Isostatic Pressing on the MT sample densities

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Mechanically activated powders (0, 10, 40, 80 and 160 minutes) were formed by isostatic pressure 300 MPa to cylindrical green bodies (ϕ 12 mm). First set of samples was sintered at 1300 °C for 30 min in air (heating rate 10 °C/min, cooling rate 5 °C/min). These samples were re-sintered at 1200 °C for 20 h in air (heating rate 20 °C/min, cooling rate 10 °C/min). Samples reached almost 90 % TD.

The second set of samples was sintered at 1400 °C for 30 in air (heating rate 10 °C/min, cooling rate 5 °C/min). Relative densities increased up to 93 % TD. The samples of absence of open porosity (MTO-10, 40, 80 and 160) were post-sintered by pressure assisted technique Hot Isostatic Pressing (HIP) at 1200 °C for 2 h in argon atmosphere with pressure 200 MPa. The samples increased densities up to 96 % TD for sample MT-160. Electrical measurements were performed in the microwave field of frequency.

OR|02

Nb/Mn Codoped $BaTiO_3$ Ceramics - Microstructure and Dielectric Properties

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The influence of additive content on microstructure and dielectric properties of Nb/Mn co-doped $BaTiO_3$ ceramics was investigated. The content of Nb_2O_5 was ranging from 0.1 to 5.0 at% Nb. The content of MnO_2 kept constant at 0.05 at% Mn in all investigated samples. Co-doped $BaTiO_3$ were obtained by a conventional solid state reaction and sintered in air at 1290^0C and 1320^0C for two hours. The homogeneous and completely fine-grained microstructure with average grain size from 0.3 to 1μm was observed in samples doped with 0.1 at% Nb. In high doped samples, apart from the fine grained matrix, the appearance of local area with secondary abnormal grains was observed. The dielectric permittivity and dissipation factor were investigated as a function of frequency and temperature. Dielectric permittivity of codoped $BaTiO_3$ was in the range of 3900 to 5800 and decreases with increase of additive content. The highest value of dielectric constant at room temperature (ε_r= 5800) and the greatest change at Curie temperature (ε_r= 7500) were measured in 0.1at% Nb doped samples. Dissipation factor was range from 0.07 to 0.62 for all investigated samples. The Curie constant (C) and Curie-Weiss temperature (T_0) together with critical exponent of nonlinearity (γ) were calculated using a Curie-Weiss and modified Curie-Weiss law. The Curie constant increase with increasing dopant content and the highest values were measured in 5.0 Nb doped samples. The obtained values of γ is in the range from 1.04 to 1.53 and pointed out the sharp phase transformation from ferroelectric to paraelectric phase at Curie temperature.

OR|03

$BaTiO_3$-Ceramics Microstructure Fractal Nature Influence on Solar Energy Sources

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Demand for energy is in growth. Therefore, the natural energy sources are insufficient, so the alternative energy sources represent a suitable replacement. All energy that mankind use, except nuclear and geothermal, is emitted by the Sun. The different renewable energy sources applications, such as solar panels and wind generators, are in growth. Solar rays photovoltaic conversion into electrical energy, by using solar cells, and their enhance by the ceramic materials structure fractal nature influence, have been introduced. The ceramic materials fractal structure importance for creating a new material for solar cells is presented. Experiments have been performed on BaTiO3-ceramics with different additives (MnCO3, CeO2, Er2O3, Yb2O3, Ho2O3) and sintering consolidation conditions (1180°C-1380°C). The samples have been exposed to analysis in the electron microscope (JEOL JSM-5300). This research provides an original contribution to the real surfaces field in the solar energy storage area and the new creation approach to intergranular capacitance, in the direction of supercapacitors, which have capital importance for new and alternative energy sources.

Low temperature co-fired-ceramics device for electromagnetic fields detection emitted by wind turbines

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The demand for renewable energy has led to a large scale deployment of wind farms. The extent of the wind turbines in the marine environment is unprecedented, and this has led to questions about whether there are any interactions between the electricity produced and the surrounding environment. Electromagnetic interference (EMI) can both affect and be transmitted by wind turbines. This paper presents a low temperature co-fired-ceramics devices introduction for electromagnetic fields detection emitted by wind turbines. The principal mechanisms are described and taken into consideration for future frontiers.

Application of surface modified titanate nanotubes in reinforcing of polyamide 11

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Hydrothermally synthesized titanate nanotubes (TTNT) were used in reinforcing of polyamide 11 (PA11) thermoplastic. Composites comprising up to 2 wt% of TTNT were fabricated by melt compounding.. To enhance dispersion and TTNT compatibility with the thermoplastic, these were modified with cetyltrimethylammonium bromide (CTAB) and sodium dodecyl sulphate (SDS). Fourier transform infrared spectroscopy and thermogravimetry demonstrated success of the surface modification prior to composite processing, while scanning transmission electron microscopy combined with energy dispersive X-ray analysis confirmed the retention of the surfactants on TTNT in composites. *Nevertheless,* scanning and transmission electron microscopy revealed incomplete dispersion of *TTNT inside polyamide matrix. I*mproved wettability on TTNT–PA11 interface, observed for composites comprising the surface modified TTNT, affect positively thermal and mechanical properties in these composites. Significant rise of decomposition temperature was detected in the composites containing TTNT modified with CTAB, while uppermost increment of the storage and Young's modulus (of about 35 and 26 %, respectively) was achieved in the composite comprising 0.5 wt% of TTNT modified with SDS. Increase of TTNT content improved yield strength and led to the drop in the strain at break.

OR|06

Nanocomposite photocatalyst based on layered double hydroxides (LDHs)/ kaolin clay associated with TiO_2

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The surfaces of building materials are constantly exposed to the actions of environmental factors, pollutants of inorganic and organic origin as well as to microorganisms, which significantly contribute to corrosion phenomena. The application of coatings decreases the negative action of the pollutants minimizing their direct contact with the substrate. Different types of coatings with additional functions have been developed. A specific problem of these applications is the lack of compatibility of the photocatalysts with the surface of the building materials and the detachment of potentially toxic TiO_2 nano-particles. In the present study, this problem was solved by the proper immobilization of TiO_2 nano-particles onto the photocatalyst support, layered double hydroxides (LDHs) / kaolin clay. The newly formed coating possesses acceptable porosity for porous building materials (porosity within the range of 24-36 %) and satisfied photocatalytic activity, as well as mineralogical compatibility with the substrates (mortars, renders, bricks). Additionally, a positive effect considering the self-cleaning and durability phenomenon was attained.

OR|07

High efficiency Sb_2S_3-based hybrid solar cell at low light intensity: cell made of synthesized Cu and Se doped Sb_2S_3

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Cu-doped (as p-doped) and Se-doped (as n-doped) Sb_2S_3 were synthesized from undoped Sb_2S_3 using a newly developed technique, simple colloidal synthesis method. X-ray diffraction measurements detected no peaks related to any of the Cu and Se compounds in Cu and Se doped samples. Energy dispersive x-ray analysis, however, confirmed the presence of Cu and Se ions in the doped samples. Diffuse reflectance spectroscopy revealed the optical band gap energy changes due to doping effect, as reported for both the p-type and the n-type material. The valence-band X-ray photoelectron spectroscopy data showed a significant shift in the valence band to higher (Se-doped; +0.53 eV), and a shift to lower (Cu-doped; -0.41 eV) binding energy respectively, when compared to the undoped sample. We report here on an inexpensive solar cell designed and made entirely of a synthesized material (ITO/p-doped Sb_2S_3 + PANI/amorphous/undoped Sb_2S_3 + PANI/n-doped Sb_2S_3 + PANI/ PANI / electrolyte (0.5 M KI + 0.05 M I_2)/Al). The cell has a high efficiency of 8-9 % at a very low light intensity of only 5% sun, which makes it particularly suitable for indoor applications. As found, the cell performance at the intensity of 5 % sun is governed by high shunt resistance (R_{SH}) only, which satisfies standard testing conditions (STC). At higher light intensities (25 % sun), however, the cell exhibits lower but not insignificant efficiency (around 2 %) governed by both the series (R_S) and the shunt resistance (R_{SH}). Minimal permeability in the UV region (up to 375 nm) and its almost constant value in the visible and the NIR region at low light intensity of 5% sun could be the reason for higher cell efficiency.

OR|08

Thermal treatment of oxides in different atmospheres

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The influence of atmosphere on changes in microstructure was observed on three oxides: TiO_2, $ZnTiO_3$, and $Mn_xZn_{1-x}Fe_2O_4$. These oxides were analyzed during thermal treatment in a dilatometer and by differential temperature analysis in air and nitrogen atmosphere. Scanning electron microscopy was also used to analyze the influence of atmosphere on the resulting microstructure. Powder dimensions and the oxide`s possibility to change stoichiometry are indicated as a significant starting factor from the viewpoint of the heating atmosphere.

OR|09

Quantum Dot Integration Into A Hybrid Polymer System: A DFT Study

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Theoretical investigation of CdSe and CdS quantum dots connected with conjugated organic linkers using Density Functional Theory (DFT) and Time-Dependent DFT (TD-DFT) shows that hopping conductivity in a system of connected quantum dots can be established using a combination of quantum-confinement extending ligand and rigid linker molecule through polymerization reaction between the two. Quantum dots can be first capped with a ligand molecule, which can then be the subject of polymerization reaction with an appropriate organic linker, creating a network of quantum dots connected through organic linkers. Electronic structure and optical properties of this hybrid polymer system shows that the absorption of the quantum dot can easily be controlled through extension of its quantum confinement through a ligand molecule, connection through organic linkers gives rise to hopping conductivity, preserving quantum confinement and leading to the prospect of creating a very adaptable and versatile optical material. DFT calculations of this hybrid polymer system linked with titanium dioxide nanocluster indicate favorable interaction for light-induced charge transfer.

Marine pollution from TBT-based antifouling paints

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Antifouling biocides, as tributyltin (TBT), have been developed to prevent settlement of organisms on vessels and therefore were directly introduced into the marine environment. Their widespread use caused high levels of contamination and raised concerns about their toxic effects on marine communities. Nowadays, the usage of TBT-based antifouling paints has been banned in many countries worldwide. However, overview of the recently published data demonstrates that marine environment is still polluted with TBT. Obviously, the ban cannot solve the problem of contamination immediately since TBT is highly persistent in sediments, which therefore represent a long term source of TBT in the marine environment. Since TBT degradation in sediments occurs very slowly, with half-lives from several years to decades, it controls the overall persistence of TBT in the entire environment. Consequently, the complete knowledge on degradation process is of crucial importance for the assessment of the time period in which TBT pollution will be present. Here we shown that organic matter, by controlling TBT adsorption/desorption processes, influences the TBT degradation efficiency and consequently defines its persistence in contaminated sediments, which thus increases in sediments rich in organic matter.

Nanoindentation of „Liquid wood“ Samples

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During the last years, enormous effort have been sustained by the researchers who tried to develop and improve green (recyclable, biocompatible and biodegradable) materials from renewable resources, strengthening this way the global sustainability. Following this need a new thermoplastic material , „liquid wood“, that meets all the above conditions was developed by a team of german researchers. There are three types of "Liquid Wood", Arboform, Arboblend and Arbofill, depending on the amount of mixed components. The main components of the material are lignin (representing the material matrix), natural fibres (from annual plants) and natural additives. This material can be processed like any other plastic material, so no need changing in terms of technological equipment. In order to obtain more information about the mechanical properties of "Liquid Wood" samples obtained by injection molding were studied by Nanoindentation testing with a Triboindenter TI-950. In addition, optical microscopy (surface probe microscopy) was used for morphological characterization of the material samples. The Nanoindentation has become a commonplace tool for the measurement of mechanical properties of materials by applying a variety of indentation hardness to small volumes. High-resolution load-displacement data, discrete events including dislocation source activation, shear instability initiation, and phase transformations can be detected during a Nanoindentation test. The research revealed the following average values of Young's modulus and nano hardness for the studied materials, 5.2±1.59GPa Young's modulus, 217.5 ±97.5 MPa nano hardness at 150°C melting temperature during the injection process of Arboform L, V3 Nature samples; in case of 160°C melting temperature the values of Young's modulus and nano hardness reveal increases, 5.86±1.42GPa respectively 351.5 ±47.5 MPa. The average values of Arbofill Fitchie and Arboform L, V3 Nature reinforced with Aramid Fibers are the same as in case of Arboform L, V3 Nature samples only the melting temperature are diferent, (140-155)°C and (165-175)°C. For Arboblend V2 Nature the values are smaller then for the others studied materials, 2.97±3.23GPa Young's modulus, 195±27 MPa nano hardness, at 160°C melting temperature and for 170°C the values are 3. 6±1 GPa and 230 ±79 MPa. Take into account the biodegradability and higher properties of "Liquid Wood", it can successfully replace the common used plastics materials.

OR|12

Lead-free piezoelectric ceramics selection by using MADM approach

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Piezoelectric materials are commonly used in sensor and actuator technologies due to their unique ability to couple electrical and mechanical displacements. Most commercially available piezoelectric materials are comprised of more than 60 weight percent lead. Due to lead harmful effects, lead-free piezoelectric materials are still being developed.

In order to find desired properties of the lead-free materials, wide range of compositions and fabrication techniques have been investigated. Taking into account that it is not possible to improve all desired properties simultaneously using one of the fabrication technique or compositional modification, this problem is studied under multiple attribute decision making (MADM) field. Namely, MADM methods are used to select the most suitable lead-free piezoelectric ceramics from the large number of alternatives for a set of selection criteria.

OR|13

Impact of crushed mineral aggregate on the pumpability of concrete during transport and placement

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In the spirit of the sustainable buildings, and with the goal of protection of river courses, in the near future an already announced directive ordering closing down of a large number of river aggregate dredging operations will be adopted. For that reason, usage of crushed mineral aggregate in concrete mixes is increasing. Irrespective of downsides of the fined crushed mineral aggregate, such as the presence of fine particles bordering the upper permissible limit and the unfavorable shape of the grain of the course aggregate for obtaining liquid consistency required for the pumpable concrete, the demanded pumpability of concrete during transport and placement has been achieved.

By adding admixtures to concrete, the required concrete properties, such as: frost resistance, simultaneous frost and salt resistance and water tightness have been achieved.

Integral characteristics of entropy and Planck's law of radiation

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The accuracy of any theory of structural hierarchy of materijals[1] should be the final check on the law of radiation of black body[2,3], which is considered one of the best established laws of physics in general.

On the other hand, the most recent tendencies towards defining the system units through natural constants[4] put this law in the foreground, bearing in mind that in him the Planck's constant is contained. This constant is considered one of the fundamental constants of the new system of units.

In this sense, this paper will, starting from of all conducting of basic law of radiation, make an attempt to get to the corresponding relations starting from the integral characteristics of entropy[5.6], i.e. following the genesis of these characteristics. Specifically, through the analysis of these characteristics, in our paper, we came to results that clearly indicates that, starting from equilibrium thermodynamic conditions, come to the equation radiation law without any additional assumptions.

Using these results, we believe that, through further mathematical analysis, it is possible to reach the temperature of the cosmic background radiation, whose value, according to the latest astronomical measurements, is probably the same as basis of natural logariatama, e, when expressed in degrees Kelvin. This, drawn by another potential way to metrology defined temperature, independent of all existing methods.

Timacum Maius: Roman Bricks as a Significant Historical Source

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Archaeological researches at *Timacum Maius* site, by modern Svrljig in eastern Serbia, are conducted for eight consecutive years by the Institute for Balkan Studies of SASA in collaboration with the Bordeaux based Ausonius Institute of Michel de Montaigne University. During the 2014 campaign a significant number of bricks with stamped inscriptions of First cohort of Cretans (*Cohors I Cretum*), one Roman auxiliary military unit, were found within the remains of the Roman baths - *thermae*. Those newly discovered findings not only reveal the Roman building technique but they also testify to the early military history of the Roman settlement and its surrounding region.

Effect of Dispersant in Engineering of Particle Interaction in Wet Ceramic Processing of Alumina Ceramics

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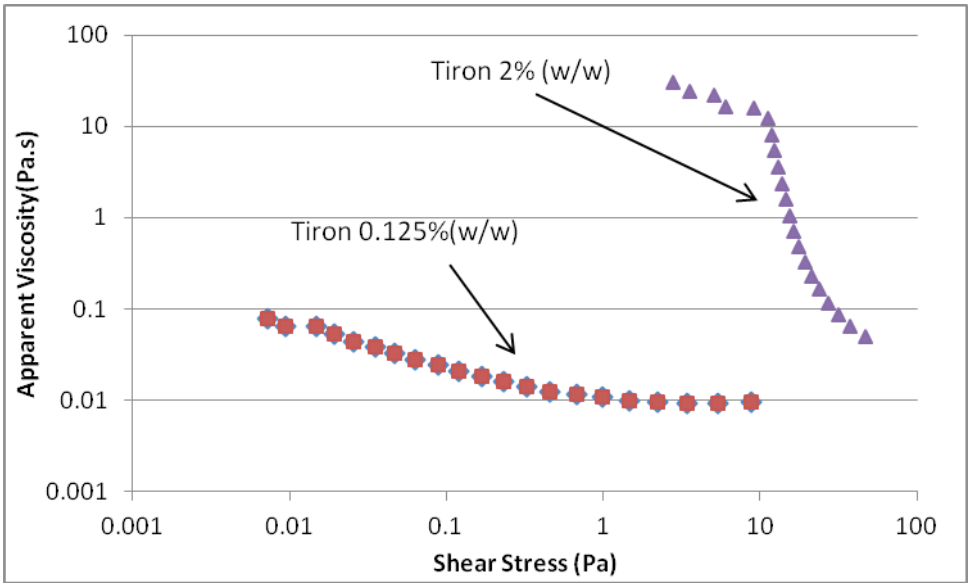
The influence of adsorbing two different types dispersant with varying amount on the rheology of Alumina ceramic has been studied. The dispersant used in this study are Darvan C (an ammonium of poly(methacrylate)) and Tiron (sodium salt of 4–5 dihydroxy-1, 3-benzene disulfonic acid, $C_6H_8Na_2O_8S_2$). It has been found that the dispersants adsorbs onto the surface of the Alumia powder particle, modify the physio-chemical properties of the surface and consequently alter the rheological characteristics of the suspension. The results of rheological studies are supported and complemented by the adsorption isotherms of the dispersant and sediment heights of the particles.



Shear stress vs. viscosity with 0.125% and 2.0% of Tiron

Biomaterials in hernia surgery-a surgeons view

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Traditional use of tension operations based on tissue hernia repair is accompanied by a high recurrence rate. Tension-free operations that involve the use of biomaterials improve the postoperative results. Today, various biomaterials are used in hernia surgery (non-absorbable or absorbable meshes, biological grafts). The biomaterials can be structured in the form of flat mesh, plug or various devices. Tension-free operations can be performed through open or laparoscopic approach and biomaterials can be positioned in onlay (prefascial), sublay (between the myofascial layers), underlay (preperitoneal) and intraperitoneal (intraperitoneal onlay mesh) position. The biomaterials used in onlay, sublay or underlay hernioplasty are usually composed of polypropylene or polyester. Intraperitoneal hernioplasty uses composite biomaterials that prevent adhesions with the intestines. They are composed either of polytetrafluoroethylene or polypropylene or polyester with antiadherent layer. The absorbable biomaterials (polyglycolic acid or polyglactine mesh) can be used as a temporary solution in the staged repair of contaminated abdominal wall defects or it can be used together with the component separation technique as a permanent solution for complex abdominal wall defects. A special group of biomaterials are biological grafts made of collagen that can be set to all layers of the abdominal wall. The use of biomaterials in hernia surgery provide the best results if the biomaterial has tissue support, while poorer results are achieved if biomaterials are used to bridge the hernia defect. The use of biomaterials in hernia surgery significantly reduced the rate of recurrences, postoperative pain and recovery period. However, it must be noted that certain physical properties of biomaterials can lead to undesirable consequences, including increased risk of infection, seroma formation, biomaterial-related intestinal obstruction and fistula formation, and failure of the hernioplasty due to shrinkage of the mesh. An individual approach to every single patient and selection of the optimal surgical approach, surgical technique and biomaterial, based on clinical experience and scientific evidence significantly improves the postoperative outcome in hernia surgery.

Aerolam honeycomb as a carrier in mosaic conservation

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Republical institution for protection of cultural monuments Belgrade

Basis of this project is to present antique mosaic previously lifted from the floor at site, on the wall in museum hall. For this purpose we had to use hard and lightweight carrier and strong glue to bind artifact and carrier. Materials we used include aerolam honeycomb board as a carrier and semi synthetic mortar mixed with latex solution as a binder. Mosaic is about 60x60x5cm and 40kg and carrier is a 70x70x8cm and about 0,5kg weight.

Aerolam board consists of aluminium honeycomb core and woven glass fibre reinforced epoxy skins and has a 83 kg/m^3 nominal density. These specifications make it perfect choice whenever we need extremely strong, flat and lightweight material. Possibilities of use are wide, beside the wall mounting it can be used on the ground too, especially on sites where mosaics covers important underground structures like hypocausts etc...

Thermal properties and resistance to fire-standing sandwich panels with "PUR" and "APN" fill

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The goal of this paper is to present the experience in fire resistance testing of the self-supporting facade sandwich panels with sheet metal lining and PIR insulation, thickness 80 and 100 mm, that have been tested to the Standard Fire Curve ISO-834 as well as external fire curve, to the scientific and professional community in field of expertise. These are unique types of testing in only accredited fire laboratory in Bosnia and Herzegovina, which is one of only few in the region, whose experience is of great importance. Particular specialty of such testing is that panels have been exposed to the internal and external fire curves separately, what is not often in the world.

Institute of fire and explosion safety Ltd. Sarajevo is an institution with more than forty five years of experience in the field of fire protection. On the basis of the Law on Accreditation of Bosnia and Herzegovina, INZA in 2010, successfully completed the process of accreditation of its testing laboratories, based on what has received confirmation of its accreditation by the national authority of the BATA Institute for Accreditation of Bosnia and Herzegovina. INZA accredited test methods in thermodynamic test for resistance to fire of construction products, especially the structural parts of buildings and structural elements, load-bearing and non-bearing partition walls, doors and windows. In accordance with the accreditation, INZA is appointed by the Ministry of Foreign Trade and Economic Relations as the national reference laboratory for the testing of fire resistance.

The curiosity of the case series from fire resistance tests presented in this paper is a re-examination in accordance with JUS U.J1.092 (1/1993) - resistance test fire division walls and non-supporting outer walls, where the sample is exposed to a reduced fire curve that is defined by the model (1) for the first 10 minutes after the first 10 minutes, the temperature inside the furnace was maintained at 658 ° C + T0. This curve corresponds to the curve so. external fire in order to investigate the transfer of fire from the outside to the inside of the building.

Upon completion of testing, according to the terms of JUS U.J1.090 (1/1986) - Test of resistance to fire walls, the behavior of elements and structures in fire conditions is considered by the occurrence of the following conditions are important for the construction of:

- Demolition of the structure;
- Penetration of flame pattern that separates the room and should prevent the penetration of flame from one room to another - the emergence of crevices, cracks or other openings through which can pass the flame; and
- The resistance of the temperature wave: pattern on the unexposed side should not have a high temperature of 140 ° C higher than the initial temperature, and in any case and in any place should not have a maximum temperature of 180 ° C higher than the initial. Regardless of the starting temperature, the sample should not have a higher temperature of 220 ° C.

The in-situ challenge of better understanding Structure-Properties relationship in nanomaterials: Possible solutions and illustrations

Dušan Popović

Analysis

The Electron Microscopy of tomorrow appears to be more and more highly dynamic, with the growing development of many different ways to look at real-time in-situ experiments. Being one of the world's leading suppliers of scientific instruments in the field of Transmission Electron Microscopy, FEI is focused on developing in-situ microscopy at ultra-high resolution by not only better integration of existing third party portable in-situ solutions and sample holders, but also by maintaining development in the very demanding field of Environmental Transmission Electron Microscopy (ETEM).

The presentation will highlight the latest developments in both directions. Firstly by demonstrating how much progress has been made in the world of ETEM through the presentation of the very latest results, followed by a full review of the enhanced versatility the most recent TEM's, can accommodate through the use of various in-situ sample holders, either from FEI or from other suppliers. Here as well, some examples will show how much a 'standard' TEM, Cs corrected or not, can associate with the most advanced in-situ solutions to become a surprising laboratory at the sub-nanometer scale…

P|01

Structural, chemical and magnetic properties of nickel vertical posts obtained by Glancing Angle Deposition technique

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In this work, Glancing Angle Deposition technique was used for obtaining nanostructured nickel thin film that is composed of vertical posts. Glass substrate was positioned 75 degrees with respect to the substrate normal and it was rotated with a suitable constant speed. Thickness of the deposited thin film was 270 nm, which was achieved for the deposition time of 1 hour and 30 minutes. The obtained nickel thin film was characterized by Scanning Electron Microscopy, Atomic Force Microscopy and X-ray Photoelectron Spectroscopy. The diameter of the columns found to be 35 nm and the surface roughness value was 2.1 nm. XPS analysis was performed after 20 minutes of sputtering with Ar ions. It was found that the deposited thin film consists of 94.0 at.% of nickel, 3.1 at.% of carbon and 2.9 at.% of oxygen. Magnetic properties of the deposited thin film were determined by Magneto-Optical Kerr Effect Microscopy. The values of the coercivity, obtained from the magnetic hysteresis loops, were analyzed as a function of the sample rotation in the magnetic field. Based on the obtained coercivity values it can be concluded that the nickel thin film has a magnetic anisotropy.

Optimization of mechanical activation of different raw materials used in production of high-temperature ceramics

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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 and alumina) used in the production of high-temperature ceramics. The modification in the behavior of activated samples has been correlated to the particle size distribution effect produced by activation via an 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 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 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 sieve mesh of 80 μm set of processing parameters (SS=0.81) for mica, sieve mesh of 120 μm set of processing parameters (SS=1.0) for talc, and sieve mesh of 120 μm set of processing parameters (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 for the processing of raw materials utilized in production of high-temperature ceramics.

P|03

The application of fractal analysis in investigation of synthesized α-alumina microstructure and properties

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The structure and performances of high temperature ceramic materials based on alumina is controlled by application of different technological methods for induction of transition of Al_2O_3 from its gamma to alpha phase. The thermo-mechanical synthesis is one of the most frequently applied methods in the production of α-Al_2O_3. This procedure requires extensive mechanical milling of the γ-Al_2O_3, which is combined with thermal treatment. In this paper, the microstructure and grain-size related properties of alumina in a variety of its transformations have been investigated. Also, the impact of the mechanical processing parameters on the alumina grain-size distribution affiliated characteristics and on the γ to α phase transformation rate were studied. The moderation in the alumina samples behavior has been correlated to the granulometric and mineralogical changes induced by activation via an ultra-centrifugal mill. Microstructural investigations were carried out using scanning electron microscope equipped with energy dispersive spectrometer. Grain size distribution was determined via cyclo-sizer. The new correlation between microstructure and obtained properties of activated alumina, based on fractal geometry and contact surface probability, has been developed. Using the fractals and statistics of the grains contact surface, a reconstruction of microstructure configurations, as grains shapes or intergranular contacts, has been successfully done. Obtained results indicated that fractal analysis and statistics model for contact surfaces of different shapes were very important for the prognosis of α-Al_2O_3 microstructure and properties. The morphology of alumina grains highlighted the validity of developing new structure analytical methods, based on different grains' shape geometries. The grains contact model based on ellipsoidal geometry was presented as new modeling tool for structure research of activated alumina. The directions of possible material properties prognosis are determined according to the correlations synthesis–structure–property. The statistical approach to the investigation of activated Al_2O_3 grains will improve energetic and economic sustainability of the activation applied in the processing of alumina used in production of high-temperature ceramics.

P|04

The Dielectric characteristic of Er doped $BaTiO_3$ Ceramics

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The doped $BaTiO_3$ ceramics, with different Er_2O_3 content, ranging from 0.01 to 1.0 at% Er, were investigated regarding their dielectical characteristics and phase transformation in this paper. Ceramics using in this investigation were prepared by the conventional solid state reaction and sintered at 1320º and 1350ºC in air atmosphere for 4 hours. SEM analysis of Er/$BaTiO_3$ doped ceramic showed, that samples doped with a smaller concentration of additive (0.01 and 0.1 at%) characterized a homogeneous microstructure with a larger grain size. For samples doped with a higher concentration of additives (0.5 and 1.0 at%) characteristic is smaller grain size. The dielectric characteristics of Er/$BaTiO_3$ ceramics like as dielectric constant, dissipation factor, electrical resistance have been done by using LCR-Meter Agilent 4248A in frequency range 20 Hz to 1 MHz, and in temperature range 30º to 170ºC. The high doped samples sintered at 1350°C, display the high value of dielectric permittivity at Curie temperature, for 1.0at% Er/$BaTiO_3$. Using a Curie-Weiss low and modified Curie-Weiss low the Curie constant C, Curie temperature Tc and a critical exponent of nonlinearity γ were calculated. The Curie constant for all series of samples increase with increase of dopant concentration and the highest values were measured from samples doped with 1.0at% of additive. Critical exponent of nonlinearity γ were calculated, and the lowest value were for samples doped with 0.01 at%, highest value were calculated for samples with 1.0 at%.

P|05

Off-resonant Raman spectroscopy of ZnS quantum dots

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ZnS nanoparticles were synthesized mechanochemically by high-energy milling. Samples were produced in three different milling times. The morphology of samples has been investigated by scanning electron microscopy (SEM). X-ray diffraction (XRD) investigation of synthesized nanocrystals identified cubic structure, and crystallite size was estimated to 1.9 nm (5 min milling), 2.3 nm (10 min) and 2.4 nm (20 min). These dimensions ensure strong confinement regime.

Raman spectroscopy studies (100 cm^{-1} to 500 cm^{-1}) have been performed. Excitation source was 514.5 nm (E_L= 2.41 eV). Dominant spectral structures are registered in spectral region 130 cm^{1}-180 cm^{-1}, around 265 cm^{-1} and around 345 cm^{-1}. First two are assigned as combination modes and mode at 345 cm^{-1} as confined ZnS LO type phonon. Absence of TO mode with visible excitation is consequence of poor scattering efficiency and anti-resonant behavior. We report relatively strong, compared to confined ZnS LO type phonon, Raman activities of combination modes away from the resonance in the strong confinement regime in ZnS nanoparticles.

P|06

Modified montmorillonite as nicotine adsorbent

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The adsorptions of nicotine at 298 K from aqueous solution onto natural Wyoming montmorillonite (Wy-M), acid-activated montmorillonite (Wy-M_A) and alkali-activated montmorillonite (Wy-M_{AL}) were investigated. The Wy-M_A and Wy-M_{AL} samples were obtained by acid and alkaline modification process using HCl and Na_2CO_3, respectively. The changes in the chemical and phase composition, as well as the textural properties of the starting and modified samples were monitored using X-ray diffraction, infrared spectroscopy and physisorption of nitrogen. The adsorption experiments were performed in a batch system. The adsorption was monitored with respect to contact time, nicotine initial concentrations (0.1-1mM), mass of adsorbent (12.5 - 200 mg) and pH (2-11). The concentration of nicotine was analyzed before and after the adsorption tests using a UV-Vis spectrophotometer at λ_{max}=261 nm. It was estimated that the equilibrium time for Wy-M and Wy-M_{AL} was 60 min, and 20 min for Wy-M_A. The adsorption study showed that the alkaline modification of montmorillonite slightly affected the adsorption of nicotine (q_e = 0.27 and q_e = 0.24 mmol/g, for Wy-M and Wy-M_{AL}, respectively). On the other hand, acid modification significantly improved adsorption capacity of montmorillonite (q_e= 0.52 mmol/g). The adsorption results were fitted by Langmuir, Freundlich and Sips adsorption isotherms.

Organomodified bentonite clay: Characterization and sorptive properties towards phenol and its derivatives

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Bentonite clay from Mečji Do locality in Serbia was organomodified. The organomodification was performed with hexadecyltrimethylammonium (HDTMA) bromide, and the sample was denoted as HDTMA-MD. The characterization of the clay-based material consisting of X-Ray diffraction, elemental analysis and point of zero charge determination, was performed.

The sorption of phenol and its three nitro derivatives: 2-nitrophenol (2NP), 3-nitrophenol (3NP) and 4-nitrophenol (4NP) on HDTMA-MD was investigated. The experiments were performed in aqueous solution, during three hours, at constant temperature (25 °C) and with initial sorbate concentrations of 2×10^{-4} mol dm^{-3}. The sorption capacity of HDTMA-MD toward phenol derivatives increased in the following order q_e (phenol) < q_e (3NP) < q_e (2NP) < q_e (4NP). The sorption capacity of different phenol derivatives could be affected by their solubility in water, hydrogen bonds that they could form with sorbent, acidity and chemical structure of the sorbate, including the presence of the nitro group and its position in phenol ring.

The influence of sorption time and initial concentration on the sorption efficiency of HDTMA-MD was studied for 4NP since it showed the best sorption on the investigated material. The isotherm data were best fitted with Langmuir model, while the sorption dynamics obeyed the pseudo-second-order kinetic model for all initial concentrations.

P|08

Structure characterization of Ni incorporated SOFC anode ceramic matrixes

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Proton conducting solid oxide fuel cells (pSOFCs) operates at intermediate temperatures (about 600°C). They use hydrogen as fuel and a solid oxide (ceramic) electrolyte to conduct protons created at the anode to the cathode. The electrochemical reaction which brings to the production of water as waste product occurs at the cathode side. Perovskite structured materials like as $BaCe_{0.85}Y_{0.15}O_{3-\delta}$ (BCY15) are known as good proton conductors. Ni cermets are usually used as anodes for SOFCs because Ni metal at the given operating temperatures performs similarly to noble metal-based catalysts, but offers significant cost savings. Generally, Ni cermet is produced by oxides powder mixtures sintering. However, this approach is costly and requires extreme experimental conditions.

The aim of this work is to study the possibilities for application of wet-chemical incorporation procedures for the synthesis of BCY15/Ni anode cermet. Ni was doped by impregnation and precipitation with different alkaline agents such as urea, NaOH and $NaCO_3$. Direct impregnation with metal Ni was also applied. The prepared Ni-BCY15 samples were characterized using X-ray diffraction and FTIR techniques.

It was found that the most promising method is urea homogeneous precipitation which provides for obtaining fine-dispersed $Ni(OH)_2$ structure – a good precondition for fine-grained metal nickel particles creation. The direct impregnation of Ni nanoparticles seems to be also a good approach. Further efforts will be concentrated on those two methods.

PEG assisted hydrothermal synthesis of $NaYF_4$:Yb^{3+}, Er^{3+} nanoparticles

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Modification of the methods for conducted synthesis of the surface modified up-conversion nanoparticles takes great interest because of their wide implementation as a drug carrier and bio-markers. Thanks to their low toxicity, good stability and low phonon energy, rare-earth (RE) doped fluorides have advantage over traditional fluorophores, such as gold nanoparticles or quantum dots. In this work $NaYF_4$ nanoparticles co-doped with Yb^{3+} and Er^{3+} were synthesized through hydrothermal method at 200°C (3 h) and were additionally calcined in argon atmosphere for 5 h at 400 °C. Polyethylene glycol (PEG) was used as the surfactant and directing agent which should promote crystallization of the hexagonal $NaYF_4$ phase. Obtained particles were analyzed by X-ray powder diffraction (XRPD), transmission electron microscopy (TEM) and energy dispersive spectroscopy (EDS). Crystallization of the cubic $NaYF_4$:Yb^{3+},Er^{3+} phase (*S.G. Fm-3m*, *a=5.48357*) is detected in the as-prepared particles with a fairly spherical shape and size ranged up to 50 nm, while appearance of the hexagonal phase (*S.G. P63/m, a=5.98033, c=3.50616*) is confirmed in the calcined grains (sized up to 150 nm). Due to appearance of the hexagonal phase after calcination, initial weak yellow-orange emission (CIE: 0.39; 0.56) of the as prepared particles turns into strong green (CIE: 0.39; 0.50) as a result of the Er^{3+} excitation ((λ=978 nm) and consequent electronic transitions from ($^2H_{11/2}$, $^4S_{3/2}$) to $^4I_{15/2}$ level.

P|10

The investigation of heavy metals leaching from coal ash

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The production and the disposal of the coal ash that is generated and processed in the power-plants represent a remarkable hazard in terms of the environmental pollution. Both fly ash that is produced in electrostatic filters of the power plant and the coal ash that is landfilled can be submitted to recycling and reusing procedure in order to diminish the consequences which their disposal might have on air, soil and underground water. The coal ash normally contains certain quantity of heavy metals in the chemical composition. The heavy metals can be regarded as toxic pollutants due to the high risk of their leaching when the ash is in contact with water. Also, there is a certain risk of toxic elements leaching even when coal ash is built-in the construction composites. However, the recycling and reapplication of fly ash in building materials industry is only sustainable economic solution for the ash disposal problem. Fly ash can be used as a component in cement, mortar, concrete and bricks. Utilization potential of the fly ash and landfilled ash, as the main residue from the lignite coal combustion in Serbian power plants, was investigated in this study. Ash from filters from five different power plants and four landfills were applied in several composite samples (mortar, concrete and brick) without any physical or thermal pre-treatment. The leachability of the potentially toxic pollutants from the ash and ash based products was investigated. The leaching behavior and potential environmental impact of the following potentially hazardous elements was tracked: Pb, Cd, Zn, Cu, Ni, Cr, Hg, As, Ba, Sb and Se. A detailed study of physico-chemical characteristics of the ash, with accent on trace elements and the chemical composition investigation is included. The results show that most of the elements are more easily leachable from the ash in comparison with the ash based composites. The leaching of investigated pollutants is within allowed range thus investigated coal ashes can be reused in construction materials production.

Characterization and SPICE Modeling of Ceramic-Core Inductors at High Frequencies

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This paper presents experimental results of admittance measurement of the ceramic core inductors in the range of 1 MHz to 3 GHz and procedures for extraction of their SPICE model parameters. The admittance value of inductors as function of operating frequency must be considered in order to simulate and study circuits where these components are used. Accurate computer models can further help designers to effectively predict and optimize the performance of complex electronic systems.

The measurements are carried out using RF impedance and material analyzer Agilent E4991A. The setup for this experiment are: measurement parameters |Y| (admittance) in logforamt and θy (phase of admittance) in linear format with frequency logarithmic sweep in 201 points. Devices under test were inductors available on the market (from 100nH to 1mH).

The experimental, simulation and analytical curves are very close to each other. The deviation of these characteristics were ranged from 0.1 – 23 %. Above the self-resonance frequency (SRF), the inductor performs like a capacitor. With increase of inductors value, minimum of admittance modulus and SRF decrease. The capacitive region of inductors changes with parasitic capacitance. The parameters for equivalent circuits estimated by analyzer show very good agreement with analytically determined parameters. The best approximation functions were determined for all parameters, with deviation ranged from 23.22 % to 80.6 %.

P|12

The influence of the carbon black on the performance of modified bentonite based electrodes in electrooxidation of phenol

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Bentonite from locality Mečji Do was acid treated, characterized and denoted as MD_A. The obtained material was used to modify glassy carbon electrode (GCE). The GCE was covered either with a suspension of MD_A and Nafion® (perfluorinated resin solution), or with the same suspension mixed with Carbon Black Vulcan XC72, Cabot Corporation (CB). Thus the influence of the presence of CB on the electrochemical performance of the modified bentonite based electrodes was examined. The electrochemical properties of the electrodes were tested by cyclic voltammetry in 0.1 M H_2SO_4 aqueous solution containing 10 mM of phenol, at the scanning rate of 10 mV/s in the potential range from -0,3V to 1,1 V. The anodic oxidation of phenol led to the formation of insulating polymeric film on modified bentonite based electrode. As a consequence, rapid decrease of the current of phenol oxidation was observed. The composite electrode prepared with CB powder exhibited better performance than its counterpart without CB. Better performance was reflected in the stability of the electrodes regarding electrode fouling during the phenol electrooxidation process and better mechanical durability of the modified bentonite based electrodes.

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Electrochemical response of alumina based electrodes

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Alumina powders, pure and doped with nickel, were sintetised by sol gel method and calcinated at 500°C, 900°C and 1100°C in order to obtain materials with different structural and textural properties. The drop of dispersion of investigated sample in 5 wt. % Nafion was applied on the surface of glassy carbon electrode. The electrochemical response of samples was tested by method of cyclic voltammetry. All potentials are reported versus Ag/AgCl (3 M KCl) reference electrode, and platinum rod served as counter electrode. Ferro/ferricyanide (2.5 mM) was used as redox probe in 0.1 M phosphate buffered saline at pH 7.4. The impact of structure and texture of alumina based electrodes on electrochemical response was quantified with the help of numerical simulations. Porosity-related effects such as decreased peak-to-peak separation and increased peak currents were observed. The correlation between electrode pore volume and apparent electrode kinetics was determined. The comparison of electrochemical response of electrodes based on pure alumina and nickel doped alumina provided insight in separate contribution of electrode morphology and electroactive sites.

P|14

Photocatalytic properties of Al_2O_3/ZnO coatings formed by plasma electrolytic oxidation on aluminum substrate

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Mixed Al_2O_3/ZnO coatings obtained by plasma electrolytic oxidation process (PEO) of aluminum in water solution boric acid and borax with addition ZnO nanoparticles. The oxide coatings were characterized by Scanning electron microscopy equipped with energy dispersive x-ray spectroscopy, x-ray diffraction, and Raman spectroscopy. It was found that chemical and phase compositions strongly depend on PEO time. It was shown that photocatalytic activity was improved by longer time of PEO process.

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Structural and optical properties of chemically deposited copper selenide thin films

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Copper selenides are interesting metal chalcogenide semiconductor materials. They exist in many phases and structural forms: different stoichiometries such as CuSe (mineral klockmannite), Cu_2Se, Cu_2Se_x, $CuSe_2$ (mineral marcasite), á - Cu_2Se, Cu_3Se_2 (mineral umagnite), Cu_5Se_4 (mineral athabaskite), Cu_7Se_4 etc. as well with non - stoichiometric form such as $Cu_{2-x}Se$ (mineral berzelianite) and can be constructed into several crystallographic forms (monoclinic, cubic, tetragonal, hexagonal, etc.). Copper selenides in different stoichiometries are semiconductors with p - type conductivity, and have been widely used in optical filters, solar cells, photo detectors, supersonic materials…

The paper describes the structural and optical properties of copper selenide thin films. The films of tree different thicknesses (56.75, 79.74 and 172.70 nm) were grown by thermal evaporation on glass substrate, at room temperature and pressure better than 1 mPa. The surface morphology of thin films was investigated by atomic force microscopy (AFM). Formation of Cu - Se thin films is concluded to proceed unevenly, in the form of islands which later grew into agglomerates. The structural characterization of Cu - Se thin film was investigated using X - ray diffraction pattern. The presence of two - phase - system is observed. The first one is low - pressure modification of $CuSe_2$. The second phase is solid solution of Cu in Se. The Raman spectroscopy was used to identify and quantify the individual phases presented in the Cu - Se films. The results of Raman spectroscopy are in good agreement with XRD results, and the presence of two phases in our system, the trigonal Se and orthorhombic $CuSe_2$, is confirmed once again.

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Annealed nanopowders YAG and YAG: Dy prepared by solution combustion synthesis

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Undoped yttrium aluminum garnet (YAG, $Y_3Al_5O_{12}$) and YAG doped with dysprosium ions (Dy^{3+}) nanopowders were prepared by the solution combustion synthesis (SCS) method. After synthesis, in order to achieve the full crystallinity, the YAG and YAG:Dy materials were annealed in air atmosphere at 1300 °C. Phase identification in the post-annealed powder samples were performed by X-ray diffraction, and morphology was investigated by high resolution scanning electron microscope (SEM). Photoluminescence characterization including emission spectra and lifetime analysis has also been done. Trivalent Dy^{3+} ions exhibit a very interesting luminescence and could be used for generation of white light emission in optical display systems. Several emission bands in Dy^{3+} emission spectrum were observed in the blue (470–500 nm), yellow (560–600 nm) and red (660-685 nm and 750-780 nm) regions, corresponding to $^4F_{9/2} - {}^6H_{15/2}$, $^4F_{9/2} - {}^6H_{13/2}$, $^4F_{9/2} - {}^6H_{11/2}$, $^4F_{9/2} - ({}^6H_{9/2} + {}^6H_{11/2})$ transitions in the 4f levels of Dy^{3+} ions, respectively.

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Magnetic properties of FeCoV alloy prepared by powder injection metal PIM-technology

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In this study were magnetically characterized Fe49Co49V2 alloys toroidal samples produced by PIM technology. The feedstock for powder injection molding was prepared by mixing starting FeCoV powder with a low viscosity organic binder (wax and thermoplastic). Green samples were subjected to solvent debinding and subsequent thermal debinding followed by sintering. Sintering was performed during 3.5 hours on few different temperatures from 1370 ^OC to 1460 ^OC in hydrogen atmosphere. Magnetic properties were investigated as a function of sintering temperature on toroidal core samples by a hysteresis graph (B-H curve at different frequencies up to 10 kHz at high level of magnetic excitation up to 10 kA/m). Magnetic power losses were analysed as frequency dependent by evidence of apparent power, i.e. the magnitude of complex power S and active (real) power P. As the hysteresis losses are proportionally to the frequency (~ f) and eddy-current losses are proportionally to the square of frequency (~ f^2) it was performed separation between these two components of active power. Numerical fitting of this functionality on frequency were performed and analysed.The results obtained were compared with the literature data for new nanocrystalline FeCoV alloys prepared with different advanced technologies.

Influence of Synthesis Parameters on Structure of 1-D TiO_2 nanostructures

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The influence of electrochemical conditions and the heat treatment on the crystal structure and the microstructure evolution of TiO_2 based nanotubes synthesized by the self-ordering anodization process is investigated in this work. The electrochemical anodization was performed at room temperature, for 30 minutes under 15, 20 and 25 V, with stirring. The as-anodized Ti foils were annealed in air at 450, 600, 650 and 700 °C for 30 minutes. The structure and the lattice dynamics of the samples has been studied by using XRD and Raman spectroscopy methods. The microstructure development of the 1-D TiO_2 nanostructures has been analyzed by FESEM.

Synthesis of novel multiferroic Fe_3O_4-nanocellulose-PVDF-$BaTiO_3$ nanocomposites

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It is well known that the properties of polymer/ceramic nanocomposites depend not only on the properties of their individual components but also on morphological and interfacial characteristics arising from the combination of used materials. The use of nanocellulose in synthesis of various nanocomposites, gain great relevance not only due to its renewable nature and biodegradability, but also due to its unique structure and tendency to form intra- and intermolecular bonding. Our research focus on the use of nanocellulose (NC) functionalized with Fe_3O_4 for the production of novel multiferroic Fe_3O_4-NC-PVDF-$BaTiO_3$ nanocomposites. Functionalized nanocellulose was prepared by co-precipitating Fe(II) and Fe(III) ions in aqueous solution containing NC with ammonia. NC\Fe_3O_4 with different content of NC were sonicated in DMF and subsequently added to PVDF/$BaTiO_3$ mixture, resulting in multi-component mixtures with four different concentrations of NC. XRD and Raman analysis were used to study the phase composition of nanocomposites, while their morphologies were examined by SEM and AFM. It has been shown that the addition of nanocellulose had a positive effect on PVDF β-phase formation, which is responsible for its ferroelectric properties. As a result, the formation of composite multi-component hybrid material with multiferroic properties is enabled.

Microstructure development and Raman responses of mechanically activated Fe/$BaTiO_3$

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The structure and lattice dynamics of mechanically activated nanocrystalline Fe/$BaTiO_3$ is investigated in this work. The powder mixture of 60%Fe and 40% $BaTiO_3$ was mechanically activated up to 240 min in 500 cm^3 zirconium oxide beakers together with balls of 10 mm in diameter (the ratio of powder and balls was 1:20). The microstructure development has been studied by scanning electron microscope equipped with energy dispersive x-ray analysis spectrometer. Room temperature Raman spectra of the samples were obtained in the spectral range from 100 to 1650 cm^{-1}, in the backscattering geometry, using 633 nm line of a He-Ne laser. Raman spectroscopy was employed to investigate the laser power dependence of the spectra of the activated samples as wells. Microstructural investigations showed that mechanical activation has led to the creation of new surfaces and the comminution of the initial powder particles. Raman spectroscopy analysis pointed out that activation had a pronounced influence on Fe/$BaTiO_3$ lattice spectra, thus affecting both the stability of the crystal structure and the phase transition phenomena.

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The Electrochemical Energy Thermodynamic Parameters and Microstructure Fractal Nature

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In the electrochemical scientific area, the new battery systems frontiers ideas, are in the research and development focus. Based on our recent research in the field of electronic ceramics, generally ceramics and materials science, enriched by the researched fractal nature, in this paper we contribute in some fundamental electrochemical laws through fractal corrections. We based this on experiments with $BaTiO_3$-ceramics and different additives, from 0.01wt% to 1wt% ($MnCO_3$, Nb_2O_5, $CaZr_2O_3$, Er_2O_3, Yb_2O_3 and Ho_2O_3) consolidated under the pressure up to 150MPa and processed in the temperatures from 1180°C to 1380°C. We performed SEM and EDS analysis. In this investigation, we contributed with electrochemical thermodynamic fundamental parameters (like T) within the adequate equations fractal corrections. Microstructure fractal nature research directly from experiments confirmed new perspectives in direction of electrochemical bulk fractal microelectronics processes.

Synthesis of anatase nanopowders by sol-gel method and photocatalytic degradation of the pure active substance and commercial product of herbicide clomazone

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TiO_2 nanopowders were produced by sol-gel technique using $TiCl_4$ as the starting material. For the preparation of anatase crystalline, this aqueous solution was the mixed with 0.05 M and 0.07 M $(NH_4)_2SO_4$ solution in a temperature-controlled bath. PH values of the solutions were 7, 8 and 9, respectively. Structural, morphological and surface properties of synthesized TiO_2 nanopowders were investigated by XRD, SEM, and BET measurements. The crystallite sizes determined by XRD measurements had range about 12 nm, and this was confirmed by SEM. The photocatalytic degradation of the pure active substance and commercial product (GAMIT 4-EC) of herbicide clomazone (0.05 mM) in aqueous suspensions of synthesized and commercial (Degussa P25) TiO_2 were examined under UV radiation. In all experiments the concentration of the catalyst was 0.50 mg mL^{-1}. BET measurements revealed that all synthesized catalyst had mesoporous structure, except the sample synthesized with 0.07 M $(NH_4)_2SO_4$ and at pH of solution 9 that had small amount of micropores. This sample had the best photocatalytic properties, even better than commercial Degussa P25, and the reason of that is rather the biggest porosity than the combination of micro- and mesoporosity.

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Correlation between crystal structure and thermal stability of fire protection coating

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Fire protection coatings on steel constructions for outdoor conditions on the basis of organic solutions have been analyzed. The first layer of coating is corrosion protection, alkyd paint „PROTHERM STEEL PRIMEPOX" manufactorer „ITALVIS PROTECT" Italy. The second layer of coating is an expanding coat for outdoor conditions „PROTHERM STEEL (EXT)" solvent-bazed, „AMONNFIRE" Italy. The third layer is final colors for metal „AMOTHERM STEEL TOP PU SB" „AMONNFIRE" Italy. XRD, DTA/TG and FTIR methods were used for sample characterization. It was found that primary and outer layer had very good adhesion. The second layer, for fire protection posseses 2.5 mass % humidity, which resulted in decrease of adhesion. XRD and FTIR analysis showed that those materials are adecvate materials for fire protection up to 1000 °C. Principles of fire protection are based on chemical reaction that are taking place in the temperature range 400-700 °C.

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Characterization and current–voltage characteristics of solar cells based on the composite of synthesized Sb_2S_3 powder with small band gap and natural dye

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Recently, we have reported the synthesis and optical and electronic properties of Sb_2S_3 nanowires with small band gap. In order to prove that the synthesized nanowires can be considered as a candidate material for solar cells and in order to obtain *I-V* characteristics, two very simple cells based on synthesized Sb_2S_3 nanowires/natural dye composite were fabricated. Exponential growth of the *I-V* curves after illumination revealed that the cells could work as electricity generators. A better current response was observed for the cell made of synthesized powder with smaller band gap. The efficiency of the cells is quite low, but this was an attempt to create a solar cell in order to better understand the properties of the synthesized Sb_2S_3 semiconductor and the processes that occur in the cell.

Dependence of the kinetic energy of association reactions for alkali metal ions with DXE

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In this work we select most probable reactions of alkali metal ions (Li^+, Na^+, K^+) with dimethoxyethane (DXE) molecule. Appropriate gas phase enthalpies of formation for the products were used to calculate scattering cross section as a function of kinetic energy with Denpoh-Nanbu theory. Calculated cross sections were compared with existing experimental results obtained by guided ion beam tandem mass spectrometry. Three body association reaction of ions with DXE for three different pressures is studied and compared to experimental results. Calculated cross sections can be used to obtain transport parameters for alkali metal ions in DXE gas.

Ceramics in Architecture as an Element of Sustainable Development

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One of the most challenging issues of 21st century is to provide better living conditions for entire population of the Earth, with simultaneous decrease of human activities (anthropogenic impacts) on natural ecosystems and global environment. The best solution for achievement of this goal is a universal concept of Environmental Sustainability and the correlated concept of Sustainable Development).

As for sustainable architecture, we can meet the requirments of sustainability of structures by implementing sustainable materials in construction of such structures. The more sustainable the materials used for construction are, the more sustainable is the building and its performance with renewable energy sources. The paper considered ceramics as a sustainable material, especially from the aspect of ceramic façade elements. i.e. cladding. Ceramic façade cladding provides people with the improved perception of urban environment. Our lives in this way obtain a new sensual and visual qualities, while satisfying the principles of sustainable development.

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The effect of HAP-alginate composite on the differentiation of bone marrow cells

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Bone tissue reconstruction and reparation is big challenge in regenerative medicine. Biomaterials based on hidroxyapatite are widely used in reparation of bone defects. Bone marrow cells have great potential of differentiation in different cells of mesenchyme tissue. The aim of this study was to investigate interaction between bone marrow cells growing in medium for mesenchymal stem cell and osteogenic medium with HAP-alginate composite material. Bone marrow cells (BMC) of Balb/c mice were seeded in tissue culture plates with HAP-alginate composite. Cultures were grown for 2 week and were then evaluated by light and scanning electron microscopy. The evaluation of osteogenic properties was performed through cytochemical staining and karyometric analysis. Results showed that the HAP-alginate is good microenvironment for differentiation of BMC into osteoblast-like cells.

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The New Materials and Technologies Space Research Review and Frontiers

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European Space Agency, German Space Agency, French Space Agency, USA-NASA and Japan actual programs and research projects. Perspectives of new technology and research in the area of new materials and technologies and materials microstructure. ESA-ELIPS, AO-2009 Physical Sciences on all Mission Platforms and NASA URC (User Requirements Collection) PHASE I and II (Center for Aerospace Device Research and Education (CADRE), North Carolina Central University). Space for climate-meteorology, telecommunications, commercial, civil, military-security and other applications. A variety of industries - information technology, aerospace, automotive, basic and new materials manufacturing - need technological innovations, which attain high-value-added and high-quality products not only for global competition, but also because of the perspective of environmental consciousness and regulations. Special aspect on fractal sciences structure applications.

The Influence of Synthesis Parameters and Heat Effect on Magnetic Properties of Powder System FexOy - BaTiO3

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Powder mixture of 60 mass % of iron (Fe) and 40 mass % of barium titanate ($BaTiO_3$) has been activated in planetary mill for 100, 120, 150, 180, 210 and 240 min in the air. During the activation the iron powder transits into iron oxides FeO, Fe_2O_3 and Fe_3O_4. Depending on the activation time the percentage of iron oxides varies. Simultaneously, with the content change of the activated system, magnetic properties change as well. The thermomagnetic measurements in the temperature interval from 20^0C up to 620^0C have shown that the powder activated for 120 minutes exhibits maximum magnetization prior to annealing. After multiple annealings of the same sample it has been shown that the maximum magnetization of the cooled sample is obtained upon annealing at 560^0C during 10 min for all activation times of as-cast powder sample. The sample obtained from pressed powder mixture activated for 120 min has the maximum magnetization, upon isothermal sintering of samples at 1200^0C during 2h, being M = 2,9 Am^2/kg. With additional annealing of the same sample up to Curie temperature (T_C = 430^0C) and subsequent cooling of the sample in the magnetic field of H = 20 kA/m, the sample is permanently magnetized. The magnetization of sample cooled in the magnetic field with intensity of 20 kA/m being M = 10,15 Am^2/kg.

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The Influence of Mechanochemical Activation and Heat Effect on Magnetic and Dielectric Properties of Multiferroic Fe_xO_y - $BaTiO_3$

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The mechanochemical activation of the initial powder mixture of 30 mass % of iron (Fe) and 70 mass % of barium titanate ($BaTiO_3$) has been conducted for 30, 40, 60, 90, 120, 150, 180, 210, 240, 270, 300 and 360 min in the air. The iron oxides FeO, Fe_2O_3 and Fe_3O_4 have been formed in the powder during the activation. Depending on the activation time the percentage of iron oxides varies in the powder. Simultaneously, with the content change of the activated system, magnetic and dielectric properties of the pressed powder change as well. It has been shown that the sample obtained from pressed powder mixture activated for 120 min has the maximum magnetization prior to annealing, being M_0 = 6,31 Am^2/kg in the applied magnetic field of H = 20 kA/m. The thermomagnetic measurements in the temperature interval from 20^0C up to 620^0C have shown that the maximum magnetization of all samples at room temperature is obtained upon annealing at 560^0C during 10 min. It has been determined that the sample obtained from pressed powder mixture activated for 120 min has the maximum magnetization even after annealing. All pressed samples sintered at 1200^0C for 2h show multiferroic properties. The ferroelectric transition in temperature range from 80^0C up to 120^0C has been observed by thermomagnetic and thermoelectric measurements of the samples sintered at 1200^0C for 2h.

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Optical response of a poly(ethylene terephthalate) membrane at various temperatures

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In this work, optical response of the poly(ethylene terephthalate) (PET) membrane have been studied in the wide temperature interval. Polymeric etch track membranes are thin polymer films with discrete pores formed through a combination of heavy ion bombardment and chemical etching. PET track membranes can be used as a matrix for the semiconductor structure in the development of optoelectronic or microfluid devices. Owing to the significant technical application of PET track membranes, it is very important to know optical properties. The transmission spectra were recorded in ultraviolet-visible (UV-Vis) region from 200 nm to 400 nm at various temperatures between 80K and 350K. The values of direct and indirect band gaps were estimated at various temperatures. It was established that the values of the direct gap slightly decreased with increasing temperatures. An absorption band is observed in the measured wavelength interval at the temperatures lower than room temperature.

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Changes in physical and chemical suspensions properties made up of bentonite clay, polyvinylpyrrolidone, soy isolate and Carbopol

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This work deals with the influence of a range of different polymers since addition of polymers can profoundly influence the properties of bentonite suspensions. Whereas polyvinyl pyrolidone and soy isolate only slightly influenced the pH and the electrical conductivity of bentonite polymers in suspension, Carbopol solution caused decreases in both pH and electrical conductivity. As expected, strong electrolytes like sodium chloride caused big changes in the electrical conductivity of the suspensions. When the temperature of the bentonite suspensions was increased, the pH was almost unchanged, but the electrical conductivity increased. Bentonite treated with polymer suspensions can be used in purifying polluted water; for example, our results suggest that high pH caused by phosphorous salts can be addressed using bentonite modified with Carbopol.

P|33

Investigations of the changes in the bentonite structure caused by H_2SO_4 treatments

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A changes in the bentonite structure were monitored after samples preparation. The bentonite samples were treated with 20 mL and 50 mL H_2SO_4 (concentrations of 10, 40 i 70 %) and then mixed in two different ways-by ultrasonic mixing and hand-mixing.

Samples treated with a higher volume of sulphuric acid show higher mass after drying. Difference in m is higher for 1:5 ratios, which means that the volume of used acid is an important factor for acid activation of bentonite clay. In relation to 1:2 ratios, m is higher than initial mass. In the case of samples treated with 10 % H_2SO_4 for 1:2 ratio, mass is smaller than the initial mass of the sample. Samples treated with 70 % H_2SO_4 show higher mass than samples treated with 10 % H_2SO_4, which show the lowest mass of the samples after drying.

Using 10 % H_2SO_4, exchanged cations between 2:1 layers firstly went out and they were replaced with H^+ ions. Because only a small quantity of Mg^{2+}, Fe^{3+} and Al^{3+} are leaving 2:1 layers, CEC is small. With 40 % H_2SO_4, cations Mg^{2+}, Fe^{3+} and Al^{3+} easily have been dissolved from 2:1 layers, so the decrease in CEC is large. With 70 % H_2SO_4, decrease in CEC is small because of the decreased quantity of Mg^{2+}, $Fe^{3+}$and Al^{3+} in 2:1 layers and hard dissolving of Al^{3+} (maximum can be 15 %) in tetrahedron's layers and also in (2:1) layers.

Acid activation with H_2SO_4 of investigated bentonite caused the increase in specific volume of micropore-mesopore. It was shown that activation by acid obtained at a constant temperature and constant period of time provides the possibility to obtain samples of bentonite of searched porosity only by changing the concentration of H_2SO_4. By thermal activation of bentonite clay in the temperature range 100-1100 °C, samples of desired porosity were acquired.

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Jewelery as a specific form of spiritual and material culture

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The main classification by type of jewelry making can be divided into handicrafts jewelery and jewelry as a product of domestic (household) production. With the arrival of Turks in the sixteenth century, there was a sudden development of (kujundzian) trade. It have been practiced by masters silversmiths, goldsmiths and manufacturers art of filigree objects made of silver or other precious metals, by forging, filigree, granulation, casting crafted decorative items - various types of jewelry to wear directly on the body or clothing. Jewelry has always been associated with the kind of "work of authorship." As far as individual artistic destiny goes, along with numerous others, there is a cumulative model that we could simply define with descriptor "when the time is up" or it happens when it is certain to happen. This principle is stated numerous times; both analytically, we can completely break it down, and always consider and verify it as correct. So, at the beginning – it is necessary beloved moment, and according to the maxim "The ideal is to be repeated," it is understood that it is necessary and what follows. **Maksim Repetitio mater Studiorum est** keeps principles of gradual addition and precipitation information, knowledge and skills, which later needs to escalate into a new quality. Looking at the development of jewelry for a longer period of time, from prehistory to modern times, it can be concluded that the jewelry have been changing its physical appearance, technology development and morphology. One of the more interesting typological classification of jewelry was done by Bratislava V. Krstić, as the classification according to the places of use, in the following types: 1.head piece jewelery; 2.neck jewelery; 3. Chest jewelery; 4.back jewelery; 5.waist jewelery;

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Effect of Frequency on Electrical Properties of Sintered $MgTiO_3$

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Magnesium titanate based dielectric materials are used for producing type-I capacitors. A common way of obtaining this material is a solid-state reaction. The process of sintering can be enhanced if mechanical activation preceedes. In this work starting powders of magnesium carbonate ($MgCO_3$) and titanium dioxide (TiO_2) with a rutile crystal modification were weighed to attain a 1:1 molar $MgCO_3$:TiO_2. Mechanical activation of the starting mixture was performed by high energy ball milling using ZrO balls and vessels with ball to powder mass ratio 40:1. The observed grinding times were 15, 30, 60 and 120 minutes. The isothermal sintering of compacted powders was conducted at 1100°C during 30, 60 and 180 minutes. For specimens synthesized in such a manner, microwave dielectric properties were measured, quality factor Q and the dielectric constant (ε_r) in function of frequency. The measurements of electrical resistivity, capacitance and loss tangent of samples were measured in the frequency range from 500 Hz to 5 MHz frequencies with a HIOKI 3532-50 LCR HiTESTER device at a constant voltage mode (amplitude 0.5 V of sinusoidal signal applied to the specimens).

Characterization of thermal treated Mn exchnage zeolite LTA and FAU frameworks topology

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The syntheses of earth-alkaline aluminosilicate phases with thermally induced transformations of LTA- or FAU framework zeolites (ZTIT methods) in the system of $MAl_2Si_2O_8$ (M= Ca^{2+}, Sr^{2+}, Ba^{2+} or Pb^{2+}) are presented in literature. The literature data for thermally induced transformations of Mn exchanged zeolites so far not published. Thermally induced phase transformation of Mn-exchange LTA and FAU zeolites are followed in the range from room temperature to 1300 ºC. Both frameworks collapse into amorphous intermediate products after heating between 600 and 650 °C. Prolonged heating of the intermediate product over 1100 °C results directly in formation of a disorder Mn anorthite$_{LTA}$ [**a**= 8.1095 (4) Å, **b** =12.824 (4) Å, **c** =7.0674 (4) Å, **β** =115.89 °(3)] and Mn anorthite$_{FAU}$ [**a**= 8.0498 (4) Å, **b** =12.758 (4) Å, **c** =7.0356 (4) Å, **β** =116.13° (3)] phase. The phase conversions in the temperature range investigated were followed by thermal (DTA, TGA, and DSC), XRPD, and FTIR analyses.

The use of zeolite ceramic materials in the process of storing the nuclear waste

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Storage of nuclear waste is a major problem today, the materials generated as waste material from nuclear power plants. For now utilized nuclear fuel (radioactive waste that is left over after its processing) is temporarily stored in special warehouses in order to take advantage of the initial period of rapid decline of its radioactivity and thus further simplify operation with him. In this paper are presents the results of preparation of materials based on natural mineral raw materials, which can be used in the process of storage and permanent disposal of nuclear waste.

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Electrolytic Oxidation of Al Alloy

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This paper considers a method for improving wear resistance of Al alloy, such as AA 6063 by formation an oxide layer. Plasma electrolytic oxidation (PEO) is based on conventional anodic oxidation of light metals and alloys in aqueous electrolyte solutions, but operated above the breakdown voltage, which results in formation of plasma micro-discharge events. This allows the formation of coatings composed of not only predominant substrate oxides but of more complex oxides containing the elements present in the electrolyte. The aim of this paper was to assess the influence of current, voltage and time on the formation of PEO layer on the alloy and its influence to microhardness properties. The experimental research was conducted according to the principals of design of experiments.

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Design of two types of photocatalyticly active coatings for application in the field of cultural heritage

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Protective self - cleaning coatings could reduce or eliminate degradation processes of building materials, especially in the field of cultural heritage. They enable the removal of the pollutants from the surface of materials. The goal of this investigation was the design and characterization of two types of the nanocomposite photocatalytic coatings with different catalyst support (LDH / kaolinite rich clay) and the TiO_2 as the photocatalyst. The Zn-Al LDH, as the first catalyst support, was synthesized by low super saturation co-precipitation method. The interaction between the Zn-Al LDH catalytic support and the active TiO_2 component (in the content of 3 and 10 wt. %) was accomplished by using vacuum evaporation priory to mechanical activation and only the mechanical activation. On the second case, a kaolinite rich clay was used as the catalyst support for the TiO_2 particles incorporated (in the content of 3 and 10 wt. %) by the mechanical activation. Surface properties (roughness, hydrophilicity and microhardness) and photocatalytic activity (UV/VIS spectrophotometry of Rhodamine B degradation under UV/VIS light) were analyzed in order to define the optimal formulation of the designed self-cleaning coatings in order to be used in the field of cultural heritage.

Measurements of electrical resistance in different types of load and their combination on the Shape Memory Alloy Nickel-Titanium orthodontic wire

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The aim of this study was to compare and evaluate the stress induced martensitic phase under different loading conditions in orthodontic wire from the Shape Memory Alloy Nickel-Titanium. For this purpose we investigated the phase transformation from austenite to martensitic due to the different loading conditions by measuring the electrical resistance which could show the type of deformation which occurs at the beginning of phase transformations. In this framework we developed two special devices for measurements of electrical resistance in different types of load and their combination on the orthodontic wire. These results were compared with the analytically calculated stresses in the orthodontic wire. It was shown that they caused complex or three-axial stress state phase transformation rather than other more simple loads such as uniaxial and two-axial loading. Finally, the article presents the deformation which occurs at the change of phase that is nearly connected to the useful superelasticity effect of the Shape Memory Alloy NiTi.

Assessment of butyltin and total tin contamination of sediments from the eastern Adriatic Coast (Croatia)

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Butyltins (BuT) have been introduced into the marine environment by the use of tributyltin (TBT) as biocide in antifouling paints since 1960s. After it was established that TBT has various toxic effects on non target organisms even at very low levels, the use of TBT-based antifouling paints has been banned in many countries worldwide, including the whole Europe, while in Croatia they are banned since 2006. In this paper we present the first data on BuT concentrations in the coastal sediments from eastern Adriatic. In order to elucidate factor influencing the level of BuT pollution, locations with different intensity of maritime activities (marinas, ports, reference sites) were selected for sampling of surface sediments. BuTs in sediments ranged from 5 to 1362 ng(Sn)g^{-1}(d.w.), while contamination levels in marinas and ports were significantly higher than at reference sites. The highest concentrations were found in sediments taken below the service hoists in marinas, where BuTs reached up to 66344 ng(Sn) g^{-1}(d.w.). In addition to BuTs, the concentrations of total tin in surface sediments were also determined in order to test the hypothesis that elevated levels of inorganic tin in marine environment originate primarily from TBT that is used in antifouling paints.

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COREDO: Android first time in creating of conservation and restoration documentation

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This study describes the development process and the practical application of COREDO, android app used for the production of conservation and restoration documentation. The application is based on the Android platform and optimized for use on tablets with tactile capacitive screens. The purpose is to promote the process of collecting and processing documentation on site through the use of all the benefits of advanced technology. Describes the creative process of application development, its capabilities, and a vision of further development through the implementation of tools for reading the physical world hyperlinks and integration into a new network of virtual register of cultural monuments.

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Modeling Piezoceramic Actuators for Active Structural Health Monitoring of Civil Engineering Structures

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Piezoceramic actuators used inverse piezoelectric effect (the internal generation of a mechanical strain resulting from an applied electrical field) to perform wave propagation through the monitored structures. They can be attached to the structure, and in this case are used for steel or reinforced concrete structures, usually for surface structual elements. Or can be embedded into the structure, and in this case called piezoelectric smart aggregates, which are utilized for reinforced concrete structures. The aim of the work is to present a very efficient, quite reliable and easy-to-use models of piezoceramic actuators based on the finite element method. The models of the bonded and embedded piezoceramic patchs as well as wave propagation through the thin steel plates and reinforced concrete beam elements are presented in this paper. Modelling of wave propagation was done by explicit finite element method while for the purpose of modeling of piezo actuators the standard finite element method has been used.

Integral Characteristics of the Maxwell-Boltzmann distribution

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One of the validation of any statistical theory of gases, and therefore the definition of basic quantity of thermodynamics – entropy and temperature, based on establishment of the Maxwell–Boltzmann distribution speed of the gas molecules, which is considered to be one of the well-established laws of physics.

In this paper we will consider integral characteristics of maxwel-bolcman distribution which, as we all know has wide usage, both in the science of the materials, as well as in Telecommunications for the analysis of noise and fading of the optical signals. Looking at the integral characteristics of the distribution, which consist of the maximum of functions of probability depending on temperature for constant speed of gas particals are similar to the dependancy of the speed of the gas particals for constant temperature. Also, the opposite is true, maximum of the functions present the spots of the first family.

Given results make it possible faster and simpler use of this distribution when we use it in metrology where she is basic in introducing of Bolzman constant as one of fundamental constants with which we define some of the units of SI sistem. Also, as we all know, this constant in the science of sintering is used for the representation of change of size of particals of ceramic systems depending on temperature of sintering.

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Contribution to the Study of Integral Characteristic of Distibution Function widely used in Telecommunications

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In this paper we studied integral characteristic with unique view, existing methods of regression analysis, analysis of measurement error in metrology, and distribution functions from telecommunications, which are used for signal analysis in the presence of fading and interference due to noise.

Clearly, with the latest aspirations that this analysis becomes an integral part of the general standards for analysing experimental results, our results are also of importance for the Science of Sintering; the basis of investigation of this science is corresponding experiments performed under specific conditions.

In this regard, starting from the method of average, in this paper we analyzed the statistical procedures, least squares method, starting from Legendere principle and Gaussian normal distribution, in line with our most recent results obtained through analysis of integral characteristics of Rayleigh, Rice, Nakagami-m and Weibull distribution, which are widely used in telecommunications.

Unique considerations of these distributions, we believe this will enable further contributions to the analysis of experimental measurement error, especially considering the performance of experiments remotely in specialized laboratories, with the use of computer and telecommunication networks, or globally accessible Internet and appropriate applications of mobile telephony.

The influence of the nanoparticles of calcium phosphate/ poly-(dl-lactide-co-glycolide) on adherence of the hela cells

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Nanomaterial calcium phosphate/poly-(DL-lactide-co-glycolide) (NPs-CP/PLGA) is a biomaterial composed of calcium phosphate particles coated with biodegadable poly-(DL-lactide-co-glycolide). HeLa cells are one of the most examined cell cultures in *in vitro* assays of nanomaterials because of their ability to divide infinitely. The aim of our study was to examine the influence of different concentrations of NPs-CP/PLGA suspensions on the adherence of HeLa cells in cell culture. The cells were cultivated in 0.5 mg/ml, 5 mg/ml and 50 mg/ml suspensions of the examined nanomaterial for 3 and 6 days in cell culture plates. After the incubation, adherent fibroblast-like cells were counted under the inverted light microscope. After 3 days of incubation in various nanomaterial suspensions, the highest number of adherent cells was in 50 mg/ml suspension of nanomaterial, which had the statistical significance. After 6 days of incubation in NPs-CP/PLGA suspensions, the highest adherence of HeLa cells was in 50 mg/ml NPs-CP/PLGA suspension which was statistically significant and with a declining trend. According to this experiment, it can be concluded that the adherence of HeLa cells depends on the concentration of NPs-CP/PLGA in suspension and increases in higher concentrations of the material, regardless of the length of incubation.

This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Grant No. III 41017)

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AC conductivity of iPP/WAX blend after treatment in a solution of lithium salt at a high positive electrical potential

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Foils made of iPP/paraffin wax (80/20 and 95/5 weight ratio) of 0,5mm thickness were treated for 3 days in a saturated solution of LiCl at room temperature and the positive potential of 4 kV. Uninterrupted measurements of surface and volume AC conductivity of the treated films were carried out for a period of 24 hours from the end of treatment. Some of treated samples show an increase in the specific conductivity up to three orders of magnitude as compared to non-treated, also, it was observed a decrease in both components of the AC conductivity, conductance and susceptance, during the measurement of 24 hours.

Bone tissue engineering on experimental models

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Bone tissue engineering (BTE) is a promising alternative for the shortcomings of applying bone grafts for bone tissue repair and regeneration. The use of various experimental models can provide good explanations of bone repair and regeneration mechanisms, as well as the application guidelines. The aim of this paper is to give an overview of the part of our research in BTE field. In our studies we used orthopic and ectopic osteogenic models in mice, rats and rabbits, as well as cell cultures *in vitro*. We used grafts composed of carriers/scaffolds loaded with cells such as macrophages, stem cells derived from bone marrow and adipose tissue, and regulatory factors. As a carrier for cells and regulatory factors we mainly used bone mineral matrix. Blood or blood components such as platelet rich plasma are mainly used as a source of regulatory factors. Assessment of osteogenic potential was performed using numerous methods such as histological staining, morphometry, immunohistochemistry, radiographic and analytical methods, specific gene expression analysis, various *in vitro* methods and others. The changes in implanted biomaterials were analyzed using methods such as SEM, EDS, FTIR and others. Appropriate combination of models, methods and approaches for testing the osteogenic potential of certain biomimetic materials, cells and factors is important for obtaining the useful information for clinical applications.

This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Grant No. III 41017).

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The New Materials and Technologies Space Research Review and Frontiers

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European Space Agency, German Space Agency, French Space Agency, USA-NASA and Japan actual programs and research projects. Perspectives of new technology and research in the area of new materials and technologies and materials microstructure. ESA-ELIPS, AO-2009 Physical Sciences on all Mission Platforms and NASA URC (User Requirements Collection) PHASE I and II (Center for Aerospace Device Research and Education (CADRE), North Carolina Central University). Space for climate-meteorology, telecommunications, commercial, civil, military-security and other applications. A variety of industries - information technology, aerospace, automotive, basic and new materials manufacturing - need technological innovations, which attain high-value-added and high-quality products not only for global competition, but also because of the perspective of environmental consciousness and regulations. Special aspect on fractal sciences structure applications.

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Mini solar power plants as a potential for development of the south of Serbia

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The experience of three years of operation of the first solar power plant in the south of Serbia indicates that there is a considerable potential for development of underdeveloped areas in the south Serbia. The most underdeveloped part of the Republic has favorable position for construction of solar power plants, because the insolation is better than in the other parts of the country. The company that constructed the 30 kW power plant possesses the data which indicate that the area is favorable for further investment in such projects. With the help of the state and by development of spatial and techno-economic model, the activities which would aid in saving the rural areas could be initiated. In this sense, this paper presents the experience and provides guidelines for future development.

Proceedure for making laboratory glasswere from self-varnishing ceramic

Ruža Nikolić

Ceramic artist

Laboratory glassware made from self-varnishing cordierite has better thermal schock ressistance than porcelain ones. Patented procedure (YU 46 121) is economically justified since that eliminates one of the making steep, biscuite baking, through enabling self varnishing during processing. Author of patent will present variety of products during conference.

Model za spomen obeležje
Akademiku Vladeti Jerotiću

Ananda i Nika iz Sankt Peterburga
sa krstom Sv. Andreja

Steve Jobs No 3

Model za spomen obeležje
Caru Dušanu Silnom

Dragan Radenović
sculptor

Zvonko Petković
SOC Academy of Art and Conservation, Belgrade, Serbia

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REM


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VODA JE POČETAK


INZA
protecting.people


imlek