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

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

PROGRAM AND THE BOOK OF ABSTRACTS

Serbian Academy of Sciences and Arts, Knez Mihailova 35
Sep 30 th - Oct 1st, 2013, Belgrade, Serbia

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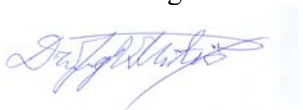
Conference program

Dear Colleagues, dear friends, we have great pleasure to welcome you to the Advanced Ceramic and Application Conference II organized by the Serbian Ceramic Society in cooperation with the Institute of Chemistry Technology and Metallurgy**,** Institute for Technology of Nuclear and Other Raw Mineral Materials, Institute for Testing of Materials and Archeological Institute of SASA. This conference brings together researchers from academia and industry to present the latest advances in synthesis and characterization in the field on new ceramic structures. The chosen Conference topics opening the new frontiers in designing of advanced ceramic materials since they cover fundamental theoretical research, modeling and simulation, controlled nanostructured materials synthesis and optimization of the consolidation process, which all together should provide practical realization of the new ideas towards device miniaturization, energy-materials-information integration and preservation of cultural heritage.



Prof. Dr Vojislav Mitić
President of the Serbian Ceramic Society
World Academy Ceramics Member

General Conference topics included:

- Basic Ceramics Science
- Nano-, Bio- and Opto-ceramic Nanotechnologies
- Multifunctional Materials
- Magnetic and Amorphous Materials
- Construction and Eco-ceramic
- Composites, Catalysis, Electro-catalysis
- Artistic Ceramic and Design, Archeological Heritage
- Young Researchers
- **Sintering processes**
  - kinetics
  - thermodinamics
  - microstructure
  - modeling

Acknowledgement 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, Institute of Technical Sciences of SASA, Institute for Balkan Studies of SASA and Academy of SOC for Fine Arts and Conservation. We are also grateful to the PTT Communication, EPS, Dunav Insurance, Nissal Co, Akademska štampa and others who support the conference.

Programme

The Serbian Ceramic Society Conference
Advanced Ceramics and Application II:
New Frontiers in Multifunctional Material Science and Processing

Monday, Sep 30th, 2013
Hall, 2st floor

14.00 – 15.00 **Registration**

Great Hall, 2nd floor

15.00 – 15.30 **Opening Ceremony of The Serbian Ceramic Society Conference »Advanced Ceramics and Application II«**
Prof. Dr. Vojislav Mitić, President of the Serbian Ceramic Society
Prof. Dr. Olivera Milošević, President of the Serbian Ceramic Society Assembly

15.30 – 16.40 **Plenary Session I**

15.30 – 16.05 **European Roadmap for Nanotechnology "Nanotechnology: Directions for Economical and for Societal needs- 2025"**
Marcel H. Van de Voorde
Delft University of Technology, Delft, The Netherlands

16.05 – 16.40 **Feature and Future of Hydrothermal/Solvothermal Reactions for Synthesis/Preparation of Nano-Ceramics with Desired Shapes, Sizes and Structures**
Masahiro Yoshimura
Promotion Center for Global Materials Research, Dept. Mater.Sci. & Eng., National.Cheng Kung University.,Tainan,Taiwan; Professor Emeritus of Tokyo Institute of Technology, Japan

16.40 – 17.30 **Cocktail & Coffee**

17.30 – 20.00 **Plenary Session II**
Chairpersons: Prof. Dr. Vladimir Pavlović, Prof. Dr Ljiljana Živković

17.30-18.00 **SiC and SiOC composites, materials and process routes**
Rainer Gadow
Institute for Manufacturing Technologies of Ceramic Components and Composites, GSaME Graduate School of Excellence in advanced Manufacturing Engineering, University of Stuttgart, Germany

18.00-18.30 Computer Study of Static and Dynamic Rearrangement in 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

18.30-19.00 Electronic simulation for the new era
Vančo Litovski[1], Miona Andrejević[2]
[1] NiCAT cluster, Niš, Serbia,
[2]University of Niš, Faculty of Electronic Engineering, Serbia

19.00-19.30 Evaluation protection and valorisation of Cultural Heritage in particular the World Cultural heritage (UNESCO) in Euro-Mediteranean Countries, in case of floods/marine submersion: contribution of Materials sciences
Jean Pierre Massué[1] and Max Schvoerer[2]
[1]Member of the Senat of the European Academy of Sciences and Arts, Past President of the European Materials Research Society,
[2]Member of the European Academy of Science and Arts Honorary Prof at the Bordeaux University

19.30-20.00 Powder materials as fractal objects
Ljubiša M. Kocić
University of Niš, Niš, Serbia

Tuesday, Oct 1st, 2013
Hall, 1st floor

08.00 – 08.30 Registration and Poster installation

Hall 2, 1st floor

08.30-10.15 Plenary Session III
Chairpersons: Dr. Dušan Jovanović, Dr. Zorica Lazarević

08.30-09.05 Plasma devices and preparing of nonconductive materials
S. Rakovsky[1], D. Garlanov[1], Filkova[1] D. Jovanovic[2]
[1]Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria
[2] University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Belgrade, Serbia

09.05-09.40 Chalcopyrite magnetic semiconductors: from nanocomposite to homogeneous material
L. Kilanski,[1)*] R. Szymczak,[1)] E. Dynowska,[1)] M. Górska,[1)] A. Podgórni,[1)] W. Dobrowolski,[1)] M. Romčević,[2)] N. Romčević,[2)] I.V. Fedorchenko,[3)] and S. F. Marenkin[3)]
[1)] Institute of Physics, Polish Academy of Sciences, Al. Lotnikow 32/46, 02-668 Warsaw, Poland
[2)] Institute of Physics, University of Belgrade, 11080 Belgrade, Republic of Serbia

[3)] Kurnakov Institute of General and Inorganic Chemistry RAS, 119991 Moscow, Russia

09.40-10.15 **Ceramics and its dimensions– heritage, creativity, visions for ceramics in a multicultural Europe**
W. Siemen
Deutsches Porzellanmuseum, Hohenberg, Germany

10.15 – 10.30 Coffee break

10.30-13.10 Invited Session

Chairpersons: Dr. Aleksandra Nikolić, Dr. Zagorka Radojević

10.30-10.55 **Sintering and measuring conditions effects on the dielectric properties of relaxor TTB ceramic materials**
Andrei Rotaru[1,2,3]
[1]University of St Andrews, School of Chemistry, North Haugh, KY169ST, St Andrews, Fife, United Kingdom
[2]INFLPR Bucharest – National Institute for Laser, Plasma and Radiation Physics, Laser Department, Bvd. Atomistilor, Nr. 409, PO Box MG-16, RO-077125 Măgurele, Romania
[3]Central and Eastern European Committee for Thermal Analysis and Calorimetry

10.55-11.20 **New approach and comparative studies of structura; and electrical properties of nano spinel ferrites prepared by soft mechanochemical synthesis**
Z. Ž. Lazarević[1], D. Sekulić[2], Č. Jovalekić[3],
M. Romčević[1], A. Milutinović[1], N. Ž. Romčević[1]
[1]Institute of Physics, University of Belgrade, Pregrevica 118, Zemun, Belgrade, Serbia
[2]Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia
[3]The Institute for Multidisciplinary Research, University of Belgrade, Belgrade, Serbia

11.20-11.45 **The integral features of electronic gass for viewpoint of quantum mechanic**
Stefanović Č. Dimitrije[1], Blagojević R. Dejan[2], Ivan D.Stefanovic[1]
[1]The Faculty of electronic engineering Nis
[2]The technical college of applied scinece Nis

11.45-12.10 **Co-Al layered double hydroxides as precursors of $CoAl_2O_4$ spinel**
Margarita Gabrovska[1], Dorel Crişan[2], Nicolae Stanica[2], Dimitrinka Nikolova[1], 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, 202 Splaiul Independentei Str., 060021 Bucharest-12, Romania

12.10-12.35 **Microelectronics miniaturization and fractal electronic frontiers**
V.V.Mitic[1,2], V.Paunovic[1], Lj.Kocic[1], S.Jankovic[3], V.Pavlovic[2,4]

[1]University of Nis, Faculty of Electronic Engineering Aleksandra Medvedeva 14, Nis, Serbia
[2]Institute of Technical Sciences of SASA, Belgrade, Serbia
[3] Mathematical institute, SASA, Belgrade, Serbia
[4]University of Belgrade, Faculty of Agriculture, 11000 Belgrade, Serbia

12.35-13.10 Niševac (Timacum Maius ?): The Role of Ceramic Tubuli in the Hypocaust System
Vladimir P. Petrović[1], Vojislav Filipović[2]
[1]Institute of Balkan Studies of SASA, Belgrade, Serbia
[2]Archaeological Institute, Belgrade, Serbia

13.10 – 14.00 Lunch — Club SASA, Mezzanine

Hall 2, 1st floor

14.00-15.30 1st Session – Basic ceramic science -Multifunctional, Magnetic, Amorphous & Construction materials – Archaeological Heritage -Sintering processes

Chairpersons: Dr. Nina Obradović, Dr. Vesna Paunović

14.00-14.15 Performance of manganese zinc ferrite core manyfactured by PIM/Sintering route
N. Mitrović, S. Djukić
Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia

14.15-14.30 Density of the $ZnTiO_3$ nanopowder as a loose powder and as a compact obtained by different methods
N.Labus[1], J.Krstić[2], A.Peleš[1], J.Živojinović[1], M.V.Nikolić[3]
[1] Institute of Technical Sciences of SASA, Knez Mihajlova 35/IV,Belgrade, Serbia
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[3] Institute for Multidisciplinary Research, University of Belgrade, Kneza Višeslava 1a, Belgrade, Serbia

14.30-14.45 Mechanochemical treatment of flotation tailing
Milan Petrov, Ljubiša Andić, Vladimir Jovanović, Slavica Mihajlović
Institute for technology of nuclear and other mineral raw materials,
86 Franchet d'Esperey Street, 11000 Belgrade, Serbia

14.45-15.00 Microstructure evolution and phase transition in Er doped $BaTiO_3$ ceramics
Vesna Paunović[1], Vojislav Mitić[1,2], Miroslav Miljković[3], Ljiljana Živković[1]
[1] University of Nis, Faculty of Electronic Engineering, Aleksandra Medvedeva 14, Niš, Serbia

[2]Institute of Technical Sciences of SASA, Belgrade, Serbia
[3]Laboratory for Electron Microscopy, University of Niš, 18000 Niš, Serbia

15.00-15.15 Production of the Late Roman Pottery in diocese Dacia: Results of the first analyses
Tatjana Cvjetićanin, Milica Marić Stojanović
National Museum in Belgrade, Trg Republike 1a, Belgrade, Serbia

15.15-15.30 Calcite tempered cooking pottery in the Central and Western Balkans – some technological issues
Biljana Djordjević[1], Richard Carlton[2]
[1] National Museum in Belgrade, Serbia
[2]University of Newcastle upon Tyne, UK

15.30 – 15.50 Coffee break

15.50 – 18.05 2nd Session – Nano, Bio, Opto & Composite Materials – Catalysis & Electrocatalysis

Chairpersons: Dr. Lidija Mančić, Dr. Predrag Banković

15.50-16.05 Designing of nanomaterials for application in nanomedicine and tissue engineering
V. Jokanović
Institute for Nuclear Sciences "Vinča", University of Belgrade, Belgrade, Serbia

16.05-16.20 Design of photocatalytic active coating based on TiO_2/ZnAl layered double hydroxides suitable for application on clay roofing tiles
Ognjen Rudić[1],Tatjana Vulić[1], Snežana Pašalić[2] ,Jonjaua Ranogajec[1]and Vilma Ducman[3]
[1] University of Novi Sad, Faculty of Technology, Bul. caraLazara 1, Novi Sad, Serbia
[2] Serbian Ministry of Education, Science and Technological Development, Nemanjina 22-24, 11000 Belgrade, Serbia
[3]The Slovenian National Building and Civil Engineering Institute, Dimičeva 12, 1000 Ljubljana, Slovenia

16.20-16.35 The possibility of application of amorphous kaolin in cement composites
Dragica Lj. Jevtić, Aleksandar R. Savić
Faculty of Civil Engineering, University of Belgrade, Bulevar kralja Aleksandra 73, 11000 Beograd, Serbia

16.35-16.50 Pilllared clays as supports for the immobilization of yeast *Saccharomyces cerevisiae* external invertase
P. Banković[1], U. Andjelković[2], A.Milutinović-Nikolić[1], N. Jović-Jovičić[1], Z. Mojović[1], Z. Vujčić[3], D. Jovanović[1]
[1]University of Belgrade-Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, Belgrade, Republic of Serbia
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[3]University of Belgrade - Faculty of Chemistry, Department of Biochemistry, Studentski trg 12 – 16, 11000 Belgrade, Serbia

16.50-17.05 **Creating of highly active calcium-silicate phases for application in endodontics**
B. Čolović, V. Jokanović, N. Jović
Institute for Nuclear Sciences "Vinča", University of Belgrade, Belgrade, Serbia

17.05-17.20 **Filler based limestone polymer industry**
Slavica Mihajlović, Živko Sekulić, Dragan Radulović, Vladimir Jovanović, Milan Petrov
Institute for Technology of Nuclear and Other Mineral Raw Materials, 86 Franche d' Esperey st., 11000 Belgrade, Serbia

17.20-17.35 **Porous sintered scaffold based on bioactive polyphosphate glass**
Vladimir D. Živanović[1], Mihailo B. Tošić [1], Jelena D. Nikolić [1], Srđan D. Matijašević [1], Snežana N. Zildović [1], Snežana R. Grujić [2], Sonja V. Smiljanić[2]
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[2] Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia

17.35-17.50 **Modified Precipitation Route for Preparation of Nanocrystalline $NiFe_2O_4$**
Vladan Ćosović[1], Aleksandar Ćosović[2], Dragana Živković[3], Tomáš Žák[4], Bohumil David[4], Nadežda Talijan[1]
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[3] Technical Faculty in Bor, University of Belgrade, Vojske Jugoslavije 12, 19210 Bor, Serbia
[4] CEITEC IPM, Institute of Physics of Materials AS CR, v.v.i., Žižkova 22, CZ-616 62 Brno, Czech Republic

17.50-18.05 **Functionalized porous nanocomposite as phenol derivatives sorbent**
S. Marinović[1], A. Milutinović-Nikolić[1], A. Nastasović[2], M. Žunić[1], Z. Vuković[1], D. Antonović[3], D. Jovanović[1]
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Hall, 1st floor

18.05 – 19.00 Poster Session

Chairpersons: Ivan Dugandzic, Suzana Filipovic

Cocktail

P01 Optimization of major oxides content and fired brick properties for various applications

M. Arsenović[1], L. Pezo[2], S. Stanković[3], Z. Radojević[1]
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[2]Institute of general and physical chemistry, 11000, Belgrade, Serbia
[3]Faculty of technology and metallurgy, University of Belgrade, 11000, Belgrade, Serbia

P02 Lightweight construction ceramic composites based of pelletized fly ash aggregate

Anja Terzić[1], Zagorka Radojević[1], Ljilana Miličić[1], Nina Obradović[2], Vladimir Pavlović[2], Ljubica Pavlović[3]
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P03 Establishing the model for predicting the moisture and velocity in the critical point during drying of green masonry products

Miloš Vasić[1], Zagorka Radojević[1]
[1]Institute for Materials Testing, Belgrade, Serbia

P04 Slag from metal magnesium production as component in ecologically clean production of various types of construction ceramics

Ljubica Pavlović[1], Anja Terzić[2], Zagorka Aćimović[3], Marko Pavlović[3]
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[3]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia.

P05 Alumina as raw material in production of ceramic materials: the changes of alumina crystal structure by mechanical activation procedure

Ljubiša Andrić[1], Anja Terzić[2], Ljubica Pavlović[1], Zagorka Aćimović[3], Marko Pavlović[3]
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P06 The luminescent properties of yttrium oxyapatite doped with Eu^{3+} ions

V. Jokanović, B. Čolović, N. Jović
Institute of Nuclear Sciences Vinča, Mike Petrovica Alasa 12-14, Belgrade, Serbia

P07 Synthesis of the glass-ceramics based on basalt

Marko Pavlović[1], Snežana Grujić[1], Anja Terzić[2], Ljubiša Andrić[3]
[1]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia
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[3]Institute for Technology of Nuclear and Other Raw Mineral Materials,
Belgrade, Serbia

P08 The influence of Ni on the performance of Al, Fe, Ni pillared bentonite based electrodes in electrooxidation of phenol

T. Mudrinić, Z. Mojović A. Milutinović-Nikolić, M. Žunić, P. Banković, A. Ivanović-Šašić, D. Jovanović
University of Belgrade - Institute of Chemistry, Technology and Metallurgy, Center for Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Republic of Serbia

P09 Mechanical activation influence on magnetic and electrical properties of the system powder 50% $BaTiO_3$ and 50% Fe_3O_4

A. Kalezić-Glišović, Z. Ristanović, B. Jordović, N. Mitrović, A. Maričić
Joint Laboratory for Advanced Materials of SASA, Section for Amorphous Systems, Faculty of Technical Sciences Čačak, University of Kragujevac, Serbia

P10 Chromite based refractory coatings used in expandable patterns casting of Fe-C alloys

Zagorka Aćimović[1], Anja Terzić[2], Ljubiša Andrić[3], Ljubica Pavlović[3], Marko Pavlović[1]
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P11 Dilatometric Analysis of Mechanically Activated $SrTiO_3$ Powder

J. Živojinović[1], D. Kosanović[1], N. Obradović[1], A. Peleš[1], N. Labus[1], S. Filipović[1], V. B. Pavlović[1], M. Mitrić[2], M. M. Ristić[3]
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[3]Serbian Academy of Sciences and Arts, Knez Mihailova 35, 11000 Belgrade, Serbia

P12 The influence of mechanical activation on the electrical properties of $Ba_{0.77}Sr_{0.23}TiO_3$ ceramics

D. Kosanović[1*], J. Živojinović[1], N. Obradović[1], V. P. Pavlović[2], V. B. Pavlović[1], M. M. Ristić[3]
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[2]Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia
[3]Serbian Academy of Sciences and Arts, Knez Mihailova 35, 11000 Belgrade, Serbia

P13 Density and electrical properties of cordierite based ceramics as function of compaction pressure

N. Obradović[1], N. Đorđević[2], N. Labus[1], A. Peleš[1], M. Mitrić[3], V. B. Pavlović[1]
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P14 Influence of MoO_2 on Sintering Temperature of Mechanically Activated MgO-Al_2O_3-SiO_2 System

N. Đorđević[1], N. Obradović[2], A. Radosavljević-Mihajlović[3], B. Jokić[4], S. Filipović[2], M. Mitrić[3], S. Marković[2]
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[4]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade

P15 Structural characterization of mechanically activated $MgO\text{-}TiO_2$ system

S. Filipović[1], N. Obradović[1], J. Krstić[2], M. Šćepanović[3], V. Pavlović[1] and M. M. Ristić[4]
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P16 Annealing and doping concentration effects of Y_2O_3: Sm^{3+}nanopowder obtained by self-propagation room temperature reaction

Sanja Ćulubrk, Vesna Lojpur, Vesna Đordjević and Miroslav D.Dramićanin
Vinča Institute of Nuclear Sciences, University of Belgrade, P.O. Box 522, Belgrade, Serbia

P17 Effect of processing parameters on structural and morphological $Y_2O_3:Yb^{3+}/Ho^{3+}$ powders characteristics

V. Lojpur[1], L. Mancic[2], B.A. Marinkovic[3], M.D. Dramicanin[1], O. Milosevic[2]
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[3] Departamento de Engenharia de Materiais, PUC-Rio, Rio de Janeiro, RJ, Brazil

P18 Dielectric characterization of microalloyed alumo-silicate ceramics by using linear regression model

Jelena Purenović[1], Vojislav Mitić[2,3], Marjan Randjelović[4], Branko Matović[5], Milovan Purenović[4]
[1] University of Kragujevac, Faculty of Technical Sciences, Svetog Save 65, Čačak, Serbia
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P19 Application of Minkowski layer for microalloyed alumo-silicate ceramics grains fractal analysis

Jelena Purenović[1], Vojislav Mitić[2,3], Ljubisa Kocić[2], Marjan Randjelović[4], Branko Matović[5], Milovan Purenović[4]
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P20 Electrical properties of sintered system $MgCO_3\text{-}TiO_2$

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P21 Novel organo-inorganic clay based catalyst for catalytic wet peroxide oxidation

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P22 *p*-Nitrophenol electro-oxidation on carbon glass electrode modified with organoclays

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P23 Characterization of mechanochemically synthesized $CaO{\cdot}ZnO{\cdot}K_2CO_3$

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P24 Biodiesel synthesis based on $CaO{\cdot}ZnO{\cdot}K_2CO_3$ as catalyst

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P25 Aerosol-assisted synthesis of hierarchically organized titania and titanates nanostructures

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P26 Characterization of mechanically activated ZnO powder

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P27 ZnO/Ag hybrid nanocubes in alginate matrix

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P28 Piezoelectric polymer/ceramic nanostructures for mechanical energy harvesting

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P29 Pulsed Laser Deposition of $BaTiO_3$ on PVDF substrate

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P30 Functionalization of graphene nanoplatelets via Bingel reaction for polymer nanocomposites

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P31 SEM-EDS analysis of cobalt-substituted hydroxyapatite nanoparticles changes in culture medium *in vitro*

Sanja Stojanović[1], Žarko Mitić[2], Stevo Najman[1], Miroslav Miljković[3], Zorica Ajduković[4], Nenad Ignjatović[5], Dragan Uskoković[5]
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P32 SEM-EDS analysis of calcium phosphate/poly-(DL-lactide-co-glycolide) nanoparticles changes in culture medium *in vitro*

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P33 Possibility of use waste materials from floating plant Feldspar ujanovac in ceramical industry after removing the surplus of iron

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P34 Recycling of waste gypsum and its repeated usage in the civil engneering and ceramic industry

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P35 The ceramic materials based on Ag doped zeolite

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P36 Investigation of construction ceramic from objects of cultural and historical heritage

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P37 Facade ceramic tiles: nicrostructural analysis of superficial defects

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P38 Biocompatibility screening of biomaterial based on porous apatite with a film of alginate polymer

Aleksić Milena[1], Rajković Jelena[1], Vasiljević Perica[1], Đorđević Ljubiša[1], Miljković Miroslav[2], Najman Stevo[2], Jokanović Vukoman[3]
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P39 Corrosion of phosphate glass-ceramics in different media

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P40 Contribution to the research of historical heritage - laboratory examination of historical mortars -

Ivana Delić-Nikolić, Olivera Vušović, Lidja Kurešević, Ljiljana Miličić
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P41 Calcium alginate and calcium alginate/zeolite beads as sorbents for nickel sorption in air-lift reactor

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P42 Integral characteristics of statistical distribution functions and processes of thermal equilibrium establishing

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P43 Synthesis, sintering and characterization of multi-doped solid ionic conductors based on CeO_2

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P44 The influence of temperature on microstructure contact surfaces on $BaTiO_3$ ceramic doped with Ho_2O_3

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P45 SEM and EDS investigation of contact surfaces for analyzis of advanced dielectric $BaTiO_3$ ceramics materials

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P46 Plasma Electrolytic Oxidation of Al Alloy

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P47 Young Researchers Look for Geothermal Solutions

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PL1

European Roadmap for Nanotechnology "Nanotechnology: Directions for Economical and for Societal needs- 2025"

Marcel Van de Voorde

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After 20 years nanoscience and nanotechnology research and development there is a need for reflection and to develop a targeted vision for the future economic success and society welfare. This lecture will provide some guidelines for the whole nanotechnology domain:

- Need for European Centres/networks of excellency: nanosynthesis, characterisation, properties, modelling....Needs for new structured European organisation schemes!

- Forerunner's position of nano-electronics in Europe: "Centre of Excellency"
- Stimulus for nanotechnology in medicine e.a. nanoCancer treatments, etc ...,.
- Nanotechnology for energy needs
- Breakthrough's of nanotechnology in traditional industries: e.g. textile industry, construction engineering, agriculture and foodstuff's
- Familiarisation of nanotechnology in daily life

- Education model for nanotechnology in Europe
- Healthy promotion of nanotechnology in industry
- Nanotechnology: base for job creation
- Safe signalisation of nanotechnology applications for society, consumer and environment

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- Place of Europe's nanotechnology in the world
- Nanotechnology pan-European strategy
- Global nanotechnology collaboration

PL2

Feature and Future of Hydrothermal/Solvothermal Reactions for Synthesis/Preparation of Nano-Ceramics with Desired Shapes, Sizes and Structures

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Hydrothermal reactions have widely been recognized in natural and artificial systems on the earth. Particularly, the formation, production, alteration, decomposition of all substances and materials in natural systems are always related with the action of water (aqueous solutions) at higher temperatures under pressures.

Solvothermal reactions using non-aqueous solvents have also been considered to be useful for various materials and chemical processing. Often Non-aqueous solvent may contain impurity water and/or byproduct water during the processing. Similarly Hydrothermal reactions may include non aqueous components during their processing. Therefore, Hydrothermal and Solvothermal are overlapping in many cases. Moreover, Hydrothermal/Solvothermal reactions can contain almost all species of liquids, gases and solids,therefore, they have following features: [1] Wide variety of liquid media, [2] Additional gases and solids, [3] Wide variety of temperature and pressure, [4] Static and Dynamic, flowing and circulating, systems, [5] Those liquids acting as (a) Surface Adsorption/Desorption agents, (b) Reactants (Coordination/Chelating agents), (c) Solvents, etc. Thus, [6] Variety of applications like chemical, physical, biological, medical, mechanical, electrical, electronic, optical, photonic, magnetic, materials, environmental, etc. I believe that Future of Hydrothermal and Solvothermal processing should be quite wide and successful.

In the present lecture, I will summarize Hydrothermal reactions on various natural and artificial materials. [1] Hydrothermal Syntheses of Nano-particles, ZrO_2, CeO_2, $(Zr,Ce)O_2$, HAp, Fe_3O_4, TiO_2, $BaTiO_3$, etc. [2] Nanostructured Films of $BaTiO_3$, $SrTiO_3$, $LiCoO_2$, $BaWO_4$ $CaWO_4$, HAp etc. and [3] Nanostructured Patterns of $BaTiO_3$, Carbon, etc. established in our group will be reviewed. In the formation of films, additional activation(s) with thermal one are very useful. Particularly electrochemistry is very attractive to prepare oxide films and patterns. Recent proposal: Growing Integration Layer [GIL] method is also using electrochemistry to make integrated oxide layer(s) on metallic material(s) to improve adhesion, anti-oxidation, bioactivity and/or other functionalities. Conbination of Polymer Complex Method and Hydrothermal reactions have been developed.

I would like to thank to my senior and younger colleagues including students during my research on hydrothermal/solvothermal and soft (solution) processing.

PL3

SiC and SiOC composites, materials and process routes

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SiC composites have been developed by various processing methods, i. e. reaction bonding, CVD/CVI and liquid phase impregnation. This class of composites is handicapped by the high cost of processing, interface coatings and raw materials and therefore only attractive for applications in astronautics and military aviation. Polymer Matrix Composites (PMC) are widely used in lightweight applications. The manufacturing technologies are fully developed and raw materials are cheap. The major drawback and limiting factor of these reinforced polymers is the acceptable service temperature. Ceramic Matrix Composites (CMC) are suitable for service temperatures up to 1500 °C. These composites are composed of ceramic matrices combined with ceramic fibers based on alumina or silicon carbide. Novel composite materials, bridging the gap between PMC and CMC, are manufactured by the use of polysiloxanes. Such competitive free formable composite are capable for service temperatures up to 600 °C in oxidative atmosphere. In order to make the material attractive for series applications, cost effective manufacturing technologies like Resin Transfer Moulding (RTM), filament winding or warm pressing techniques are employed.

Beside the improved thermal and chemical resistivity in comparison to reinforced polymers and light metals, a major benefit of SiOC composites is investigated in the field of friction materials. The excellent properties in wear resistance and an adjustable coefficient of friction make it an interesting and much cheaper alternative for CFC and CMC. The different processing and materials properties are described for SiC and SiOC composites Composite Structures for Intermediate Service Temperatures with Increased Friction Properties.

PL4

Computer study of static and dynamic rearrangement in liquid phase sintering

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The rearrangement process during liquid phase sintering has been generally accepted that driven by the capillary forces between solid particles embedded in liquid. This process assumes that if there is good wetting between liquid and solid phases, solid particles will rearrange themselves under the action of surface tension forces, producing more stable packing. Generally speaking, the rearrangement of such systems result from the attractive forces developed between the particles by the liquid bridges, and these forces may be both capillary and viscous in nature (i.e. static and dynamic, respectively). Capillary forces usually dominate in cases where the liquid exists as discrete bridges, but viscous forces can become significant when the liquid viscosity is very high or at high interparticle velocities.

This presentation outlines computer-based methods for time dependent computer simulation of rearrangement induced by both capillary and viscous forces. In that sense, the theoretical models dealing with the fundamental interaction forces that exist between particles attached by liquid bridges will be outlined and the development from these pair-wise interactions to multi-particle models will be described. It will be shown that the rearrangement is essentially governed by geometrical factors where uniformity of initial particle packing and a high degree of mixing homogeneity are prerequisites for effective densification. The methods will be also applied to the analysis of the effects of the the liquid bridge volume, contact angle, initial particle distance (representing the green density) and particle size on densification by rearrangement.

PL5

Electronic simulation for the new era

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Electronic processes, components, circuits and system simulation is a permanently challenging task thanks to the rise of the complexity and diversity of modern electronics. Within the subject, several main topics are of main importance e.g.: system description, equation formulation, equation solution and modelling, all these enabling the simulation run. Here we will, first, give an overview of the solutions applied in modern electronic simulation systems. A unified approach will be presented describing a simulation algorithm being independent on the domain of application.

A short set of examples will be used to illustrate the capabilities of such simulation approach. Different domains will be visited starting with linear and nonlinear electronic circuits, control systems, digital systems, systems based on embedded software, micro-electro-mechanical systems, electro-thermal phenomena, opto-electronic systems, mixed signal systems etc. Then, concepts of electronic modelling will be discussed and modelling procedure based on artificial neural networks will be described. Consequently, a set of modelling and simulation examples will be given. Finally, concepts implementable for simulation of very complex systems will be discussed includin implementation of parallel algorithms and grid computing.

PL6

Evaluation protection and valorisation of Cultural Heritage in particular the World Cultural heritage (UNESCO) in Euro-Mediteranean Countries, in case of floods/marine submersion: contribution of Materials sciences.

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Tourism is an economic activity capable of generating growth and employment in the EU, while contributing to development and economic and social integration, particularly of rural and mountain areas, coastal regions and islands, outlying and outermost regions or those undergoing convergence. The Cultural heritage is a major component of tourism to attrack people. The European Union remains the world's No 1 tourist destination, with 370 million international tourist arrivals in 2008 for example. European States have in particular to establish appropriate objectives for the management of flood risks focusing on the reduction of potential adverse consequences of flooding for the environment, cultural heritage and economic activity.

Scope of the proposal presented: Review, analysis and proposals of initiatives taken to answer to the requirements of the E.U. Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks concerning the protection of the cultural heritage in particular the "World cultural heritage as defined by UNESCO. Analysis of the contribution of "Materials Sciences" to the protection, restoration and conservation of the cultural heritage against floods and marine submersion.

PL7

Powder materials as fractal objects

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Although it relies on Euclidean geometry, the Fractal geometry has its own rules which are to be formulated in the multidisciplinary terms of algebra, functional analysis and topology. Better understanding of the phenomenon of powder materials imposes necessity of taking into account irregularity of grain surfaces, even if it may look insignificant. Quantitative expression of such irregularity may be correctly expressed using Hausdorff measure and its refinements in light of Brownian motion. In this presentation, some available approaches of transition from two-dimensional contours to three-dimensional model of grain will be discussed. Special attention will be paid to the change in fractal dimension caused by sintering of ceramic materials.

PL8

Plasma devices and preparing of nonconductive materials

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Nanosized materials exhibit unique properties thank to non-compensate surface forces and they are attractive for various high performance applications. Nitrides are used in the optoelectronic as light-emitting diodes and semiconducting lasers. Carbides as boron carbide (B_xC $x \geq 4$) have excellent chemical resistance, it is extremely hard, and because of it, high neutron absorption makes him a valuable material for nuclear applications.

Zirconium carbide (ZrC_x) is elevated hardness - between alumina and diamond, and it has a high melting temperature of 3420^0C (3540^0C from some sources). It is high chemical stability at room temperature and it use in nuclear plants as a low neutron absorbing and high mechanically resistant refractory material and also as a constituent in cathodes made of UC-ZrC. It is also used in the form of tubes, boats and crucibles to handle molten metals and as part of electronic devices used for thermoionic transducers.

Silicon carbide (SiC) is an important semiconductor which can be operated at high powers, high temperatures, and high frequencies.

Due to its exceptional hardness and superior wear resistance, tungsten carbide (WC) and WC-Co cemented carbides are applied in a wide range of industrial processes.

Titanium carbonitride phases, TiC_xN_{1-x} are characterized by high hardness, electrical conductivity, wear resistance and chemical inertness.

Ti_3SiC_2 is considered as a potential structural/functional material for its combined merits of metals and ceramics, such as good electrical and thermal conductivity, as well as easy machinability, good resistance to thermal shock, high toughness, high temperature strength.

Ti_3AlC_2 exhibits compressive plasticity at both room and high temperatures. Such salient properties provide this kind of material with wider potential applications in the high-tech field, e.g., it can be used as a promising candidate for high temperature structural material, and also to fabricate abrasion-resistant components and rotating parts.

It is known that combining B_4C with a metal such as aluminum can mitigate the problems associated with suppressed fracture toughness.

Cr_3C_2-NiCr plasma sprayed coatings have a high resistance against abrasive wear and a low friction coefficient, from room temperature up to 850^0C, due to their high thermal stability and oxidation resistance.

Zirconia-alumina composites and wide application as high-temperature materials in cutting tools, ball bearings and furnace materials due to their high melting point, mechanical properties, fracture toughness and corrosion and shock resistance.

Because of the advantages of plasma methods for synthesis of various nanomaterials with wide practical applications, the aim of this paper is to summarize the investigations published recently about the plasma-chemical preparation of the nanosized materials.

PL9

Chalcopyrite magnetic semiconductors: from nanocomposite to homogeneous material

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Room temperature ferromagnetism in transition metal-doped II-IV-V_2 ferromagnetic semiconductors is found to be related with the presence of MnAs nano-precipitates. The two regimes of alloying with magnetic impurities, i.e. homogeneous and nanocomposite regime offers interesting physical phenomena implying possible practical applications.

High level of Mn-alloying offer possibilities to study magnetic and electrical properties associated to the presence of ferromagnetic nanoclusters. The intra- and inter-grain interactions inducing magneto-tunneling of the conducting carriers is responsible for giant and colossal magnetotransport effects in II-IV-V_2 materials. Our systematic studies of structural and magnetic properties of $Zn_{1-x}Mn_xGeAs_2$ and $Cd_{1-x}Mn_xGeAs_2$ compounds have shown that the observed room temperature ferromagnetism and giant magnetotransport effects are due to the presence of nano-sized MnAs inclusions.

The magnetic interactions in $(Cd,Zn)_{1-x}Mn_xGeAs_2$ alloys show weak magnetic coupling of magnetic moments in these materials at a low dilution limit. Paramagnetic response of low Mn-content samples indicate that the solubility of magnetic impurities in chalcopyrite materials is higher than that of their III-V binary analogs. Moreover, these systems show higher Mn-hole exchange constant and the strong p-type conductivity – features needed for inducing long range carrier mediated ferromagnetism.

PL10

Ceramics and its dimensions– heritage, creativity, visions for ceramics in a multicultural Europe

W. Siemen

Deutsches Porzellanmuseum, Hohenberg, Germany

Ceramics has always played a prominent role in the life of people in every European Country. Its products were used for decoration or representation and they are present in homes as well as in public.

Ceramics has been shaped by Europe's cultural regions, techniques and colours, used in a context such as for eating and drinking, decoration or architecture. Ceramics connects people, enables regional differences, such as traditions, life-styles, social or economic behaviour, witnessing individual identity.

Creativity and innovation are based on the inimitable tradition of European people within a global context. The traces of the past and the needs of the present, the knowledge of the processes of change in economy, ecology and the multicultural diversity sharing the eagerness for the same products and trends can lead to visions how future may look like.

To improve the benefit of the results and sustainability for tomorrow the project brings together museums, universities and companies.

INV1

Sintering and measuring conditions effects on the dielectric properties of relaxor TTB ceramic materials

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Apparently, since the recent revival of tungsten bronzes as potential ferroelectrics or multiferroics, scientists working in this field have directed their researches *ab initio* to the development of lead-free systems. This structure is one of the most flexible structure that can accommodate practically infinite ionic species. However, the majority of the tetragonal tungsten bronzes (TTBs) reported in the literature exhibit relaxor properties.

Our research aimed to provide useful information and a supplementary understanding of the tetragonal tungsten bronze structure with respect to the relaxor properties and hopefully offer solutions for tuning properties and developing novel ferroelectrics and, potentially, multiferroics.

The relaxor properties were investigate in more detail for the family of TTBs: A-site substitutions were carried out for $Ba_{6-x-y}Sr_x,Ca_yGaNb_9O_{30}$, while $Ba_6M^{3+}Nb_9O_{30}$ (M^{3+} = Ga^{3+}, Sc^{3+} and In^{3+} and also their solid solutions) was used for B-site substitutions. More specifically it was hoped to understand the microscopic origins of the relaxor behaviour (*i.e.*, may be the dipolar response attributed to a specific cation site, either on the A- or B- cationsublattice) and to determine if these materials are relaxor ferroelectric or canonical relaxor dielectrics. In order to do this, the materials were characterised by a combination of electrical measurements (dielectric and impedance spectroscopy), and crystallographic studies using powder X-ray and neutron diffraction as a function of temperature.

In the family $Ba_6M^{3+}Nb_9O_{30}$ (M^{3+} = Ga^{3+}, Sc^{3+} and In^{3+}) we have investigated the effects of the sintering, annealing and measuring conditions. This study has proved to be crucial before attempting to prepare various TTB ceramic compounds with ferroelectric or relaxorproperties; the influence of cation distribution, microstructural effects and how measurements shall be conducted led to a complete understanding of these materials and offered the possibility for tuning properties.

INV2

New approach and comparative studies of structura; and electrical properties of nano spinel ferrites prepared by soft mechanochemical synthesis

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Ferrites are very attractive materials for technological applications due to their combined properties as magnetic conductors (ferrimagnetic) and electric insulators. Spinel ferrites, by virtue of their structure, can accommodate a verity of cations at different sites enabling a wide variation in electrical and magnetic properties. Spinel ferrites MFe$_2$O$_4$ (M=Mn, Ni, Zn) were obtained by soft mechanochemical synthesis in a planetary ball mill. The appropriate mixture of oxides and hydroxides were used as initial compounds. This mixture was mechanically activated, uniaxial pressed and sintered at 1100°C/2h. The phase composition of the sintered samples was analyzed by XRD, Raman and IR spectroscopy. Morphologies were examined by SEM. In this study, DC-resistivity was measured as a function of temperature from 298-473 K and activation energy of sintered samples was determined. The AC-conductivity measurements in the same temperature range were carried out in the frequency range 100Hz-1MHz. The electrical conductivities show an increase with increasing temperature indicating the semiconducting behavior of the studied ferrites. The conduction phenomenon of the investigated samples has been explained on the basis of hopping model. Analysis of the complex impedance spectra has been used to study the effect of grain and grain boundary on the electrical properties of ferrites.

INV3

The integral features of electronic gass for viewpoint of quantum mechanic

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The integral features of statistical system with finite number of available states present thought its envelopes have been used for analyzing the process of equilibrium establishing at micro and macro system level and creation of new structures. These results on one side and Voltas conclusions which relates at he balance of charges on the other side, will be used in the creation of the approach to the electron as a well ordered system with five available states, The first three states has been determined by the kinetics process while the other two have been determined by function of potential. This approach will provide a different insight into the quantum nature of the process of structure creation and the monitoring process of balancing inside the system.

INV4

Co-Al layered double hydroxides as precursors of $CoAl_2O_4$ spinel

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Spinels of the type $M^{2+}M^{3+}{}_2O_4$ continue to attract a great deal of interest because of their many practical applications. The controlled thermal treatment of layered double hydroxides (LDHs) with general formula $[M^{2+}{}_{1-x}M^{3+}{}_x(OH)_2]^{x+}[A_{x/m}{}^{m-}\cdot nH_2O]^{x-}$ results in formation of nano-sized mixed metal oxide and spinel phases with homogeneous distribution of M^{2+} and M^{3+} ions.

Co-Al LDHs with a ratio of Co^{2+}/Al^{3+} = 0.5, 1.5 and 3.0 were prepared by co-precipitation followed by stepwise heating in the range 200–1000^{o}C after drying at 105^{o}C. The influence of the decomposition temperature on the phase composition and magnetic properties of the solids were investigated using specific surface area (SSA), powder X-ray diffraction (PXRD) and magnetic susceptibility (MS) measurements.

It was found that the sample crystallinity corresponds to the crystallite size increase accompanied by SSA decrease with the decomposition temperature enhancement. The magnetic properties of the oxide products are compatible with the crystalline phases identified by PXRD.

The obtained results suggest that the pre-spinelic and well defined spinel $CoAl_2O_4$ phase obtained from Co-Al precursors are able to be considered as promising materials for the preparation of ceramic pigments with different properties and applications.

INV5

Microelectronics miniaturization and fractal electronic frontiers

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The intergrain ceramic structures are very complex and difficult to describe by using traditional analytical methods. In this study, in order to establish grain shapes of sintered ceramics, new approach on correlation between microstructure and properties of doped $BaTiO_3$ -ceramics based on fractal geometry has been developed. $BaTiO_3$ ceramics doped with CeO_2, Bi_2O_3, Fe_2O_3, $CaZrO_3$ Nb_2O5, $MnCO_3$, La_2O_3, Er_2O_3, Yb_2O_3 and Ho_2O_3, were prepared using conventional solid state procedure and sintered at 1350°C. The sintered specimens microstructure was investigated by SEM-5300 and capacitance has been done using LCR-metra Agilent 4284A. The fractal modeling method using a reconstruction of microstructure configurations, like grains or intergranular contacts shapes has been successfully done. Furthermore, the area of grains surface was calculated by using fractal correction which expresses the grains surface irregularity through fractal dimension. For better and deeper the ceramics material microstructure characterization the Voronoi model and mathematical statistics calculations, are applied, also. The fractal nature for ceramics structure analysis providing a new ideas for modeling the grain shape and relations between the $BaTiO_3$ ceramic structure and dielectrical properties and new frontier for higher integration on electronic circuits. The presented results indicate that fractal method for structure ceramics analysis creates a new approach for describing, predicting and modeling the grain shape and relations between the $BaTiO_3$ -ceramic structure and dielectric and generally electric and microelectronics properties.

INV6

Niševac (Timacum Maius ?): The Role of Ceramic Tubuli in the Hypocaust System

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Systematic archaeological excavation in the area of the village of Niševac, near Svrljig in Eastern Serbia, of an ancient Roman site, possibly Timacum Maius station has been going on for five years. This settlement was on the main Roman road *Lissus–Naissus–Ratiaria*, connecting the Adriatic, Central Balkans and the Danube.

The previous campaigns exposed, among the other findings, the Roman structure, with two rooms that is unique in many aspects. It was furnished with a hypocaust system for heating the floors and walls. A total of twenty-six intermittently perforated ceramic *tubuli* — circular-sectioned pipes filled with pebbles were found. The *tubuli* flanked the flue conveying the hot air into the under-floor chamber and walls. The furnace, *praefurnium*, was also discovered. The ceramic *tubuli* with perforations which could be blocked with ceramic stoppers, were filled with small pebbles which kept and slowly emitted heat. This example demonstrates the knowledge and conscience of Roman constructors for the need of energy saving. The *terminus post quem* for the erection of the building is the date on which ceramic *tubuli* began to be widely used for the hypocaust systems in the Roman Empire, which is the period between AD 70 and 80 and it may have served in balneal purpose.

O1

Performance of manganese zinc ferrite core manufactured by PIM/Sintering route

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MnZn ferrites attracted attention due to a wide range of relative magnetic permeability values (from 10^3 to 10^4 and therefore low magnetic losses) as well as due to increased thermal stability (high saturation magnetic flux density at high temperatures (B_s> 0.4 T at 373 K) and a relatively high Curie temperature). Furthermore, excellent corrosion resistance and chemical stability enable their application in extreme exploitation conditions.

Recently, a variety of preparation routes have been examined for MnZn ferrite production: mechanochemical processing, chemical co-precipitation method, sol-gel or microemulsion. This paper deals with MnZn ferrites produced by Powder Injection Moulding (PIM) technology. This technology can produce a number of ferrites in very shorter time compared to the classic method, i.e. it offers large scale manufacturing of small and geometrically complex parts. Magnetic performances of the MnZn ferrite core prepared from feedstock by PIM method followed by de-binding and sintering toroidal sample in air (3.5 hours at 1713 K) were presented.

Magnetic properties were measured on toroidal samples by hysteresis graph (B-H curve at different excitation magnetic fields up to 6 kA/m and at different frequencies up to 10 kHz). Temperature dependence of magnetic characteristics was performed up to 373 K.

Magnetic permeability as well as magnetic losses was analyzed as frequency and temperature dependent. 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 components. The results obtained were compared with the data from available literature for MnZn ferrite samples obtained by conventional methods.

O2

Density of the $ZnTiO_3$ nanopowder as a loose powder and as a compact obtained by different methods

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Nanopowder density, as well as compact density, is due to powder particle size, different in their values, compared to micron powders. Also, the technique used for density determination induces large mutual value discrepancies. Scanning electron micrographs of as received powder are presented as an illustration of the shape and size of powder particles and agglomerates. The density of the loose powder pretreated differently was determined using mercury porosimetry and He pycnometry. The methods used for determining the apparent density of the compacts were pycnometry with water as the wetting liquid, mercury porosimetry and also a new approach using a combination of mercury pycnometry along with nitrogen adsorption. Bulk densities of compacts were determined by dimension measurement and mercury pycnometry. Conclusions about nanopowder usage as a charge for dry compaction as well as the most appropriate way for the determination of compact and powder densities are shown.

O3

Mechanochemical treatment of flotation tailing

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The paper presents research results of mechanical-chemical activation of pyrites from Bor flotation tailing (BFJ), in order to define the optimal techno-economic process of recycling of mineral waste. BFJ in its composition has about 10% pyrite-metallic-minerals and 90% non-metallic minerals. There are indications that the mechanical-chemical process may contribute to the separation metallic from non-metallic minerals so that appropriate treatment in the vibrating mill can form a complex of pyrites with high magnetic properties. The basic idea is that the mechanical-chemical process make changes in the fields of coordination of a crystal spin complex arising from pyrites and thus make changes in magnetic properties BFJ. Complex arising from pyrites belongs to the so-called jarosite group minerals chemical formula XFe_3 $[(SO4)_2$ $(OH)_6]$, where X can be K, Na, Mg, Ag, NH_4. Created a complex group of jarosite is alkaline and sulfate ferum with water and with the changed optical and magnetic properties and consists of the central metal ion surrounded by ligands, which are considered to be dotted charge. Preliminary researches had the task to determine whether a possible mechanical-chemical process to get jarosite structure. It also made tracking of on needed levels of activator mechanism that made the change of crystal field at pyrites. The experimental mechanism of the chemical treatment BFJ with 4% NaOH, there was a creation Sodium jarosite with the changed magnetic properties compared to pyrite. The paper used vibratory mill and Humboldt high gradient magnetic separator room. BFJ is activated dry process in vibratory mill with and without NaOH. After displaying mechanical-chemical products treated with magnetic field whose intensity 2T there is a separation of magnetic BFJ and non magnetic fraction. The results show that it is clearly noticeable difference in the share magnetic and non magnetic fractions in function of added reagents, NaOH.

O4

Microstructure evolution and phase transition in Er doped $BaTiO_3$ ceramics

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The Er doped $BaTiO_3$ ceramics, with different Er_2O_3 content, ranging from 0.01 to 1.0 wt% Er, were investigated regarding their microstructural and dielectric characteristics in this paper. Doped $BaTiO_3$ were prepared by using conventional method of solid state sintering at 1380 ^oC for four hours. SEM analysis of Er/$BaTiO_3$ doped ceramics showed that in samples doped with a rare-earth ions low level, the grain size ranged from 20-40 μm, while with the higher dopant concentration the abnormal grain growth is inhibited and the grain size ranged between 2-10μm. Dielectric measurements were carried out as a function of temperature up to180°C at different frequencies. The low doped samples sintered at 1380 °C, display the high value of dielectric permittivity at room temperature, 2160 for 0.01 Er/$BaTiO_3$. A nearly flat permittivity-response was obtained in specimens with higher additive content. 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 temperature of doped samples were ranged from 126 to 130 °C. The Curie constant for all series of samples decrease with increase of dopant concentration and the lowest values were mesured from samples doped with 0.01 wt% of aditive. The obtained value of γ pointed out that the specimens have almost sharp phase transition.

O5

Production of the Late Roman Pottery in diocese Dacia: Results of the first analyses

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Late Roman glazed pottery represents particular phenomenon of the late 3^{rd} – 6^{th} centuries AD in the region of middle and lower Danube provinces. Although archaeologically well defined regarding chronological and morphological development, its origin, technology of production, workshops and distribution patterns are not sufficiently researched. Analyses of ceramic from Roman fortresses Diana and Čezava are made by means of ICP-OES spectroscopy, optic microscopy, statistical hierarchic analyses and SEM-EDX analyses of cross sections. Hierarchical cluster analyses are showing one sample as the outlier and the rest of the assembly having level of similarity more than 60%. ICP-OES analyses have shown low calcareous composition of the clay material. Linear correlations of MgO-Fe_2O_3 and CaO-MgO can indicate the same or similar origin of row material. Low content of K_2O, MgO and P_2O_5 is excluding addition of wood or plant ash in to the clay. SEM-EDXRF analyses are showing that the presence of the lead is connected to the glaze layer. Considering the low calcareous content, optical microscopy has revealed a partial reducing atmosphere in production with temperatures below 900^0 C. Further analyses are necessary to understand details of technology, connection with or identification of clay resources as well as firing methods. All that data will help us understand important phase in the Roman pottery production, attributes of rarely researched coarse kitchen pottery, as well as appearance of the glazed pottery in general.

O6

Calcite tempered cooking pottery in the Central and Western Balkans: some technological issues

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In the Central and Western Balkans calcite-tempered pastes are strongly preferred for making utilitarian pottery by potters using hand-wheels and open, or single-chamber, firing techniques. Explanations for the use of calcite generally conclude that its ability to alleviate thermal stress caused to pottery vessels during firing and repeated episodes of use is sufficient to counter the considerable difficulties involved in processing and firing the material. Experiments with prepared calcite pastes have shown that the temperature and duration of firing is critical to its successful use, with temperatures over around 750^{o}C causing oxidation of the calcium carbonate particles and subsequent lime-spalling. Two recent field observations, however, have called into question some of these accepted views. First, the apparent resilience to thermal shock of sand-tempered vessels made at Bejići in northern Bosnia call into question the perceived superiority of calcite temper. Second, the use of double-chambered kilns and extended firing periods for firing calcite-tempered pots at Zlakusa, in Western Serbia, challenges the view that calcite-tempered pastes are best-suited to open firing techniques. Further field investigations as well as experimental work, including microstructural analysis, are proposed to develop a better understanding of these interrelated technological issues.

O7

Designing of nanomaterials for application in nanomedicine and tissue engineering

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The synthesis, structural and morphological properties of a porous calcium hydroxyapatite scaffold with various polymer thin films on its surface, has been investigated in this paper. The analysis of pore geometry and nanotopology of the scaffold thin walls was made by SEM and AFM. The very interesting nano-morphology of the scaffold thin walls shows a great potential of this material for cell adhesion and occupation.

Biological assays of biofunctionality performed on New Zeeland white rabbits, using these materials as bone substitutes for two full-thickness defects of critical size, showed their great potential. The evaluated parameters were: the defect size, the presence of giant cells, neoangiogenesis, basophiles, percentage of mineralization, non-specific inflammation of the tissue, newly formed bone and fibroplasia in the tissue.

Comparison of these materials with the most famous world brand BioOss, a global gold standard as a bone substitute, was done.

O8

Design of photocatalytic active coating based on TiO_2/ZnAl layered double hydroxides suitable for application on clay roofing tiles

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Large surfaces of clay roofing tiles are exposed to outdoor conditions and suffer from different physico-chemical and biological degradation. Protective coatings with self-cleaning properties could reduce or even eliminate these problems. Recently, nanosized titanium-oxide has been studied as photocatalyst for clay roofing tile coatings providing removal of pollutants from material surfaces, as well as hydrophillicity of surface necessary for self-cleaning effect. The aim of this study was to increase the compatibility of the photocatalysts with clay roofing tiles and avoid detachment of potentially toxic TiO_2nano-particles from the surface. Photocatalyst based on layered double hydroxides (LDH) associated to TiO_2weresuccessfully used for immobilization of TiO_2, having also considerable photocatalytic activity. Different methods for the preparation of the suspension with TiO_2/ZnAl_LDH were studied in order to design suitable photocatalytic coatings on clay roofing tiles. Properties, important for evaluation of self-cleaning effect, were analyzed including characterization of surface properties (roughness, micro-hardness and hydrophillicity) and measurement of photocatalytic activity (assessed by spectroscopic measurement of rhodamine B dye degradation under UV light irradiation). The comparative study revealed that the use of di-ammonia-hydrogen citrate as dispersant produces photocatalytic coatings which improve surface properties of studied clay roofing tiles.

O9

The possibility of application of amorphous kaolin in cement composites

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The results of testing physical and mechanical properties of mortars made with natural sand, cement type CEM I and amorphous kaolin (AF) are presented in the paper. AF used for the study was produced by mechanochemical activation of clay from „Garaši“, Aranđelovac basin, and possesses certain pozzolanic properties. This material was used in the mortars with the aim to decrease cement content, i.e. emision rate of CO_2 needed for its production, and thus provide environmental benefits. Four mortar series were made, reference without AF, and three more series made with 5%, 10% and 20% of AF replacing the corresponding amount of cement. Investigations included density tests (fresh mortars) and investigation of mechanical and rheological properties, i.e. compressive strength, flexural strength and shrinkage (hardened mortars). Density of fresh mortars was in the range of 2.139-2.183 g/cm^3; 28-day compressive and flexural strength achieved 42.5-52.0 MPa and 7.3-9.3 MPa, respectively. With the increase of AF there was a drop in flexural and compressive strength of 11.7-20.8% and 1.3-18.3%, respectively. General conclusion can be drawn that it is possible to use amorphous kaolin as a pozzolana, in order to obtain new composites with favorable physical and mechanical properties, with respect to the principles of sustainable development, decrease of CO_2 emission, and energy consumption in the process of kaolin production.

O10

Pilllared clays as supports for the immobilization of yeast *Saccharomyces cerevisiae* external invertase

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Bentonites are abundant, inexpensive and environment friendly materials rich in smectite clay minerals suitable for various important applications. By pillaring smectites are transformed in thermally stable micro- and/or mesoporous materials with retention of the layer structure. In this work domestic pillared clays (PILCs) were tested as external invertase isoform 1 (EINV1) supports. Pillaring was performed using Al^{3+} and Fe^{3+} pillaring cations in different ratios and followed by acid modification. The samples were characterized by X-ray diffraction, N_2 physisorption and FT-IR spectroscopy. The influence of immobilization on enzyme activity, pH and temperature optima as well as thermal stability was investigated. It was found that the amount of bound activity of EINV1 decreased with the increase of Fe^{3+} content in PILCs and acidity of samples. On the other hand, thermal stability of immobilized invertase was significantly improved in comparison with free invertase, when acid modified PILC was used as support. The PILCs and acid modified PILCs should be regarded as promising supports for invertase immobilization.

O11

Creating of highly active calcium-silicate phases for application in endodontics

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The synthesis of active silicate phases by combined sol gel and high-temperature self-propagating wave method, is described in this paper. They show a significant decrease of setting time and good mechanical properties, which are very important for its potential application in endodontic practice.

Particularly, process of hydration of calcium silicate phases is carefully analyzed, from the aspect of phase changes during their soaking in water for 1, 3, 7 and 28 days. XRD and FTIR methods were used for phase analysis of all samples, while morphological characteristics and chemical composition of the given phases were investigated by SEM and EDS.

O12

Filler based limestone polymer industry

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In the polymer processing industry, amongst additions that affect the quality of the final product, the most important is a set of special additives named fillers. The term fillers mostly refers to inorganic materials that have the task to improve the final product quality, without increasing the costs of the production process or of the final product. The use of fillers based on limestone is extremely high. For example, among all of the fillers used in the PVC processing industry, the fillers of limestone type encompass nearly 80%. The limiting factor in the application of limestone as a filler in the polymer industry is its hydrophilic surface, as such incompatible with the hydrophobic polymer surface. Recent development trends in polymer industry are aimed to increased use of limestone fillers, among which the surface modified mineral calcite is the most frequent. In processes of the surface modification of calcite, as the main mineral in limestone, some organic modifiers of surfactant type can significantly improve the quality of limestone as filler. To obtain a hydrophobic calcite surface in the process of modifying, the surfactant monocarboxylic acids with aliphatic hydrocarbon chain, the so-called fatty acids and their salts are commonly used.

O13

Porous sintered scaffold based on bioactive polyphosphate glass

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The aim of this study is the preparation of highly porous slow-release glassy carrier for hydrocarbon degrading bacteria. The bioactive polyphosphate glass selected from the $P_2O_5 – SiO_2$-$B_2O_3 – CaO – MgO – K_2O$ system was prepared by standard melt quenching technique. To obtain glass powder (< 20μm) the glass was micronized in a laboratory ultra-centrifugal mill RETSCH ZM-1. The scaffold was fabricated by using the polyurethane (PU) foam replication technique. The foam in a form of cube was impregnated with glass particles previously suspended in distilled water and then dried overnight at room temperature. In order to sinter glass particles the scaffold was heated in an electric furnace (Carbolite 1300 CW) with rate of 2°C/min up to 650°C and then held for t = 1h. The temperature of sintering was determined previously by hot stage microscopy (E. Leitz -Wetzlar). The sintered scaffold was analyzed by XRD and SEM methods. SEM microphotographs revealed a presence of the network of macropores with dimensions up to 900 μm. Only small area with non-homogenous contribution of glass particles on scaffold was observed. XRD pattern of the powdered sample confirmed its glassy structure e.g, the thermal treatment was not induced the crystallization of glass particles.

O14

Modified Precipitation Route for Preparation of Nanocrystalline $NiFe_2O_4$

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Nanosize Ni-ferrite powders were synthesized by modified precipitation process in which soluble starch was used as dispersing agent. $NiSO_4$·and $Fe(NO_3)_3$ were used as precursors for NiO and Fe_2O_3, respectively and Na_2CO_3 was used as a precipitating agent. Since soluble starch reacts with sodium in alkalization reaction added amount of Na_2CO_3 had to be determined using the degree of substitution (DS). Two scenarios in which starch reacts with sodium up to level when DS=1 and DS=3 were studied. The obtained Ni-ferrite powders were analyzed and discussed through structural, compositional and magnetic characterization. Formation of nanocrystalline $NiFe_2O_4$ phase was confirmed by the subsequent X-Ray diffraction analysis (XRD), Fourier transform infrared spectroscopy (FTIR) and ^{57}Fe Mössbauer spectroscopy (MS). Although, the average crystallite size of 21 nm was determined by XRD for both studied powders the results of field-emission and conventional scanning electron microscopy FE-SEM/SEM demonstrate noticeable differences in morphology and particle size. The obtained room temperature magnetic hysteresis loops, measured on vibrating sample magnetometer (VSM), illustrate subtle differences between magnetic properties of studied materials and exhibit characteristic “S” shape with coercivity of about 10^1 kA/m and the specific moment up to 40 Am^2/kg.

O15

Functionalized porous nanocomposite as phenol derivatives sorbent

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Nanocomposite of poly (glycidyl methacrylate-*co*-ethylene glycol dimethacrylate) and acid modified bentonite was prepared by radical suspension copolymerization. The porosity of the obtained nanocomposite was confirmed by mercury porosimetry. In order to be tested as sorbent for phenol derivatives the composite was functionalized with diethylene triamine and denoted CP-S_A-deta. Sorption at constant temperature (25 °C) was performed on water solutions of three phenol derivatives: 4-nitrophenol (4NP), 2-nitrophenol (2NP) and 2-chloro-4-nitrophenol (2Cl4NP). The influence of pH, sorption time and initial concentration of sorbates on sorption efficiency of CP-S_A-deta was studied. The isotherm data were best fitted with Langmuir model, while the sorption dynamics obeyed the pseudo-second-order kinetic model for all derivates. Under the same experimental conditions the sorption capacity of CP-S_A-deta toward phenol derivatives increased in the following order q_{max}(2NP)=0.34 mmol g^{-1} < q_{max}(4NP)=0.58 mmol g^{-1} < q_{max}(2Cl4NP)=0.70 mmol g^{-1}. On the other hand the sorption rate was similar for 2NP and 4NP, but somewhat slower for 2Cl4NP. The synthesized functionalized nanocomposite can be regarded as promising sorbent for phenol derivatives.

P1

Optimization of major oxides content and fired brick properties for various applications

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The optimal samples content of major oxides (SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O, MnO and TiO_2), firing temperature (800–1100 °C) and final properties of tiles, hollow blocks and solid cubes were chosen depending on a final usage of the raw material in heavy clay brick industry. Optimization procedure was performed using Fuzzy Synthetic Evaluation (FSE) algorithm on the basis of previously developed artificial neural networks models that predict compressive strength, water absorption, firing shrinkage, weight loss during firing and volume mass of laboratory products. Trapezoidal membership function is defined by experimentally obtained values and optimal ranges of tested properties. The objective function included all the fired products parameters with equal participation, and its maximum is determined the optimization results. Objective function gained values between 0.6 and 0.7. Solid bricks are proved to be producible of heavy clays containing the highest free SiO_2 and CaO content, by firing at high temperatures. Highly sinterable clays should be used for hollow bricks and the highest quality raw materials in roof tiles production, by firing at 900 °C at laboratory conditions.

P2

Lightweight construction ceramic composites based of pelletized fly ash aggregate

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As coal combustion byproduct fly ash represents a risk for environment: direct ash emission from open land-fills causes pollution of air, soil and water. The solution for this severe pollution problem is fly ash reapplication in various construction ceramic composite materials. Although pelletization of waste powdery material is a known technique in the production of artificial aggregates, it still has not been widely used in construction sector. Here investigated cold-bonded fly ash aggregate was produced in semi-industrial pelletizing device. The fly ash particles were bonded with water-glass (Sodium silicate - Na_2SiO_3) and used as substitution for aggregate in Portland cement based composite. Half of the produced lightweight aggregate was submitted to thermal treatment and afterwards applied in the construction composite in the same ration as in the case of cold-bonded pellets. The performance characteristics of two types of lightweight composites were mutually compared and afterwards correlated with characteristics of normal-weight concrete. Compressive

strength, modulus of elasticity and tensile strength were used as represents of the composites mechanical behavior. Mineral constituents of fly ash pellets were analyzed by means of X-ray diffraction analysis, differential thermal analysis was applied in crystalline phase investigation, and scanning electron microscopy in microstructural analysis. The leaching behavior and environmental impact of hazardous elements were also analyzed. It was concluded that content of potentially toxic elements found in leachate of fly-ash based composites was far below tolerance limit proposed by actual standards for the building materials, characterizing the fly ash non-harmful secondary raw material and enabling its reapplication in building materials industry. Utilizing fly ash to produce quality aggregates should yield significant environmental benefits.

P3

Establishing the model for predicting the moisture and velocity in the critical point during drying of green masonry products

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The aim of this study was to establish the model for predicting the moisture and velocity in the critical point during drying of green masonry products. The raw material was first dried at a temperature of 60°C, and then after cooling to room temperature, was milled down using perforated rolls mill. Milled material was identified and subject to further classical preparation, which precedes the formation on the vacuum presses. Thus prepared sample carried the name - sample A. The starting raw material was mechanically activated for 30 minutes. Thus prepared sample carried the name - sample B. Laboratory samples 120x50x14 mm were formed in a laboratory extruder under a vacuum of 0.8 bar. These samples were used in further experimental work. Drying process was monitored and all process parameters such as: temperature, relative humidity of the drying air, weight changes, linear shrinkage, temperature of the surface and in the centre of test samples were recorded continually.Two mathematical models, based on multi factorial experimental design technique, were set up. The first describes the moisture and the second one the velocity value of the samples B in the critical point as a function of temperature, relative humidity and the velocity of the drying medium.

P4

Slag from metal magnesium production as component in ecologically clean production of various types of construction ceramics

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In this paper application possibilities of the slag from production of metal magnesium in the plant *Bela Stena, Baljevac*, as an initial component in construction ceramics is investigated. During technological processes of materials manufacturing significant number and quantities of secondary raw materials are being produced. Such by-products are frequently causing number of complex problems connected to their storing, as well as water, air and soil pollution. Majority of these secondary materials can be sorted in the group of useful and reusable materials according to their chemical and mineralogical composition and properties. Secondary raw materials can be applied as basic components in manufacturing processes of number of ceramic building materials. By re-application secondary raw materials are obtaining their significance judging from the economical as well as ecological aspect. During technological process of manufacturing of the metal magnesium, entire specter of by-products occurs. Most of such obtained waste materials can be reused as secondary components in a number of industrial processes. Aim of this investigation is to point out the possibility of slag reusing. Given slag is the by-product from the process of magnesium manufacturing and it can be applied as basic component for number of building materials: building ceramics, building mortars and thermo-insulation mortars. The slag, here investigated, is by-product from magnesium production and it belongs to the four components system Cao-MgO-Al_2O_3-SiO_2. Results of the investigation showed that ceramic based on this secondary material can be used as one of starting components in floor, wall and roof tiles manufacturing. Magnesium production slag application in the composite materials used for production building ceramics is very important because of its economical as well as ecological aspects.

P5

Alumina as raw material in production of ceramic materials: the changes of alumina crystal structure by mechanical activation procedure

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In this paper mechano-chemical activation of alumina and the influence of the activation process on the change of the alumina crystal structure is presented. This study is based on investigation of kinetics and mechanism of the particle formation together with the phase transformations occurring in the process. Theoretical principles of operation of high-energy mechano-activators, such as vibration and planetary mechano-activators during the mechano-

chemical activation of alumina were used in the investigation, along with their dependance on selected experimental conditions, detailed investigation of the possibility to obtain high-grade αAl_2O_3 alumina in the form of micron-sized, non-agglomerated particles by the method of mechano-chemical activation combined with heat treatment, and starting from the γAl2O3 alumina modification after the Bayern process. The elements that are necessary for determination of operation of high-energy mechano-activators, particularly vibration and planetary ones, were determined by detailed investigation of the alumina mechano-chemical activation; also, conditions required to define the both technological and production parameters of mechano-chemical activation are fulfilled, too. Based on investigated parameters and theoretical consideration of the alumina mechano-chemical activation, together with its influences on change of the alumina crystal structure by usage of mechano-chemical activators with advanced construction and contemporary instrumental techniques used in determination and observation of the most important physical, chemical and thermic characteristics, kinetic model which is the basis for a quick and efficient determination of above parameters in order to optimize and automatise mechano-chemical activation processes was developed.

P6

The luminescent properties of yttrium oxyapatite doped with Eu^{3+} ions

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The luminescent properties of yttrium oxyapatites doped with europium ions, synthesized by reflux method, were investigated in this paper. This low temperature procedure of synthesis gave, by the first time, pure oxyapatite phase as ideal host material for incorporation of any rare earth ion. The SEM investigations showed a very specific rope-like morphology of the obtained powder. The structure of yttrium apatite with incorporated Eu^{3+} ions, as luminescent active centers, had shown the most important reflections of hexagonal phase of yttrium oxide silicate - yttrium oxyapatite, obtained as a consequence of the Y^{3+} ion stabilization. The alternative positions of Eu^{3+} ions in crystal lattice of oxyapatite influenced its specific luminescent properties, induced by various crystal environments of Eu^{3+} ions which substitute calcium or yttrium ions. The deep analysis of the europium emission spectra showed that it is possible to refine positions of Eu^{3+} ions inside the oxyapatite crystal cell.

P7

Synthesis of the glass-ceramics based on basalt

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In this paper, results and investigation of possibility of sythesis of the glass-ceramics based on basalt are presented. Glass-ceramic due to its specific properties (high hardness, abrasion resistance, good chemical consistency, etc.) has wide area of application in mining, civil engineering and building industry, metallurgy, for manufacturing of parts of equipment or devices, constructing materials, etc. For obtaining of the glass-ceramic basalt from *Vrelo, Kopaonik* deposit was used. A series of melting on various temperatures from 1150 to 1300°C were performed. Synthesis parameters, temperature, melting interval, and cooling rate were defined. Selection of composition of glassy mixture was performed in order to obtain satisfactory quality. On thus obtained products various conditions of thermal treatment were performed and optimal regime was determined: gradual heating up to 850°C in time intervals of 1.5 h and progressive cooling gave good physico-mechanical properties. Structure of glass-ceramic samples obtained by melting of basalt after thermal processing is crypto–crystal accompanied by appearance of small low-crystallized aggregates. The structure also contains bubbles filled with either air of glass. These are initial results of investigation of application of basalt from Serbian deposits for obtaining glass-ceramics. These products are not carcinogenic and they can successfully substitute materials such as: asbest or various metallic materials. Technology applied in manufacturing of basalt is ecologically clean, which is of high importance from economical, ecological and energetically point of view.

P8

The influence of Ni on the performance of Al, Fe, Ni pillared bentonite based electrodes in electrooxidation of phenol

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Composite Nafion-clay modified glassy carbon electrodes (GCEs) were tested in the electrooxidation of phenol in acidic media. The clay originated from Mečji Do, a seldom investigated bentonite deposit in Serbia. Raw clay was Na-enriched and pillared with different species. The following pillared clays (PILCs) were obtained: Al90Fe10-PILC, Al85Fe10Ni5-PILC and Al90Fe5Ni5-PILC, where numbers represent the molar percentage of each species in the pillaring solution. The aim of this investigation was to test the influence of Ni on the electrochemical performance of PILC bearing electrodes. The obtained materials were characterized by X-ray diffraction, FTIR spectroscopy and X-ray photoelectron spectroscopy. The cyclic

voltammetry was used for the investigation of electrooxidation of phenol in acidic environment using composite GCEs. All electrodes exhibited similar electrochemical behavior but differed in current intensities and stability of the electrochemical response. Deactivation of electrodes based on Na-enriched, Al90Fe10-PILC, Al85Fe10Ni5-PILC was observed, while good stability was found for the Al90Fe5Ni5-PILC based electrode. Also, different Tafel slopes were obtained for different electrodes. It can be assumed that the Fe/Ni ratio plays the key role in the performance of Al, Fe, Ni-PILC based CGEs in the electrooxidation of phenol.

P9

Mechanical activation influence on magnetic and electrical properties of the system powder 50% $BaTiO_3$ and 50% Fe_3O_4

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Electrochemically obtained nanostructural powder Fe_3O_4 and commercial powder BaTi in mass ratio 1:1, have been ground as mechanical mixture in Planetary Ball Mill for 3 h, 6 h and 12 h. The activated powder has been further pressed into disc-shaped samples under the pressure of 500 MPa.
The magnetic properties of the samples have been investigated by thermomagnetic measurements based on Faraday method in the temperature range from room temperature up to 600^0C during the heating and upon cooling. It has been shown that the powder sample activated 3 h before annealing has approximately 67 % higher initial magnetization per gram as compared to the magnetization of the as cast sample. Upon annealing of the sample activated for 3 h, its magnetic permeability at room temperature increases for about 41% as compared to the initial permeability before the annealing. It has been shown that the magnetic properties of the powder samples activated for 6 h and 12 h vary insignificantly from the magnetic properties of the non-activated powder both before and after the annealing. Thermoelectrical measurements in the temperature range from room temperature up to 600 ^{0}C have shown that the powder activated for 3 h has the best electrical properties.

P10

Chromite based refractory coatings used in expandable patterns casting of Fe-C alloys

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A possibility to develop new chromite-based refractory coatings for casting applications has been investigated in this paper. The results of monitoring of synthesis and characterization procedure and finally application of the refractory coatings showed that sediment stability of coating suspension was crucial parameter for the quality of the coating. Optimization of the coating composition with the controlled rheologic properties was achieved by application of different coating components, particularly by application of a new suspension agent and by alteration of coating production procedure. Chromite was applied as filler. The chromite sample was tested by X-ray diffraction analysis, diffraction thermal analysis and scanning electron microscopy. The shape and grain size were analyzed with program package OZARIA 2.5. It was shown that application of this type of water-alcohol-based lining had a positive influence on surface quality, structural and mechanical properties of the castings of Fe-C alloys obtained by casting into sand molds, according to the method of expandable patterns.

P11

Dilatometric Analysis of Mechanically Activated $SrTiO_3$ Powder

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Strontium-titanate powder was mechanically activated in a planetary ball mill for 0, 5, 10, 30, 60, 90 and 120 minutes. Non-isothermal sintering of non-activated and activated $SrTiO_3$ powder samples in the temperature interval from 50 to 1300 ^{0}C with three different heating rates (10, 15 and 20 ^{0}C/min) was investigated on a dilatometer. X-ray powder diffraction and scanning electron microscopy (SEM) were used to determine the phase composition, lattice microstrains and microstructure morphology of the samples. XRD results showed the presence of new phases: $SrCO_3$ (strontuim-carbonate) and TiO_2 (anatase) after 30 minutes of mechanical activation.

P12

The influence of mechanical activation on the electrical properties of $Ba_{0.77}Sr_{0.23}TiO_3$ ceramics

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Ferroelectric ceramic barium strontium titanate ($Ba_{0.77}Sr_{0.23}TiO_3$), BST, was prepared by solid-state reactions using starting powders of barium carbonate ($BaCO_3$), strontium carbonate ($SrCO_3$) and titanium dioxide (TiO_2-anatase). Non-activated and mechanically activated mixtures with high-energy planetary ball mill (0, 5, 10, 20, 80 and 120 minutes) were sintered at 1100, 1200, 1300 and 1400 °C for two hours in air. The maximum value of ceramic density is about 86.20% TG. X-ray diffraction analysis was used to obtain information on the phase composition, as well as determining the influence of mechanical activation on the half height width of the diffraction lines (111) BST isothermally sintered samples at 1400 °C during two hours. Defects and the beginning process of sintering on the microstructure were investigated by scanning electron microscopy (SEM). Electrical measurements (loss tangent of the angle, Nyquist diagrams and influence the activation time dependence of $X_C = f(\log \nu)$) are made of ceramics sintered at 1400 °C for two hours.

P13

Density and electrical properties of cordierite based ceramics as function of compaction pressure

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Mechanical activation is widely used and relatively inexpensive procedure for sintering process sample preparation. However, the influence of pressure, which is used for compaction, has not been completely investigated. Cordierite, $2MgO{\cdot}2Al_2O_3{\cdot}5SiO_2$, is a very actual high-temperature ceramic material, due to its characteristics. Based on our previous investigation, the mechanical activation of the starting mixtures with 5.00 mass% TiO_2 was performed in a high energy ball mill during 10 minutes. Compaction pressure varied from 0.5 to 6t/cm^2 (49 MPa - 588 MPa). Sintering process was performed at 1350^{o}C for 4h in air atmosphere. The phase composition of activated and sintered samples was analyzed by the X-ray diffraction method. Scanning electron microscopy was performed to analyze the microstructure of both compacted and sintered sample. Non-isothermal sintering up to 1400^{o}C, with a constant heating rate, was investigated by thermal shrinkage change with dilatometer. In this paper we research green bodies and sintered samples compaction pressure influence electrical properties.

P14

Influence of MoO_3 on sintering temperature of mechanically activated $MgO-Al_2O_3-SiO_2$ system

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Cordierite, $2MgO{\cdot}2Al_2O_3{\cdot}5SiO_2$, is a very attractive high-temperature ceramic material, due to its outstanding electrical characteristics, such as the low temperature expansion coefficient, low dielectric constant and good mechanical properties. In order to accelerate the process of sintering, 5.00 mass% MoO_3 has been added to the starting mixtures. The mechanical activation of the starting mixtures was performed in a high energy ball mill during 0-80 minutes. The particle size analysis (PSA) was employed in order to determine the changes in the particle size of the mechanically treated powders. The phase composition of the starting powders and sintered samples was analyzed by the X-ray diffraction method. Furthermore, differential thermal analysis (DTA) was used in order to determine characteristic temperatures within the system during heating. Based on the obtained DTA results, it was established that mechanical activation has some influence on temperatures of phase transitions. Sintering process was performed in air at 1200^{o}C for 2h.

P15

Structural characterization of mechanically activated $MgO-TiO_2$ system

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In this article the influence of ball miling process on structure of $MgO-TiO_2$ system was investigated. The mixtures of $MgO-TiO_2$ powders were mechanically activated in a planetary ball mill for the time period from 0 to 120 minutes. The influence of mechanical activation on the lattice vibrational spectra was studied by Raman spectroscopy at room temperature. Structural investigations have been performed on produced powders. Nitrogen adsorption method was used to determine the BET specific surface area and pore size distribution. Unusual results have been obtained: specific surface area continuosly decreased up to 40 minutes of activation and increased after that, reaching its minimun value of 5.5 m^2/g. The Raman spectra of activated powders have shown that anatase modes have been decreasing in intensity and broadening as the time of

activation extended. Also, the additional modes attributed to TiO_2 II, srilankite and rutile phases started to appear as a consequence of activation.

P16

Annealing and doping concentration effects of Y_2O_3: Sm^{3+}nanopowder obtained by self-propagation room temperature reaction

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In this report, structure, morphology and luminescence of Y_2O_3:Sm^{3+}nanoparticles prepared by self-propagating room temperature reaction are presented. This new, simple and cost effective synthesis allows obtaining desired phase composition by mixing appropriate amounts of yttrium and samarium nitrates together with sodium hydroxide. A set of samples is prepared with different Sm^{3+}concentrations (0.1, 0.2, 0.5, 1 and 2 at %) in order to observe changes of luminescence properties. Also, effects of post synthesis annealing at several temperatures (600 °C, 800 °C and 1100 °C) are analyzed. For all samples X-ray diffraction showed that powders have cubic bixbyite structure (Ia-3), and TEM analysis showed particles of about 50 nm. Luminescence emission spectra clearly show peaks characteristic for electronic spin-forbidden transition of Sm^{3+} ions $^4G_{5/2}\rightarrow{}^6H_{5/2}$, $^6H_{7/2}$ and $^6H_{9/2}$ centered at 578, 607 and 654 nm, respectively. Emission lifetime values decrease with Sm^{3+} ion concentration increments, from 1.94ms for 0.1 at% to 0.97 ms for 2 at%. In addition, enlargement of lifetime values observed when thermal treatment is done at the highest temperature due to the elimination of luminescence quenching species from the surface of particles.

P17

Effect of processing parameters on structural and morphological Y_2O_3 :Yb^{3+}/Ho^{3+} powders characteristics

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Up-converting yttrium oxide powders doped with Yb^{3+} and co-doped with Ho^{3+} were synthesized through hydrothermal processing at 200 °C/3 h. Reverse precipitation of the starting nitrates mixture is performed with the help of ammonium hydrogen carbonate (AHC) solution up to pH 7 or pH 9 prior to hydrothermal treatment. Morphological features of the as-prepared (asp) powders and rare earth oxides obtained after powders additional annealing at 1100 ^oC (3 and 12 h) are discussed based on X-ray powder diffractometry (XRPD), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). Structural refinement confirmed generation of the cubic bixbyte-structure (S.G. *Ia*-3) with non-uniform accomodation of dopants at C_2 and S_6 cationic sites. SEM revealed that the particles have plate-like or rod-like morphology in dependence of hydrothermal processing (pH). Due to the fact that are composed from nanograins (30-100 nm) they

demonstrate prominent green luminescence centered at 550 nm after been excited with the infrared laser source (λ=978 nm).

P18

Dielectric characterization of microalloyed alumo-silicate ceramics by using linear regression model

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In this paper, dielectric characterization of porous alumo-silicate ceramics, modified by alloying with magnesium and microalloying with aluminum, was investigated. Microstructure investigations have revealed non-uniform and highly porous structure with broad distribution of grain size, specifically shaped grains and high degree of agglomeration. Complex multiphase system, as active microalloyed ceramics, has specific behavior under external electrical field influence. Dielectric properties (the changes of permittivity, electrical resistivity, dielectric losses and impedance) were measured in the frequency range 20 Hz – 1 MHz. All characteristics showed nonlinear distribution and complex functional dependences because of significant nonhomogeneity of active microalloyed ceramics. Values for permittivity ranged between 140 – 430. Order of magnitude for electrical resistivity was about 10^6 Ωm, for impedance 10^4 – 10^8 Ω, and loss tangent had values much greater than 0.05. Mathematical model of linear regression was applied on the dielectric characterization results. Consistency with experimental data was approved, since the values for correlation coefficient r and determination coefficient r^2 were obtained near value 1.

P19

Application of Minkowski layer for microalloyed alumo-silicate ceramics grains fractal analysis

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Porous aluminium-silicate ceramics, modified by alloying with magnesium and microalloying with alluminium belongs to a group of advanced multifunctional ceramics materials. This multiphase solid-solid system has predominantly amorphous microstructure and micro morphology. Intergranular and interphase areas are very complex, because they represent areas, where numbered processes and interactions take place, making new boundaries and regions with fractal nature. Solid contact between grains is actually very complex configuration of microcontacts with fractal nature. Fractal analysis of intergranular microstructure has included application of Minkowski layer. This layer is in correlation with fractal dimension, and defines grains contact probability. It represents convex layer of grains contour roughness and irregularity. Considering the fractal nature of intergranular contacts, it is possible to establish correlation between material electrical properties and fractal analysis, as a tool for future correlation with microstructure characterization.

P20

Electrical properties of sintered system $MgCO_3$-TiO_2

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Important role among ceramic materials have those that are applied in electronics. Most common way of obtaining those materials is by using the process of sintering. During mechanical activation of the inorganic materials, they are subjected to grinding and the grain size is being reduced. Crystal structure is distorted and changed, which, in some systems, leads to chemical reaction and formation of new compound. In this paper we explain the influence of mechanical activation on electrical properties in system $MgCO_3$-TiO_2. Important domains in ceramic materials are those materials that are applied in electronics. Magnesium titanate ($MgTiO_3$) based dielectric materials are used for producing type-I capaicitors. Common way of obtaining this material is solid state reaction during reaction sintering. Process of sintering can be enhanced if mechanical activation precedes. In this work starting powders of magnesium carbonate ($MgCO_3$) and titanium dioxide (TiO_2) with a rutile crystal modification were weight to attain 1:1 molar $MgCO_3$:TiO_2 ratio. 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^{o}C during 30, 60 and 180 minutes. For specimens synthesized in such a manner, microwave dielectric properties were measured, quality factor (Q,) specific electrical resistivity (ρ) and the dielectric constant (ε_r).

P21

Novel organo-inorganic clay based catalyst for catalytic wet peroxide oxidation

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This work presents results of a preliminary study of a novel organoinorganic material based on bentonite clay (Mečji Do, Serbia) that was investigated as catalyst in the Catalytic Wet Peroxide Oxidation (CWPO) of Tartrazine dye. The material was obtained by supporting Fe^{3+} ions on organobentonite with hexadecyltrimethylammonium loading (HDTMA-MD), according to analogy with strong binding of toxic metal cations from water by adsorption on HDTMA-MD. The purpose of organic loading was to assure that the majority of Fe^{3+} is supported on the clay particle surface instead of clay interlamellar region.

XRD analysis showed the incorporation of HDTMA in the interlamellar region, while there was no indication of the presence of Fe^{3+} between the smectite lamellae; XRF analysis confirmed increased Fe content of the organo-inorganic clay material. Fe-HDTMA-MD showed good performance in the catalytic degradation at different initial concentrations of the dye; increased temperature had beneficial effect on the decolonization of Tartrazine solutions.

P22

p-Nitrophenol electro-oxidation on carbon glass electrode modified with organoclays

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A glassy carbon electrode (GCE) was modified with a thin layer of modified clay obtained from insufficiently investigated locality Mečji Do in Serbia. The clay is very rich in smectite with only traces of other minerals like crystoballite. Na-enriched smectite and a series of tetramethylammonium smectites (TMA-S) with different TMA/S ratios were tested as constituents of GCE based working electrode in the electro–oxidation of *p*-nitrophenol (*p*-NP) in H_2SO_4 as support electrolyte. The modified clays were characterized by XRF, X-ray diffraction and FTIR

spectroscopy and the incorporation of TMA in the smectite structure was confirmed. Cyclic voltammetry was used for electrochemical investigation. The presence of TMA increased the current density of the *p*-NP oxidation wave in comparison with the oxidation signals obtained using a Na-enriched based electrode. It can be assumed that the increased electrochemical activity of TMA-S based electrodes toward *p*–NP oxidation was achieved due to the adsorption of *p*–NP on the electrode surface, since the adsorption commonly precedes the electro-oxidation process. The adsorption of *p*–NP was favored by the presence of TMA.

P23

Characterization of mechanochemically synthesized $CaO{\cdot}ZnO{\cdot}K_2CO_3$

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The mixed oxide of $CaO{\cdot}ZnO$ and K_2CO_3 were prepared by ball milling of CaO and ZnO powders and water, with addition of K_2CO_3 and afterward by calcination at 700 ^oC. Influence of different molar ratio of K_2CO_3 and CaO (x=1, 2 and 4 moles of K_2CO_3 per 10 moles of CaO) was studied . The prepared samples were characterized by X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), thermogravimetric analysis (TGA), infrared spectroscopy (FTIR), scanning electron microscopy/energy-dispersive spectroscopy (SEM/EDS) and the particle size laser diffraction (PSLD) distribution. The addition of smaller amount of K_2CO_3 at the beginning of ball miling ($x \leq 2$), favors the formation of calcium zinc hydroxide hydrate, while it is not the case when K_2CO_3 larger addition was used ($x > 2$). A larger amount of potassium carbonate in the initial composition of powder mixture negatively affected formation of $CaZn_2(OH)_6{\cdot}2H_2O$. Bimodal distribution were detected for all samples after calcination at 700 ^oC and the results showed that the distribution of elements in the bulk is not homogeneous and that surface of formed mixed oxide $CaO{\cdot}ZnO$ (XPS analysis) after calcination is mainly covered by potassium species. That evidence indicate that the K_2CO_3 was not fully incorporated into the matrix. Prepared samples could be used for methanolysis of vegetable oil and fatty acid methyl esters (FAME, i.e. biodiesel) synthesis.

P24

Biodiesel synthesis based on $CaO{\cdot}ZnO{\cdot}K_2CO_3$ as catalyst

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Mixed oxide-carbonate with composition $CaO{\cdot}2ZnO{\cdot}_xK_2CO_3$ obtained by ball milling of CaO, ZnO, K_2CO_3 (where x=0, 1, 2 and 4, moles of K_2CO_3 per 10 moles of CaO) and water, after calcination at 700 ^oC was used as catalyst for biodiesel synthesis in 300 cm^3 batch autoclave at 70 ^oC. Used molar ratio of methanol to sunflower oil of 10:1 and 2 wt% of catalyst based on oil weight was usual working condition in all the experiments of biodiesel synthesis. The prepared catalysts were characterized by base strength using Hammett indicator, by measurement of bulk and surface catalyst composition using inductively coupled plasma (ICP) and X-ray photoelectron spectroscopy (XPS), as well as by determination of Ca, Zn and K ions solubility in methanol at 60 ^oC. Conversion of triglyceride (TG) during methanolysis catalyzed with prepared catalyst was determined by gas chromatography. Addition of K_2CO_3 in the process of $CaO{\cdot}ZnO$ mixed oxide preparation significantly improve an initial rate of methanolysis (during the first hour of biodiesel synthesis) comparing to the "pure" $CaO{\cdot}ZnO$ catalyst. It was shown that addition of higher amount of K_2CO_3 for mixed oxide-carbonate preparation significantly increases the initial activity of catalyst and that such an effect is caused by homogeneous–heterogeneous catalysis of biodiesel synthesis.

P25

Aerosol-assisted synthesis of hierarchically organized titania and titanates nanostructures

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The aerosol route, representing a feasible bottom-up technique for nanomaterials processing in disperse system, was applied for the low-temperature (T=150 ^oC) synthesis of spherical, non-agglomerated, hierarchically organized titania and titanates nanostructures. The diverse levels of structural, morphological and functional complexity were explored by using appropriate colloidal precursors comprising either spherical nanoparticles or nanotubes. In both cases, spherical, grained, submicronic sized particles with the average diameter of ~350 nm for titania and ~ 450 nm for titanates were obtained. The detailed structural and morphological investigations were done according to X-ray powder diffraction (XRPD), scanning and field emission electron microscopy (SEM/FESEM), particle size distribution (PSD) and transmission electron microscopy (TEM)

results. Results revealed that particles have clustered inner structure and are composed from primary nanounits in form of nanoparticles or nanotubes. Such hierarchically organized particles are expected to have potential application not only in the field of photovoltaics but also in various branches of photocatalysis.

P26

Characterization of mechanically activated ZnO powder

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Materials based on ZnO structure have more frequently application as fillers in polymer ceramics nanocompozites. Performances of these materials depends on fillers morphology, surfaces texture and particles size. According to this, in this paper, the authors investigated the influence of mechanical activation of ZnO powder on crystal and micro structure. Commercially available ZnO powder was activated in a planetary ball mill for 2, 5, 10 and 30 minutes. Characterization of such obtained powders was performed using XRD, SEM and Raman spectroscopy. XRD patterns indicated at lowering of peak intensities along with its broadening wich is realted to partical fragmentation and amorphyzation. Micrographs show irregularly shaped particles at the beginning and with prolonged milling time, particles gained uniformed distibution, while after 30 minutes of activation agglomerates started forming. The results we got by investigation of dynamical structure by Raman spectroscopy are in correlation with the other results of structures analysis. Results presented here enable further optimization of, polymer nanocompozite based on ZnO and PVDF, making process.

P27

ZnO/Ag hybrid nanocubes in alginate matrix

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Ag/ZnO heterostructure of ZnO nanocubes decorated with spherical Ag nanoparticles were prepared in the presence of alginate biopolymer. It has been shown that nanostructures of two or more distinct components and geometries may exhibit additional properties due to an anisotropic distribution of surface functional groups and charges. The obtained ZnO/Ag nanostructures were characterized by UV–vis absorption and photoluminescence spectroscopy, as well as scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The photocatalytic activity of ZnO/Ag-nanohybrids was significantly improved with respect to the bare ZnO particles. Antimicrobial activities ZnO/Ag-alginate nanocomposites were tested against gram-positive (*S. aureus*) and gram-negative (*E. coli*) types of bacteria.

P28

Piezoelectric polymer/ceramic nanostructures for mechanical energy harvesting

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Vibration-based mechanical energy is one of the most accessible energy source in the surroundings. Harvesting this type of energy exhibits a great potential for remote/wireless sensing, charging batteries, and powering electronic devices. Piezoelectric and ferroelectric materials, including PZT, $BaTiO_3$, ZnO, polyvinylidene fluoride (PVDF), etc., can be used for converting ambient mechanical energy into electricity. Based on these materials, a variety of micro- or nanoelectromechanical systems can be developed for harvesting energies from random vibrations, mechanical waves, or body movements like walking, running, or typing. Recent investigations on nanocomposites of electroactive ceramics and ferroelectric polymers exploit this approach in order to produce new multifunctional materials for mechanical energy harvesting. Taking into account that mechanical activation is one of the methods for modification of physico-chemical properties of the filler, in this study we investigate the influence of mechanical activation of ZnO particles on structural properties of ZnO/polyvinylidene fluoride nanocomposites. The nanocomposite films were prepared by solution casting method and investigated by X-ray diffraction (XRD) method and Raman spectroscopy, while the microstructure morphology has been analyzed by scanning electron microscope (SEM). Presented results will enable optimization of PVDF processing techniques for the production of new mechanical energy harvesting devices.

P29

Pulsed Laser Deposition of $BaTiO_3$ on PVDF substrate

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Piezoelectric materials play an important role in development of advanced Micro-electro-mechanical systems (MEMS) and Nano-electro-mechanical systems (NEMS). Their applications span the aero-space industry, communications, defense systems, national security, health care, information technology and environmental monitoring. Materials used in MEMS/NEMS must

simultaneously satisfy numerous requirements for chemical, structural, mechanical and electrical properties. Although traditionally MEMS in particular have relied on silicon, the materials used in MEMS/NEMS are becoming more heterogeneous. Taking into account that materials nanostructuring can produce unique mechanical, electrical and piezoelectric properties, in this article the investigation of pulsed laser deposition of $BaTiO_3$ on PVDF substrate has been performed. The titanium-saphire laser operated at 800 nm with 40-fs pulse duration and 1 kHz repetition rate was focused onto a mechanically activated $BaTiO_3$ target. Deposition on PVDF substrate was done at an oxygen partial pressure of 10^{-7} Torr using a laser pulse frequency of 1 kHz at room temperature. The crystal structure and the microstructure of the films were examined using an X-ray diffractometer and scanning electron microscope, while the surface morphology was observed by atomic force microscopy.It was found that pulsed laser deposition of $BaTiO_3$ on PVDF substrate offers a new set of opportunities for development of advanced flexible piezo-films for the next generation of NEMS.

P30

Functionalization of graphene nanoplatelets via Bingel reaction for polymer nanocomposites

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In this study, we have performed functionalization of graphene nanoplatelets (GNPs) via Bingel reaction and investigated influence on the addition of covalently functionalized GPNs on the structural changes of the poly(methyl methacrylate). Preparation of poly(methyl methacrylate) nanocomposites with functionalized GNPs has been accomplished by drop casting method of dissolved PMMA mixed with modified graphene nanoplatelets dispersed in a *N*-methyl-1-pyrrolidone. Functionalizaton of graphene has been achieved under the conditions of Bingel reaction, which implies introduction of diethyl malonate on the graphene surfaces through the cyclopropane ring formation. Introduction of the cyclopropane ring on to the surface of graphene does not significantly affect the initial structural properties of graphene nanoplatelets, allowing better dispersible properties due to interaction of covalently attached diethyl malonate groups with the polymer chains. Fourier transform infrared spectroscopy (FTIR) and elemental analysis confirmed the effectiveness of the addition of diethyl malonate via Bingel reaction on the surface of GNPs. Scanning electron microscopy (SEM) has been used to provide information on the morphology of functionalized GNPs. Prepared nanocomposites have been characterized by Raman and FTIR spectroscopy. The changes regarding glass transition temperature have been monitored with differential scanning calorimetry (DSC).

P31

SEM-EDS analysis of cobalt-substituted hydroxyapatite nanoparticles changes in culture medium *in vitro*

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In this study we examined changes in the surface of cobalt-substituted hydroxyapatite (CoHAp) nanoparticles and content of ions before and after extraction in culture medium *in vitro*. Appropriate amount of CoHAp nanoparticles was extracted in Dulbecco's Modified Eagle Medium (DMEM) for 3 days at 37^{o}C. After that material was dried, coated with gold and studied by scanning electron microscopy (SEM). The semi-quantitative analysis of calcium and cobalt content in CoHAp nanoparticles was determined by EDS spectroscopy. These analyses were performed on CoHAp nanoparticles before extraction as well. Changes in the shape and size of nanoparticles can be seen after extraction by SEM analysis. EDS analysis shows that cobalt ions concentration decreases after extraction.

P32

SEM-EDS analysis of calcium phosphate/poly-(DL-lactide-co-glycolide) nanoparticles changes in culture medium *in vitro*

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In this study we examined changes in the surface of calcium phosphate/poly-(DL-lactide-co-glycolide) (CP/PLGA) nanoparticles and content of ions before and after extraction in culture medium *in vitro*. Appropriate amount of CP/PLGA nanoparticles was extracted in Dulbecco's Modified Eagle Medium (DMEM) for 3 days at 37^{o}C. After that material was dried, coated with gold and studied by scanning electron microscopy (SEM). The semi-quantitative analysis of calcium and phosphorus content in CP/PLGA nanoparticles was determined by EDS spectroscopy. These analyses were performed on CP/PLGA nanoparticles before extraction as well. Changes in the shape and size of nanoparticles can be seen after extraction by SEM analysis. EDS analysis show that concentration of calcium and phosphorus ions increases after extraction of nanoparticles in DMEM which may lead to the conclusion that new layer consisting mainly of hydroxyapatite is formed onto the nanoparticles surface.

P33

Possibility of use waste materials from floating plant Feldspar ujanovac in ceramical industry after removing the surplus of iron

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In this work is given a scheme of the results of determining the conditions under which the waste material from plant for flotation "Feldspar" Bujanovac can become the start as row material for the ceramic industry. Also, in this paper is given a review of results determining conditions of thickening and filtration of waste material from the flotation plant “Feldspar” – Bujanovac.

Tests of possibilities of thickening and filtration of the non-magnetic fraction of waste material sample of the class -0,063 mm after magnetic separation in laboratory conditions have been carried out within this research. Based on dewatering testing, time of thickening and diagram review of the results have been determined.

P34

Recycling of waste gypsum and its repeated usage in the civil engneering and ceramic industry

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This paper shows result of investigation of possibilities of recycling waste gypsum and finding the adequate appliances of revitalized gypsum in the ceramic industry and civil engineering. The gypsum which is used in the ceramic industry is very fine material. It has high content of semi-hydrate gypsum. After usage of molds in the process of the production of sanitary-ware, the gypsum in the form of dihydrate become useless. The gypsum for production of molds could be reused thanks to development of this, suggested technology. This is the way for supstitution imported component. Appliance of revitalized secondary gypsum is highly important in both following aspects: economical and environmental.

P35

The ceramic materials based on Ag doped zeolite

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The method of the thermal treatment of cation exchanged zeolites (ZTIT) is shown as very acceptable for synthesis of alkaline earth and alkaline framework aluminosilicates. The type and valence state of extraframework cations give rise to recrystallization of amorphous substances to different framework topologies. The fully exchanged Ag^{+} - forms of these zeolites were prepared after several successive exchanges from 0.21 M $AgNO_3$, The ion exchanged samples were thermally treated in the temperature range between 900 to 1300 oC for 1h.

P36

Investigation of construction ceramic from objects of cultural and historical heritage

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Gothic-Romanic monastery on the location of Novi Rakovac, Gradina is significant site from aspect of historical and cultural heritage of the Republic of Serbia. Exact date of building of the monastery can not be clearly identified. Also, it is probable that during monastery "life" additional changes of building construction elements and, even, some reparation works have been performed. However, today, the monastery building is mostly in ruin. Thus, investigation has been carried out in order to make restoration and renovation plans. First step was to mark sampling locations on the building and its elements which would not make further harm or damage to the monument. Afterwards, sampling of stone, mortar and brick specimens has been performed. All specimens were well preserved and carefully stored for its continuity and compactness would be maintained for further laboratory testing. Thus, results were utmost exact and precise and, furthermore, plans for restoration and renovation could be established. Namely, basing on the obtained results from investigations of given materials, new materials, which resemble old ones, could be designed and applied in restoration process. This paper presents results of investigation conducted on brick samples. Applied investigation is mostly engaged with textural characteristics of material in question. Reason for such choice of investigated properties is the fact that first task given to newly designed brick, which should replace old, original brick in the monument, is to aesthetically fit in the building conception. In relation to building functionality, other properties such are compressive strength; water absorption and adhesiveness were investigated. Thus, future durability of the renovated historical and cultural monument could be satisfied.

P37

Facade ceramic tiles: nicrostructural analysis of superficial defects

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This investigation was conducted with an aim to determine nature and cause of defects appearing on the glazed facade ceramic tiles. The results of the investigation of incusions visible surface of ceramic tiles are presented in this paper. Glazed ceramic tiles, were previously in use, namely they were embedded on the exterior of a facility. Influenced by atmosphere, defects appeared on visible surface of glazed ceramic tiles. Defects were shaped as dark-brown dots surrounded by yellow halo. Investigation was conducted on the tiles previously embedded on the façade, as well as on new, previously not used ceramic tiles. With an aim to obtain answer on the question of defects origin, investigation was conducted in accordance with standard SRPS ISO 10545: determination of dimensions and surface quality; determination of moisture expansion; determination of chemical resistance; determination of resistance to stains. Microstructural analyses were conducted by means of optical microscope and scanning electron microscope coupled with energy dispersive spectrometer device. Analysis of results highlighted possibility of defects cause being carbon and iron as impurity, both present in raw material used for glaze production.

P38

Biocompatibility screening of biomaterial based on porous apatite with a film of alginate polymer

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New generation of biomaterials is identified as a priority area with emphasis on ability to last longer and be better adapted to the environment of the human body. The primary requirement is biocompatibility of the biomaterials. This study was conducted in order to examine biomaterial based on porous apatite with a thin film of alginate polymer (PA + A). *In vivo* test and *in vitro* hemolytic assay were used in order to assess the biocompatibility. PA + A was implanted in Wistar rats subcutaneously in the interscapular region and intramuscularly in muscle gastrocnemius at two, four and eight weeks. After this period, the rats were euthanized and the implants with surrounding tissue were surgically removed from rats and prepared for light microscopy and scanning electron microscopy analysis (SEM). Histopathologic and SEM analysis showed the presence of multinuclear giant cells, fibroblasts and increased collagen production which should be related as inflammatory response. The results of the hemolytic assay showed that the studied biomaterial had low hemolysis. These findings suggests that the biomaterial is compatible with blood, but the inflammatory reaction in tissue to the biomaterial indicates that it is necessary to perform further tests.

P39

Corrosion of phosphate glass ceramics in different media

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In this work the results of dissolution of the glass-ceramics prepared from complex phosphate glass containing different divalent cations were presented. The investigation of kinetic and mechanism of dissolution were performed with powder samples under static conditions in distilled water and 2% citric acid. The influence of the kind of solution on kinetic and mechanism of dissolution was analysed. The change of glass mass loss and resistance of solution as a function of dissolution times were analysed and a significant difference of the mass loss of glass-ceramics in distilled water and 2% citric acid was detected. The effect of solvent type decreases with increase of temperature The initial dissolution rates r_o determined at T = 20 and 30 $^{\circ}$C in distilled water are: - 0.069 and 0.092 g/m^{2}h; and constants of dissolution k are 0.0025 and 0.0039 h^{-1} . In 2% citric acid r_o are: - 0.089 and 0.11 g/m^{2}h ; and k are: 0.0029 and 0.0042 h^{-1}. The results showed that during the process of dissolution the influences of solvents and temperatures were changed. The process of electrolytic dissociation dominates for short times of dissolution.

P40

Contribution to the research of historical heritage - laboratory examination of historical mortars -

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Historical mortars represent the composite materials, consisting of the aggregates, binders or the mixture of binding materials and various admixtures. Knowing the original recipes and production methods, and the type and degree of their degradation yields a good basis for mending, conservation and restoration with the ultimate aim in preservation of the original, indigenous appearance and the identity of the reconstructed cultural or historical properties for the future generations. Good practice imposes cooperation of conservationists and experts in materials science, with mutual aim to understand the procedure used for production of these materials as well as possible. Characterisation of historic mortars demands a complex approach, starting with visual observation to laboratory examinations with various methods: mineralogical-petrographical, chemical, physico-mechanical etc. A particular problem is the integration of thus obtained data into a complete picture. Therefore, the cooperation of experts of various profiles is necessary: geologists, crystallographists, technologists, chemists, civil engineers, historians, archaeologists, architects. One of the key questions is regarding the sampling procedure – first the choice of the sampling method, which must be as less invasive as possible, due to the nature of the material, then the size, number and the positions of the necessary samples. In the laboratories of the IMS Institute, we have examined the Roman mortars from the archaeological sites Viminacium and Sirmium, medieval mortars from the monasteries Gradac, Dombo, Peć patriarchy and from Smederevo fortress. Also, we have examined the modern times mortars – from the façade of the National

museum. The results following these examinations point to the differences in recipes for mortars for different purposes, for mortars from different historical periods, and also differences due to the availability of certain ingredients.

P41

Calcium alginate and calcium alginate/zeolite beads as sorbents for nickel sorption in air-lift reactor

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The aim of this study was to investigate application of calcium alginate beads for immobilization of natural zeolite for nickel sorption in an air-lift reactor. The performed research was divided in three parts: production of sorbents (i); sorption studies in an air-lift reactor (ii) and investigation of sorbent's presence on reactor hydrodynamic parameters (iii).

Preparation of sorbents in the form of the spherical beads was performed by dripping technique. Spherical beads were prepared by extrusion of sodium alginate only (control beads) and by extrusion of sodium alginate/zeolite dispersion into collecting solution of calcium chloride. The sorption and hydrodynamic experiments were carried out in an external air-lift glass reactor. Air, aqueous Ni (II) solution, Ca-alginate/zeolite and empty Ca-alginate (control) beads represented gas, liquid and solid phase in the reactor, respectively.

This study showed a promising potential of alginate beads loaded with zeolite for removal of nickel(II) ion from water solutions in the investigated conditions of air-lift reactor. It has been found that air-lift reactor provides good environment for Ni(II) adsorption. Sorbents based on alginate did not have significant influence on reactor hydrodynamic parameters. Our results showed that alginate/zeolite sorbents could be used for the removal of metal ions from water solutions.

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Integral characteristics of statistical distribution functions and processes of thermal equilibrium establishing

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In our previous, we have shown that the sets of curves that represent the multinomial coefficients have a characteristic behavior, when we followed their extremes with other conditions related to partitions and compositions of integers n. Alos these conclusion have been applied in the field of telecommunications, where we pointed out that almost all used distribution function held at integralcharacteristics. In this paper, we will try opting a concept that would enable us to bring the same level two, at first glance, the opposite direction of the research. The concept is based on a

fundamental analysis of the curves of entropy, on the one hand, which is analogous to "fine-crushing" statistical mechanics. On the other hand, compared to the Planck's or Bose-Einstein distribution, bi-curves through a more efficient analysis of the number of states for a given energy and number of particles, which corresponds to the "coarse grinds" statistical mechanics.

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Synthesis, sintering and characterization of multi-doped solid ionic conductors based on CeO_2

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Nanopowdery solid solutions with the fluorite type crystal structure of CeO_2 were synthesized from CeO_2 as a major component and rare earth (Nd, Sm, Gd, Dy and Y) oxides added at a dopant level. The two synthesis procedures were applied: the modified glycine-nitrate procedure (MGNP method), and room temperature self-propagating reaction (SPRT method). The modification of glycine-nitrate method consisted in partial replacement of nitrate by acetate salts, in order to slow down the combustion rate. The SPRT procedure presented a spontaneous and fast room-temperature reaction. The overall mole fraction (x) of dopants was kept constant, x = 0.2. A part of the obtained powdery samples was underwent to densification at 1550 ºC, in an air atmosphere for 1 h. The samples were characterized by XRD, TEM, BET methods and Raman spectroscopy. According to XRD results and Raman spectroscopy, single phase solid solutions of fluorite structure was evidenced regardless on number of dopants and on the synthesis procedure. The conductivity of the sintered samples was measured by complex impedance method. The highest conductivity was found for the samples with the composition $Ce_{0.8}Nd_{0.01}Sm_{0.04}Gd_{0.04}Dy_{0.04}Y_{0.07}O_{2-\delta}$, amounting at 700 ºC to 8.06×10^{-2} and 1.69×10^{-2} $\Omega^{-1}cm^{-1}$ for MGNP and SPRT synthesis methods, respectively. The corresponding activation energies of conductivity amounted to 0.431 (MGNP) and 0.485 (SPRT) eV in the temperature range 500 - 700 ºC.

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The influence of temperature on microstructure contact surfaces on $BaTiO_3$ ceramic doped with Ho_2O_3

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The materials based on $BaTiO_3$ can be controlled using different technological parameters and different additives. We investigate the influence of different temperature levels of sintering (1320°C, 1350°C and 1380°C) on the size of contact area for 0.1% Ho_2O_3 doped $BaTiO_3$ ceramic. Microstructural investigations were carried out using scanning electron microscopy (JEOL-JSM 5300) equipped with EDS (QX 2000S) system. Grain size distribution was determined by quantitative metallography method.

The new correlation between microstructure and dielectric properties of doped $BaTiO_3$-ceramics based on fractal geometry and contact surface probability is recently developed. The presented results indicate that statistical model of contact surfaces is very important for the prognosis of $BaTiO_3$-ceramics microstructure and dielectric properties.

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SEM and EDS investigation of contact surfaces for analyzis of advanced dielectric $BaTiO_3$ ceramics materials

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BaTiO3-ceramics are one of the most important group of functional ceramics that can be used in different applications. BaTiO3-ceramics properties can be significantly changed by adding variety of additives. It is known that addition of various dopants to barium-titanate results in modification of grain-boundary region making possible the control of different electrical properties. The purpose of this paper is an investigation of the effects of different additives on the microstructure properties and contact surfaces.

The grain size and microstructure were investigated using SEM and EDS analysis.
SEM and EDS studies were performed by scanning electron microscopy (JEOL-JSM 5300) equipped with EDS (QX 2000S) system.

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Plasma Electrolytic Oxidation of Al Alloy

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This paper considers novel methods for improving corrosion and wear resistance of Al alloy, such as AA 6063. 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. PEO is a very attractive, cost-effective, environmentally friendly surface engineering technique for light alloys. The aim of this paper was to establish the conditions for forming of PEO layer on the alloy and its influence to wear and corrosion properties. Based on literature data can be recommended optimal conditions for oxide ensuing in order to maximal improve of the properties.

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Young Researchers Look for Geothermal Solutions

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As a part of a solution for an energy hungry world, young researchers in Canada are looking at ancient and new solutions for geothermal heating and cooling using ceramic and other natural materials as well as newly developed substitutes. International business students attending post diploma program at Red River College in Manitoba, Canada are preparing to execute an applied research project associated with geothermal heating and cooling solutions in four continents Asia, Europe, North America, Australia and Oceania.

Driven by high energy costs, North American business community is showing growing interest in geothermal cooling and heating systems. According to 2013 research from Frost and Sullivan, "heating and cooling accounts for 40 percent to 50 percent of power consumption in non-residential buildings. Need to reduce costs and increase energy efficiency is driving tremendous growth in geothermal market revenue. Estimated value of $102.8 million in 2012 is expected to reach $174.6 million in 2017" (Konkana Khaund , 2013). Furthermore recently published articles by The American Ceramic Society indicate an ongoing DOE commitment to funding for research and advancements in geothermal solutions.

The Canadian applied research project in industry intelligence field will cover global practices in using ceramic and other natural materials in creating effective GHC solutions.
The multidisciplinary, multilingual team includes graduate students from 10 countries including Canada, India, China, Ukraine, Turkey, Nigeria, USA and Mexico, whose background ranges from engineering and business to history and anthropology.

Students will use their diverse skills to source information from different regions as well as historic periods. Through collaboration with another team of young researchers, archaeologists from Serbia and France, Canadian team will be able to analyze and compare contemporary solutions with ancient technologies. The knowledge exchange will enable both teams to bridge both geographic and time barriers in searching for effective solutions for energy crisis.

Canadian project is led by RRC business applied research prime Ms. Tatjana Brkic partnered with consultants from Canadian business and applied research community and select group of academics. European team is led by Dr Vladimir P. Petrovic, senior research fellow in the Institute of Balkan Studies of Serbian Academy of Sciences and Arts. To create links between past and present young researchers will have access to geothermal energy experts, material scientists, engineers and archaeologists who will volunteer they time and share their knowledge to support the students' work.