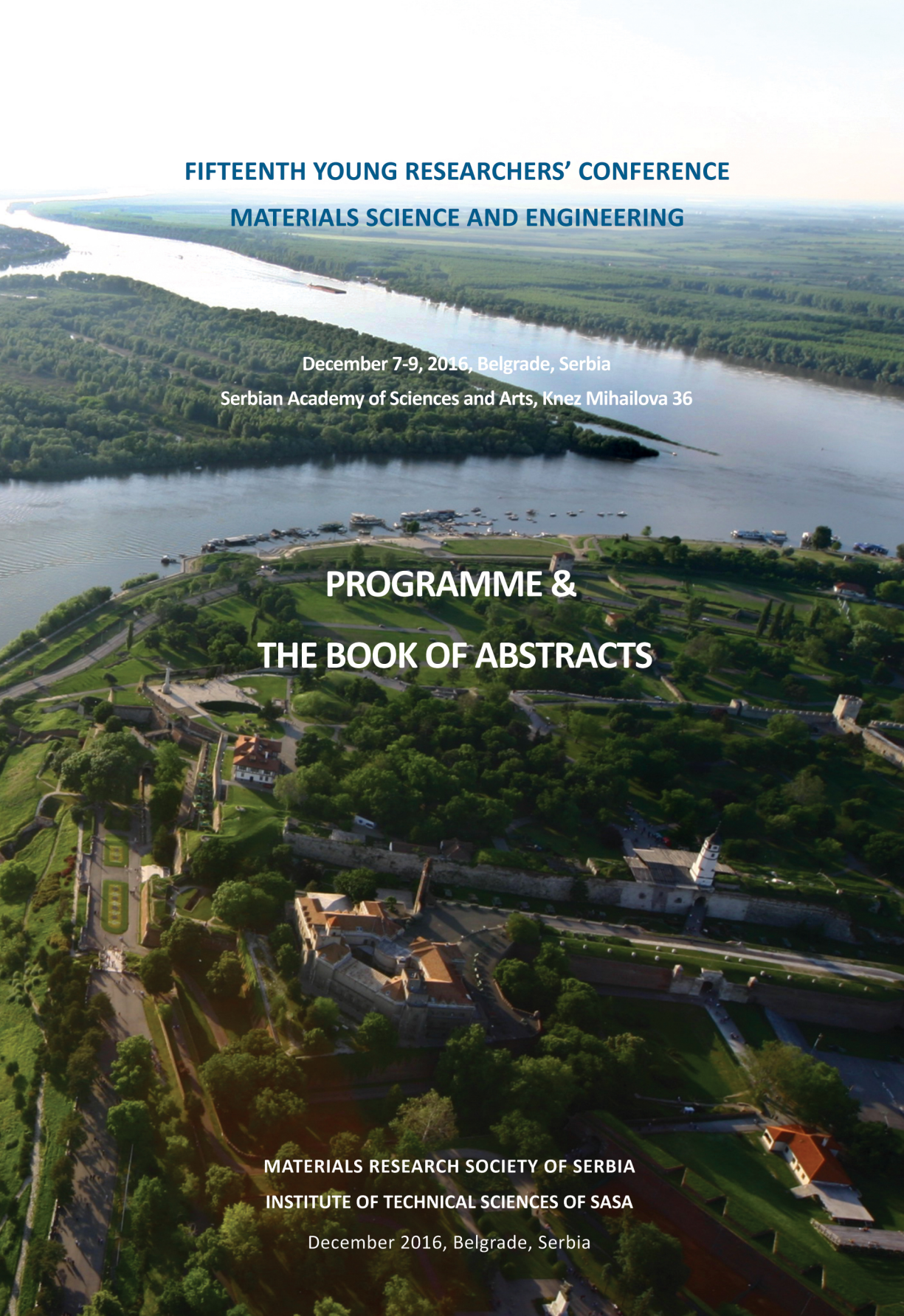

FIFTEENTH YOUNG RESEARCHERS' CONFERENCE

MATERIALS SCIENCE AND ENGINEERING

December 7-9, 2016, Belgrade, Serbia

Serbian Academy of Sciences and Arts, Knez Mihailova 36

PROGRAMME &

THE BOOK OF ABSTRACTS

MATERIALS RESEARCH SOCIETY OF SERBIA

INSTITUTE OF TECHNICAL SCIENCES OF SASA

December 2016, Belgrade, Serbia

FIFTEENTH YOUNG RESEARCHERS' CONFERENCE
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Program and the Book of Abstracts

Materials Research Society of Serbia
&
Institute of Technical Sciences of SASA

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Aim of the Conference

Main aim of the conference is to enable young researchers (post-graduate, master or doctoral student, or a PhD holder younger than 35) working in the field of materials science and engineering, to meet their colleagues and exchange experiences about their research.

Topics

Biomaterials
Environmental materials
Materials for high-technology applications
Nanostructured materials
New synthesis and processing methods
Theoretical modelling of materials

Scientific and Organizing Committee

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Results of the Conference

Beside printed «Program and the Book of Abstracts», which is disseminated to all conference participants, selected and awarded peer-reviewed papers will be published in journals "Tehnika – Novi Materijali" and "Processing and Application of Ceramics". The best presented papers, suggested by Session Chairpersons and selected by Awards Committee, will be proclaimed at the Closing Ceremony.

Sponsors

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Programme
Fifteenth Young Researchers Conference
Materials Science and Engineering

Wednesday, December 7, 2016

08.30 Registration

09.30 – 10.00 Opening Ceremony

10.00 – 11.15 1st Session – Biomaterials I
Chairpersons: Prof. Dr. Bojana Obradović and Dr. Kai-Chiang Yang

10.00 – 10.15 New calcium phosphate - magnesium phosphate ceramic materials with the ratio of (Ca + Mg)/P = 2 for medical applications
Margarita Goldberg, Valeriy Smirnov, Olga Antonova, Sergey Smirnov, Sergey Barinov
Baikov Institute of Metallurgy and Materials Science, Russian Academy of Sciences

10.15 – 10.30 The impact of adipose-derived mesenchymal stem cells in vitro induced into osteogenic cells on vascularization process in ectopic osteogenic implants
Jelena G. Najdanović,[1,2] Stevo J. Najman,[1,2] Vladimir J. Cvetković,[3] Sanja Stojanović,[1,2] Jelena M. Živković,[1,2] Marija Đ. Vukelić-Nikolić,[1,2] Maja M. Čakić-Milošević[4]
[1]Department of Biology and Human Genetics, Faculty of Medicine, University of Niš, Blvd. Dr Zoran Đinđić 81, 18000 Niš, Serbia, [2]Department for Cell and Tissue Engineering, Faculty of Medicine, University of Niš, Blvd. Dr Zoran Đinđić 81, 18000 Niš, Serbia, [3]Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia, [4]Faculty of Biology, Institute of Zoology, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia

10.30 – 10.45 Osteogenic potential of freshly isolated adipose-derived stromal vascular fraction cells and platelet-rich plasma loaded on bone mineral matrix in an ectopic bone-forming model
Vladimir J. Cvetković,[1] Stevo J. Najman,[2,3] Jelena G. Najdanović,[2,3] Sanja Stojanović,[2,3] Marija Đ. Vukelić-Nikolić,[2,3] Milica N. Andrejev,[1] Jelena M. Živković[2,3]
[1]Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia, [2]Department of Biology and Human Genetics, Faculty of Medicine, University of Niš, Blvd. Dr Zoran Đinđić 81,

18000 Niš, Serbia, [3]Department for Cell and Tissue Engineering, Faculty of Medicine, University of Niš, Blvd. Dr Zoran Đinđić 81, 18000 Niš, Serbia

10.45 – 11.00 2D-materials heterostructures as a potential sensor of amino acids and proteins

Jasna Vujin, Radmila Panajotović
Graphene Laboratory, Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia

11.00 – 11.15 Regulation of insulin secretion in pancreatic beta cells by intercellular coupling

Kai-Chiang Yang,[1,2] Goichi Yanai,[2] Shoichiro Sumi[1]
[1]School of Dental Technology, College of Oral Medicine, Taipei Medical University, Taipei 11031, Taiwan, [2]Department of Organ Reconstruction, Institute for Frontier Medical Sciences, Kyoto University, Kyoto 6068507, Japan

11.15 – 11.30 Break

11.30 – 13.00 2nd Session – Biomaterials II

Chairpersons: Dr. Magdalena Stevanović and Dr. Pavel Gurikov

11.30 – 11.45 Cytotoxicity studies of alginate hydrogels with silver nanoparticles in cell and tissue cultures

Jelena Petrović, Jovana Zvicer, Vesna Mišković-Stanković, Bojana Obradović
Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia

11.45 – 12.00 Synthesis of silver nanoparticles in honey solutions

Nataša Stanojević, Jasmina Stojkovska, Bojana Obradović
Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia

12.00 – 12.15 Hybrid pectin-based porous materials for multifunctional applications

Pavel Gurikov,[1] Irina Smirnova,[1] Aleksandra Nešić[2]
[1]Institute of Thermal Separation Processes, Hamburg University of Technology, Germany, [2]University of Belgrade, Vinča Institute for nuclear sciences, Mike Petrovića-Alasa 12-14, Belgrade, Serbia

12.15 – 12.30 Comparison of the release of selenium nanoparticles from poly (ϵ-caprolactone) microparticles in four different degradation mediums

Nenad Filipović,[1] Sanja Jeremić,[2] Lidija Đokić,[2] Slavica Ražić,[3] Magdalena Stevanović[1]

[1]Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, Belgrade 11000, Serbia, [2]Institute of Molecular Genetics and Genetic Engineering, University of Belgrade, Serbia, [3]Department of Analytical Chemistry, Faculty of Pharmacy, University of Belgrade, Serbia

12.30 – 12.45 Electrospun biobased bioactive platforms

Aleksandra Miletić, Ivan Ristić, Branka Pilić
University of Novi Sad, Faculty of Technology, Blvd cara Lazara 1, Novi Sad, Serbia

12.45 – 13.00 Silver/polyvinyl alcohol/chitosan/graphene hydrogels - electrochemical synthesis and characterization

Katarina Nešović, Ivana Jevremović, Vesna Mišković-Stanković
Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia

13.00 – 14.00 Lunch break

14.00 – 15.30 3rd Session – Biomaterials III

Chairpersons: Dr. Đorđe Veljović and Dr. Aleksandra Nešić

14.00 – 14.15 New eco-sustainable microwave-assisted method for extraction of alginate: From coastal beach waste to agricultural mulching films

Aleksandra Nešić,[1] Antonije Onjia,[1] Valentina Bizzarro,[2] Barbara Immirzi,[2] Giovanni Dal Pogetto,[2] Gabriella Santagata,[2] Maria Valeria De Bonis,[3] Gianpaolo Ruocco,[3] Mario Malinconico[2]
[1]University of Belgrade, Vinča Institute for nuclear sciences, Mike Petrovića-Alasa 12-14, Belgrade, Serbia, [2]Institute for Polymers, Composites and Biomaterials; National Council of Research, via Campi Flegrei 34, 80078 Pozzuoli, Naples, Italy, [3]Scuola d'Ingegneria;Università degli Studi della Basilicata, Campus Macchia Romana, 85100 Potenza, Italy

14.15 – 14.30 Characterization of porous scaffolds based on gellan gum and bioactive glass under biomimetic bioreactor conditions

Gorana Prica,[1] Jovana Zvicer,[1] Kata Trifković,[1] Đorđe Veljović,[1] Ana Gantar,[2,3] Saša Novak[2,3] Bojana Obradović[1]
[1]Faculty of Technology and Metallurgy, University of Belgrade, [2]Department for Nanostructured Materials, Jožef Stefan Institute, Ljubljana, Slovenia, [3]Jožef Stefan International Postgraduate School, Ljubljana, Slovenia

14.30 – 14.45 Operating conditions in the bioreactor prototype applying hydrostatic pressures

Mia Radonjić, Jovana Zvicer, Bojana Obradović
Faculty of Technology and Metallurgy, University of Belgrade, Serbia

14.45 – 15.00 Effect of ethanol storage on the degree of conversion of bulk-fill, low-shrinkage and conventional composites

Dejan Perić,[1] Jovana Stašić,[2] Steva Lević,[3] Vesna Miletić[2]
[1]University of Pristina, School of Medicine, Dental Clinic, Anri Dinana st., 38220 Kosovska Mitrovica, Serbia, [2]University of Belgrade, School of Dental Medicine, DentalNet Research Group, Rankeova 4, 11000 Belgrade, Serbia, [3]University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11081 Belgrade-Zemun, Serbia

15.00 – 15.15 Discoloration of resin-based dental composites from different manufacturers

Milica Antonov,[1] Nikola Jovanović,[2] Miroslav D. Dramićanin,[1] Jovana Stašić,[3] Ivana Zeković,[1] Dragica Manojlović,[1,3]
[1]University of Belgrade, Vinča Institute of Nuclear Sciences, P. Box 522, Belgrade, 11001, Serbia, [2]University of Belgrade, Faculty for Mechanical Engineering, Kraljice Marije 16, 11120, Belgrade, Serbia, [3]University of Belgrade, School of Dental Medicine, Rankeova 4, Belgrade, 11000, Serbia

15.15 – 15.30 Influence of size, concentration and shape of iron oxide nanoparticles on hyperthermic efficiency

Marco Cobianchi,[1] M. Avolio,[1] P. Arosio,[2] A. Guerrini,[3,4] C. Sangregorio,[3,4] C. Innocenti,[3,4] M. Corti,[1] A. Lascialfari[1,2]
[1]Dipartimento di Fisica and INSTM, Università degli Studi di Pavia, Pavia, Italy, [2]Dipartimento di Fisica and INSTM, Università degli Studi di Milano, Milano, Italy, [3]Dipartimento di Chimica and INSTM, Università degli studi di Firenze, Sesto F.no, Italy, [4]ICCOM-CNR, Sesto F.no, Italy

15.30 – 15.45 Break

15.45 – 17.00 4th Session – Environmental Materials I

Chairpersons: Dr. Jasmina Dostanić and Vesna Teofilović

15.45 – 16.00 Agroindustrial waste as substrate for cellulase production by Paenibacillus chitinolyticus CKS1

Neda R. Radovanović, Miona G. Miljković, Slađana Z. Davidović, Milica D. Milutinović, Katarina R. Mihajlovski, Suzana I. Dimitrijević-Branković
University of Belgrade, Faculty of Technology and Metallurgy, Department for Biochemical Engineering and Biotechnology, Karnegijeva 4, Belgrade, Serbia

16.00 – 16.15 Investigation of catalytic possibilities of impregnated soybean hulls in decolorization process
Aleksandra Kulić, Milena Bečelić-Tomin, Đurđa Kerkez, Gordana Pucar, Božo Dalmacija
University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000 Novi Sad, Republic of Serbia

16.15 – 16.30 The properties of chitosan beads based on alginate and iron-oxide prepared using layer-by-layer deposition method
Vesna Teofilović,[1] Ayse Aroguz,[2] Sibel Aydogan,[2] Jaroslava Budinski-Simendić, Mirjana Jovičić,[1] Jelena Pavličević,[1] Sinem Karademir[2]
[1]University of Novi Sad, Faculty of Technology, Novi Sad, Serbia, [2]Istanbul University, Faculty of Engineering, Istanbul, Turkey

16.30 – 16.45 Properties of seashell waste as a sorbent material for cationic pollutants
Marija Egerić,[1] Ivana Smičiklas,[1] Mirjana Ristić[2]
[1]University of Belgrade, Institute of Nuclear Sciences "Vinča", P.O.B. 522, 11000, Belgrade, Serbia, [2]University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11000, Belgrade, Serbia

16.45 – 17.00 Determination of experimental conditions for examination of cobalt catalyst supported by polymer Bray-Liebhafsky oscillatory reaction performed in open reactor
Kristina Stevanović, Branislav Stanković, Jelena Maksimović, Maja Pagnacco
Faculty of Physical Chemistry, University of Belgrade, Studentski trg 12-16, Belgrade, Serbia

17.00 – 17.15 Break

17.15 – 18.45 5th Session – Environmental Materials II
Chairpersons: Dr. Irena Nikolić and Tijana Đuričić

17.15 – 17.30 On the preparation of zeolite-based adsorbent for phosphate removal from water media
Iva Kaplanec,[1] Aleksander Rečnik,[2] Nevenka Rajić[1]
[1]Faculty of Technology and Metallurgy, Belgrade, Serbia, [2]Jožef Stefan Institute, Ljubljana, Slovenia

17.30 – 17.45 Determination the content of anionic active agents in detergents
Aleksandra Šinik, Marija Vukobrad
Faculty of Technology, University of Banja Luka, Republic of Srpska, B&H

17.45 – 18.00 Selection and consumption of electrode material for electrocoagulation of landfill leachate

Tijana Đuričić, Borislav N. Malinović, Darko Bodroža, Pero Sailović
University of Banja Luka, Faculty of Technology, Stepe Stepanovica 73, 78000 Banja Luka, B&H

18.00 – 18.15 Hybrid composites prepared from industrial waste: microstructure, water absorption and mechanical properties

Daniel Pugar,[1] Lidija Ćurković,[1] Ivan Primorac,[1] Zrinka Šokčević,[1] Mihone Kerolli-Mustafa[2]
[1]University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Ivana Lučića 5, 10000 Zagreb, Croatia, [2]International Business College Mitrovica, Department of Environment and Agriculture Management, 40000 Mitrovica, Kosovo

18.15 – 18.30 Mechanical and physical properties of light-weight ceramic aggregates prepared from different composition of waste materials

Marcin Godzierz, Paweł Wilkołek, Tomasz Pawlik, Małgorzata Sopicka-Lizer
Silesian University of Technology, Piechy 3/10, Ruda Śląska, Poland

18.30 – 18.45 The earth's crust as a catalytic generator of hydrogen emission in the atmosphere and possible role of this process in the phenomena of ozone layer degradation

Viktor V. Barelko,[1] Oleg G. Safonov,[2] Denis A. Bobreshov,[3] Maxim V. Kuznetsov[3]
[1]Institute of Problems of Chemical Physics, Russian Academy of Sciences, 1 Academician Semenov Ave, Chernogolovka, Moscow Region, 424321 Russia, [2]Institute of Experimental Mineralogy, Russian Academy of Sciences, 4 Academician Osipyan Street, Chernogolovka, Moscow Region, 424321 Russia, [3]All-Russian Research Institute on Problems of Civil Defense and Emergencies of Emergency Control Ministry of Russia (EMERCOM), 7 Davidkovskaya Str, Moscow, 121353 Russia

Thursday, December 8, 2016

09.00 – 11.00 6th Session – Theoretical Modeling of Materials

Chairpersons: Dr. Željka Nikitović and Ana Dobrota

09.00 – 09.15 Clustering of OH groups on graphene for enhanced charge storage

Ana S. Dobrota,[1] Sanjin Gutić,[2] Igor A. Pašti,[1] Natalia V. Skorodumova[3,4]
[1]University of Belgrade, Faculty of Physical Chemistry, Studentski trg 12-16, 11158 Belgrade, Serbia, [2]Department of Chemistry, Faculty of Science, Zmaja od Bosne 33-35, Sarajevo, Bosnia and Hercegovina, [3]Department of Materials Science and Engineering, School of Industrial Engineering and Management, KTH – Royal Institute of Technology, Brinellvägen 23, 100 44 Stockholm, Sweden, [4]Department of Physics and Astronomy, Uppsala University, Box 516, 751 20 Uppsala, Sweden

09.15 – 09.30 Theoretical analysis of adsorption properties of doped hexagonal MgO nanotubes

Aleksandar Jovanović
Faculty of Physical Chemisty, University of Belgrade, Serbia

09.30 – 09.45 Collision of hydrogen molecules interacting with two graphene sheets

Dragana Malivuk Gak,[1] Saša Nježić[2]
[1]University of Banjaluka, Faculty of Natural Sciences, Mladena Stojanovića 2, Banjaluka, [2]University of Banjaluka, Faculty of Medicine, Save Mrkalja 14, Banjaluka

09.45 – 10.00 Micromechanical investigating of the critical parameter's influence on adhesive properties of porous EVA/PMMA polymer blends using finite element method

Nataša Z. Tomić,[1] Predrag Milanović,[2] Đorđe Veljović,[2] Bojan Međo,[2] Marko Rakin,[2] Vesna Radojević,[2] Radmila Jančić Heinemann[2]
[1]Innovation center of Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11070 Belgrade, Serbia, [2]Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11070 Belgrade, Serbia

10.00 – 10.15 The analysis of SEM photographs of fractured surfaces of steel P91 and compared with the mechanical properties such as impact energy (toughness)

Bojana Aleksić,[1] Abubkr Hemer,[2] Radmila Jančić Heinemann,[2] Marija Dimitrijević,[1] Ljubica Milović[2]
[1]Innovation Center of the Faculty of Tehnology and Metallurgy, [2]University of Belgrade, Faculty of Tehnology and Metallurgy

10.15 – 10.30 Transmission singularities and infinite tunneling times in complex potentials

Nikola Opačak, Vitomir Milanović, Jelena Radovanović
School of Electrical Engineering, University of Belgrade, Bulevar kralja Aleksandra 73, 11120 Belgrade, Serbia

10.30 – 10.45 Negative refraction in quantum cascade structures based on cubic nitrides

Miloš Dubajić, Jelena Radovanović, Vitomir Milanović

School of Electrical Engineering, University of Belgrade, Bulevar kralja Aleksandra 73, 11120 Belgrade, Serbia

10.45 – 11.00 Helical edge states in silicene and germanene nanorings in perpendicular magnetic field: A numerical investigation
Dušan Jakovljević, Marko Grujić, Milan Tadić
School of Electrical Engineering, University of Belgrade, P.O. Box 35-54 11120 Belgrade

11.00 – 11.15 Break

11.15 – 12.45 7th Session – Nanostructured Materials I
Chairpersons: Dr. Zoran Jovanović and Mila N. Krstajić Pajić

11.15 – 11.30 The impact of changes of experimental conditions and organic solvent on nC_{60} particle size
Igor Medić,[1] Ivana Borišev,[1] Danica Jović,[1] Vladimir Srdić,[2] Aleksandar Đorđević[1]
[1]University of Novi Sad, Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Science, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, [2]University of Novi Sad, Faculty of Technology, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

11.30 – 11.45 Detection of low-index {100} planes at Pt nanoparticles
Mila N. Krstajić Pajić,[1] Sanja I. Stevanović,[1] Vuk V. Radmilović,[2] Velimir R. Radmilović,[3,4] Snežana Lj. Gojković,[3] Vladislava M. Jovanović[1]
[1]Department of Electrochemistry, ICTM, University of Belgrade, [2]Innovation Center, Faculty of Technology and Metallurgy, University of Belgrade, [3]Faculty of Technology and Metallurgy, University of Belgrade, [4]Serbian Academy of Sciences and Arts

11.45 – 12.00 Innovative nanostructured ITO coatings for the display and biomedicine technique
Michael Zimnukhov,[1,3] Svetlana Likhomanova,[1,2] Natalia V. Kamanina,[1,3]
[1]Vavilov State Optical Institute, Kadetskaya lin. 5/2, 199053, St. Petersburg, Russia, [2]ITMO University, St. Petersburg, 197101, Russia, [3]Saint Petersburg Electrotechnical University "LETI", St. Petersburg, 197376, Russia

12.00 – 12.15 Overview of nanostructured LC-mesophase time parameters
Andrew Malinovskiy,[1,3] Svetlana Likhomanova, Natalia V. Kamanina
[1]Vavilov State Optical Institute, Kadetskaya Line V.O., dom 5, korpus 2, 199053, Saint-Petersburg, Russia, [2]ITMO University, St. Petersburg, 197101, Russia, [3]Saint Petersburg Electrotechnical University "LETI", St. Petersburg, 197376, Russia

12.15 – 12.30 Photorefractive properties thin films COANP-graphene: experimental and modeling results

Svetlana Vladimirovna Likhomanova,[1,2] Natalia V. Kamanina[1,3]
[1]Vavilov State Optical Institute, St.-Petersburg, Russia, [2]ITMO University, St. Petersburg, Russia, [3]Saint Petersburg Electrotechnical University "LETI", St. Petersburg, Russia

12.30 – 12.45 Electronic nature of the low-temperature anomalies of ideal and disordered graphene

Anna Belosludceva,[1] Nadezhda Bobenko,[2,3] Alexander Ponomarev,[2,3] Leonid Barkalov,[1] Alexander Latishev,[2] Eugenia Istomina[1]
[1]Tomsk State University of Control Systems and Radioelectronics, 634050 Tomsk, Russia, [2]Institute of Strength Physics and Materials Science of SB RAS, Tomsk 634021, Russia, [3]National Research Tomsk Polytechnic University, 634050 Tomsk, Russia

12.45 – 13.00 Development of nanobiocatalyst systems for application in biosynthesis of functionally active galactoside

Nevena Lukić, Aleksandra Jakovljević, Milica Carević, Katarina Banjanac, Dejan Bezbradica
Department of Biochemical Engineering and Biotechnology, Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4 Belgrade, Serbia

13.00 – 14.00 Lunch break

14.00 – 15.30 8th Session – Nanostructured Materials II

Chairpersons: Dr. Miodrag Lukić and Dr. Sonja Jovanović

14.00 – 14.15 Investigation of changes in positronium trapping in pores under the water influence in nanostructured MgO-Al_2O_3 ceramics

Halyna Klym,[1] Yuriy Kostiv,[1] Andriy Ivanusa,[2] Taras Tkachuk[1]
[1]Lviv Polytechnic National University, 12 Bandera str., Lviv, 79013, Ukraine, [2]Lviv State University of Life Safety, 35 Kleparivska str., Lviv, 79000, Ukraine

14.15 – 14.30 Ethylenediaminetetraacetic acid (EDTA) assisted hydro/solvothermal synthesis of up-converting rare earth fluorides

Ivana Z. Dinić,[1] Marko Nikolić,[2] Maria Eugenia Rabanal,[3] Olivera B. Milošević,[1] Lidija T. Mančić[1]
[1]Institute of Technical Sciences of Serbian Academy of Sciences and Arts, Belgrade, Serbia, [2]Photonics Center, Institute of Physics Belgrade, Belgrade, Serbia,

[3]Materials Science and Engineering Department and IAAB, Universidad Carlos III de Madrid, Leganes, Madrid, Spain

14.30 – 14.45 Zinc-copper ferrite nanoparticles prepared via solvothermal synthesis route

Sonja Jovanović,[1,3] Jelena Rmuš,[2] Marija Vukomanović,[3] Danica Bajuk-Bogdanović,[2] Bojana Nedić-Vasiljević,[2] Danilo Suvorov[3]
[1]Laboratory of Physics, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia, [2]Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, [3]Advanced Materials Department, Jožef Stefan Institute, Ljubljana, Slovenia

14.45 – 15.00 Application of soft X-ray absorption spectroscopy for estimation of spin and valence states of cations in $Sr_{1-x}Ce_xMn_{1-y}Co_yO_{3-\delta}$

Margarita Sergeevna Udintseva,[1] Vitaly Vladimirovich Mesilov,[2] Vadim Rostislavovich Galakhov,[2] Sergey Nilolaevich Shamin,[2] Tatyna Ivanovna Chupakhina,[3] Gennady Vasilyvich Bazuev[3]
[1]Ural State University of Railway Transport, 620134 Ekaterinburg, Russia, [2]M. N. Miheev Institute of Metal Physics, Ural Branch of the Russian Academy of Sciences, 620137 Ekaterinburg, Russia, [3]Institute of Solid State Chemistry, Ural Branch of the Russian Academy of Sciences, 620137 Ekaterinburg, Russia

15.00 – 15.15 Structure of electro-explosion resistant coatings consisting of immiscible components

Denis Anatolevich Romanov, Maksim Andreevich Stepikov, Egor Aleksandrovich Gaevoj, Valentina Olegovna Apanina
Siberian State University of Industry, Kirov str. 42, 654007 Novokuznetsk, Russia

15.15 – 15.30 Possibility of obtaining core/shell structure in system $NiFe_2O_4/ZnFe_2O_4$

Milana Orelj, Ivan Stijepović, Marija Milanović
Faculty of Technology Novi Sad, University of Novi Sad, Serbia

15.30 – 15.45 Break

15.45 – 17.15 9th Session – Nanostructured Materials III

Chairpersons: Dr. Nadica Abazović and Zorka Vasiljević

15.45 – 16.00 XPS analysis of N-doped TiO_2 nanotube array

Jelena Vujančević,[1] Anđelika Bjelajac,[2] Maja Popović,[3] Veljko Đokić,[4] Jovana Ćirković,[5] Rada Petrović,[4] Zlatko Rakočević,[3] Đorđe Janaćković,[4] Vladimir Pavlović[1]
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16.00 – 16.15 Fabrication, characterization and photoelectrochemical behavior of Fe_2TiO_5 screen printed thick films

Zorka Ž. Vasiljević,[1] Obrad S. Aleksić,[2] Miloljub D. Luković,[2] Milica Vujković,[3] Vladimir Pavlović,[1] Nebojša Labus,[2] Maria V. Nikolić[2]

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16.15 – 16.30 Synthesis and characterization of ZnO:Fe nanoparticles

Vladimir Rajić,[1] Smilja Marković,[2] Miodrag Mitrić,[3] Valentin Ivanovski,[3] Miloš Mojović,[1] Srečo Davor Škapin,[4] Stevan Stojadinović,[5] Stevan Lević,[6] Vladislav Rac,[6] Dragan Uskoković[2]

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16.30 – 16.45 Decomposition mechanism and kinetics of zinc–isophthalate complex with 2,2'-dipyridylamine as a precursor for obtaining nanosized zinc oxide

Jelena D. Zdravković,[1] Lidija D. Radovanović,[1] Bojana M. Simović,[2] Dejan D. Poleti,[3] Jelena R. Rogan,[3] Ivana Zeković,[4] Miroslav D. Dramićanin,[4] Katarina R. Mihajlovski,[3] Željko M. Radovanović[1]

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16.45 – 17.00 Soft X-ray absorption spectroscopy nano titanium dioxide impurities of cobalt

Margarita S. Udintseva[1], Vitaly V. Mesilov, Vadim R. Galakhov, Anatolii Yermakov[2], Mikhail Uimim[2]

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17.00 – 17.15 Organic-inorganic nanocomposites prepared from polyurethane and colloidal silica dispersions
Magdalena Serkis, Milena Špírkováa
Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovský Sq. 2, 162 06 Prague 6, Czech Republic

17.15 -17.30 Levitation-jet synthesis of titanium nitride and In-O ferromagnetic nanoparticles
Iurii G. Morozov,[1] Renata.L. Galiullina,[2] Maxim.V. Kuznetcov[2]
[1]Institute of Structural Macrokinetics and Materials Science, Russian Academy of Sciences, 8 Academician Osipyan Street, Chernogolovka, Moscow Region, 142432 Russia, [2]All-Russian Research Institute on Problems of Civil Defense and Emergencies of Emergency Control Ministry of Russia (EMERCOM), 7 Davidkovskaya Street, Moscow, 121352 Russia

Friday, December 9, 2016

09.00 – 10.15 10th Session – New Synthesis and Processing Methods I
Chairpersons: Dr. Rastko Vasilić and Marijana Majić Renjo

09.00 – 09.15 Electrodeposition and characterization of Zn-Mn alloy deposited from choline-chloride-urea deep eutectic solvent
Stefan Đokić, Ivana Jevremović, Jelena Bajat
University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11120 Belgrade, Serbia

09.15 – 09.30 Properties of Zn-Al alloys with Mg addition for hot dip galvanizing
Anna Skupińska, Henryk Kania, Piotr Liberski
Silesian University of Technology, Institute of Materials Science, 40-019 Katowice, Krasińskiego 8, Poland

09.30 – 09.45 Rheological properties of alumina-zirconia suspensions
Marijana Majić Renjo, Zrinka Šokčević, Lidija Ćurković
University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia

09.45 – 10.00 On the formation of composite powders based on complex compounds by the self-propagating high-temperature synthesis
Hanna Shcherba, Tatiana Talako, Andrew Letsko, Alexander Ilyuschenko

Powder Metallurgy Institute, 41, Platonov str., Minsk, Republic of Belarus

10.00 – 10.15 Application of principal component analysis in rehabilitation of post-stroke patients
Marija M. Petrović, Dejan B. Popović
[1]Faculty of Electrical Engineering, University of Belgrade, Bulevar kralja Aleksandra 73, 11000 Belgrade, Serbia, [2]Institute of Technical Sciences of SASA, Knez Mihailova 35, 11000 Belgrade

10.15 – 10.30 Break

10.30 – 11.45 11th Session – New Synthesis and Processing Methods II
Chairpersons: Dr. Smilja Marković and Sanja Šešlija

10.30 – 10.45 Synthesis and characterization of pectin esters obtained by reaction with dichlorides of glutaric and sebacic acid
Sanja Šešlija,[1] Vesna Panić,[2] Pavle Spasojević,[2] Ana Pantelić,[1] Ivanka Popović[3]
[1]Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [2]Innovation Center of the Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, [3]Faculty of Technology and Metallurgy,University of Belgrade, Belgrade, Serbia

10.45 – 11.00 The study of mechanical properties of polymers depending on the fillers
Nataly V. Khan[1], Olesya A. Tyumentseva[1], Tlek A. Ketegenov[2]
Institute of Combustion Problems, Kazakh National University, Kazakhstan

11.00 – 11.15 pH-sensitive membranes with crosslinked poly(acrylic acid) hydrogel for controlled delivery
Željko Janićijević,[1] Filip Radovanović[2]
[1]University of Belgrade, School of Electrical Engineering, Belgrade, Serbia, [2]Institute of Technical Sciences of SASA, Belgrade, Serbia

11.15 – 11.30 PEM fuel cell catalyst layers - pulsed laser deposition
Ivana Perović,[1] Dubravka Milovanović,[1] Carmen Ristoscu,[2] Bojan Radak,[1] Vladimir Nikolić[1]
[1]University of Belgrade, Vinca Institute of Nuclear Sciences, Belgrade, Serbia, [2]National Institute for Lasers, Plasma, and Radiation Physics (INFLPR), Magurele, Bucuresti, Romania

11.30 – 11.45 Analysis of electrical parameters of metal–semiconductor Au/AlPc-H/p-Si/Al organic diode

Ibrahim Missoum,[1] Mostefa Benhaliliba,[2] Abla Chaker,[3] Yusuf Selim Ocak,[4] Charazade-Elj Benouis[5]
[1]Energy Physics Laboratory, Department of Physics, Faculty of Exact Sciences, University of Brothers Mentouri Constantine 1, Aïn El bey Road, 25000 Constantine, Algeria, [2]Material Technology Dept. Physics Faculty, USTO-MB University, BP1505 Oran, Algeria, [3]Energy Physics Laboratory, Department of Physics, Faculty of Exact Sciences, University of Brothers Mentouri Constantine 1, Aïn El bey Road, 25000 Constantine, Algeria, [4]Dicle University, Education Faculty, Science Department, 21280 Diyarbakir, Turkey, [5]Material Technology Dept. Physics Faculty, USTO-MB University, BP1505 Oran, Algeria

11.45 – 13.00 Lunch break

13.00 – 14.30 12th Session – Materials for High-Technology Applications I

Chairpersons: Dr. Dragana Jugović and Jernej Bobnar

13.00 – 13.15 Modification of lithium surface with graphene derivates

Jernej Bobnar,[1] Matic Lozinšek,[2] Boštjan Genorio,[3] Robert Dominko[1]
[1]National Institute of Chemistry, Department of materials chemistry, Ljubljana, Slovenia, [2]Jožef Stefan Institute, Department of Inorganic Chemistry and Technology, ljubljana , Slovenia, [3]Faculty of chemistry and chemical technology, Department of Chemical Engineering and Technical Safety, Ljubljana, Slovenia

13.15 – 13.30 Cellulose based separator for lithium – sulphur batteries

Nejc Pavlin,[1] Silvo Hribernik,[2] Robert Dominko[1]
[1]National Institute of Chemistry, Ljubljana, [2]Faculty of Mechanical Engineering, University of Maribor

13.30 – 13.45 Influence of in situ addition of different combinations of d-metals on electrolytic hydrogen production in alkaline electrolyzer

Slađana Lj. Maslovara, Dragana D. Vasić Anićijević, Dragana L. Žugić, Milica P. Marčeta Kaninski, Vladimir M. Nikolić
Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia

13.45 – 14.00 Electrical efficiency of anode- and electrolyte-supported SOFCs

Natalia Lysunenko,[1] Mykola Brychevskyi,[1] Polishko Ihor,[1] Valentine Mokiychuk[2]
[1]Frantsevich Institute for Problems of Materials Science of NASU, Krzhizhanivsky Str., 3, 03680, Kyiv, Ukraine, [2]National aviation university, Kosmonavta Komarova, 1, Kyiv, 03058, Ukraine

14.00 – 14.15 Influence of temperature and electrolyte concentration on the performance of flexible supercapacitors

Petar Laušević,[1,2] Vladimir Nikolić,[2] Milica Marčeta Kaninski,[2] Zoran Laušević,[2] Predrag Pejović[1]
[1]School of Electrical Enginering, University of Belgrade, Serbia, [2]Laboratory of physical chemistry, Vinca institute of nuclear sciences, University of Belgrade, Serbia

14.15 – 14.30 Composite solid electrolytes based on $LiNO_2$
Yulia G. Mateyshina[1-3], Larisa Brezhneva[1], Yulia Lyshko[2], Nikolai F. Uvarov[1-3]
[1]Institute of Solid State Chemistry and Mechanochemistry SB RAS, Russia, [2]Novosibirsk State Technical University, Russia, [3]Novosibirsk State University, Novosibirsk, Russia

14.30 – 14.45 Break

14.45 – 16.15 13th Session – Materials for High-Technology Applications II
Chairpersons: Dr. Smilja Marković and Aleksandar Miletić

14.45 – 15.00 Investigation of microstructure and phase characteristics of tribo-functional gas-thermal composite coatings based on NiAl
Olena Poliarus,[1] Piotr Bobrowski,[2] Maciej Szczerba[3]
[1]Institute for Problems of Materials Science, National Academy of Sciences of Ukraine, Kyiv, Ukraine, [2]Institute of Metallurgy and Materials Science Polish Academy of Sciences, Krakow, Poland

15.00 – 15.15 Industrially prepared TiSiN nanocomposite coatings
Aleksandar Miletić,[1] Peter Panjan,[2] Miha Čekada,[2] Lazar Kovačević,[1] Pal Terek,[1] Dragan Kukuruzović,[1] Branko Škorić[1]
[1]University of Novi Sad, Faculty of technical sciences, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, [2]Jožef Stefan Institute, Jamova 39, 1000, Ljubljana, Slovenia

15.15 – 15.30 Interactions of Al-Si-Cu alloy casting with duplex PVD coatings intended for application on high pressure die casting tools
Pal Terek,[1] Lazar Kovačević,[1] Aleksandar Miletić,[1] Dragan Kukuruzović,[1] Branko Škorić,[1] Aljaž Drnovšek,[2] Peter Panjan[2]
[1]University of Novi Sad, Faculty of technical sciences, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, [2]Jožef Stefan Institute, Jamova 39, 1000, Ljubljana, Slovenia

15.30 – 15.45 Using inverse opal structure to enhance the charge collection in the dye-sensitized solar cell
Mohammad Hossein Nateq, Riccardo Ceccato

Department of Industrial Engineering, University of Trento, Via Sommarive 9, I-38123, Trento, Italy

15.45 – 16.00 Effect of surface roughness on scratch adhesion of nitride PVD coatings with different layer designs

Dragan Kukuruzović,[1] Pal Terek,[1] Aleksandar Miletić,[1] Lazar Kovačević,[1] Branko Škorić,[1] Peter Panjan[2]
[1]University of Novi Sad, Faculty of technical sciences, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, [2]Jožef Stefan Institute, Jamova 39, 1000, Ljubljana, Slovenia

16.00 – 16.15 Industrial application of PVD hard coatings for improvement of high pressure die casting tools

Lazar Kovačević,[1] Pal Terek,[1] Aleksandar Miletić,[1] Dragan Kukuruzović,[1] Branko Škorić,[1] Peter Panjan[2]
[1]Faculty of Technical Sciences, University of Novi Sad, Trg D. Obradovića 6, Novi Sad, Serbia, [2]Jožef Stefan Institute, Jamova 39, Ljubljana, Slovenia

16.15 – 16.30 Break

16.30 – 17.45 14th Session – Materials for High-Technology Applications III

Chairpersons: Dr. Zoran Stojanović and Daniel Pawlak

16.30 – 16.45 Influence of cobalt doping on optical properties of ultrafine SnO_2 nanocrystals.

Tijana Radovanović, Marko Radović, Zorana Dohčević-Mitrović, Novica Paunović
Condensed matter physics and material science, Institute of physics, Belgrade

16.45 – 17.00 From hydrophobic, via superhydrophobic to icephobic surfaces

Daniel Pawlak, Maciej Psarski, Grzegorz Celichowski
Department of Materials Technology and Chemistry, University of Lodz, Poland

17.00 – 17.15 Heat-resistant coating of the composite powder FeAlCr/Al_2O_3

T. Talako, A.I. Letsko, Nikolay Parnitsky, M.S. Yakovleva
Powder Metallurgy Institute, 41, Platonov str., 220005, Minsk, Belarus, Institute for Problems of Materials Science of Ukraine, 3, Krzhyzhanovsky str., 03680, Kiev, Ukraine.

17.15 – 17.30 Comparative analysis of cavitation erosion resistance of ceramic sample

Marko Pavlović, Marina Dojčinović, Sanja Martinović, Milica Vlahović, Tatjana Volkov Husović

University of Belgrade, Faculty of Technology and Metallurgy Belgrade, Carnegie 4, Belgrade, Serbia

17.30 – 17.45 Preheat effects on LiF: Mg, Ti at low dose

Mokhtar Halimi,[1] D. Kadri,[1] A. Mokeddem,[1] I. Missoum,[2]
[1]*Department of Materials Technology, Faculty of Physics, University of Sciences and Technology of Oran (USTO-MB), Algeria,* [2]*Energy Physics Laboratory, Department of Physics, Faculty of Exact Sciences, University of Brothers Mentouri Constantine, Aïn El bey Road, Constantine 25000, Algeria*

17.45 – 18.00 Pittcon 2016 experience in Atlanta – firsthand conference impressions from ACS delegate

Zoran Stojanović
Institute of Technical Sciences of SASA, Knez Mihajlova 35/IV, 11001 Belgrade, Serbia

18.00 Closing Ceremony

1-1

New calcium phosphate - magnesium phosphate ceramic materials with the ratio of (Ca + Mg)/P = 2 for medical applications

Margarita Goldberg, Valeriy Smirnov, Olga Antonova, Sergey Smirnov, Sergey Barinov
Baikov Institute of Metallurgy and Materials Science, Russian Academy of Sciences, Leninskii pr. 49, Moscow, 119991, Russia

The problem of development of new materials for replacement and restoration of bone tissues is highlytopical [1,2]. Most promising for this goal are materials based on calcium phosphates. The mineral constituent of the human bone tissue contains ≈0.9 wt % sodium, 0.72 wt % magnesium, and 0.03 wt % potassium and also trace amounts of other elements (zinc, manganese, iron, copper, selenium, strontium, etc.) [3]. Magnesium actively participates virtually in all physiological processes taking place in the human body as the regulating factor [4]. Up to 60% of the total amount of magnesium in the body occurs in the bone tissues [5]. This communication reports the first synthesis of powders and ceramics and investigation of the phase composition and properties of materials with the ratio of (Ca + Mg)/P = 2 and with the degree of magnesium substitution for calcium of up to 20 wt %.

There was new powders preparation in the calcium phosphates–magnesium phosphates system by precipitation method. It was shown that upon increase in the magnesium content, the degree of crystallization of the powders decreases, while the specific surface area increases to 36 m^2/g. We have studied the effect of heat treatment in a wide temperature range (from 300 to 1500 °C) on the phase composition, heat effects and weight loss of powder materials in a system of calcium phosphates and magnesium phosphates with (Ca + Mg)/P = 2. The results demonstrate that crystalline magnesium-substituted whitlockite phases begin to form at temperatures above 600°C. Raising the heat treatment temperature reduces the degree of magnesium substitution for calcium in the structure of the magnesium-substituted whitlockite. Tetracalcium phosphate, a high-temperature phase, is formed through apatite phase recrystallization.

Ceramic materials with a strength of up to 50 MPa characterized by the presence of magnesium-substituted whitlockite structure were obtained. Also, upon the introduction of magnesium ions, pH of the ceramics decreases from 9.6 to 8.2, which makes these materials promising for development of scaffolds for bone tissue engineering.

This work was supported by the Russian Science Foundation, grant no. 16-13-00123.

1. Spector, M., Tissue Engineering: Applications in Maxillofacial Surgery and Periodontics, Lynch, S.E., Genco, R.J., and Marx, R.E., Eds., Carol Stream: Quintessence Publ., 1998, pp. 3–16.
2. Dorozhkin, S.V., Calcium Orthophosphates: Applications in Nature, Biology, and Medicine. L.: CRC Press, 2012.
3. Suchanek, W. and Yoshimura, M., J. Mater. Res. Soc, 1998, vol. 13, p. 94.
4. Elin, R.J., Disease a month., 1988, vol. 34, no. 4, pp. 166–218.
5. Rychkova, T.I., Pediatr., 2011, vol. 90, no. 2, pp. 114–120

1-2

The impact of adipose-derived mesenchymal stem cells in vitro induced into osteogenic cells on vascularization process in ectopic osteogenic implants

Jelena G. Najdanović[1,2], Stevo J. Najman[1,2], Vladimir J. Cvetković[3], Sanja Stojanović[1,2], Jelena M. Živković[1,2], Marija Đ. Vukelić-Nikolić[1,2], Maja M. Čakić-Milošević[4]
[1]Department of Biology and Human Genetics, Faculty of Medicine, University of Niš, Blvd. Dr Zoran Đinđić 81, 18000 Niš, Serbia, [2]Department for Cell and Tissue Engineering, Faculty of Medicine, University of Niš, Blvd. Dr Zoran Đinđić 81, 18000 Niš, Serbia, [3]Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia, [4]Faculty of Biology, Institute of Zoology, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia

Development of vascular network precedes bone tissue formation. Therefore, providing an adequate blood supply is of key importance in bone tissue engineering (BTE). It is well-known that adipose derived mesenchymal stem cells (ADSCs) can be in vitro induced into osteogenic cells. Our aim was to examine in vivo vasculogenic potential of ADSC in vitro induced osteogenic cells in ectopic osteogenic implants. ADSCs isolated from mice epididymal fat pads were in vitro induced into osteogenic cells for fifteen days and loaded onto bone mineral matrix (BMM) in combination with platelet-rich plasma (PRP). Implants were placed ectopically, extracted two and eight weeks after implantations and analyzed regarding immunoexpression of vasculogenic markers – VEGFR-2 and VCAM-1. Immunoexpression of VEGFR-2 and VCAM-1 in single cells between BMM granules as well as in blood vessel wall increased eight weeks after implantations compared to two-week observation point. It was concluded that combination of ADSCs induced into osteogenic cells, BMM and PRP has an excellent vasculogenic potential in ectopic osteogenic implants that is sustainable at later observation points during in vivo experimental period. This could be a good reason for applying such combination for the implants' construction in BTE and possible application in bone regenerative medicine.

Acknowledgement: This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Grant No. III41017.

1-3

Osteogenic potential of freshly isolated adipose-derived stromal vascular fraction cells and platelet-rich plasma loaded on bone mineral matrix in an ectopic bone-forming model

Vladimir J. Cvetković[1], Stevo J. Najman[2,3], Jelena G. Najdanović[2,3], Sanja Stojanović[2,3], Marija Đ. Vukelić-Nikolić[2,3], Milica N. Andrejev[1], Jelena M. Živković[2,3]
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Bone tissue engineering implies combination of three key components: osteogenic cells, regulatory signals and biomaterials. It is known that freshly isolated adipose-derived stromal vascular fraction (SVF) represents a good source of osteogenic progenitors and platelet-rich plasma (PRP) is source of multiple regulatory signals. In this study we examined osteogenic process in implants composed of bone mineral matrix (BMM) granules that was used as carrier for two autologous components, freshly isolated adipose-derived SVF cells and PRP. Control group was only BMM granules. The experiment was conducted in an ectopic bone-forming model in Balb/c mice. The implants were extracted at two and eight weeks after implantation and analyzed using histochemical and histomorphometrical analyses. Presence of bone-like cells, signs of resorption and osteoid-like tissue were more pronounced in implants which contained freshly isolated adipose-derived SVF cells and PRP compare to control group. Percentage of infiltrated tissue between BMM granules and vascularization were higher in implants with freshly isolated adipose-derived SVF cells and PRP than in control group. According to results, BMM granules loaded with freshly isolated adipose-derived SVF cells and PRP represents promising combination for treatment of bone defects.

Acknowledgement: This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Grant No. III41017.

1-4

2D-materials heterostructures as a potential sensor of amino acids and proteins

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In the last few years the 2D materials, graphene and transition metal dichalogenides, in combination with various biomolecules (lipids, biopolymers, amino acid, protein...) attracted considerable attention as organic electronic devices - Field Effect Transistor (oFET). These nanodevices have been extensively used as biosensors, in both biomedical research and technological applications, particularly in the field of bioelectronics. 2D materials produced from liquid phase are proven to be excellent component for oFET for detection of amino acids. Because of their good electrical response and simplicity of their production, these are not just promising materials for bio-sensors but as well for development of various devices in bioelectronics and biotechnology. In this presentation we demonstrate a new method for detection of amino acids using large-scale films of 2D materials obtained from liquid phase exfoliation. In order to establish the sensing properties of our heterostructures films, we used amino acid cysteine, as it presents an important structural component of many proteins, such as enzimes.

In our research we produce organic field effect transistors based on the silicon oxide-supported thin few layer films of graphene and WS2. Thin graphene and WS2 films are obtained from liquid dispersion of these materials using a Langmuir – Blodgett method. Physico-chemical characterization of these heterostructures is performed using AFM, FTIR and Raman spectroscopy, as well as the X –ray photoelectron spectroscopy. In order to examine electrical properties, I-V curves are recorded before and after deposition of aqueous solution of cysteine on the films, confirming the sensing properties of such a device.

1-5

Regulation of insulin secretion in pancreatic beta cells by intercellular coupling

Kai-Chiang Yang[1,2], Goichi Yanai[2], Shoichiro Sumi[1]
[1]School of Dental Technology, College of Oral Medicine, Taipei Medical University, Taipei 11031, Taiwan, [2]Department of Organ Reconstruction, Institute for Frontier Medical Sciences, Kyoto University, Kyoto 6068507, Japan

The integrity and hierarchical structure of islet influence pancreatic β-cells physiology dramatically. Cell-cell communications are critical to insulin secreting. Moreover, the size of cell spheres influences biological behaviors of cells. Thus, formation of intercellular coupling in β-cell spheres with controllable size shall benefit cell therapy to diabetes. In this study, mouse β-cells (MIN-6) were cultured on micropatterned substrates. Insulin gene expressions and insulin secretion were analyzed. Cell spheroids were further transplanted into diabetic C57BL/6 mice to evaluate the in vivo performance. Animals were sacrificed four weeks post-OP for histologic inspections. Results showed that β-cells aggregated as cell spheroids on micropatterned substrates. Cell density determined the size of cell spheroids as well as survival rates. Apoptosis is noticed in irregular and large cell aggregates. Compared with monolayer cells, cell spheroids had a higher insulin stimulation-index. The mRNA expressions of insulin related genes of cell spheroids were up-regulated. Western blot analysis revealed that cell spheroids had higher connexin 36 protein productions. Conversely, E-cadherin and MafA were down-regulated. Animals that received both monolayers and cell spheroids had decreased blood glucose levels and regained body weight. Histologic studies showed monolayers and cell spheroids were positive to insulin staining. Interestingly, the area under curve for the intraperitoneal glucose tolerance test and serum insulin levels showed cell spheroids had superior in vivo performance. This study reveals that micropatterned substrate promotes β-cells aggregating. Formation of cell spheroid regulates insulin gene expression to improve insulin secretion. The in vivo performances of β-cell were also enhanced. Therefore, the isolated islets or insulin-producing cells can be cultured on micropatterned dishes to improve/maintain integrity prior to transplantation.

2-1

Cytotoxicity studies of alginate hydrogels with silver nanoparticles in cell and tissue cultures

Jelena Petrović, Jovana Zvicer, Vesna Mišković-Stanković, Bojana Obradović
Faculty of Technology and Metallurgy, University of Belgrade, Serbia

The aim of this study was to examine cytotoxicity of nanocomposite alginate hydrogels with silver nanoparticles (2.2 mM) and compare the effects in 2D and 3D cultures. Contact test was performed on monolayers of bovine calf chondrocytes in parallel with articular cartilage explants cultured in a biomimetic bioreactor in direct contact with the Ag/alginate discs dynamically compressed in the physiological regime (337.5 μm/s rate, 10 % strain, 1 h on/1 h off). After 4 days of culture, mild cytotoxic effects were observed in monolayers, in contrast to intact explants, which confirmed the utility of biomimetic bioreactors as appropriate 3D models.

2-2

Synthesis of silver nanoparticles in honey solutions

Nataša Stanojević, Jasmina Stojkovska, Bojana Obradović
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

The aim of this work was optimization of silver nanoparticle (AgNP) synthesis in honey followed by production of nanocomposite alginate-based hydrogels for potential use as antimicrobial wound dressings. AgNPs were synthesized by chemical reduction in aqueous solutions of honey (50-90 wt%) at slightly alkaline pH~7.5. The best results were obtained in the 50 wt% honey solution with spherical AgNPs 5 – 10 nm in size at the concentration of 3.4 mM, stable for 30 days. Upon mixing with Na-alginate, the obtained colloid solution was gelled in different forms (films, sheets, microbeads, microfibers) with retention of AgNPs as confirmed by UV-visible spectroscopy.

2-3

Hybrid pectin-based porous materials for multifunctional applications

Pavel Gurikov[1], Irina Smirnova[1], Aleksandra Nešić[2]
[1]*Institute of Thermal Separation Processes, Hamburg University of Technology, Germany*
[2]*University of Belgrade, Vinča Institute for nuclear sciences, Mike Petrovića-Alasa 12-14, Belgrade, Serbia*

Highly porous, lightweight, renewable versatile pectin-based materials were prepared via dissolution–gelation and subsequent various drying routes. First step involved dissolution of pectin in aqueous solution and ionic crosslinking reaction with calcium ions, in order to obtain crosslinked three dimensional pectin wet gels. The obtained wet gels were further subjected to three different drying methods: supercritical CO_2 drying, freeze-drying and ambient pressure evaporative drying. The influence of drying method on the density, porosity and morphology of pectin-based materials is investigated and discussed. By understanding the underlying mechanisms, the findings provide the optimal drying method for precise control over surface micro-macroarchitecture, topography and size which are important parameters for polysaccharide-based materials for being used in various applications such as tissue engineering, drug delivery and food packaging.

2-4

Comparison of the release of selenium nanoparticles from poly (ϵ-caprolactone) microparticles in four different degradation mediums

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One of the most prominent properties of poly (ϵ-caprolactone) (PCL) as a biodegradable polymer is slow degradation rate. Due to this advantage the PCL is often used in versatile systems for drug delivery or tissue engineering. When it comes to drug delivery systems, this property of PCL provides the slow release of encapsulated medicaments in order to avoid acute toxicity i.e. to enhance therapeutic efficiency, or protects medicaments from "aggressive" environment and ensures prolonged effect. Selenium nanoparticles (SeNp) recently gained attention as a potential candidate for cancer therapy and prevention with antibacterial properties as well. The major drawback of SeNp is substantial risk of toxicity. Degradation itself is a function of several material properties as well as the nature of surrounding medium. In this work it is examined the release of SeNp from PCL microparticles during the degradation in four different mediums: phosphate buffered saline (PBS), solution of lipase isolated from porcine pancreas in PBS, 0.1 M hydrochloric acid (HCL) and Psseudomonas aeruginosa cell free extract in PBS. The main idea was to compare the release of the selenium nanoparticles in physiological conditions (the first three medium) and in the pathological conditions (the fourth medium), respectively. Firstly, the PCL/SeNp were suspended in adequate medium and placed in water bath at 37 °C. At exact times, samples were collected and examined by different techniques: X-ray diffraction (XRD), inductively coupled plasma-atomic emission spectroscopy (ICP-AES), scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS), differential scanning calorimetry (DSC). The release of selenium nanoparticles in physiological conditions occurred in a very slow manner without burst release while in the presence of bacterial extract the release was much more pronounced, even after 24 h.

2-5

Electrospun biobased bioactive platforms

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Biobased, biodegradable and biocompatible polymers are under huge research in recent years, in many fields of applications connected with human wellbeing. New processing technique, electrospinning, is under development and process of commercialization, for production of novel polymeric materials. Electrospinning is nanotechnology technique which enables production of nanofibers with diameters from few nanometers to 1 μm from polymeric solutions or melt, using high voltage as driving force. Parameters which have influence on fiber morphology are molecular weight and sort of polymer, solution parameters (choice of solvent/group of solvents, viscosity and conductivity of solution), process parameters (distance between needle and collector, feed rate and voltage, single- or multi-nozzle or coaxial spinning) and type of collector used (flat for random fibers and drum collector for aligned fibers). Solution parameters are limiting ones and directly influence the success of electrospinning process. Potential applications of non-wovens obtained this way are numerous: they can be used in drug delivery systems, tissue engineering, as wound dressings, in packaging, air and water filtration etc. The main advantages are low weight of membrane, big surface area, high porosity and possibility of encapsulation of different active agents. Nanofibers from few different biopolymers are prepared in this work and the influence of different parameters is explained in details. Scanning electron microscopy (SEM) imaging was used as a tool for examining different morphological structures of obtained non-wovens and for determination of diameter of nanofibers. Results of mechanical characterization on tensile testing machine proved that even very thin samples can be used as self-standing materials.

2-6

Silver/polyvinyl alcohol/chitosan/graphene hydrogels - electrochemical synthesis and characterization

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In this paper, silver/polyvinyl alcohol/chitosan/graphene (Ag/PVA/CHI/Gr) nanocomposite hydrogels were obtained by in situ electrochemical reduction of silver ions in the hydrogel matrices, previously cross-linked by the freezing-thawing method. In order to investigate the influence of chitosan concentration, the hydrogels were synthesized with 0.1 wt. % and 0.5 wt. % CHI. UV–visible spectra of Ag/PVA/CHI/Gr hydrogels showed absorption peaks at 400–410 nm, proving the presence silver nanoparticles in polymer matrix, due to surface plasmon resonance effect. Cyclic voltammetry (CV) was used to examine the electrochemical properties of synthesized hydrogels. Fourier transform infrared spectroscopy (FTIR) investigations showed strong hydrogen bonding between functional groups of polyvinyl alcohol and chitosan, as well as coordination bonding of silver with functional groups on polymer chains. The structure of hydrogels becomes more amorphous and more porous with higher chitosan concentration, as shown by scanning electron microscopy (SEM). These nanocomposite polymeric materials with incorporated silver nanoparticles have potential for use in biomedical purposes, due to good antimicrobial properties of silver.

3-1

New eco-sustainable microwave-assisted method for extraction of alginate: From coastal beach waste to agricultural mulching films

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In this paper, cost-effective and eco-sustainable microwave assisted method for extraction of alginate by Sargassum raw seaweed waste was proposed. Dried Sargassum seaweeds particles were exposed to controlled microwave energy in a specific equipment, where power density, duration, thermal regime of working air and exposure uniformity were optimized. Treated substrate was then subjected to sodium alginate extraction process, using hot water or sodium carobante as solvent. At the same time, raw algae underwent to conventional microwave-extractive procedure. Preliminary spectroscopic analysis (FTIR-ATR), structural analysis (GPC), thermal (TGA, DSC), and morphological (SEM) investigations of obtained alginates have been performed. SEM analysis confirmed that new extractive method induced seaweeds cell wall breaking, thus promoting the availability of alginic acid, whereas spectroscopic investigation assessed the extraction of the polymer in both cases. GPC and TGA analysis showed that alginate obtained from new extractive methods had higher molecular weight and higher thermal stability in comparison to the commercial alginate and alginate obtained from conventional protocol. Finally, preliminary results related to SA extraction, evidenced that MAE technique could represent both a valid method to obtain sodium alginate in a cost-effective way and an environmentally friendly approach finalized to the upgrading of coastal beach waste materials.

3-2

Characterization of porous scaffolds based on gellan gum and bioactive glass under biomimetic bioreactor conditions

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Porous nanocomposite scaffolds containing 2 wt% gellan gum (GG) and 2 wt% bioactive glass nanoparticles (BAG, 70 mol% SiO_2, 30 mol% CaO) were examined regarding the initial mechanical properties, as well as hydroxyapatite (HAp) formation in a perfusion bioreactor. 2 wt% GG samples served as controls. Over 7 days in the simulated body fluid, HAp formed both under continuous perfusion (1.1 ml min-1) and under static conditions as confirmed by FEG-SEM and EDS analyses. Mechanical evaluation has revealed the need for optimization of the synthesis procedure in order to discern if the HAp formation was kinetically or mass transfer controlled.

3-3

Operating conditions in the bioreactor prototype applying hydrostatic pressures

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A new bioreactor prototype was constructed with the possibility to apply hydrostatic pressures up to 3 MPa in order to imitate conditions in intervertebral discs. The bioreactor consists of a pressurized chamber filled with oil closed by a membrane transferring the pressures to the cultivation chamber mounted underneath. The prototype was examined in terms of achieving and maintaining a given pressure, response dynamics of the system, and the reproducibility of experimental conditions. Measurements and analysis of pressures in two chambers were used to determine the pressure transmittance rate, signal delay in the cultivation chamber as well as the presence of bubbles.

3-4

Effect of ethanol storage on the degree of conversion of bulk-fill, low-shrinkage and conventional composites

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The aim of this study was to determine the effect of ethanol storage on the DC of bulk-fill, low-shrinkage and conventional composites.

Five samples of each of the bulk-fill (Filtek Bulk, 3M ESPE; Tetric EvoCeram Bulk, Ivoclar Vivadent; Beautifil Bulk, Schofu and EverX Posterior, GC), low-shrinkage (Kalore, GC) and conventional composites (Tetric EvoCeram, Ivoclar Vivadent and Filtek Z250, 3M ESPE) were prepared in standardized moulds and light-cured using an LED light-curing unit (LEdition, Ivoclar Vivadent) followed by 24 h of dark cure. The DC was measured on the non-irradiated surface using micro-Raman spectroscopy after dark cure and then after 48 h of storage in absolute ethanol. Uncured composites were used as reference materials. Data were statistically analyzed using two-way ANOVA and post-hoc tests and paired t-tests with Bonferroni correction at α=0.05.

The highest DC in the range of 67-71% was found for Filtek Bulk, EverX Posterior and Tetric EvoCeram whilst the lowest DC was found for Kalore (50-51%) both initially and after ethanol storage. Significantly higher DC occurred in Beautifil Bulk (10.3%), Tetric EvoCeram Bulk (4.7%), EverX Posterior (3.5%) and Tetric EvoCeram (8.5%). Increase, albeit not statistically significant, was also detected in Filtek Bulk (1.4%) and Kalore (1.9%). Higher DC in most of the tested composites following ethanol storage indicates the presence of up to 10% of uncured monomers capable of eluting out in the organic solvent. The majority of remaining C=C double bonds are in the form of pendant groups attached to polymer chains.

3-5

Discoloration of resin-based dental composites from different manufacturers

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Discoloration of resin-based composites (RBCs) varies depending on the manufacturer and the type of restorative material. This study aimed to assess the extent of changes in RBCs properties after their staining and to compare these changes between composites of several commercial brands of the same shade designation. Specimens were prepared from composites of five different brands all having the B1 shade designation: Tetric, N'Durance, Z250, Charisma, Gradia (n=25). Then, samples were immersed in black tea (Sir Winston Tea, English breakfast) for 7 days. Measurements were repeated after polishing of the specimens to assess the contribution of adsorbed and absorbed stains. The color of samples was determined from reflection measurements and presented in CIELAB color scale (with standard D65 illumination against white and black). Also, the translucency of RBCs was calculated and fluorescence measured. The surface of specimens was evaluated from Atomic Force Microscopy measurements. Though the shade of all specimen was the same (B1), color coordinates, an extent of color changes after staining, fluorescence, and translucency were different when compared among the various RBC manufacturers. These differences were analyzed with respect to their aesthetics in restorative dentistry.

3-6

Influence of size, concentration and shape of iron oxide nanoparticles on hyperthermic efficiency

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We present size, concentration and shape effects on the magnetic proprieties of Iron-Oxide magnetic nanoparticles (MNPs), studied by means of DC and AC magnetic susceptibility and magnetic hyperthermia measurements. The nanoparticles are constituted by an inorganic core of maghemite (γ-Fe_2O_3), having three different core diameters, 10 (A), 14 (B) and 20 (C) nm, with a coating composed by polyacrilic acid (PAA), and are dispersed in water solution. The MNPs are analyzed for possible uses in biomedical area, in particular for Magnetic Fluid Hyperthermia. The frequency and magnetic field selected for hyperthermic measurements are in the range 100÷1000 kHz and 3÷20 kA/m.

We focus our attention on the variation of Specific Loss Power (SLP) to compare the theoretical results and experimental data, in particular for what concerns the dependencies of SLP from magnetic field and frequency in the superparamagnetic or ferromagnetic regime [1].

The theoretical model [2] predicts SLP proportional to H2 in the superparamagnetic regime and SLP proportional to H3 in the ferromagnetic multi-domains regime. During the transition, if the system is not in the Stoner-Wohlfarth condition, there is still no satisfactory explanation for the evolution of SLP(H). We report SLP data and the best fit curves for MNPs in different regimes to estimate the variation of the low SLP(H): if $\xi=\mu 0MSVH/kBT$ is less than 1 (it depends from magnetic proprieties of samples) the Linear Response Theory (LRT) predict SLP proportional to H2. If ξ is higher than 1, one has SLP proportional to Hn in the region of H values corresponding to the passage from superparamagnetic to ferromagnetic regime.

In addition to this analysis, the variation of SLP with the concentration of MNPs in water and the influence of the shape of MNPs on SLP considering cubic particles were studied.

[1] Magnetic fluid hyperthermia: Focus on superparamagnetic iron oxide nanoparticles, S. Laurent, S. Dutz, U. O. Häfelia, M. Mahmoudi, Advances in Colloid and Interface Science 166 (2011) 8–23.
[2] Simple models for dynamic hysteresis loop calculations of magnetic single domain nanoparticles: Application to magnetic hyperthermia optimization, J. Carrey, B. Mehdaoui, and M. Respaud, Journal of Applied Physics 109, 083921 (2011); doi: 10.1063/1.3551582

4-1

Agroindustrial waste as substrate for cellulase production by Paenibacillus chitinolyticus CKS1

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Agricultural waste abundant in lignocellulosic materials, present a potential source of environmental pollution due to its low degradability. In order to reduce such pollution, the use of "cleaner technologies" is becoming more common. The degradation of agroindustrial wastes by different bacterial strains is shown to be suitable for cleaner and economical production of microbial metabolites such as industrially important enzymes-cellulases. In this study, four different agricultural waste products: wheat bran, barley bran, oat bran and rye bran, respectively, were used as solid substrates for cellulase, carboxymethyl cellulase (CMC-ase) and Avicelase production. Solid state fermentation (SSF) was performed by a natural bacterial isolate Paenibacillus chitinolyticus CKS1.

Among four tested substrates, rye bran produced the highest CMC-ase and Avicelase activities. The optimization of process parameters (moistening agents and the solide: moisture ratio, substrate particle size, concentration of inoculum, incubation time and surface/volume ratios) were done using rye bran as a substrate. Data showed that distillised water was the best moistening agent, followed by molasses (2%), ISP1broth (yeast extract 3g/l and 5 g/l casein hydrolisate) and buffers (0.1M acetate buffer pH 4, 0.1 M phosphate buffer pH 7 and 0.1M glycine-NaOH buffer pH 9 respectively) for obtaining maximum CMC-ase and Avicelase activities. Optimal particle size of rye bran was 800μm-2mm, while the optimum solid: moisture ratio was 1:1. Maximum CMCase activity of 1.13 U/g and Avicelase activity of 1.46 U/g was obtained on the fourth day of fermentation with 15% of inoculum using 300 mL volumetric flasks.

The results obtained in this study showed that lignocellulosic agricultural waste, especially rye bran, is suitable for obtaining value-added products, such as industrially important enzymes. Also, microbial degradation of such waste materials contribute to cleaner technologies and finally to the reduction of environmental pollution.

4-2

Investigation of catalytic possibilities of impregnated soybean hulls in decolorization process

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In this study impregnated bio-waste material (soybean hulls) was used as a catalyst support in determining of removal efficacy of two synthetic textile dyes from aqueous solutions. Impregnation of the starting material was conducted with Fe-polycation, thus synthesizing Fe-SBH. Characterization of the initial and modified soybean hulls was carried out using point of zero charge, surface area analysis (BET), scanning electron microscopy (SEM), energy dispersive X-ray spectrometry (EDS) and Fourier transform infrared spectroscopy (FTIR). Applying these methods, it was concluded that there was a significant change in the structure of soybean hulls after impregnation with Fe (III) ions, namely an increase in specific surface area (BET), the change in appearance (SEM) and in the composition of modified material (EDS). Afterwards, adsorption and advanced oxidation (Fenton) processes were implemented for decolorization of Reactive Blue 4 (RB4) and Brilliant Blue R (BBR) dye solutions and reaction kinetics were followed during 180 minutes. Achieved adsorption efficiency on Fe-SBH was 34% and 57% for RB4 and BBR, respectively. Fenton process efficacy in the decolorization of RB4 solution was higher than adsorption, and was 73%, while BBR dye removal was the same (57%). Our results indicated the potential of the Fe-impregnated bio-waste material as a catalyst in the oxidation of organic pollutants, such as synthetic textile dyes.

4-3

The properties of chitosan beads based on alginate and iron-oxide prepared using layer-by-layer deposition method

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The very important goal for the waste water purification is to find long life adsorbents with high selectivity. Wastewater containing dyes is very difficult to purify, since some of them are resistant to aerobic digestion. Many of the industrial dyes are toxic, teratogenic, and carcinogenic. A synthetic dye cannot be efficiently decolorized by traditional methods. All technologies for colour removal (biological, chemical and physical) have advantages and drawbacks. Chemical methods include coagulation or flocculation combined with flotation and filtration, conventional oxidation methods by oxidizing agents, precipitation-flocculation with Fe(II)/$Ca(OH)_2$, electroflotation, irradiation or electrochemical processes. The main goal of our work was to prepare composite beads based on midium molecular weight chitosan and a bio-degradable sodium alginate magnetite nanoparticles composites for dyes removal from water. Magnetic adsorbents can be efficiently used for the separation of dyes from solutions and suspensions. Beads coated with chitosan were prepared using layer-by-layer deposition method. The solution of red dye 4,4'-(1,1-dioxido-3H-2,1-benzoxathiole-3,3-diyl)bis(2-methylphenol) was prepared in distilled water with different concentrations for measuring bead adsorption efficiency. During the adsorption process, the samples were taken at the pre-determined time intervals and adsorbents were separated from the solution using a magnet. The difference between the concentrations of cresol red solutions before and after adsorption gives the amount of dye on the adsorbents. The substantial characteristic of an adsorbent is the quantity of adsorbate accumulated on adsorbent, which is generally estimated from the adsorption isotherms.

4-4

Properties of seashell waste as a sorbent material for cationic pollutants

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Harvesting and farming of various seashell species for human consumption simultaneously generate vast amounts of shells, which accumulation becomes a common ecological problem in many coastal countries. SW is primarily composed of biogenic calcium carbonate with minor amounts of organic phase, and potentially has significance as a raw material. Therefore, development of technologies for utilization of seashell waste (SW) material represents a significant alternative to disposal. In this study, possibility of SW application in removal of Cu^{2+}, Zn^{2+}, Pb^{2+} and Sr^{2+} ions from aqueous media was investigated in batch conditions. The experiments were conducted by varying sorption parameters such as the initial metal concentration, contact time, solution pH and sorbent/solution ratio. Experimentally obtained results were fitted by mathematical models, for the calculation and comparison of maximum sorption capacities and sorption rate constants. In addition, SW was submitted to temperature treatments (200-900 °C) in order to analyze the solid phase transformation and the resulting impact onto metal removal efficiency. SW exhibited high potential for the immobilization of investigated cations which can be of benefit in water treatment and soil remediation processes, and a promising strategy for saving natural resources such as limestone.

4-5

Determination of experimental conditions for examination of cobalt catalyst supported by polymer Bray-Liebhafsky oscillatory reaction performed in open reactor

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Structural analysis of cobalt(II)-nitrate supported on the macroreticular copolymer of poly-4-vinylpyridine and divinylbenzene (Co-PVPDVB), a catalyst which can be used for oxidation of many pollutants , was done by infrared spectroscopy, scanning electron microscopy and atomic force microscopy. The Bray-Liebhafsky oscillatory reaction, as an extremely sensitive matrix, can be used for examination of catalyst properties. Bifurcation analysis in continuously feed well stirred tank reactor was done in order to find the best conditions for testing catalitical activity of Co-PVPDVB. The regions in vicinity of bifurcation points are identified as optimal conditions for catalyst test, since in these dynamical states oscillatory system is the most sensitive to any pertubations. Moreover, it has been shown that Andronov-Hopf supercritical bifurcation point obtained at temperature, T=56,0 °C, flow rate, $j0=2.95\cdot10^{-2}$ min^{-1}, and initial experimental conditions, $[H_2O_2] = 1.50\cdot10^{-2}$ M, $[KIO_3] = 5.90\cdot10^{-2}$ M, and $[H_2SO_4] = 8.00\cdot10^{-2}$ M, is the optimal one.

5-1

On the preparation of zeolite-based adsorbent for phosphate removal from water media

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The aim of this work was to prepare a sustainable and an environmentally acceptable adsorbent for phosphate removal from water media. High concentrations of phosphates are mainly responsible for eutrofication in surface water bodies and efficient methods for phosphate removal are still investigated.

Natural zeolites with their high surface area, porous structure, ion-exchange ability, and availability present good candidates for design of phosphate adsorbents. In this study we used zeolitic tuff from Iran for which we have found to contain more than 90 mas. % of zeolite – clinoptilolite, to have a high cation exchange capacity (CEC= 190 mmol M+/100 g) and to exhibit the specific surface area (SBET) of 31 $m^2 g^{-1}$.

The tuff was modified by a simple two-step procedure including an ion exchange reaction in order to obtain Fe(III)-containing clinoptilolite (FeZ) and calcination at 600 °C to convert FeZ into FeO-containing clinoptilolite (FeOZ). The modification significantly increased SBET being 90 m^2g^{-1} whereas the crystalinity of clinoptilolite remains intacta. A detailed analysis performed by transmission electron microscopy showed randomly dispersed nano-oxide particles of about 10 nm at the surface of FeOZ crystals belonging to amorphous FeO. The adsorption capacity of FeOZ was examined at 25-45 °C by batch experiments using different initial phosphate concentrations (50- 400 mg PO_4^{3-} dm^{-3}). The adsorption kinetics follows the pseudo-second order kinetics with the rate constant which decreases by increase of the initial phosphate concentration. The adsorption process is best described by the Langmuir equation (qmax = 21.27 mg g^{-1} at 45 °C) indicating highly homogenous surface of the prepared adsorbent.

All results indicate that the Fe(III)-modified clinoptilolite could be perspective adsorbent for phosphate ions present in water media.

5-2

Determination the content of anionic active agents in detergents

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Surfactants and detergents are an integral part of our daily life and play an important role in industry processes. In detergents as active substances can be anionic and non-ionic substances, individually or in combination. In this paper is analyzed the content of anionic active substances in some products, which are on the market Republic of Srpska. For the determination of the anionic active substance was used a method of titration with a standard solution Hyamin 1622 in the presence of mixed indicators. Use and disposal of cleaning products release sodium lauryl sulphate into the environment via household wastewater systems. Sodium lauryl sulphate is readily biodegradable under aerobic and anaerobic conditions and, therefore, does not persist in the environment.

5-3

Selection and consumption of electrode material for electrocoagulation of landfill leachate

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During electrochemical wastewater treatment, special attention is paid to the choice of electrode material. In this paper was investigated the effect of anode material on the turbidity removal efficiency and total dissolved solids (TDS) removal efficiency by the electrocoagulation of landfill leachate. Iron anode achieved higher turbidity removal efficiency compared to aluminum anode at all applied current densities (j=10; 25; 50 mA/cm^2). Also, at low current densities TDS removal efficiency is higher for iron anode. The consumption of electrode material is calculated in accordance with Faraday's law, and is increased with increasing current density and duration of electrolysis. In order to examine the influence of cathode material stainless steel (SS) is also used as the cathode. Higher removal efficiency of TDS and turbidity obtained using a stainless steel cathode, so the iron cathode can be successfully replaced by the cathodes of stainless steel.

5-4

Hybrid composites prepared from industrial waste: microstructure, water absorption and mechanical properties

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In this paper, hybrid composites were prepared with polyester matrix reinforced with fiberglass and jarosite industrial waste particles as filler. Jarosite waste released from zinc metal extraction process is very hazardous in nature due to the presence of toxic substances such as zinc, lead, cadmium, copper and other metallic and non-metallic oxides. The disposal of jarosite released from Trepca Zinc Industry in Kosovo has become a major environmental concern. This work presents the attempt of immobilizing the jarosite waste as a value added product into the hybrid composites. Therefore, the hybrid composites were prepared with polyester matrix reinforced with five sheets fiberglass chopped strand mat and adding 5, 10 and 15 wt. % of jarosite waste particles as filler. Hand lay-up technique was adopted for preparation of the composite with previous ultrasonic probe dispersion jarosite particles in polyester resin. Morphology of prepared composites was analyzed by optical microscope. Water absorption of the composites was determined by immersing specimens in distilled water at 25 °C and 50 °C for different time durations. Flexural properties (flexural strength, modulus and apparent interlaminar shear strength), Charpy impact strength and hardness were determined and analyzed. The highest values of flexural strength, modulus, apparent interlaminar shear strength and Charpy impact strength were achieved for hybride composites with addition of 10 wt. % of jarosite waste particles as filler in polyester matrix reinforced with five sheets fiberglass. The highest hardness was measured for the sample containing 5 wt. % of jarosite filler in the fiberglass reinforced polyester matrix.

5-5

Mechanical and physical properties of light-weight ceramic aggregates prepared from different composition of waste materials

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This paper presents the mechanical and physical properties of the porous ceramic aggregates, manufactured from the local waste materials. Granules were produced from the mixture of aluminosilicate-based mine slates and the car wind-shield glass, contaminated by the PVB foil. Change of the composition of the initial materials ratio had an influence on the physical and mechanical properties of aggregates. Porosity, apparent density and water absorption were examined according to EN 1097 standard, and compressive strength was examined according to UNE-EN 13055-1 standard. Modification of the initial materials composition significantly changes both, physical as well as mechanical properties, up to the critical addition of wind-shield glass.

5-6

The earth's crust as a catalytic generator of hydrogen emission in the atmosphere and possible role of this process in the phenomena of ozone layer degradation

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Fluids play an important role in the processes of chemical and physical evolution of the crustal and mantle rocks. They intensify melting processes and polymorphic transformations, which influences on various types of deformations and re-crystallization in mineral aggregates. However the opposite processes such as catalytic effects of rocks and minerals on the chemical reactions between the fluid components, is a poorly studied topic of geochemistry related to the fluid-mineral interactions. An analysis of the catalytic transformations of fluids in the Earth's crust demonstrates a possibility for many processes being analogous to the known industry technologies, such as synthesis of hydrocarbons and their oxygen-bearing derivatives as a result of H_2O, CO, CO_2, H_2 reactions via the Fisher–Tropsch mechanism used for the production of synthetic fuel, catalytic NH_3 synthesis from H_2 and N_2 (Haber synthesis) etc. Present study is aimed to the further development of the conception about a role of the heterogeneous-catalytic mechanisms of transformations in fluids penetrating through the Earth's crust. It shows the experimental results on the catalytic activity of three crustal rocks - massive serpentinite, oceanic ophitic gabbro, and serpentine asbestos, with respect to the CH_4 vapor conversion reaction (the reaction of "synthesis-gas" formation). Serpentinite is found to be the most catalytically active rock. The degree of CH_4 conversion into H_2 increased with temperature and reached 14 vol. % at 845°C. The methane conversion to CO and CO_2 at the same temperature was 3 vol. % for each component. An unexpected result of the experiments is a qualitative detection of CH_3OH and C_2H_5OH amongst the reaction products. Degree of CH_4 conversion into H_2 on the asbestos was much lower than that on the serpentinite. Nevertheless, it increased with temperature from 4% at 600-700 °C and reached 10 vol. % at 825 °C. The catalytic activity of the gabbro is minimal. The outcome of H_2 increased from 0.4 vol. % at 600 °C just to 4 vol. % at 845 °C. Degree of CH_4 conversion into H_2 on the gabbro also increased with temperature from 4-5 % at 600-700°C and reached 9 vol. % at 845°C. However, such experimental research can be promising in the development of hypothesis regarding the mechanisms of ozone layer degradation in the atmosphere and create some prerequisites for the formation of new scientific direction – catalytic Geochemistry. Until recently, seemingly settled view about the anthropogenic cause of ozone depletion as a result of aerosols CFCs emissions to the atmosphere due to the human activities. However, an alternative version was recently put forward, according to which the agent of ozone destruction was given to hydrogen, rising up from the depths of the Earth. In this respect, the catalytic conversion of fluids on the earth's crust rocks should be considered as a real mechanism of the additional hydrogen formation and emission from the earth's crust into the atmosphere.

6-1

Clustering of OH groups on graphene for enhanced charge storage

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Graphene, a two-dimensional material of extraordinary properties, has captured the attention of the Materials Science community as a potential candidate for various applications. However, when it comes to applications relying on the surface reactivity, such as charge storage, pristine graphene is not the best choice due to its chemical inertness, including weak interaction with alkali metals [1]. On the other hand, graphene produced by graphene oxide reduction, a method which results in some OH groups residues on the graphene basal plane, is a promising option for such applications. Using Density Functional Theory calculations, we have simulated interaction of 1-5 OH groups with graphene basal plane, as well as Li, Na and K interaction with such oxidized graphene systems. We have noticed that OH groups show the tendency to cluster, preferring to form aggregates with an even number of OH groups on graphene. Such behaviour leads to stronger OH bonding to the graphene basal plane compared to a single OH, resulting in stabilization of alkali metal interactions with such systems and no phase separation. The strength of the interaction increases from Li to K. Since the electrical conductivity is preserved, as no band gap opening has been noticed, the modelled material appears to be a good candidate for charge storage applications. Some experimental insights into this idea will also be provided.

References:
[1] A. S. Dobrota, I. A.Pašti, N. V. Skorodumova, Oxidized graphene as an electrode material for rechargeable metal-ion batteries – a DFT point of view. Electrochim. Acta 2015, 176, 1092-1099.

6-2

Theoretical analysis of adsorption properties of doped hexagonal MgO nanotubes

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Oxide materials have a wide range of application in various fields of technology. Oxides exhibit diverse electronic and crystalline structures, and their conductive properties can vary from insulators to conductivity similar to those of metals. MgO is one of the oxides whose properties are being intensively studied. Due to its availability, stability and chemical inertness, it's a subject of many studies that are investigating the possibilities of functionalizing it for applications such as selective adsorbents or catalyst support.

Here we will show the results of DFT calculations of the properties of hexagonal MgO nanotubes of varying sizes. The properties of these nanotubes were altered by doping with Li, B, C, N, and F, at various sites along the nanotube. Change of electronic structure and the induction of magnetization at the dopant site points towards the possible use of these systems as adsorbents or catalysts, or as new nanostructured magnetic materials. Adsorption properties are tested using CO as a probe molecule. It is shown that adsorption energy is drastically changed by doping, the change being localized at and around the dopant site.

6-3

Collision of hydrogen molecules interacting with two graphene sheets

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We have performed the computational experiments with two hydrogen molecules and two graphene sheets. H_2-H_2 and H_2-C interactions are described by Lennard-Jones potential. We numerically solve equations of motion of the wave packet centre. The initial molecule velocity is determined by temperature and collisions occur in central point between two sheets. The molecules after collision stay near or get far away graphene. Then one can find what temperatures, graphene sheet sizes and their distances are favourable for hydrogen storage. It is found that quantum corrections of the molecule classical trajectories are not significant here. Those investigations of possibility of hydrogen storage by physisorption are of interest for improvement of the fuel cell systems. The main disadvantages of our computational experiments are: (1) we cannot compute with very large number of C atoms, (2) we assume that C atoms are placed always in their equilibrium positions and (3) the changes of wave packet width are not considered.

6-4

Micromechanical investigating of the critical parameter's influence on adhesive properties of porous EVA/PMMA polymer blends using finite element method

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Incompatible polymers can be processed in order to obtain improved mechanical or chemical properties of blends. Incompatibility causes formation of pores that are deteriorating mechanical properties and inducing porosity. Ethilenevynil acetate (EVA) and poly methyl metacrylate(PMMA) are two incompatible polymers exhibiting different behavior and their combination can give the material having improved ductility compared to PMMA and better strength compared to EVA. The mixture of those polymers results in a material having large pores and mechanical properties were not at expected level. Compatibilization of EVA/PMMA polymer blends with EVA-g-PMMA decreased pore diameter and improved mechanical properties.

Image analysis of SEM micrographs enabled statistical analysis of pore diameter and other morphological parameters including data about their positions. Positions of pores on the image enabled the calculation and creation of Voronoi diagrams and Delaunay triangulation analysis which was done by using Pythonlibraries. The coordinates of pores contours are processed by The Ramer–Douglas–Peucker algorithm (RDP) and used for establishing the proper models in Abaqus finite elements calculation software. This process is iterative and enables the parametric study of the problem. The aim of this analysis was to determine the area of regular pores that will correspond to the real structure. The relationship of experimental results and numerical simulation of parts identical to SEM images was confirmed.

Employed analysis of spherical pores by changing porosity and pore diameter showed that porosity and pore shape can change the slope of stress-strain curve (modulus of elasticity) and the maximal pore diameter affected the maximal shear stress.

6-5

The analysis of SEM photographs of fractured surfaces of steel P91 and compared with the mechanical properties such as impact energy (toughness)

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Material designated as P91 demonstrated in this paper is the ferritic steel used for manufacturing of process equipment for fossil fuel power plants operating in supercritical steam conditions (steam temperature 600 ºC at the operating pressure of 290 bar). Behavior of steam line components' welded joints (WJ) was investigated. After welding of components made of P91 steel is performed, post weld heat treatment (PWH) is obligatory. Behavior data of the heat-affected zone (HAZ) of P91 WJ were obtained from thermo mechanical simulation of welding. Testing was done with smooth specimens, which were simulated at different peak temperatures in order to get different regions of the HAZ.

In present paper the results of impact energy testing are shown and images of specimens fracture surfaces were processed in order to suggest morphological parameters which could characterize the fracture surfaces.

On the characteristic places on the sample microstructure of samples were visualized using the SEM images. Those images were subjected to analysis with image analysis tools. The dark areas in the structure images were considered as pores and they were observed as objects in image analysis. Morphological parameters used for image analysis were Area, Clumpiness, Diameter, Fractal Dimension and Heterogenity. Determined and Hauzdorf dimensions of the upper and lower cross-sectional images. Values Hauzdorf dimension differ in images, namely images representing the upper parts have a cross-section sample value 1.6699 for sample 1 and 1.7929 HD for sample 2, while the lower specimen area image have the value of 1.5114 for sample 1 and 1.7518 HD for sample 2. Sample 2 has a higher value of Hauzdorf dimensions of the sample 1.

The analysis of the morphology of the fracture surface of samples by using analysis of the degree of grayness samples shows unevenness in the refractive surface. These bumps are compared at specified places on the samples and it could be concluded that larger unevenness were observed on the first sample.

6-6

Transmission singularities and infinite tunnelling times in complex potentials

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Let us consider the case of a potential barrier and an incident free particle, whose energy is lower than the barrier. Quantum mechanics implies, as is well known, a finite, non-vanishing probability for the particle to cross the barrier (i.e. the tunnel effect). When there is a change in the incident probability flux, it is necessary to introduce a non-vanishing imaginary part of the potential. The case of absorptive medium where we have reduction of the incident flux, corresponds to the potential with negative imaginary part, and conversely, the case where the absorption is negative and we have gain of the incident flux corresponds to the potential with positive imaginary part. We have investigated the cases of double rectangular potential barrier, and double delta potential barrier. After obtaining the expression for transmission probability and inserting the values of the parameters, we have discovered that for one particular positive value of imaginary part of the potential, the transmission probability approaches infinity at resonance condition, while at the same time, the unitary condition is satisfied. We have also investigated the tunnelling times, primarily the group delay, which considers a wave packet and represents the delay in the appearance of the wave function at the front and at the end of the potential barrier. After determining the analytical expression for the group delay, it yields that the tunnelling time possesses a singularity (approaches infinity) for the same set of parameters as the transmission. It is shown that for every given value of the real part of the potential, we can find a corresponding imaginary part of the potential so that the mentioned phenomenon occurs. This applies both for potential barriers and potential wells.

6-7

Negative refraction in quantum cascade structures based on cubic nitrides

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One of the proposed solutions for overcoming losses in metamaterial unit cells at optical frequencies of interest, which are caused by the commonly used metallic inclusions, is to introduce optical gain via an active medium. This active medium is suitably comprised of quantum cascade laser (QCL)-like layer sequence. We have chosen cubic GaN/AlGaN material platform for implementation of the quantum wells/barriers in order to explore theoretical possibilities of achieving negative refraction under conditions more appropriate for practical realization than active QCL-like designs proposed so far. By applying global optimization routine to produce new optimized structure we managed to meet the requirements for room temperature operation without inclusion of additional quantization via e.g. magnetic field. At the same time, we have extended the frequency range where negative refraction condition is fulfilled, while carrier sheet densities required for the effect have been significantly lowered.

6-8

Helical edge states in silicene and germanene nanorings in perpendicular magnetic field: A numerical investigation

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Silicene and germanene are monolayer honeycomb structures of silicon and germanium. Due to intrinsic spin-orbit interaction arising from their buckled structure, silicene and germanene are topological insulators, they show quantum spin Hall effect. Using the Kane-Mele model for honeycomb lattice we numerically calculated electronic structure of hexagonal silicene and germanene nanorings with zigzag and armchair edges that are in perpendicular magnetic field. These results include magnetic field dependence of energy spectrum and spatial distributions of the spin up and spin down states. Using the classical model of closed current contour in the magnetic field to interpret these, we show that silicene and germanene nanorings with zigzag edges have helical edge currents on inner and outer edges, although the crystal momentum is ill-defined. There is no observation of the same quantum spin Hall states in two considered nanorings with armchair edges, one of silicene and the other of germanene.

7-1

The impact of changes of experimental conditions and organic solvent on nC_{60} particle size

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Due to its hydrophobic nature, powdered C_{60} is virtually insoluble in water with solubility less than 10^{-9} mg/L. However, solvent exchange method could be a promising way for C_{60} solubilization through its dispersing in water.

In this work we assessed the impact of changes of the experimental conditions and organic solvent on nC_{60} particle size. Namely, with increasing of stirring rate and using of EtOH during dispersion we tried to provoke formation of nC_{60} particles smaller in diameter. DLS technique was employed for particle size monitoring.

According to the results we obtained, positive effects of increasing stirring rate, as well as using of EtOH, was confirmed. We succeeded to decrease particle size almost five times compared to the initial size.

7-2

Detection of low-index {100} planes at Pt nanoparticles

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Carbon supported Pt catalysts for fuel cell applications were synthesized by water-in-oil microemulsion method. The addition of HCl in the nanodroplets was used to cause a preferable growth of {100} Pt planes, which resulted in the formation of the cubic shaped nanoparticles. These planes with {100} orientation were detected by electrochemical methods, cyclic voltammetry in supporting electrolyte and electrooxidation of adsorbed organic molecules such as carbon-monoxide and ammonia. These molecules exhibit different affinity towards differently oriented Pt planes, which is electrochemically detectable. Results obtained by electrochemical methods are compared to high resolution transmission electron microscopy (HRTEM) results, and both show increased presence of {100} planes on the particle surface.

7-3

Innovative nanostructured ITO coatings for the display and biomedicine technique

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Investigations of the thin films ITO doped with single carbon nanotubes (CNTs) which were prepared by using contactless laser technique under varying the electric field have been presented in the work. Calculation of the penetration depth of the CNT on the surface ITO layers by classical molecular dynamics with the software package LAMMPS have showed the change refractive and spectral parameters studied material, but also explain the significant increase in the mechanical hardness and laser strength. Ellipsometry method was found 20 % decrease the films with modification ITO refractive index in the wavelength range 350-520 nm, with subsequent by alignment of refractive parameters in the wavelength range 520-900 nm. Atomic force analysis has been used for more detailed study topography of the modified nanotubes ITO. AFM picture of considered films reflects the processing result of the spatial electromagnetic waves (SEW). We can conclude that ITO modification films Use allows you to SEW further reduce roughness the surface and create a practically smooth relief.

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7-4

Overview of nanostructured LC-mesophase time parameters

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Among other technical procedure to influence on the parameter of the liquid crystal (LC) mesophase, at the present time the structuring processes of the LC system via the introduction of the nano-objects, such as fullerenes, nanotubes, nanowires, shungates, J-aggregates, etc. are quite scrupulously studied. These processes are accompanied by self-organization of the LC with the dynamics of changes in a number of physical parameters: changing the phase transition temperature of the LC, changing the order system parameter, changing the polarization properties of the sensitized matrix system, so changing the performance of devices based on the selected electro-optical components.

The overview of nanostructured LC-system time parameters is represented in that work. It's shown in articles [1,2] that the switching times nanostructured LC with fullerene-based complexes and with the complexes of the quantum dot CdSe/CdTe are decreased. The time parameter of sensitized LC-cell has been decreased less than 1 ms at the LC layer thickness ~ 4 mm [3]. The switching times for standard composition of nematic thickness for 4 ÷ 10 microns is in the range of about 5 ÷ 10 ms. It has been studied in [4,5] the influence of fullerenes and fullerene-containing complexes with charge transfer based on the organic pyridine molecules, polyimides, polyaniline nanoparticles phthalocyanine, etc. It has been shown that the sensibilization with the charge transfer complex (CTC) based on the new composites leads to obtain the nematic LC self-organization and to a significant increase the speed of the LC cells as a consequence. The additional dipole moment [6] in the LC sensitized with system organic molecule-fullerenes/quantum dots increases the polarization in the sensitized structure. In the current paper we continue the job in this direction to improve the dynamic properties of the nanostructured LC.

The results have been supported by FP7 program, Marie Curie Action, project "BIOMOLEC" (2012-2015), by the Russian project "Nanocoating GOI" (2012-2015) as well as by the RFBR grant №13-03-00044-a (2013-2015).

[1] Kamanina, N.V. Fullerene-dispersed liquid crystal structure: dynamic characteristics and self-organization processes // Physics-Uspekhi 48 (4), 419-427 – 2005.
[2] Kinkead, B. Effects of size, capping agent, and concentration of CdSe and CdTe quantum dots doped into a nematic liquid crystal on the optical and electro-optic properties of the final colloidal liquid crystal mixture / B. Kinkead, T. Hegmann // J. Mater. Chem. – 2010. – V. 20. – P.448.
[3] Effect of CdSe/ZnS semiconductor quantum dots on the dynamic properties of nematic liquid-crystalline medium / Shurpo, N.A., Vakshtein, M.S., Kamanina, N.V. // Tech. Phys. Lett., 2010, Vol. 36, Issue 4, P. 319–321.
[4] Kamanina N. V. Optical investigations of a C70-doped 2-cyclooctylamino-5-nitropyridine–liquid crystal system // J. Opt. A: Pure Appl. Opt. 2002. Vol. 4, № 4. P. 571–574.
[5] Optical properties of the fullerene-doped polyimide in the near infrared / N. V. Kamanina, Yu. M. Voronin, A. V. Varnaev et al. // Synth. Met. 2003. Vol. 138, № 1–2. P. 317–322.
[6] Self-organization and dynamic characteristics study of nanostructured liquid crystal compounds / N.V.Kamanina, Yu.A.Zubtsova, V.A. Shulev et.al. // Solid State Phenomena. 2005. Vol.106. P.145–148.

7-5

Photorefractive properties thin films COANP-graphene: experimental and modelling results

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A wide study of the system COANP (2-cyclooctylamino-5-nitropyridine) -fullerenes nonlinear optical properties presented in our previous papers [1, 2]. Photorefractive parameters such as light induced nonlinear refractive index Δn, nonlinear refractive n2 and third-order nonlinear susceptibility χ(3) of thin films based on pyridine matrices (COANP) doped with graphene have been considered in present article. Both the results of experimental work and theoretical modelling have been presented. The calculations of nonlinear parameters Δn, n^2, χ(3) were based on an experimental part for recording of a Raman-Nath diffraction grating. Values of these parameters are $\Delta n=0.95*10^{\wedge(-2)}$, $n^2=4.84*10^{\wedge(-11)}$ cm^2/W, $\chi(3)=1.6*10^{\wedge(-9)}$ cm^3/erg. For example, $\chi(3)=8.5*10^{\wedge(-8)}$ esu for pure carbon nanotubes [3]. Relation on the diffraction efficiency of the light induced nonlinear refractive index has been modelled through Bessel function of the 1-st order.

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1. N.V. Kamanina, P.V. Kuzhakov, S.V. Likhomanova, A. Chantal, I. Rau, F. Kajzar, «Photorefractive, photoconductive, dynamic features and interfaces of the optical materials modified with nanoobjects», Nonlinear Optics, Quantum Optics: Concepts in Modern Optics; V. 45 Issue 4, p. 283-292
2. S.V. Likhomanova, N.V. Kamanina, “COANP-fullerenes system for optical modulation”, Journal of Physics: Conference Series, V. 741, №1, p. 012146, 2016
3. Satoshi Tatsuura, Makoto Furuki, “Optical switching system”, US Patent No. 6.806.996. B2, Oct. 19, 2004

7-6

Electronic nature of the low-temperature anomalies of ideal and disordered graphene

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The graphene electronic density of states (DOS) has been studied in two methods: the temperature Green's function [1] and density functional theory (DFT).

DFT gives results consistent with other calculation methods (linear energy dependence of DOS near the Fermi level) for ideal graphene [2]. For the case of ordering and stratification, this method changes the density of states in the scattering of electrons on local short range order is not displayed, but only is sensitive to changes of number of electrons per atom at introducing foreign atoms.

Temperature Green's function method allows detecting the influence of electron scattering by impurities and structural inhomogeneities in the graphene structure and shows that the change in the structure from ordering to stratification is able to open or close the gap in DOS. Thus, it is the scattering of electrons on the structural inhomogeneities of the type of short-range order may be responsible for a change of the type of conductivity of graphene.

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7-7

Development of nanobiocatalyst systems for application in biosynthesis of functionally active galactoside

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In the recent years, many researches were focused on development nanoparticles which would be efficient supports for enzyme immobilization. Generally, in comparison to macro-sized particles, nanoparticles have shown altered or enhanced properties during usage as supports for enzyme immobilization due to their large surface area to volume ratio, law mass transfer resistance and high enzyme loadings. Also, in many cases during immobilization nanoparticles can reduce enzyme unfolding and can improve stability and catalytic performance of enzyme. Among various inorganic nanoparticles (nano Fe_3O_4, silica nanoparticles, nanodiamond, nano-size magnetite, zirconia nanoparticles and etc.) silica based ones are probably the most frequently used concerning their features such as high specific surface area, thermal, chemical and mechanical stability, biocompatibility and high resistance to microbial contamination and organic environments. Additionally, surface of silica nanopaticles can be easily modified by silanization with organosilanes resulting in modified surface which can enchase attachment of enzymesvia adsorption or via formation of covalent interactions. Immobilized enzyme on unmodified or by silanization modified silica based nanoparticles can be implemented in biosynthesis of different functionally valuable products.

The aim of this work was to establish an efficient nanobiocatalyst preparation by implementation of commercial, nonporous, fumed nanosilica particles (FNS)for immobilization of β-galactosidase from Aspergillusoryzae, in terms of promoting functionally active galactoside biosynthesis. In order to achieve the formation of stable enzyme-carrier covalent bonds, and thus ensure more stable and productive preparations, both support and enzyme modifications were introduced. Firstly, amino functionalized nanosilica particles were obtained using 3-aminopropyltrimethoxysilane (APTMS), bearing in mind the high affinity of this particular enzyme towards this type of supports. Thereafter, in view of enabling covalent immobilization, the enzyme was successfully modified through activation of the carboxyl groups on the enzyme surface with carbodiimide (EDAC). The proposed protocol proved to be highly effective, since obtained covalent immobilized preparation exhibited enhanced thermal and operational stability, a yielded the substantial amount of highly valuable functionally active galactoside.

8-1

Investigation of changes in positronium trapping in pores under the water influence in nanostructured MgO- Al_2O_3 ceramics

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It is known that nanostructured MgO-Al_2O_3 ceramics are one of the best materials for humidity sensors. The functionality of such ceramics is dependent on microstructure of grains, grain boundaries and pores. These elements significantly affect on their nanostructurization. In addition, electrical properties of ceramics depend on the sorption processes in these materials. In this work we used positron annihilation lifetime (PAL) spectroscopy to investigation of changes in PAL parameters in nanopores MgO-Al_2O_3 ceramics sintered at 1100 °C at different stage of water-immersion and drying. The PAL investigation were performed using ORTEC spectrometer (22Na source) in the ceramic samples dried in vacuum at 120 °C for 4 hours as well as after 1, 2, 3 and 7 days immersion in water vapor. The four-component fitting procedure with positron lifetimes tau1, tau2, tau3 and tau4 and intensities I1, I2, I3 and I4 was used for analysis of PAL spectra.

It is established that the main changes caused by sorption of water are observed in the third and fourth positronium (o-Ps-related) components. The number of nanopores corresponds to the intensity of these components. Thus, the intensity I4, which corresponds to the number of larger nanopore with radius of ~ 18 Å, significantly decreases after 1 day after water-immersion. The lifetime tau4 decreases, which reflects lessening of nanopore radius calculated within Tao-Eldrup model. It is connected with penetration of nanopores by water molecules (fully or partially filling) changing characteristics of o-Ps-related component. Obviously, such pores should have access to environmental and internal communications at the nanoscale. Additional studies of MgO-Al_2O_3 ceramics after 2, 3 and 7 days after water-immersion shows a gradual increase in the lifetime tau4 and intensity I4, indicating release of water from the inner voids of ceramics. After final drying in vacuum at 120 °C for 4 hours, the initial distribution of pores in MgO-Al_2O_3 ceramics tends to recovery. However, the parameters of the fourth component are not fully recovered, testified that some water molecules remaining adsorbed.

The most significant changes caused by water sorption processes are observed for the largest nanopore. The intensity of this component does not return to initial value after drying of ceramics, because not all water released into the nanopore interior. Reducing the value of the lifetime tau4 after drying of ceramics with poorly developed porosity can be due to the formation of thin layers of water molecules surrounding the large pores that completely freed moisture at 120 °C. The lifetime tau3 decreases after water-immersion of ceramics with a gradual increase in drying and intensity I3 grows, indicating annihilation of o-Ps in water-filled nanopores. Water in the nanopores of smaller radius ~3 Å after drying, reflects in increasing of intensity I3 and a slight decreasing of lifetime t3. It is noted that the lifetime of

~ 1,8 nm reflects the annihilation in the water "bubbles" with radius near 3 Å. Its number increases in accordance with intensity I3.

Thus, it is shown that lifetimes of third and fourth positronium (o-Ps)-related component of PAL spectra decreases in water-immersed MgO-Al_2O_3 ceramics reflected decreasing of free-volume after water-immersion. The amount of biggest nanopores decreases, while positronium trapping in smaller nanopores carried out simultaneously with annihilation in water “bubbles”.

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8-2

Ethylenediaminetetraacetic acid (EDTA) assisted hydro/solvothermal synthesis of up-converting rare earth fluorides

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Over the last decade, a lot of effort was directed toward developing of the representative methodologies for the preparation of up-converting (UC) particles which exhibit a unique narrow visible emission when excited by lower-energy photon radiation. This work presents the impact of different processing parameters on structural, morphological and optical properties of up-converting (UC) rare earth fluorides obtained by hydro/solvothermal synthesis. Monodisperse $NaYF_4$:Yb_{3+}/Er_{3+} particles with different morphology, size and crystal phase were synthesized with a help of ethylenediaminetetraacetic acid (EDTA) through adjusting the precursor concentration, degree of doping, polarity of solvent and reaction time. They are characterized by X-ray powder diffraction, scanning and transmission electron microscopy, energy dispersive X-ray and Furrier transform infrared spectroscopy, as well as photoluminescence measurements. It was shown that particle size and phase composition are dependent on the precursor concentration, type of solvent and doping degree, while the cubic to hexagonal transformation of $NaYF_4$:Yb_{3+}/Er_{3+} phase is affected by the reaction time. The crystallization of the orthorhombic YF_3:Yb_{3+}/Er_{3+} phase is established either after decreasing concentration of dopants or increasing polarity of solvents. All of the synthesized particles exhibited efficient up-conversion emission which can be tuned from pure green to the yellowish-orange through control of particles size and phase composition.

8-3

Zinc-copper ferrite nanoparticles prepared via solvothermal synthesis route

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In the past two decades spinel ferrites nanoparticles have been extensively investigated due to their potential applications in a variety of fields (data storage, catalysis, energy, environment, biomedicine, etc.). It is known from the literature that there are various synthesis methods for preparation of ferrite nanoparticles, such as co-precipitation, thermal decomposition, sol-gel method etc. Among them, hydro-/solvothermal synthesis has some advantages, such as simplicity, high yield, better shape control, better nucleation control, lower reaction temperature, etc.

In the present work, the zinc ferrite nanoparticles doped with copper ions ($Zn_{1-x}Cu_xFe_2O_4$; x = 0; 0.2; 0.4; 0.6) were synthetized via solvothermal method and the physicochemical properties of as-prepared samples were investigated. The prepared samples were characterized by X-ray powder diffraction (XRD), transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FT-IR) and vibrating sample magnetometry (VSM). The XRD results show only a presence of cubic spinel phase, while TEM images reviled that samples are consisted of sphere-like particles, 5-7 nm in size. The presence of oleic acid, which was used as a capping agent, on the surface of nanoparticles was confirmed by FTIR analysis. The magnetic measurements show the superparamagnetic behavior of obtained powders.

8-4

Application of soft X-ray absorption spectroscopy for estimation of spin and valence states of cations in $Sr_{1-x}Ce_xMn_{1-y}Co_yO_{3-\delta}$

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Soft X-ray absorption spectroscopy and magnetic measurements have been applied to the study of solid solutions $Sr_{1-x}Ce_xMn_{1-y}Co_yO_{3-\delta}$. Doping Mn position with Co ions reduces the antiferromagnetic interaction in the initial compounds, which leads to a decrease of the Neel temperature and to the magnetic transition of the material into the spin-glass state. Comparing the oxidation state of the cations derived from the magnetic measurements and absorption spectra, we can conclude that there is qualitative agreement between the methods used. Analysis of the absorption spectra showed that the solid solution $Sr_{0.8}Ce_{0.2}Co_{0.2}Mn_{0.8}O_{2.96}$ contains Ce^{4+}, Mn^{4+}, and Co^{2+} cations. Magnetic measurements specify that about 10% of manganese ions present as cation Mn^{3+}. The solid solutions $Sr_{0.9}Ce_{0.1}Co_{0.4}Mn_{0.6}O_{2.85}$, according to the spectroscopic studies, consists of Ce^{4+}, Mn^{4+}, Co^{2+} and Co^{3+} cations. According to the magnetic susceptibility measurements, all the manganese ions are in the 4+ oxidation state and cobalt ions are in a mixed state (75% of Co^{3+} and 25% Co^{2+} ions). Co^{3+} ions are in the high-spin of state. In general, the study found that a combination of these methods makes it possible to estimate reliably the charge state of the transition metals in multicomponent oxide compounds. The valence and spin states defined by X-ray absorption spectra have been consistent with the magnetic moments measurements of the set temperature using magnetic susceptibility measurements.

8-5

Structure of electro-explosion resistant coatings consisting of immiscible components

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The composite coatings consisting of immiscible components of TiB_2-Cu and Mo-Cu systems are formed by method of electro-explosion spraying. The structure of coatings is studied by method of transmission electron microscopy. It is established that the coatings are the particles of titanium, tungsten or molybdenum diboride in copper matrix. The coatings range in thickness from 90 to 100μm. It is shown that in electro-explosion spraying of coatings of various systems the one of their structural elements is the globular regions of meso-scale level whose initiation may be explained by principles of physical mesomechanics. According to them the 'chess board' distribution of compressive and tensile normal stresses resulting in the initiation of mesorotations of material coatings originates in the spayed coatings under the action of shock waves. High temperature and deformation effect of plasma jet results in the formation of pores in the substrate.

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8-6

Possibility of obtaining core/shell structure in system $NiFe_2O_4/ZnFe_2O_4$

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In this work, the synthesis of particles with core/shell structure is suggested, with a unique combination of two soft ferrites for precursors, nickel ferrite ($NiFe_2O_4$) for core and zinc ferrite ($ZnFe_2O_4$) for the shell. These two ferrites with spinel structure were chosen because of low toxicity of the shell, simple preparation of the samples, reproducibility of the synthesis and also high physical and chemical stability, and magnetic properties which can be easily controlled with the size of the particles. Particles with these properties are starting point for obtaining multifunctional particles used in biomedicine. Additional advantage of core/shell structure is that adding an inert layer, like silica, can increase biocompatibility and hydrophilicity of surface, and also colloid stability of particles. Furthermore, additional surface functionalization is possible. Systems $NiFe_2O_4/ZnFe_2O_4$ are synthesized by using the hydrothermal method and coprecipitation. Some samples are modified with surface modifiers, PDDA was used to stabilize the cores of some of the samples, while citric acid was used for the shell. The obtained samples were tested with XRD, TEM, DLS and VSM methods. X-ray analysis confirmed the spinel structure of synthesized nanoparticles. TEM analysis indicated that synthesised nanoparticles are aglomeratted, with possibility to obtain the core/shell structure. DLS analysis showed there is a pH range where the formation of the desired structure is favored. Magnetic measurement showed that most of the examined samples exhibit superparamagnetic to ferrimagnetic behavior, which is desired for using these particles in biomedicine. With the right choice of stabilizers and parameters of synthesis, it is possible to synthesize ferrite nanoparticles with core/shell structure.

9-1

XPS analysis of N-doped TiO_2 nanotube array

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TiO_2 is a promising photoactive material but just in the UV region. One of many approaches that are proposed in order to achieve the TiO_2 activity in the visible region is doping of TiO_2 with nonmetals, such as F, C, S, N. Among them, nitrogen atom has similar atomic size as oxygen atom and small ionization energy. Because of that there are many publications with nitrogen doping, but many questions are still open. The aim of this study is XPS investigation of nature of N-doping TiO_2 nanotubes. Highly ordered nanotubes were prepared by anodization of titanium foil in HF/CH_3COOH electrolyte. As-anodized amorphous nanotubes were annealed in NH_3 atmosphere, where time of heat treatments was varied. Optical responses of undoped and N-doped TiO_2 films were investigated by UV-Vis DRS. The XPS results revealed three N1s peaks: ~ 396, ~ 399 and ~ 401 eV, that describe substitutional and interstitial nature of nitrogen in TiO_2 films. Longer time of annealing decreases total amount of nitrogen and that is in correlation with optical measurement.

9-2

Fabrication, characterization and photoelectrochemical behavior of Fe_2TiO_5 screen printed thick films

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Pseudobrookite paste was composed of a mixture of starting nanopowders of hematite (α-Fe_2O_3) and anatase (TiO_2) in the molar ratio 1:1.5, organic vehicle and glass frit. The paste was screen printed on on fluorine-doped tin oxide (FTO) glass substrate using screen printing technology. Structural, morphological and optical studies have been carried out using X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS) and transmission electron microscopy (TEM). The photo-electrochemical performance of Fe_2TiO_5 screen printed thick film was examined under xenon lamp illumination in 1 M NaOH electrolyte.

9-3

Synthesis and characterization of ZnO:Fe nanoparticles

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Among the semiconducting oxides, ZnO offers significant potential in providing charge, photonic, and spin-based functionality. It is one of the most studied materials due to its potential applications in electronics, optoelectronics and spintronics. Spin-based multifunctional electronic devices have advantages over the conventional charge-based devices regarding data-processing speed, nonvolatility and higher integration densities which makes spintronics an active area of research. According to recently published data, ZnO substituted with 3d transition metal (Cr, Mn, Fe, Co, Ni, Cu) are applicable for spintronic due to the room temperature ferromagnetism. Also, it have been shown that the magnetism of transition metal substituted ZnO is very sensitive to surface defects, particle size, type of the transition metal and concentration of native or artificially introduced defects. In present study, ZnO:Fe nanoparticles with nominally 5, 10, 15, 20 at.% of Fe ions were synthesized by microwave (MW) processing of a precipitate. Qualitative and quantitative elemental analysis of the ZnO:Fe samples were determined by EDS and ICP-OES techniques. X-ray diffraction and Raman spectroscopy were used to investigate the crystal structure and phase purity of the samples. The valence state of the iron ions in the ZnO:Fe crystal structure were clarified using electron paramagnetic resonance (EPR) and Mössbauer spectroscopy studies. The particles morphology and size distributions were characterized by FE–SEM and laser diffraction particle size analyzer, respectively. UV–Vis diffuse reflectance were used to study the optical properties of ZnO:Fe nanoparticles, while photoluminescence (PL), photoluminescence excitation (PLE) and EPR spectroscopy were used to study the nature of the visible emission in ZnO:Fe.

9-4

Decomposition mechanism and kinetics of zinc–isophthalate complex with 2,2'-dipyridylamine as a precursor for obtaining nanosized zinc oxide

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Studies related to the synthesis of nanosized ZnO as the antibacterial agent have become an interdisciplinary area gathering chemists, physicists, biologists, and medics. The broad scope of materials based on ZnO resulted in the development of various techniques for its preparation. Considering the dependence of particle shape and size onto physical and chemical properties of ZnO, the synthesis procedure is of major importance. In this work, an unconventional methodology of synthesis is proposed for obtaining nanosized ZnO. Polymeric zinc complex containing 2,2'-dipyridylamine (dipya) and dianion of 1,3-benzenedicarboxylic acid (ipht), [Zn(dipya)(ipht)]n, was used as precursor. Besides the crystal structure of [Zn(dipya)(ipht)]n which was already published [1], the luminescent properties are presented in this work. Also, the amazing antibacterial activity of this precursor prompted us to investigate the relationship between the crystal structure and thermal properties, especially if we bear in mind the lack of similar studies in the literature. Therefore, the mechanism and kinetics of its degradation was investigated under non-isothermal conditions in nitrogen and air atmospheres.

Degradation enthalpies, thermodynamic activation parameters, pre-exponential factor, A, and the apparent activation energy, Ea, were determined for each step using Kissinger's and Ozawa's equations. The complexity of degradation steps has been analyzed using isoconversional methods. TG/DCS data were collected at four different heating rates: 10, 15, 20 and 25 ^{o}C min^{-1}, while the formation of nanosized ZnO was confirmed using XRPD and FESEM techniques. The influence of precursor on the crystallite size and morphology of the resulting ZnO along with its antibacterial activity was examined. The obtained results will be discussed and compared.

[1] L. Radovanović, J. Rogan, D. Poleti, M. Milutinović, M.V. Rodić, Polyhedron 112 (2016) 18.

9-5

Soft X-ray absorption spectroscopy nano titanium dioxide impurities of cobalt

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The charge state of cobalt ions in nanopowders anatase TiO_2 *c* lattice studied by soft X-ray absorption spectroscopy. It found that at low concentrations of impurities cobalt (2 at.%) Of cobalt ions in the 2+ oxidation state are mostly in the tetrahedral oxygen environment ions. On the surface of the samples before heat treatment is amorphous titania.

Annealing under vacuum and hydrogen leads to surface enrichment of nanoparticles ions Co 2+, the remainder of the change in coordination with the cobalt ions for octahedral tetrahedral, to stabilize the anatase structure and to the disappearance of the amorphous phase.

The crystal lattice of the samples with a relatively high impurity concentration of cobalt (12 at.%) Is distorted, and no annealing leads to the disappearance of the amorphous TiO_2 phases. When hydrogen annealing in samples with high concentrations of cobalt is observed to metallic cobalt recovery.

9-6

Organic-inorganic nanocomposites prepared from polyurethane and colloidal silica dispersions

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Polyurethane water dispersions (PUDs) have found to be attractive materials for production of flexible wood, textile and leather coatings[1]. In order to obtain thermoplastic materials easy for processing, shaping and forming by industrial processes, PUDs were synthetized from hexamethylene diisocyanate (HDI), polycarbonate diol (PCD) and butane-1,2-diol (BD).

Although films obtained after drying of PUDs based on linear PUs are possible to recycling, they are rather poor materials. One of the methods how to improve properties of thermoplastic PUs is preparation of the organic-inorganic (O-I) nanocomposites[2].

We prepared several PUDs with different PCD/BD ratio and dried in order to obtain films. PUD particle size, stability and thermomechanical properties of the films were investigated. PUD with the best particle properties was chosen as organic matrix for O-I nanocomposites. Two types of commercial colloidal silica: Ludox AS and Ludox TMA were used as inorganic nanofillers. Aqueous PUD was mixed with appropriate amount of silica water dispersions in order to obtain film nanocomposites with 5, 32 and 50 wt% of silica. This procedure resulted in formation of thermoplastic films reinforced by hydrogen bonds between PU and the filler particles. The nanocomposites were characterized by tensile testing, TGA DMTA, water uptake measurements, SEM and AFM. The films prepared with Ludox AS feature better mechanical and thermal resistance in comparison with materials obtained using Ludox TMA, due to difference in particle size and shape of the both colloidal silica types. PUD nanocomposites with montmorillonite Cloisite Na^+ were prepared and tested as well.

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References:
1. Serkis M et al: J.Appl. Polym. Sci.2015; 132: 42672
2. Serkis M et al: Compos. Interf. 2016; 23:157-173

9-7

Levitation-jet synthesis of titanium nitride and In-O ferromagnetic nanoparticles

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Cubic and near-spherical TiN nanoparticles (NPs) ranging in average size from 20 to 125 nm as well as octahedral and rough-spherical In-In_2O_3 nanoparticles ranging in average particle size from 30 to 300 nm were prepared by levitation-jet aerosol synthesis through condensation of titanium or indium vapor in inert or helium gas flow with gaseous oxygen/air/nitrogen injection at normal and reduced ambient pressure. SEM, BET, XRD, UVvis, FT-IR, VSM, Raman and XPS studies demonstrated a predominant role of the material composition on all the NPs properties. All the synthesized materials are ferromagnetic at room temperature (RT). RT ferromagnetism with maximum magnetization of up to 2.5 emu/g and coercive force of up to 110 Oe were recorded for the TiN nanoparticles. The maximum magnetization oscillates with an indirect band gap values and tends to grow up with an increase of TiN bond densities. Such behavior may be interpreted in terms of a defect structure of the NPs surface, containing Ti and N vacancies or di-vacancies. Its densities and degree of mutual interactions may be controlled by varying of the preparation conditions such as size, morphology and composition of aerosol-generated NPs. Here, it should be taken into account, that these conditions may influence the NPs characteristics in an independent manner. In addition, because of that, it may leads to the different values of defect density and, consequently, to various maximum magnetization values. We hope to use “smart” levitation-jet synthesis in the future and obtain NPs of other nitrides and chemical compounds with the larger values of maximum magnetization at room temperature. Such NPs could in principle be used as an advanced material for spintronic applications. All the In-In_2O_3 materials are also ferromagnetic at room temperature with relatively high maximum magnetization of up to 0.072 emu/g and coercive force of up to 140 Oe. Maximum magnetization of In/In_2O_3 NPs tends to grow up with decrease in In unit cell volume. Such behavior may be also interpreted in terms of defect structure of the metal-oxide interface, containing In and O vacancies. It may leads to the different values of defect density and, consequently, to various maximum magnetization of NPs.

10-1

Electrodeposition and characterization of Zn-Mn alloy deposited from choline-chloride-urea deep eutectic solvent

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Corrosion of steel and iron parts is one of the greatest problems in their application. One of the most used techniques for steel corrosion protection is electrodeposition of various metals and alloys. In this work Zn-Mn alloy was deposited from non-aqueous electrolyte based on choline-chloride and urea (DES) on cathode made of cold-rolled low-carbon steel sheet (Č 0.146). Alloy coatings were electrodeposited galvanostatically, at different current densities, at 70 °C, with the aim of getting high Mn content alloy coatings on steel with high current efficiency [1-3]. Composition and morphology of deposits were examined by scanning electron microscopy and energy dispersive spectroscopy. Due to the absence of hydrogen evolution from water, the current efficiency in this type of DES of 90% was achieved, which is much higher than in aqueous solutions. It was also shown that Mn content was much higher in alloys deposited from DES, than in alloys that were deposited from aqueous solutions. In addition, high Mn content in alloy coatings from DES was obtained at much lower current densities. The high Mn content is favorable in corrosion protection, so these alloy coatings seem as promising alternative for conventionally used sacrificial zinc coatings.

Literature:
(1) Guo J., Guo X., Wang S., Zhang Z., Dong J., Peng L., Ding W.: Effects of glycine and current density on the mechanism of electrodeposition, composition and properties of Ni–Mn films prepared in ionic liquid. Appl. Surf. Sci. 365 (2016) 31-37
(2) Yang H.Y., Guo X.W., Chen X.B., Wang S.H., Wu G.H., Ding W.J.,Birbilis N.: On the electrodeposition of nickel–zinc alloys from a eutectic-based ionic liquid. Electrochim. Acta 63 (2012) 131-138.
(3) Endres F., Abbot P.A., MacFarlane R.D.: Electrodeposition from ionic liquids, John Wiley &Sons, Weinheim (2008) pp. 3-77.

10-2

Properties of Zn-Al alloys with Mg addition for hot dip galvanizing

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In the paper the authors present the results of corrosion resistance tests on ZnAl alloys with Mg addition, for the batch hot dip method. ZnAl alloy with composition of 15% Al was chosen. The amount of Al was replaced with Mg addition. Corrosion resistance tests were conducted on following alloys: ZnAl15, ZnAl12Mg3, ZnAl9Mg6, ZnAl6Mg9, ZnAl3Mg12. Alloy ZnAl3Mg12 was rejected because of technical problems with casting due to fast oxidation. Accelerated laboratory tests in neutral salt spray and corrosion tests in moist atmosphere containing sulphur were conducted. Melting point of ZnAl alloys with the addition of Mg has been determined, based on solidification curves. It was established that the addition of Mg can significantly improve corrosion resistance of ZnAl alloys. What is more some of tested alloys with Mg had lower melting point which can decrease costs of hot dip galvanization process. As a comparative alloy ZnAl with eutectic composition of 5%Al was chosen.

10-3

Rheological properties of alumina-zirconia suspensions

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The influence of a dispersant, polyelectrolyte DOLAPIX CE 64, on rheological properties of highly concentrated alumina-zirconia suspensions was investigated. Prepared suspensions contained 70 wt. % of dry ceramic powder. Two groups of composite alumina-zirconia suspensions were prepared, as well as one control suspension, containing only alumina. Ratio of alumina and zirconia was 99:1 for the first group and 90:10 for the second one. The amount of chosen dispersant was varied within the each group in order to determine the optimal one. Rheological properties of prepared suspensions were determined by measuring the apparent viscosity at different shear rates. The optimal amount of DOLAPIX CE 64 was the one resulting in the lowest apparent viscosity. It was established that the amount of added dispersant increases with the increase of zirconia content, but it can be confirmed that the chosen dispersant is applicable for this system.

10-4

On the formation of composite powders based on complex compounds by the self-propagating high-temperature synthesis

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Possibilities of formation of complex compounds in multi-component systems during the self-propagating high-temperature synthesis have been discussed. Structure and properties of synthesized powders obtained in Ti-Al-C-MoS_2 charge mixture have been investigated. Complex carbosulfides of the MAX-phase type having P_{63} / mmc crystal structure were formed during the synthesis. As-synthesized powders seem to be promising for the creation of antifriction materials.

10-5

Application of principal component analysis in rehabilitation of post-stroke patients

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Rehabilitation of post-stroke patients includes the therapy for restoring healthy like gait. The quantified assessment of the gait is necessary for adjusting the intensity and type of the therapy. The aim of our research was to develop an algorithm for automatic detection of deterioration or improvements of the gait based on data acquired wirelessly from an inexpensive and easy-to-use set of inertial measurements units (IMU). We built the application which uses the principal component analysis (PCA). PCA is a multivariate statistical technique for analyzing stochastic data, like the kinematic data collected during the gait. We tested the algorithm in a group of healthy subjects and a group of patients after stroke. We obtained information about the gait phase when the difference occurs between the normal and post-stroke gait suggesting which movement should be improved. Our results quantitatively show that the biggest differences are between the angular velocities of leg segments (foot angular velocity is too low and shank acceleration is too big in the affected leg, while the shank acceleration of the non-affected leg is too weak). The application of this method and instrumentation is envisioned in the design of therapeutic sessions of humans after stroke. The results call for a larger randomized study to prove the results and further refine the technique.

11-1

Synthesis and characterization of pectin esters obtained by reaction with dichlorides of glutaric and sebacic acid

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Pectin is an important natural anionic polysaccharide extracted from the cell walls of higher plants. It is based on (1→4)-linked α-D-galacturonic acid units, interrupted by L-rhamnose residues with side chains of neutral sugars, mainly L-rhamnose, L-arabinose and D-galactose. The galacturonic acid residues may be partially methyl-esterified on the carboxyl group and O-acetylated at C-2 or C-3. This polysaccharide is known as a gelling agent, thickener, texturizer, emulsifier and stabilizer. The properties of good biocompatibility, non-toxicity, and biodegradability as well as high nutritional values make pectin an attractive biopolymer, which can be employed in the pharmaceutical industry, health products and cosmetic applications. However, the functionality of pectin sometimes needs to be strengthened or altered to satisfy market demand for innovative and functional products. A number of hydroxyl and carboxyl groups distributed along the backbone, as well as a certain amount of neutral sugars present as side chains in pectin enable the preparation of a broad spectrum of derivatives.

Since the high hydrophilicity of native pectin often limits its application, the aim of this work was the modification of native pectin to obtain the material with enhanced hydrophobicity compared to the starting one. We conducted the conventional esterification of active pectin groups using chlorides of saturated carboxylic diacids: glutaric and sebacic. Calculated per single galacturonic acid unit, the acid dichlorides were added dropwise to the reaction mixture in different molar ratios (1:3, 1:15), using DMSO as a solvent. The reaction was carried out for 3 h at 50 °C. Hydophobic chains of different length and density were inserted and the esterification reaction was confirmed using FTIR spectroscopy. A new approach in the synthesis of modified pectin proposed in this investigation resulted in materials with modified properties compared to native pectin. We report the synthesis, GPC analysis, particle size distribution, rheological behavior of concentrated solution as well as the sorption potential of modified pectins toward copper ions.

11-2

The study of mechanical properties of polymers depending on the fillers

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Feasibility of obtaining chemically and mechanically resistant polymer materials is determined by the prospect of their use in a wide range of industries. But the limiting factor of application polymer coatings is the lack of mechanical strength of the products. The solution of this problem is in several directions, one of which is in the introduction of new types of fillers. In present time as fillers use a variety of materials both natural and synthetic origin, from the most common well known carbonate compounds to the most exotic, for example, chitin nanofibers. The promising raw materials for fillers are various technological and household wastes, which are represented by a variety of groups of substances.

This report presents the results of a study on the use as fillers for plastics the cenospheres from coal fly ash of thermal power station and of calcium carbonate from eggshells. As a polymer matrix was use the polyester - polyethylene terephthalate. We are special used diametrically different materials and showed how the mechanical activation influence on the end product.

Using the cenospheres and eggshell as fillers for polymer material is also ambiguous effect on the characteristics of the resulting composite materials. However, it found that the polymeric materials with fly ash and eggs shell as fillers with thin dispersion show better performance of mechanical, water repellency and acid resistance properties than their counterparts on the basis of traditional raw materials.

11-3

pH-sensitive membranes with crosslinked poly(acrylic acid) hydrogel for controlled delivery

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Polymeric pH-sensitive membranes and hydrogels are interesting materials for the controlled delivery of chemical agents triggered by external stimuli. In this contribution, we present a novel membrane design consisting of a polyethersulfone polymeric base and a crosslinked poly(acrylic acid) hydrogel containing pH-responsive carboxyl groups. Membranes were prepared using the modified traditional liquid phase inversion process. Solutions containing all membrane precursors were cast on a glass plate and cured by UV irradiation. UV curing was followed by immersion into the water bath to achieve phase separation and solidification. Obtained membranes exhibited high ion-exchange capacity and a moderate swelling degree dependent on the crosslinker properties. Studies of membrane loading with methylene blue and subsequent release of methylene blue from the membrane into the alkaline and acidic buffered solutions demonstrated pH-dependent delivery kinetics.

11-4

PEM fuel cell catalyst layers - pulsed laser deposition

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Fuel cells (FC) with a proton exchange membrane (PEM) take very important role within hydrogen economy concept by transforming hydrogen chemical energy to electrical energy with water and heat as by-products. The present work is part of a study of obtaining thin metal layers on appropriate supports as electrocatalysts in PEM fuel cells. In this matter PLD technique has numerous advantages, and one of the most important is stoichiometric deposition of the target to the substrate and excellent adherence of deposited layer to substrate surface. Experimental results are presented and analyzed for catalytic platinum films of very low thickness of 0.7-2.12 nm and Pt loading of 1.47-4.47 μg cm-2 deposited using the PLD method with an excimer laser, wavelength 248 nm, at room temperature. In spite of very low catalyst loadings, our fuel cells performances are comparable to commercially available FC membrane electrode assembly with loadings higher by three orders of magnitude.

11-5

Analysis of electrical parameters of metal–semiconductor Au/AlPc-H/p-Si/Al organic diode

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The Au/AlPc-H/p-Si/Al organic diodes based on Al-phthalocyanine diodes are fabricated by the spin coating process onto p-type silicon substrate. The Au/AlPc-H contact is thermally evaporated in vacuum at 10-6Torr. Here, we investigate the electronic parameters obtained from the current-voltage (I-V) characteristics achieved at room temperature under dark conditions within the -1V, +1V bias voltage range. The Cheung's and Norde approximations are used for the calculation of the electronic magnitudes.The obtained values, such as ideality factor (n), barrier height (Φb) series resistance (RS), are approximately similar which approve the consistency of Cheung's and Norde methods. The AlPc Hydroxide/ p-Si contacts exhibit high rectification ratio (RR) in order of 2.73×104 and large ideality factor of 7.37.

12-1

Modification of lithium surface with graphene derivates

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Lithium metal batteries are the most promising batteries of high energy density storage due to very high capacity of the lithium metal and lowest potential of all metallic anode materials. However the secondary lithium metal batteries suffer from low Coulombic efficiency and low safety due to lithium metal high chemical and electrochemical reactivity. High lithium reactivity leads to the formation of heterogeneous solid electrolyte interface (SEI) which causes lithium dendritic growth during the electrochemical cycling.

Dendritic growth can be suppressed with different approaches, such as preparing artificial SEI on the lithium surface. The ideal artificial SEI is as thin as possible, highly lithium ion conductive and electronically isolative material with high Young's modulus. Functionalized graphenes are promising materials as artificial SEIs due to their high Young's modulus. By functionalizing the graphene, its properties, such as ion conductivity and electronical isolativity, can be modified. In the presentation, the use of functionalized graphenes as artificial SEI will be discussed in order to prevent dendritic growth on lithium surface.

12-2

Cellulose based separator for lithium – sulphur batteries

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The demand for energy storage increases steadily with time due to population and economic growth and advances in lifestyle. With the energy density of the Li-ion battery approaching its ceiling, researchers moved their interest to systems beyond Li-ion. Because of their high theoretical energy density and cost effectiveness, Li-S batteries have become attractive candidates for next-generation high-energy rechargeable Li batteries.

Sulphur, is cheap and abundant and can deliver a specific capacity of 1675 Ah kg^{-1} and an energy density of 2600 Wh kg^{-1}, which are several times higher than those of state-of-art Li-ion batteries. However, the practical applications of Li-S batteries are still hindered by some major obstacles. One of the major challenges is the shuttle effect of lithium polysulphides (Li_2S_x, $4 \leq x \leq 8$), produced in discharge process. They can dissolve in organic electrolyte and diffuse to the anode where can be reduced to lower order polysulphides at the interface of the lithium anode. This process takes place repeatedly and cause loss of active material and the low coulombic efficiency of Li-S batteries. In addition, the formation of dendritic lithium during charge could lead to a short circuit that could results in failure of battery cell.

To address these challenging issues in Li-S batteries, various approaches have been proposed by research teams over the latest three decades. Tailoring the physical and chemical properties of the separator was demonstrated to be a viable way to improve the performance of Li-S.

Cellulose nanofibers have many astounding properties as extremely large surface area, easy modification, biodegradability, good mechanical properties and chemical durability. All these properties predict that appropriately modified cellulose nanofibers could be a promising material for the application as high performance Li-S separator.

12-3

Influence of in situ addition of different combinations of d-metals on electrolytic hydrogen production in alkaline electrolyzer

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We investigated the influence of in situ addition of different combinations of d-metal compounds (called ionic activators) into the standard 6M KOH electrolyte, on the efficiency of hydrogen production in alkaline electrolyzer. Three combinations of ionic activators (NiCoMo, NiCuMo and CoCuMo) were studied using quasi-potentiostatic, galvanostatic and impedance spectroscopy techniques. Reduction in energy consumption for hydrogen production in presence of ionic activators was between 15-20 %, compared to standard 6M KOH electrolyte. Enhancement of kinetics of hydrogen evolution reaction was also confirmed in all cases, as the overvoltage at current density 100 mA/cm^2 was reduced by 100-300 mV.

12-4

Electrical efficiency of anode- and electrolyte-supported SOFCs

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Solid oxide fuel cell is considered now as a promising technology for reliable and environmentally safe energy generation. SOFC convert chemical energy of fuel and oxidant directly into electrical energy through electrochemical reactions.
The applications of fuel cells vary depending of the type of fuel cell to be used. Since fuel cells are capable of producing power anywhere in the 1 W to 1 GW range they can be applied to almost any application that requires power. On the smaller scale they can be used in cell phones, personal computers, and any other type of personal electronic equipment. The SOFC technology is an interesting building block. It has high efficiency and is virtually free from green-house gas emissions. The efficiency, lifetime and cost of the fuel cells are getting closer to the target, but there are still some issues left to solve. For a commercial using of SOFC its electrical efficiency must be improved, which still remain development issue for some of the possible SOFC applications. A lot of efforts have focused on improving properties of SOFC materials, such as power density, catalysts activity, electrolyte conductivity etc., but operation and control of SOFC have not been study captiously, understanding of SOFC working dynamics is very necessary to achieve the new objective. In this paper the cell performances of two different cells tested under the same conditions are presented. Anode- and electrolyte-supported SOFCs were tested to evaluate advantages of different construction and materials for different SOFCs application.

Electrolyte-supported SOFC consisted of: 10Sc1CeSZ – electrolyte, NiO-10Sc1CeSZ - anode, LSCF ($La_{1-x}Sr_xCo_{1-y}Fe_yO_{3-\delta}$) - cathode. Anode-supported SOFC consisted of: 8YSZ – electrolyte, 8YSZ-NiO – anode, LSCF ($La_{1-x}Sr_xCo_{1-y}Fe_yO_{3-\delta}$) – cathode. SOFC of type 1 showed efficiency on 27% higher than type 2 cell due to 10Sc1CeSZ provides the highest ionic conductivity, despite of the more thick electrolyte. The SOFC of type 1 showed the best result among others types of the cells, but still structure (anode permeability, thicknesses of all layers etc.) needs to be optimized to get high performances.

12-5

Influence of temperature and electrolyte concentration on the performance of flexible supercapacitors

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The field of flexible energy storage has witnessed a dramatic expansion and great attention has been focused on flexible supercapacitors (SC). In this paper a self-supported porous carbon flexible thin film SC electrode has been derived starting from polyimide film (Kapton). SC working temperature and electrolyte concentration play an important role in performance optimization, lifetime estimation and degradation. Most published work has focused on characterizing new electrode materials at room temperature so thermal characterization of flexible SC in a wide temperature range needs to be addressed. Electrochemical impedance spectroscopy, cyclic voltammetry and cyclic charge-discharge measurements were performed at different temperatures (-5 °C to 60 °C) and different electrolyte concentrations in order to better understand their influence on SC characteristics.

12-6

Composite solid electrolytes based on $LiNO_2$

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Electrolytes with different type of charge carrier can find widely application in different using, e.g. sensors, batteries and others $LiNO_2$ is characterised by ionic conductivity ~ 10^{-4} S/cm at 180 °C and more stable as compared with lithium nitrate and can be used as a component for synthesis of composite electrolytes. In this work composite solid electrolytes in the binary system $LiNO_2$ - A (A= CeO_2, SiO_2, SnO_2, Al_2O_3) were synthesized and their structural, thermodynamic and electrical properties investigated.

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13-1

Investigation of microstructure and phase characteristics of tribo-functional gas-thermal composite coatings based on NiAl

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The main direction of research is to improve the wear-resistance of friction pair of gas turbine engines, operating at high temperature (blades of GTE). In order to achieve this goal, new composite heat and wear resistant materials should be developed.

The NiAl intermetallic was chosen as a matrix for the development of new composite materials. For improve the wear-resistance of NiAl at high-temperature friction condition, the additives of refractory compounds, such as titanium, chromium and zirconium borides, are introduced into their structure.

To determine the wear mechanisms of developed composite coatings at different temperatures (T=20 °C, 500 °C, 700 °C, 800 °C and 1000 °C) is necessary to carry out complex investigations of the friction surfaces structure and phase composition after wear tests. The detonation and plasma spraying coatings structures were studied by SEM and XRD analysis. The friction surfaces structure and phase composition of initial coatings based on NiAl intermetallic and composite coatings after wear tests were investigated in this research work. It was established that the additives of borides into intermetallics leads to the formation of oxide tribofilm which further behaves as solid lubricant. That prevents the adhesive seizure of contact surfaces and improves wear resistance of tribocouple.

13-2

Industrially prepared TiSiN nanocomposite coatings

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Hard nitride coatings have been widely used for increasing the quality and lifetime of many different tools and mechanical components. Recently, great attention is given to nanocomposite and nanolayered coatings. In this study, TiSiN nanocomposite coatings which consist of crystalline and amorphous phases were prepared. Coatings were deposited by magnetron sputtering technique in an industrial unit, in which tools rotate during coating deposition. Influence of type of rotation on crystal structure, microstructure, mechanical properties and surface morphology was studied. X-ray photoelectron spectroscopy, X-ray diffraction, scanning electron microscopy, transmission electron microscopy, nanoindentation, stylus profilometry and atomic force microscopy were employed for coating characterization. It was found that type of rotation have great impact on coating microstructure and its properties. When prepared with 1-fold rotation TiSiN grows in columnar fashion. On the other hand, columnar structure completely disappears, and fine-grained microstructure forms when coatings are prepared with 2-fold and 3-fold rotation. As a result, surface morphology and mechanical properties change with type of rotation. Average surface roughness decreased from 48 nm to 11 nm, while hardness increased from 26 GPa to 48 GPa with changing type of rotation from 1-fold to 3-fold.

13-3

Interactions of Al-Si-Cu alloy casting with duplex PVD coatings intended for application on high pressure die casting tools

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Duplex PVD coatings applied on high pressure die casting tools markedly reduce their wear, extend their life and increase production efficiency. Although, there is a great potential for their further improvement, there is also a lack of information about inherent wear mechanisms and parameters which predominantly affect their performance. This investigation considered the effects of surface roughness and coatings growth defects on cast alloy soldering tendency toward duplex PVD coatings (CrN and TiAlN), uncoated steel and plasma nitrided H11 steel. Investigation employed ejection test with sample-casting assemblies produced by conventional and delayed solidification of cast Al-Si-Cu alloy. Before and after the tests, samples were evaluated by surface profilometry, confocal and scanning electron microscopy and focused ion beam. It was found that coated samples display a pronounced sensitivity of ejection force on surface roughness. Machining marks and coating growth defects have an important role in cast material transfer. Unlike the uncoated samples, coated samples did not chemically react with the cast alloy. However, it was detected that corrosion of the underlying substrate initiates through growth defects, which afterwards induces coatings deterioration. This investigation identified the coating growth defects as essential coating features which affect their performance and endurance in application on tools for high pressure die casting.

13-4

Using inverse opal structure to enhance the charge collection in the dye-sensitized solar cell

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Conventionally, in dye sensitized solar cells (DSSCs), a thin flat layer of transparent conductive oxide (TCO) plays the collecting role for the charges transferred to the substrate through the thickness of the mesoporous (MP) layer. Lower MP thickness means less charge transfer distance and therefore less charge recombination, but on the other hand, it results in less charge generation. So there is always an optimum value for the MP layer thickness. To overcome the limitation, a photoanode was fabricated using the template-assisted synthesis in which, the TCO layer is extended into the MP layer to shorten the charge transfer distance, needless to decrease the MP layer thickness. The nanostructure of the fabricated substrate and electrode was observed by scanning electron microscopy (SEM) to investigate the optimum values for synthesis parameters resulting less structural defects. The current density–voltage (J–V) measurements show an increase in current density (Jsc) and therefore, the power conversion efficiency of the cells with extended TCO in comparison with the cell having a flat TCO.

13-5

Effect of surface roughness on scratch adhesion of nitride PVD coatings with different layer designs

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Due to ongoing need to reduce production cost and increase tool life, surface coatings have become everyday presence in tool production. Considering that surface roughness and substrate material play a vital role in tool production cost and coating performance, it is important to recognise its optimal value before coating deposition. This investigation concerned tribological behaviour of three kinds of PVD coatings (TiAlN, AlTiN/TiN, a-CN) with different layer design deposited on three different steel substrates prepared to different grades of surface roughness. Stylus profilometry was used to evaluate surface morphology before and after coating deposition. Coating mechanical properties and adhesion were assessed by nanoindentation and scratch test, respectively. It was found that surface roughness of all coatings increased after the deposition, which is due to formation of coating growth defects. Roughness of all coatings converged to almost one value, except on hard grounded surface. Concerning the scratch adhesion, behaviour of TiAlN and a-CN coatings (of single and double layer design) is just slightly dependent on the surface roughness. On the other side the AlTiN/TiN of a nanolayered design shows a higher susceptibility to the influence of surface roughness. Such findings suggest that nitride coatings of a different type and layer design display different sensitivity of adhesion on surface roughness.

13-6

Industrial application of PVD hard coatings for improvement of high pressure die casting tools

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High pressure die casting is an important commercial process for the production of complex near net shape aluminum alloy castings. Due to high melt velocity that causes erosion and tendency of the molten alloy to react with the tooling, there is a gradual destruction of die surfaces during service. This process decreases product quality, limits die lifetime, and increases down-time due to regular removal of the soldered layers. In order to mitigate this problem different surface treatments are sometimes employed for high production tools. Within this study, two duplex hard coatings, CrN and TiAlN, were deposited on core pins by physical vapor deposition (PVD) process. Core pins were tested in four industrial production runs of an automotive component. In every run, tool was mounted with one pin that was PVD coated, and one that was gas nitrided. Nitrided core pins were used as a base standard, since they are most commonly used surface treatment. TiAlN coated pins were able to complete full production run of 22000 shots without significant damage. CrN coating showed somewhat higher soldering tendency and erosion rates. Considering that the untreated steel core pins were able to withstand only 5500 shots, it can be concluded that PVD coatings can significantly improve die lifetime. Additionally, results indicate that more adequate surface preparation methods that could increase performance of PVD coatings even further.

14-1

Influence of cobalt doping on optical properties of ultrafine SnO_2 nanocrystals

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Ultrafine nanocrystalline $Sn_{1-x}Co_xO_2$ (x=0, 0.01, 0.03, 0.05) powders were prepared by microwave assisted hydrothermal technique. Structural and morphological properties of the SnO_2 samples were investigated with X-ray diffraction (XRD), transmission electron microscopy (TEM) and Brunauer-Emmett-Teller (BET) methods. Obtained results indicate that all synthesized samples have crystalized in the rutile structure of SnO_2, with the crystallite size in the range of 2-3 nm and with high specific surface area. Optical properties of the SnO_2 nanocrystals were studied using infrared (IR) spectroscopy and spectroscopic ellipsometry. Trough the analysis of IR data, we have concluded that cobalt doping has significant influence on E1u and A2u LO modes, which shift to higher frequencies indicating strong interaction of these phonon modes with free carriers. From the results of numerical modelling of ellipsometry measurements, by Tauc model of imaginary part of dielectric function, we have observed that cobalt doping causes increase of the band gap value, making the material transparent in the visible range. This interesting effect can be explained by taking into account influence of quantum confinement and Burnstein-Moss effects. Concentration of free carriers has been determined from Burnstein-Moss effect, and the results point out that doping increases concentration of free charge near the Fermi level, which is in good agreement with IR spectroscopy results. Controling the shift of the band gap and concentration of charge carriers by doping can have significant impact on application of SnO_2 nanomaterials in advanced technologies.

14-2

From hydrophobic, via superhydrophobic to icephobic surfaces

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Ice build-up is a serious problem in industrial and daily life applications (aircraft, power lines, car windshields, refrigerators, etc.). Effective anti-icing strategies need to address two basic questions – how to prevent ice accretion or how to reduce ice adhesion for easy de-icing?

One of possible solutions to this problem are superhydrophobic surfaces (SHS). Theirs non-wetting properties should results in improved resistivity to icing eg. decreased surface contact area between droplet and surface causes lower heat conductivity and as a result delay of freezing. SHS also exhibit water droplet bouncing behavior in dynamic wetting conditions which significantly reduces time of contact between droplet and surface and prevent freezing.

The influence of surface micro- and nanostructure and chemistry on wetting properties and ice adhesion are investigated in the present study. The substrates were based on SU-8 photoresist and epoxy resin and exhibited a range of topographical and hydrophobic characteristics. Flat surfaces of SU-8 and epoxy were treated with RF air and oxygen plasma, which resulted in surface nanoroughness generation in some substrates. Micropatterned SU-8 surfaces were obtained using standard photolithography procedure, employing several geometries (honeycombs, pillars, and brick wall-like). Micropatterned epoxy surfaces were obtained by replication of photolithographic patterns the use of the silicon stamp technique. Modification with a homologous series of perluoroalkylchlorosilanes, using vapour phase deposition, provided the substrates with a range of surface free energies. The effect of modifier carbon chain length on resulting wettability of flat substrates and ice adhesion was investigated. The influence of nanoroughness generated during plasma etching and silanization process was also examined. Next, the effect of microstructural patterns and hierarchical topography, resulting from superposition of nano- and microstructures, on wetting and ice adhesion was determined.

Surfaces without microstructure exhibited high advancing contact angles and low receding contact angles (high contact angle hysteresis, CAH), that resulted in high ice adhesion. Surfaces with hierarchical topography exhibited superhydrophobicity (even higher advancing angles and low CAH) and lower ice adhesion. This indicates that receding contact angles or CAH are important in predicting adhesion of ice on such surfaces.

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14-3

Heat-resistant coating of the composite powder FeAlCr/ Al_2O_3

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Properties of $FeAlCr/Al_2O_3$ powder produced by mechanically assisted self-propagating high-temperature synthesis (MASHS) using aluminothermic reactions and of the detonation sprayed coatings from it have been investigated. The powder has sufficiently uniform composite structure consisting of alloyed with chromium ordered B_2-FeAl and fine inclusions of alpha chromium and alpha alumina. Coatings from the powder mainly inherit its structure and phase composition though some aluminum and chromium oxidation takes place during spraying. The oxidation behavior of coatings from the synthesized powder has been discussed. Alpha chromium, chromium oxide and different modifications of alumina are supposed to accelerate the protective film formation suppressing nucleation and growth of hematite at the early oxidation stages at the temperatures up to 950 °C.

14-4

Comparative analysis of cavitation erosion resistance of ceramic samples

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The paper presents the results of cordierite, zircon and mullite ceramics behavior in the conditions of cavitation erosion. Ceramic samples were sintered at 1200 °C. Cavitation erosion resistance was monitored using ultrasonic vibration method with stationary sample. Weight loss and level of degradation of surface of samples were monitored using the image analysis. The lowest weight loss and the level of degradation of the surface were measured for the mullite samples. Zircon and cordierite samples exhibited higher values for weight loss and degradation level. Obtained results showed high level of resistance to the cavitation erosion for all three types of ceramics. These results could be applied for the further possibility of application their use in conditions where cavitation erosion is expected.

14-5

Preheat effects on LiF: Mg, Ti at low dose

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Thermoluminescence (TL) is a method used to characterize materials in order to define their potential applications. The pre and post-irradiation annealing is crucial for its response, especially, for long term application in personal monitoring. LiF: Mg, Ti is one of the most important passive dosimeter. Extensive work on pre –irradiation heat treatment has shown that strong modifications to its (LiF: Mg, Ti) glow curve structure are induced. In this present work we study the Effects of preheat treatment on LiF at low dose. TL measurements were carried out using Riso TL/OSL reader (model TL/OSL-DA-15) equipped with a beta particle source, delivering a nominal dose rate of 0.063G/s.

14-6

Pittcon 2016 experience in Atlanta – firsthand conference impressions from ACS delegate

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In this informal presentation and chat about my Pittcon 2016 experience held in Atlanta, US, I will attempt to give you an insight of this extraordinary event which is held annually and is considered as a leading conference and exposition on laboratory science. I will also try to give you a guidelines how to apply for travel grants which are sponsored by Pittcon organizers in collaboration with ACS Committee on International Activities (IAC). These grants are available to early career analytical chemists from all around the globe, and are given for a different region annually. Beside great lectures provided by eminent scientists from all around the world, updating with latest achievements in instrumentation from all companies in the field of analytical and lab equipment, possibility to meet and make collaborations with participating scientists and companies, you will certainly enjoy hanging around with other ACS delegates from your part of the world.

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The authors regret that the name of the second author has been listed incorrectly. The correct author name is Nikola Kuzmanović, University of Belgrade, Faculty for Mechanical Engineering, Kraljice Marije 16, 11120, Belgrade, Serbia. The authors would like to apologise for any inconvenience caused.

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