The 15th International Balkan Workshop on Applied Physics

July 2 – 4, 2015

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~ Book of abstracts ~

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15th International Balkan Workshop on Applied Physics

Constanţa, Romania, July 2-4, 2015

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Topics

1. Materials Physics

- Semiconductors, Dielectrics and Organic Materials
- Spintronics, Magnetism and Superconductivity
- Crystal growth, Surfaces, Interfaces and Thin Films
- Polymers and Amorphous Materials

2. Laser, Plasma and Radiation Physics and Applications

- Laser Physics and applications
- Plasma Physics and applications
- Optoelectronics and photonics
- Applied and non-linear optics
- Ultrafast phenomena and applications

3. Nuclear and sub-Nuclear Physics and Applications

- Nuclear and subnuclear sciences and Engineering
- Advanced detection systems
- Accelerated particle beams
- Nuclear Techniques and applications
- Nuclear Safety and Radiation Protection

4. Cross-disciplinary Applications of Physics

- Nonlinear dynamics, complex systems and applications
- Biological complexity and genetics, Biophysics and bioengineering
- Econophysics
- Physics of Social Systems

5. Engineering and Industrial Physics

- Physics of energy transfer, conversion and storage
- Environmental Physics
- Sensors and Device Physics
- Micro- and Nanoelectronics
- Microelectromechanical systems
- Instrumentation and Metrology
- Imagining, Microscopy and Spectroscopy and their applications
- Instrumentation, processing, fabrication and measurement technologies
- Applications of fluid mechanics and microfluidics

6. Topics in Physics Education Research

- Physics curriculum design
- Active learning techniques
- Classroom teaching, demonstrations and laboratory experiments

PLENARY SECTION

SO 01	***Magnetic dipole discharges*** **Roman SCHRITTWIESER**
SO 02	***Electronic properties of Fe/LiF(LiBr)/Fe magnetic tunnel junctions*** **Emil BURZO**
SO 03	**Daniela MORARU- Human Resources for ELI-NP research**
SO 04	***Electrical probes - a bridge between the low- and the high-temperature plasma diagnostics*** **Milan TICHY**
SO 05	***Perspectives for nuclear physics applications at ELI-NP*** **Calin UR**
SO 06	***Conformational Transitions of Nucleic Acids under External Forces: Examples and a Stochastic Path Integral Theory for their Kinetics*** **Ioan ANDRICIOAE**
SO 07	***Transport properties of nanowires*** **Ionut ENCULESCU**

SECTION 1 Materials Physics

Invited Lectures

S1 L1	**MULTIFERROIC AND MAGNETOELECTRIC METAL-ORGANIC FRAMEWORKS** *Alessandro Stroppa, Paolo Barone, Domenico Di Sante, Prashant Jain, Manuel Perez-Mato, Anthony K. Cheetham, Harold W. Kroto, Martijn Marsman, Silvia Picozzi*
S1 L2	**ZnO NANOWIRES IN ORGANIC LIGHT EMITTING DIODES** *Silviu Polosan, Elena Matei, Corina Ciobotaru, Claudiu Ciobotaru*
S1 L3	**THE VIBRATIONAL CHEMISTRY OF THE SPIN-CROSSOVER PHENOMENA. NEW CASE STUDIES** *Fanica Cimpoesu, Marilena Ferbinteanu*
S1 L4	**OPTICAL AND MORPHOLOGICAL PROPERTIES OF DYE-DOPED NANOSTRUCTURES** *Monica Enculescu, Alexandru Evanghelidis, Ionut Enculescu*
S1 L5	**MAGNETIC NANOPARTICLES FOR BIO-MEDICAL APPLICATIONS** *Victor Kuncser, Nicusor Iacob, Petru Palade, Andrei Kuncser, Cezar Comanescu, Gabriel Sdchinteie*
S1 L6	**INVESTIGATION ON THE PROPERTIES OF SOME N DOPED SiC NANOSTRUCTURED THIN FILMS** *Victor Ciupina, Cristian P. Lungu, Rodica Vladoiu, Gabriel C. Prodan, Stefan Antohe, Corneliu Porosnicu, Iuliana Stanescu, Ionut Jepu, Sorina Iftimie, Marius Belc, Aurelia Mandes, Virginia Dinca, Eugeniu Vasile, Valeriu Zarovski, Virginia Nicolescu*
S1 L7	**IMAGE DIPOLES IN METAL SURFACES: FROM QUANTITATIVE EVALUATION OF SURFACE ENHANCED RAMAN SCATTERING EFFECTS TO POLARIZATION STRENGTHENING AT FERROELECTRIC-METAL INTERFACES** *Cristian M. Teodorescu*
S1 L8	**UNIVERSAL FERMI LIQUID CROSSOVER AND QUANTUM CRITICALITY IN A MESOSCOPIC SYSTEM** *A. J. Keller, L. Peeters, C. P. Moca, I. Weymann, D. Mahalu, V. Umansky, G. Zar´and, D. Goldhaber-Gordon*

Oral presentations

S1 O1	**PREDICTION OF ALMEN INTENSITY IN SEVERE SHOT PEENING ON COMMERCIALLY PURE TITANIUM TO SURFACE NANOCRYSTALLIZATION USING ARTIFICIAL NEURAL NETWORK** *Erfan Maleki, Abolghasem Zabihollah*
S1 O2	**μ3-OXO TRINUCLEAR IRON CARBOXY-CLUSTERS AS EFFECTIVE ALTERNATIVE SOURCES FOR THEIR OXIDE NANOPARTICLES** *Mihail Iacob, Carmen Racles, Codrin Tugui, George Stiubianu, Maria Cazacu*

S1 O3	**INFLUENCE OF ELECTRO-CODEPOSITION PARAMETERS ON TiO2 NANOPARTICLES INCLUSION INTO NICKEL MATRIX: STRUCTURE, MORPHOLOGY AND CORROSION RESISTANCE** *Lidia Benea, Eliza Dănăilă, Valentin Dumitraşcu*
S1 O4	**TRIBOLOGICAL NANOSTRUCTURED MULTILAYER THIN FILMS FROM COMPOUND MATERIALS CHARACTERIZED BY AFM AND RBS** *Alice-Ortansa Mateescu, Gheorghe Mateescu, Cristina Ionescu, Ion Burducea, Liviu Craciun*
S1 O5	**FRETTING-CORROSION BEHAVIOR OF Ni/WC HYBRID COATING SYSTEM FABRICATED BY ELECTRODEPOSITION** *Lidia Benea, Eliza Dănăilă, Nadège Caron, Olivier Raquet*

Posters

S1 P1	**AN ANALYTICAL - NUMERICAL MODEL FOR THE MOBILITY OF InGaN/InN/InGaN HIGH ELECTRON MOBILITY TRANSISTOR (DHEMT)** *R. Yahyazadeh, Z. Hashempour*
S1 P2	**MAGNETIC PROPERTIES OF FERROFLUIDS WITH THE Fe3O4 and CoFe2O4 NANOPARTICLES PROBED WITH POLARIZED MUONS** *T.N. Mamedov, D.S. Andrievskii, M. Balasoiu, K.I. Gritsaj, V.N. Duginov, A.L. Getalov, E.N. Komarov, S.A. Kotov, A.E. Moroslip, I.I. Pavlova, G.V. Shcherbakov, C. Stan, L. Vekas , S.I. Vorobyev*
S1 P3	**INFLUENCE OF BENT-CORE AZOCOMPOUNDS ON FLUORESCENT PEPTIDES** *Catalina-Ionica Ciobanu, Sabina Bancila, Laura Habasescu, Gabi Drochioiu*
S1 P4	**THE STABILITY OF HALF-METALLIC PROPERTIES FOR THE Zr2CoIn FULL-HEUSLER COMPOUND** *Anca Birsan, Petru Palade, Victor Kuncser*
S1 P5	**COMPARATIVE STRUCTURE ANALYSIS OF WATER-BASED FERROFLUIDS OBTAINED BY DIFFERENT METHODS: SMALL-ANGLE NEUTRON SCATTERING INVESTIGATIONS** *Anatolii Nagornyi, Victor Petrenko, Mikhail Avdeev, Olexandr Ivankov, Leonid Bulavin, Anatolii Belous, Sergii Solopan, Oleksandr Yelenich*
S1 P6	**FINE STRUCTURE OF Co2+ ENERGY LEVELS IN KZnF3 CRYSTAL** *Ana-Marinela Barb, Adrian-Sorin Gruia, Calin N. Avram*
S1 P7	**PROPERTIES OF ITO THIN FILMS DEPOSITED BY MAGNETRON SPUTTERING** *Radu-Paul Apetrei, Marius Dobromir, Valentin Nica, Tamara Potlog, Dumitru Luca*
S1 P8	**NANOSTRUCTURED Mo-B-C COATINGS** *Jiří Buršík, Vilma Buršíková, Pavel Souček, Lukáš Zábranský, Petr Vašina*
S1 P9	**ANALYSIS AND CONDITION MONITORING OF AGED OR RECYCLED POLYMERIC INSULATION MATERIALS FROM ELECTRIC AND ELECTRONIC ITEMS** *Radu Setnescu, Marius Eduard Lungulescu, Tanta Setnescu, Iulian Bancuta, Anca Irina Gheboianu*
S1 P10	**EFFECT OF HEAT TREATMENT ON MANGANESE FERRITE OBTAINED BY ULTRASONICALLY ASSISTED HYDROTHERMAL METHOD** *Iosif Malaescu, Antoanetta Lungu, Catalin N. Marin, Paulina Vlazan, Paula Sfarloaga*
S1 P11	**GROWTH OF HIGHLY (110)-, (001)- AND (111)-TEXTURED IRIDIUM THIN FILMS ON MgO SINGLE-CRYSTAL SUBSTRATES** *Lucian Trupina, Liviu Nedelcu, Marian Gabriel Banciu, Corinne Champeaux, Frédéric Dumas-Bouchiat, Pascal Marchet, Laure Huitema, Valérie Madrangeas, Aurelian Crunteanu, Damien Passerieux*
S1 P12	**UV-INDUCED FORMATION OF GOLD NANOPARTICLES IN PHOTOPOLYMERIZABLE GLYCOMONOMERS** *Andreea L. Chibac, Tinca Buruiana, Violeta Melinte, Ionel Mangalagiu, Emil C. Buruiana*
S1 P13	**FABRICATION OF CHITOSAN/XANTHAN MULTILAYER FILMS ON POLYLACTIC ACID SUBSTRATES** *Ivan Bodurov, Ivanka Vlaeva, Asya Viraneva, Ginka Exner, Sotir Sotirov, Bissera Pilicheva, Yordanka Uzunova, Tsenka Grancharova, Maria Marudova, Temenuzhka Yovcheva*
S1 P14	**STRUCTURAL INVESTIGATIONS OF CIGS THIN FILMS DEPOSITED BY MAGNETRON SPUTTERING TECHNIQUE** *P. Prepelita, V. Craciun, F. Garoi*

S1 P15	**INFLUENCE OF PRECURSOR CRYSTALLINITY ON PHOTOCATALYTIC PERFORMANCE OF CdS/ZnS COMPOUNDS** *Paula Svera, Andrei V. Racu, Cristina Mosoarca, Daniel Ursu, Radu Baies, Radu Banica*
S1 P16	**PROPERTIES OF TRANSPARENT CONDUCTING TI-DOPED IN2O3 THIN FILMS PREPARED BY RF MAGNETRON SPUTTERING** *Narong Mungkung,Toshifumi Yuji*
S1 P17	**DEPOSITION OF POLYELECTROLYTE MUTILAYER FILMS MADE FROM CHITOSAN AND XANTHAN ON BIODEGRADABLE SUBSTATE: EFFECT OF PH AND IONIC STRENGHT** *Ivanka Vlaeva, Sotir Sotirov, Ivan Bodurov, Bissera Pilicheva, Yordanka Uzunova, Asya Viraneva, Ginka Exner, Tsenka Grancharova, Maria Marudova, Temenuzhka Yovcheva*
S1 P18	**MATERIALS MICROSTRUCTURE CHARACTERIZATION USING HIGH RESOLUTION NEUTRON DIFFRACTON** *Gizo BOKUCHAVA*
S1 P19	**ABOUT STRUCTURAL ORDERING OF PROTEINS IN WATER SOLUTION** *Andrey Rogachev, Alexey Vlasov, Tatiana Murugova, Sergey Grudinin, Oleksandr Ivankov, Dmytro Soloviov, Adam Round, Yury Ryzhykau, Egor Zinoviev, Alexey Mishin, Taras Balandin, Valentin Borschevskiy, Valentin Gordeliy, Alexander Kuklin*
S1 P20	**MORPHOLOGICAL AND COMPOSITINAL INVESTIGATIONS OF TiO2:Ag; TiO2 :N2 AND TiO2:Ag+N2 COATINGSOBTAINED BY MAGNETRON SPUTTERING DEPOSITION METHOD** *Alice-Ortansa Mateescu, Gheorghe Mateescu, Cristina Ionescu, Ion Burducea, Liviu Craciun*
S1 P21	**RECENT RESULTS FROM THE GRAINS REFLECTOMETER AT IBR-2 REACTOR** *M.V.Avdeev, I.V.Gapon, V.I.Petrenko, L.A. Bulavin, O.V. Tomchuk, A.V.Nagornyi, V.I. Bodnarchuk*
S1 P22	**THERMOANALYTICAL AND INFRARED STUDIES OF VERY DEGRADED WOODEN ARTEFACTS CONSOLIDATION WITH A RADIATION-CURING RESIN** *Silvana Vasilca, Ioana Rodica Stanculescu, Marian Virgolici, Cosmin Pintilie, Valentin Moise, Bogdan Lungu, Quoc-Khoi Tran, Laurent Cortella*
S1 P23	**ASSESSMENT OF THE METAL CONTAIN IN THE INSULATING POLYMERIC MATERIALS FROM ELECTRICAL ROTATING MACHINES USING ICP-MS.** *Marius BUMBAC, Ionv. POPESCU, Mircea IGNAT, Gabriela TELIPAN, Bogdan VARATICEANU, Cristiana. RADULESCU, Ioana DULAMA, Claudia STIHI*
S1 P24	**THE STUDY OF OXIDATIVE STRESS ON THE POLYMERS USED AS INSULATORS FOR ELECTRICAL ROTATING MACHINES** *Marius Bumbac, Traian Zaharescu, Ion V. Popescu, Bogdan Varaticeanu, Tanta Setnescu, Claudia Stihi, Iulian Bancuta, Anca Gheboianu*
S1 P25	**NUCLEATION OF PALLADIUM NANOSTRUCTURES IN PLATINUM-NICKEL MATRIX** *Lucian Petrăşescu, Victor Ciupină, Ştefan Gabriel Tutun, Rodica Vlădoiu, Aurelia Mandes, Virginia Dinca, Gabriel Prodan, Corneliu Poroşnicu, Eugeniu Vasile, Iulian Prioteasa, Radu Manu*
S1 P26	**APPLICATION OF SOME CARBON-TUNGSTEN BASED NANOSTRUCTURES IN DIVERTORS COATING FROM FUSION REACTOR** *Ştefan Gabriel Tutun, Victor Ciupină Lucian Petrăşescu, Rodica Vlădoiu, Aurelia Mandes, Virginia Dinca, Gabriel Prodan, Corneliu Poroşnicu, Eugeniu Vasile, Iulian Prioteasa, Radu Manu*
S1 P27	**THE STUDY OF GMR EFFECT ON THIN LAYERS OF CuCoFe** *Victor Ciupina, Iulian Prioteasa, Corneliu Porosnicu, Gabriel Prodan, Eugeniu Vasile, Lucian Petrăşescu, Ştefan Gabriel Tutun, Radu Manu*
S1 P28	**LATTICE DYNAMICAL AND THERMODYNAMICAL PROPERTIES OF WURTZITE BN AND InN** *Daljit Singh, M M Sinha*
S1 P29	**HYDROPHILIC VERSUS HYDROPHOBIC OLEATE COATED MAGNETIC PARTICLES** *Emil Puscasu, Liviu Sacarescu, Adrian Domocos, Rodica Turcu, Cristian Leostean, Dorina Creanga, Maria Balasoiu*
S1 P30	**FERROELECTRIC TRANSITIONS IN Ba1-xSrxTiO3 SOLID SOLUTIONS** *L. Nedelcu, L. Trupina, C. P. Ganea, C. D. Geambasu, M. Cioangher, M. G. Banciu*
S1 P31	**SIZE DEPENDENT EFFECT ON THE FREE VIBRATION ANALYSIS OF NANOBEAMS WITH INTERNAL VISCOUS DAMPING** *Erfan Maleki, Khalil Sherafatnia*

S1 P32	**IMPROVING THE HYDROPHILIC PROPERTIES OF TiO2 THIN FILMS BY DOPING** *Catalin Adomnitei, Diana Mardare*
S1 P33	**INTERACTION ENERGIES IN SOLUTIONS OF DIPOLAR ORGANIC COMPOUNDS** *Andreea Celia Benchea, Dana Ortansa Dorohoi*
S1 P34	**SPECTRAL MEANS TO ESTIMATE THE ENERGY OF INTERNAL INTERACTIONS IN LIQUIDS** *Cezarina Morosanu, Dana Ortansa Dorohoi*
S1 P35	**MAGNETIC AND ELECTRICAL PROPERTIES OF Ca2Fe1-xNixMoO6 DOUBLE PEROVSKITES** *Istvan Balasz-Muresan, Alex-Adrian Farcas, Emil Burzo*
S1 P36	**EFFECT OF SUBSTRATE TEMPERATURE ON THE STRUCTURAL AND MORPHOLOGICAL PROPERTIES OF SILVER THIN FILMS DEPOSITED BY DC MAGNETRON SPUTTERING METHOD** *Zahra Kavyani, Alireza Hojabri*
S1 P37	**SYNTHESIS AND CHARACTERIZATION OF VA-MWCNTS COATED WITH SILVER THIN FILMS** *Farshid Marefat Khodaei, Seyed Majid Borghei*
S1 P38	**SOLVATOCHROMIC STUDY OF TWO PYRIDAZINIUM YLIDS BINARY SOLUTIONS** *Daniela Babusca, Dana Ortansa Dorohoi*
S1 P39	**THE ITO THIN FILM PRODUCTION ADJUSTABLE SURFACE RESISTANCE AND TRANSPARENCY** *Soner Özen, Volkan Şenay, Suat Pat, Şadan Korkmaz*
S1 P40	**AN INVESTIGATION ON SURFACE PROPERTIES OF A SN-DOPED GaAs THIN FILM PRODUCED BY TVA** *Volkan Şenay, Soner Özen, Suat Pat, Şadan Korkmaz*
S1 P41	**OPTICAL, MORPHOLOGICAL AND SURFACE FREE ENERGY CHARACTERIZATION OF AN Al-Doped GaAs SEMICONDUCTING FILM** *Volkan Şenay, Soner Özen, Suat Pat, Şadan Korkmaz*
S1 P42	**THE INFLUENCE ON SURFACE PROPERTIES OF Mo DOPING IN GaN GROWTH PROCESS** *Soner Özen, Volkan Şenay, Suat Pat, Şadan Korkmaz*
S1 P43	**EFFECT OF POLYMER STRUCTURE ON THE ELECTRO-OPTIC PROPERTIES OF QUATERNIZED POLYSULFONES** *Luminita Ioana Buruiana, Raluca Marinica Albu, Gabriela Calin, Ecaterina Avram, Silvia Ioan*
S1 P44	**FUNCTIONAL PROPERTIES OF COMPOSITE SYSTEMS OF ZnO NANOPARTICLES / POLYMER FIBERS** *Gabriela Calin, Alexandra Burlui, Simona Nichitus, Niculae Olaru, Liliana Olaru, Felicia Iacomi, Vasile Burlui, Carmen Stadoleanu*
S1 P45	**DIELECTRIC SPECTROSCOPY OF PARAELECTRIC Ba1-xSrxTiO3 CERAMICS** *Nicoleta Vineticu, Carmen Mindru, Raluca Bacsei,, Horia V. Alexandru*
S1 P46	**MCSA USED FOR FAULT DETECTION AND IDENTIFICATION IN SINGLE-PHASE CENTRIFUGAL PUMPS - AN INTRODUCTORY STUDENT EXPERIMENT** *Petru Aurelian Simionescu, Adrian Georgescu*

SECTION 2 Laser, Plasma and Radiation Physics and Applications

Invited Lectures

S2 L1	**LASER BEAM SCATTERING ON TiOx NANOPARTICLES IN HOLLOW CATHODE PLASMA JET** *Roman Perekrestov, Pavel Kudrna, Milan Tichý*
S2 L2	**SYNTHESIS AND CHARACTERIZATION OF THIN FILMS** *Branko Škorić*
S2 L3	**HIGH-PEAK POWER PASSIVELY Q-SWITCHED Nd:YAG/Cr4+:YAG LASERS FOR SUCCESFUL IGNITION OF AN AUTOMOBILE ENGINE** *Nicolaie Pavel,Gabriela Salamu, Oana Valeria Grigore, Mihai Dinca, Traian Dascalu, Niculae Boicea, Adrian Birtas*

S2 L4	**OPTIMISATION OF MECHANICAL PROPERTIES OF NANOLAMINATE COATINGS** *Vilma Buršíková, Jiří Buršík, Pavel Souček, Lukáš Zábranský, Petr Vašina*
S2 L5	**COMPOSITES OF CARBON AND TITANIUM BASED NANOSTRUCTURES DEPOSITED BY TVA METHOD FOR INDUSTRIAL APPLICATIONS** *R. Vladoiu, A. Mandes, V. Dinca, G. Prodan*
S2 L6	**DIFFERENT APPLICATION OF THERMIONIC VACUUM ARC (TVA)** *Suat Pat*
S2 L7	**FUNCTIONAL MULTICOMPONENT HARD COATINGS** *Mariana Braic, Alina Vladescu, Mihaela Dinu, Iulian Pana, Anca Parau, Viorel Braic, Mihai Balaceanu*
S2 L8	**TERNARY COMPOSITE FILMS INTERACTION WITH HIGH POWER LASER BEAM** *Cristian LUNGU*
S2 L9	**ATMOSPHERIC PRESSURE DIELECTRIC BARRIER DISCHARGE FOR PRODUCING POLYETHYLENE GLYCOL-LIKE FILMS** *George Bogdan RUSU, Valentin POHOATA, Codrina IONITA, Roman SCHRITTWIESER*

Oral presentations

S2 O1	**LASER INDUCED TRIBOLOGICALMODIFICATIONS OF COMPOSITE LAYERS OBTAINED BY TVA** *Corneliu Porosnicu, Ionut Jepu, Cristian Petrica Lungu, Mihail Lungu, Paul Dinca, Oana Pompilian, Ion Tiseanu*

Posters

S2 P1	**THE TRANSPORT OF DIRAC FERMIONS THROUGH A ONE-DIMENSIONAL QUANTUM WIRE** *Doru Marcel Baltateanu, Ion Cotaescu Jr.*
S2 P2	**STUDY ON THE AXIAL DISTRIBUTION OF THE STORED MICROPARTICLES IN AN ELECTRODYNAMIC TRAP BY USING SOFTWARE IMAGE PROCESSING** *O. S. Stoican*
S2 P3	**APPLICATION OF IONIZING IRRADIATION FOR BIOPOLYMER DEGRADATION** *Mirela Braşoveanu, Monica R. Nemţanu*
S2 P4	**IONIZING IRRADIATION GRAFTING OF NATURAL POLYMERS HAVING APPLICATIONS IN WASTEWATER TREATMENT** *Monica R. Nemţanu, Mirela Braşoveanu, Mihai Ştefănescu*
S2 P5	**NUMERICAL INVESTIGATION OF THE PARAMETERS AFFECTING ON INSTABILITY LOW CURRENT VACUUM ARC** *Narong Mungkung , Somchai Arunrungrusmi, Toshifumi Yuji*
S2 P6	**FORMATION OF NANO β-SiC BURIED LAYER IN THE SILICON BY METHANE IMPLANTATION INTO Si AND INVESTIGATION OF DOSE EFFECTS ON THE QUALITY OF β-SiC LAYER BEFORE AND AFTER ANNELING** *Hassan Dibaji, Farhad Izadi*
S2 P7	**PROPERTIES OF Mg2Si THIN FILMS OBTAINED BY THERMIONIC VACUUM ARC (TVA) METHOD** *Aurelia Mandes, Rodica Vladoiu, Virginia Dinca Balan, Gabriel Prodan*
S2 P8	**MECHANICAL AND TOPOGRAPHYCAL CHARACTERIZATION OF C-Ag NANOCOMPOSITE THIN FILMS OBTAINED BY THERMIONIC VACUUM ARC TECHNOLOGY** *Virginia Dinca Balan, Rodica Vladoiu, Aurelia Mandes, Oana Ciuraru, Vilma Bursikcova*
S2 P9	**IR EMISSION FROM $^4I_{13/2}$ ENERGY LEVEL OF Er^{3+} ION OF $Y_{0.98}Er_{0.02}FeO_3$ PUMPED WITH 1064 NM LINE** *A.V. Racu, R. Banica*
S2 P10	**SOLITON REGIME OF PROPAGATION OF OPTICAL PULSES UNDER THE INFLUENCE OF THIRD ORDER OF LINEAR DISPERSION AND DISPERSION OF NONLINEARITY** *Aneliya Dakova, Diana Dakova, Liubomir Kovachev*
S2 P11	**MATRIX ASSISTED PULSED LASER EVAPORATION OF TiO2 FOR DYE SENSITIZED SOLAR CELLS** *Jeanina Lungu, Gabriel Socol, Nicolaie Ştefan, Adrian Georgescu, Dorel Albu, Mihai A. Gîrţu, Ion N. Mihăilescu*

S2 P12	**APPROXIMATE SOLUTION OF THE NONLINEAR AMPLITUDE EQUATION INCLUDING THE RAMAN EFFECT** *Valeri Slavchev, Diana Dakova, Lubomir Kovachev, Aneliya Dakova*
S2 P13	**SPR ASSISTED WITH CHIRAL LIQUID CRYSTAL AND HIGH REFRACTION PRISM** *Katerina Zhelyazkova, Minko Petrov, Boyko Katranchev, Georgi Dyankov*
S2 P14	**APPLICATION OF POROUS COPPER PLATES IN PEM FUEL CELLS** *Cristina Mihaela Sima, Victor Ciupina*
S2 P15	**COMPARATIVE DISCUSSION ON TWO GLOBAL MODELS FOR OPTICAL PROPERTIES OF BI_2O_3** *Gabriel Murariu, Adrian Dinescu, Adrian Gabriel Murariu, Simona Condurache-Bota*

SECTION 3 Nuclear and sub-Nuclear Physics and Applications

Invited Lectures

S3 L1	**CALCULATION OF NUCLEAR MATTER IN THE PRESENCE OF STRONG MAGNETIC FIELD USING LOCV TECHNIQUE** *G. H. Bordbar, Z. Rezaei*
S3 L2	**PRESSURE EFFECTS ON OXIDE FERROELECTRICS: STRUCTURAL STUDIES** *Sergey Kichanov, Denis Kozlenko, Sakin Jabarov, Evgenii Lukin, Boris Savenko*
S3 L3	**ROSPHERE – A DEDICATED IN-BEAM FAST TIMING HPGe-LaBr3(Ce) ARRAY** *Nicolae MARGINEAN*
S3 L4	**SANS INVESTIGATION OF MAGNETIC ELASTOMERS POLYMERIZED IN TRANSVERSAL AND LONGITUDINAL MAGNETIC FIELDS** *Maria Balasoiu, Vasily Lebedev, Ioan Bica, Madalin Bunoiu, Yuriy Raikher*

Oral presentations

S3 O1	**ENERGY LEVEL MEASUREMENT OF Ar^{36} and Ar^{37} , BY SHELL MODEL CODE OXBASH AND FITTING THE RESULT WITH EMPIRICAL DATA** *Amin Attarzadeh, Saeed Mohammadi*
S3 O2	**USE OF CR-39 TYPE RSKS SOLID STATE NUCLEAR TRACK DETECTORS IN ASSESMENT OF THE RADON RISK EXPOSURE IN TWO LIMESTONE CAVES IN ROMANIA** *Nicoleta Bican-Brișan, Constantin Cosma, Alexandra Cucoș, Denissa Burghele, Botond Papp, Silviu Constantin, Mircea Moldovan, Sorina Gîfu*
S3 O3	**BRONZE AGE SILVER ARTIFACTS FROM ROMANIA – AN ARCHAEO-METALLURGICAL STUDY USING A PORTABLE XRF SPECTROMETER** *Bogdan Constantinescu, Daniela Cristea-Stan, Anca-Diana Popescu*
S3 O4	**V0 PHYSICS AT LHCB** *Ana Elena Dumitriu*
S3 O5	**ISOSPIN DYNAMICS IN NECK FRAGMENTATION REACTION MECHANISM** *Mihai Marciu, Virgil Băran, Roxana Zus*
S3 O6	**DESIGNING AND IMPLEMENTING TEST BENCHES FOR RADIATION HARDNESS QUALIFICATION OF READOUT ELECTRONICS FORM THE LHCb RICH PHOTODETECTORS** *Lucian Nicolae Cojocariu, Vlad Mihai Plăcintă*
S3 O7	**RARE RADIATIVE DECAYS AT LHCb@CERN** *Lavinia-Elena Giubega*

Posters

S3 P1	**CBM TIME OF FLIGHT SUBDETECTOR, SMALL POLAR ANGLES ARHITECTURE** *Laura Radulescu, Mariana Petris, Mihai Petrovici, Victor Simion*
S3 P2	**XRF AND MICRO-PIXE AS INVESTIGATION TOOLS FOR ANCIENT BRONZE METALLURGY – THE CASE OF PRE-MONETARY SIGNS TYPE "ARROWHEADS" FROM HISTRIA** *Daniela Cristea-Stan, Bogdan Constantinescu, Gabriel Talmatchi*

S3 P3	**EFFECTIVE EQUATIONS FOR THE DYNAMICS OF BOSE-EINSTREIN CONDENSATES** *Mihaela Carina Raportaru, Alexandru I. Nicolin, Antun Balaž*
S3 P4	**EFFECT OF MAGNESIUM OXIDE PARTICLE SIZE AND THE FILLER CONTENT ON MAGNESIUM POTASSIUM PHOSPHATE CEMENT PROPERTIES** *M. Nicu, L. Ionascu, F. Dragolici, Gh. Dogaru*
S3 P5	**MINIMIZATION OF RADIOACTIVE WASTE VOLUME BY SUPERCOMPACTION** *Gheorghe Dogaru, Felicia Dragolici, Laura Ionascu, Mihaela Nicu*
S3 P6	**HEAVY METALS ACCUMULATION IN DIFFERENT PARTS OF TREES** *Ioana – Daniela Dulama, Claudia Stihi, Cristiana Radulescu, Ion V. Popescu, Gheorghe Valerica Cimpoca, Lucica Grigora Toma, Ioan Alin Bucurica, Raluca Stirbescu, Dorin Let, Elena Daniela Chelarescu*
S3 P7	**THE POSSIBILITIES OF SMALL ANGLE NEUTRON SCATTERING SPECTROMETER YuMO FOR SOFT MATTER INVESTIGATIONS** *Ivankov O.I, Soloviov D.V, Rogachev A.V, Kovalev Yu.S, Sirotin A.P, Petukhova T.B, Kirilov A.S, Soloviev A.G, Gordeliy V.I, Kuklin A.I*
S3 P8	**INVESTIGATION OF NATURAL AND ARTIFICIAL RADIOACTIVITY IN GRAPHITE FROM VVR-S NUCLEAR REACTOR DEPOSIT BY GAMMA-RAY SPECTROMETRY** *Anişoara Scarlat, Ana Pantelică, Ioan Iorga, Mitică Drăguşin*
S3 P9	**RADIOACTIVITY LEVELS IN PARAFFIN AND WATER SAMPLES FROM THE DECOMMISSIONING VVR-S NUCLEAR REACTOR BY GAMMA-RAY SPECTROMETR** *Ioan Iorga, Anişoara Scarlat, Ana Pantelică, Mitică Drăguşin*
S3 P10	**RADIATION MONITORING EXPERIMENT USING TLD FOR THE TR19 CYCLOTRON AREA IN IFIN-HH** *Ana Stochioiu, Liviu Stefan Craciun, Felicia Mihai, Ion Tudor*
S3 P11	**RECENT ACTIVITIES ON THE TR19 CYCLOTRON AT IFIN-HH** *Liviu Stefan Craciun, Tiberiu Esanu, Cristina Ionescu, Dana Niculae*
S3 P12	**PRACTICAL TEST BENCH USED FOR TESTING PHOTOMULTIPLIER TUBES, TYPE MAPMT** *Vlad-Mihai Plăcintă, Lucian Nicolae Cojocariu*
S3 P13	**IN-BEAM GAMMA-RAY SPECTROSCOPY OF - ^{67}GE USING ROSPHERE** *A.E. Serban, C.R. Nita, R.E. Mihai, R. Marginean, N. Marginean, D. Bucurescu, G. Cata-Danil, I. Cata-Danil, C. Costache, N. Florea, D.G. Ghita, T. Glodariu, A. Ionescu, R. Lica, C. Mihai, A. Mitu, I.O. Mitu, A. Negret, S. Pascu, A. Olacel, A. Opre, T. Sava, L. Stan, L. Stroe, R. Suvaila, S. Toma, A. Turturica, G. Suliman, C.A. Ur*
S3 P14	**MODELLING OF THE MAGNETIC NANOPARTICLES INFLUENCE ON ELASTOMER MATRIX FROM SAS DATA** *Maria Balasoiu, Alexandra-Maria Balasoiu-Gaina, Andrey Rogachev, Alexander Zhigounov, Ioan Bica*
S3 P15	**NEUTRON DIFFRACTION INVESTIGATION OF RAIL WHEEL STEEL TEXTURE** *Tatiana Lychagina, Dmitry Nikolaev*

SECTION 4 Cross-disciplinary Applications of Physics

Invited Lectures

S4 L1	**PHASE SYNCHRONIZATION IN COHERENT EXCHANGE RATE SERIES** *E.I. Scarlat, Mona Mihailescu*
S4 L2	**MATHEMATICAL ASSESMENT OF POST RAIT 131I SCINTIGRAPHY WITH TUMOR MARKERS LEVELS IN THYROID CANCER** *Monica Vasile, Mariana Purice, Daniela Neamtu, Lavinia Vija, Gabriela Voicu, Maria Belgun, Andrei Goldstein*

Oral presentations

S4 O1	**PHONON DYNAMICS OF Fe_2SiO_4 AND Mg_2SiO_4 SILICATES** *Murari Mohan Sinha, Harleen Kaur*
S4 O2	**NEUTRON TIME-OF-FLIGHT QUANTITATIVE TEXTURE ANALYSIS** *Dmitry Nikolayev, Tatiana Lychagina*

S4 O3	**MEASURING FOLDING MECHANISM IN CHAOTIC DYNAMICS** *Virgil Baran, Noel-Mircea Zus*
S4 O4	**THE TEST OF BIO-COMPATIBILITY « IN VIVO » OF DENTAL ACRYLATS, THROUGH PHYSICAL METHODS** *Mihaela-Papusa VASILIU, Liliana SACHELARIE, Laura Ecateriana Dartu*

Posters

S4 P1	**NANO LAYERED ANTIBACTERIAL METAL COATINGS** *Zerrin Pat, Hüseyin Yüksel*
S4 P2	**FRACTAL DIMENSION OF THE TRAJECTORY OF A SINGLE PARTICLE DIFFUSING IN CROWDED MEDIA** *Laura Pitulice, Dana Craciun, Eudald Vilaseca, Sergio Madurga, Isabel Pastor, Francesc Mas, Adriana Isvoran*
S4 P3	**BEHAVIOUR OF GELATIN, STABILIZED WITH NATURAL ANTIOXIDANTS, IN DIFERENT BIOLOGICAL FLUIDS** *Oana-Roxana Bancuta, Andrei Chilian, Iulian Bancuta, Rodica-Mariana Ion, Radu Setnescu, Tanta Setnescu, Anca Gheboianu*
S4 P4	**MOLECULAR ORIENTATION IN AMLODIPINE BESYLATE** *Tanya Popiuk, Dorota Chudoba, Leonid Bulavin, Jan Wasicki*
S4 P5	**STUDY ON BIOACTIVITY OF PHOSPHOCALCIC GLASSES** *Dana Avram, Anca Gheboianu, Dan Ungureanu, Iulian Bancuta, Tanta Setnescu, Nicolae Angelescu*
S4 P6	**REVERSIBLE TO IRREVERSIBLE COMPONENT OF WATER HYSTERESIS LOOP FROM POROUS MEDIA** *Ilie Bodale, Alexandru Stancu*
S4 P7	**NEUTRON AND THERMAL ANALYSIS OF ETHER COMPLEX LITHOCHOLIC ACID DERIVATIVE IN DMSO** *Yulia Gorshkova, Magdalena Ordon, Mirosława Ossowska-Chruściel*
S4 P8	**WILLAMOWSKI-RÖSSLER MODEL OF CHEMICAL REACTIONS** *Ilie Bodale, Victor Andrei Oancea*
S4 P9	**A SIMPLE OPTICAL PROCEDURE FOR ESTIMATING YEAST CONCENTRATION IN AQUEOUS SUSPENSIONS** *Dan Chicea*
S4 P10	**THE INFLUENCE OF THE STORAGE CONDITIONS ON DAHLIA TUBERS STRUCTURE EVIDENCED BY IR AND RAMAN SPECTROSCOPY** *I. Ciobanu, K. Magyari, R. Stefan, M. Cantor, A. Pui, M. Baia*
S4 P11	**THE THERMODYNAMIC PARAMETERS OF SOME COMPOUNDS WITH PHARMACO-THERAPEUTICS ACTION** *Andreea Celia Benchea, Dana Ortansa Dorohoi*
S4 P12	**WAVES FORMATION IN THE COSMIC BOSE EINSTEIN CONDENSATION MODEL** *Afrodita Liliana Boldea, Costin Radu Boldea*
S4 P13	**LIFE EXPECTANCY ANALYSIS DEPENDING ON VARIOUS SOCIO-DEMOGRAPHIC INDICATORS** *Alexandra-Maria Balasoiu-Gaina, Vladimir V. Ulyanov*
S4 P14	**A NUMERICAL APPROACH FOR OPTIMISATING THE EFFICIENCY OF A SPECIFIC HEAT ENGINE** *Gabriel Murariu, Adrian Dinescu, Nicusor Nistor, Adrian Gabriel Murariu*
S4 P15	**THE ANNUAL DYNAMICS OF PHYSICO-CHEMICAL PARAMETERS FOR WATER QUALITY ANALYSIS. CASE STUDY - GRINDU AREA** *Mihaela Cudalbeanu, Mihaela Istrate, Bocioc Elena, Murariu Gabriel, Lucian Georgescu*
S4 P16	**NEURAL NETWORKS USING IN THE STUDY OF TRANSPORT PHENOMENA IN COMPLEX SYSTEMS. CASE STUDY - THE FREEZE FRONT MOVING** *Gabriel Murariu, Adrian Gabriel Murariu, Gheorghe Puscasu, Adrian Dinescu, Ciprian Vlad*
S4 P17	**RELEVANCE OF JOINING PROCESS BETWEEN VARIABLES OF DATA COMMUNICATION AND WEIGHTED ENTROPY LEVELS** *Valentin Ghişa, Marius Belc, Sorin Moraru*

S4 P18	**THE IMPORTANCE OF VOCAL PARAMETERS CORRELATION IN THE MODELING OF INFORMATIONAL PROCESSES** *Valentin Ghișa, Marius Belc, Sorin Moraru*

SECTION 5 Engineering and Industrial Physics

Invited Lectures

S5 L1	**QUARTZ CRYSTAL MICROBALANCE TECHNOLOGIES USED IN REAL-TIME CHARACTERIZATION OF INTERFACES AND MOLECULAR INTERACTIONS** *Gheorghe Valerica Cimpoca, Alin Bucurica, Ioana Dulama, Ion V Popescu* **ANALYTICAL**
S5 L2	**TECHNIQUES FOR ANALYSIS OF IONIC IMPURITIES IN ELECTRICAL ROTATING MACHINES INSULATORS** *Ion V. Popescu, Claudia Stihi, Cristiana Radulescu, Ioana Daniela Dulama, Iulian Bancuta, Anca Gheboianu, Mircea Ignat, Gabriela Telipan, Bogdan Varaticeanu*
S5 L3	**GRAPHENES – EXCELLENT SUBSTITUTES FOR NOBLE METALS IN CATALYSIS** *Vasile I. Parvulescu*
S5 L4	**METHODS OF PROCESSING PROFILES EXTRACTED FROM THE ELECTRON DIFFRACTION FIGURES OBTAINED ON TOOTH ENAMEL** *Gabriel Prodan, Victor Ciupina, Radu Manu, Agripina Zaharia*

Oral presentations

S5 O1	**THE STUDY OF HEAVY METAL CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM LOWER DANUBE EUROREGION** *Oleg Bogdevich, Antoaneta Ene, Dina Izmailova, Elena Culighin, Oleg Cadocinicov*
S5 O2	**ENHANCEMENT OF CARRIER COLLECTION EFFICIENCY IN PHOTODIODES BY INTRODUCING A SALICIDED POLY SILICON CONTACT** *Yelena Kaminski, Eitan Shauly, Yaron Paz*
S5 O3	**CLEANROOMS AND TECHNICAL CLEANLINESS IN TODAY'S INDUSTRY** *Geanina Valentina Mihai*
S5 O4	**EARTHQUAKE PRECURSORS ASSESSMENT IN VRANCEA REGION THROUGH OPTOSPECTRAL SATELLITE AND IN-SITU MONITORING DATA** *Maria Zoran, Roxana Savastru, Dan Savastru*
S5 O5	**SEISMICITY OF THE ROMANIAN TERRITORY AND HIS CHARACTERISTICS** *Mihail Diaconescu, Andreea Craiu, Dragos Toma-Danila*
S5 O6	**CORRELATION BETWEEN HEAVY METAL CONCENTRATIONS, DETERMINED BY XRF AND AAS ANALYTICAL METHODS, IN BIOINDICATOR SAMPLES** *Elena Daniela Chelarescu, Ioana Daniela Dulama, Claudia Stihi, Cristiana Radulescu, Marius Belc*
S5 O7	**AN ANALYTICAL-NUMERICAL MODEL FOR THE TWO DIMENSIONAL QUANTUM WELL RESISTIVITY OF AlGaN/GaN TRANSISTORS** *R. Yahyazadeh, Z. Hashempour*

Posters

S5 P1	**FTDT INVESTIGATIONS FOR FABRICATION THE SUB-WAVELENGTH METAL WIRE-GRID POLARIZER, QUARTER WAVEPLATE AND SUPERLEN** *Costel Cotirlan-Simioniuc, Constantin Logofatu, Rodica Ghita, Adrian Stefan Manea*
S5 P2	**GAS DIFUSION LAYER AND REACTANT GAS CHANNEL INFLUENCE ON THE PERFORMANCE OF A HT-PEM FUEL CELL** *Viorel Ionescu*
S5 P3	**ANALYSIS OF SOURCE PROPERTIES FOR THE EARTHQUAKE SEQUENCES IN THE SOUTH-WESTERN CARPATHIANS (ROMANIA)** *Anica Otilia Placinta, Emilia Popescu, Felix Borleanu, Mircea Radulian*
S5 P4	**DETECTION OF EVENTS IN A MULTIDISCIPLINARY NETWORK MONITORING VRANCEA AREA** *Victorin-Emilian Toader , Iren-Adelina Moldovan, Alexandru Marmureanu*

S5 P5	**INPUT PARAMETERS FOR THE PROBABILISTIC SEISMIC HAZARD ASSESSMENT IN THE EASTERN PART OF ROMANIA AND BLACK SEA AREA** *Iren-Adelina Moldovan, Mihail Diaconescu, Emilia Popescu, Angela Petruta Constantin, Dragos Toma-Danila, Anica Otilia Placinta*
S5 P6	**THE INFREP EUROPEAN VLF/LF RADIO MONITORING NETWORK - PRESENT STATUS AND PRELIMINARY RESULTS OF THE CYPRUS MONITORING SYSTEM** *Iren-Adelina Moldovan, Angela Petruta Constantin, Konstantinos Katzis, Haris Haralambous, Dragos Toma-Danila, Pier Francesco Biagi*
S5 P7	**EVALUATION OF THE DISPERSION OF THE POLLUTANTS RELEASED BY A WASTE INCINERATOR USING NUMERICAL SIMULATIONS** *Mihai Lungu, Adrian Neculae, Antoanetta Lungu, Madalin Bunoiu, Nicolae Strambeanu, Daniel Arghiriade, Laurentiu Demetrovici*
S5 P8	**THERMAL DEPOSITION OF TiO_2 NANOPARTICLES ON SnO_2:F ELECTRODES USED IN DSSC** *Andrei Chilian, Oana-Roxana Bancuta, Iulian Bancuta, Rodica-Mariana Ion, Radu Setnescu, Tanta Setnescu, Anca Gheboianu, Alin Bucurica, Cristiana Radulescu*
S5 P9	**ACTIVE FAULTS FROM ONSHORE AND OFFSHORE OF THE BLACK SEA COAST** *Mihail Diaconescu, Andreea Craiu, Dragos Toma-Danila, George Craiu*
S5 P10	**INVESTIGATION OF EARTHQUAKE SIGNATURES ON THE IONOSPHERE USING TEC VALUES OVER THE EUROPEAN REGION** *Eduard Nastase, Haris Haralambous, Christina Oikonomou, Alexandra Muntean, Doru Mateciuc, Iren Adelina Moldovan*
S5 P11	**INFRARED SPECTROSCOPY AND DSC AS ANALYSIS TOOLS IN PRODUCTION AND DIAGNOSIS OF CARBON FIBERS (FROM PAN PRECURSORS)** *Marius Eduard Lungulescu, Radu Setnescu,Adela Bara, Tanta Setnescu*
S5 P12	**SATELLITE IMAGERY FOR ASSESSMENT OF BUCHAREST URBAN GREEN CHANGES** *Maria Zoran, Roxana Savastru, Dan Savastru, Marina Tautan, Sorin Miclos, Laurentiu Baschir*
S5 P13	**IMPACTS OF CLIMATE AND ANTHROPOGENIC PRESSURES ON FOREST ECOSISTEMS IN ROMANIA FROM SATELLITE DATA** *Maria Zoran, Adrian Dida*
S5 P14	**AFM INVESTIGATION OF MORPHOLOGICAL MODIFICATIONS INDUCED BY DIFFERENT DECONTAMINATION TREATMENTS ON BACTERIA** *Zorila Florina Lucica, Ionescu Cristina, Craciun Liviu Stefan, Zorila Bogdan*
S5 P15	**X-RAY STRUCTURE ELUCIDATION OF NEW BENZIMIDAZOLIUM HEXAFLUOROPHOSPHATES** *Costel Moldoveanu, Mircea Apostu, Gheorghiță Zbancioc, Dorina Mantu, Vasilichia Antoci, Ionel Mangalagiu*
S5 P16	**X-RAY STRUCTURE ELUCIDATION OF ACETOPHENONE DERIVATIVES** *Ana Maria Zbancioc, Costel Moldoveanu, Mircea Apostu, Gheorghiță Zbancioc,Gabriela Tataringa, Ionel Mangalagiu*
S5 P17	**METROLOGY AND OPTICAL PROPERTIES OF SOME TRANSPARENT OXIDES THIN FILMS** *F. Garoi, P. Prepelita*
S5 P18	**EARTHQUAKE TRIGGERING EFFECTS CAUSED BY WATER LEVEL FLUCTUATION AT 2 DAMS FROM EASTERN CARPATHIANS** *Felix Borleanu, Traian Moldoveanu, Mihaela Popa, Iren-Adelina Moldovan, Angela Petruta Constantin, Dragos Toma-Danila*
S5 P19	**FRACTAL PROPERTIES OF OSTEOBLAST-LIKE CELLS FROM HOLOGRAPHIC PHASE IMAGES** *Mona Mihailescu, Eugen I. Scarlat, Irina Alexandra Paun, Irina Grigorescu, Adriana Acasandrei*
S5 P20	**CHARACTERISTICS OF THE MACROSEISMIC INTENSITIES OF THE 2014 VRANCEA CRUSTAL EARTHQUAKE** *Angela Petruta Constantin, Iren Adelina Moldovan, Mircea Radulian, Constantin Ionescu*
S5 P21	**MIGRATION OF Cu IONS IN POLYETHYLENE XLPE INSULATION BY THERMAL STRESS** *Iulian Bancuta, T. Setnescu, Radu Setnescu, Ion V. Popescu, Oana-Roxana Bancuta, Andrei Chilian, Anca Gheboianu, Gheorghe Vlaicu*

S5 P22	**HEAVY METALS CONTENTS FROM THE MUNICIPAL AND INDUSTRIAL SLUDGES IN DAMBOVITA COUNTY** *Oana-Roxana Bancuta, Iulian Bancuta, T. Setnescu, Andrei Chilian, Radu Setnescu, Ion V. Popescu, Anca Gheboianu, Otilia Culicov, Gheorghe Vlaicu*
S5 P23	**GEOTECTONIC STUDY OF THE DOBROGEA (ROMANIA) AREA USING GNSS DATA** *Alexandra Muntean, Eduard Nastase, Constantin Ionescu, Boudewijn A.C.Ambrosius, Victor Mocanu, Gina Andrei, Alina Dragut*
S5 P24	**EVALUATION OF TRACE ELEMENTS CONTENT IN EDIBLE MUSHROOMS BY ICP-MS** *Andreea Antonia Georgescu, Andrei Florin Danet, Claudia Stihi, Cristiana Radulescu, Ioana Daniela Dulama*
S5 P25	**FERRITE COMBUSTION CATALYST ON MULLITE SUPPORT** *C. Doroftei, P.D. Popa, N. Rezlescu, E. Rezlescu*
S5 P26	**STUDY ON THREE NANO-GRAINED FERRITES AS CATALYSTS FOR ACETONE COMBUSTION** *N. Rezlescu, E. Rezlescu, P.D. Popa, C. Doroftei, M. Ignat*
S5 P27	**ADVANCED MICROWAVE ANTENNAS USING LOW-LOSS, HIGH DIELECTRIC PERMITTIVITY MATERIALS** *Cezar Dragos Geambasu, Marian Gabriel Banciu, Liviu Nedlcu*
S5 P28	**TITANIA BASED NANOARCHITECTURES – KEY ASPECTS IN PHOTOCATALYTIC APPLICATIONS** *Zs. Pap,V. Danciu, G. Kovács, M. Baia, V. Cosoveanu, A. Vulpoi, K. Magyari, L. Baia*
S5 P29	**CHARACTERIZATION OF CULTURAL HERITAGE MATERIALS USING ADVANCED ANALYTICAL TECHNIQUES** *Maria-Mihaela Manea, Marian Virgolici, Daniela Lungu, Ioana Stanculescu, Valentin Moise*
S5 P30	**Al_2O_3 LAYER GROWN ON RuAl BOND COATS DURING HIGH TEMPERATURE OXIDATION** *Amalia Soare, Ioana Csáki, Ioan Costina, Cristina Oprea, Sorin Soare, Cristian Predescu, Mirela Sohaciu*
S5 P31	**GENERATION OF COMPLEX THREE-DIMENSIONAL MICROSTRUCTURES WITH DIFFERENT FUNCTIONALITIES FOR SELECTIVE DEPOSITION OF METALS** *Iuliana Stoica, Andreea Irina Barzic, Magdalena Aflori, Emil Ghiocel Ioanid, Camelia Hulubei*
S5 P32	**ORIENTATION DISTRIBUTION FUNCTION OF BIOTITE PALETS BASED ON OPTICAL, THIN SECTION AND MICRO-CT IMAGES IN AN OUTOKUMPU (FINLAND) BIOTITE GNEISS: COMPARISON WITH NEUTRON DIFFRACTION TEXTURE ANALYSIS** *Tatiana I. Ivankina, Octavian G. Duliu, Eduard Herman, Calin Ricman, Ion Tiseanu*
S5 P33	**INVESTIGATION OF SYNTHESIZED DIAMONDS, LITHIUM AND BORON NITRIDES USING SEM-EDX AND XRD TECHNIQUES** *Antoaneta Ene, Marina V. Frontasyeva, Oleg V. Ignatenko, Alina Cantaragiu*
S5 P34	**INVESTIGATION OF PRE-EARTHQUAKE IONOSPHERIC ANOMALIES RELATED TO GLOBAL M>5.8 EARTHQUAKES** *Christina OIKONOMOU, Haris HARALAMBOUS, Iren-Adelina MOLDOVAN*
S5 P35	**NONDESTRUCTIVE DEFECT ANALYSIS USING CT – 3D RECONSTRUCTIONS** *Geanina Valentina Mihai*
S5 P36	**STATISTICAL ANALYSIS OF PHYSICAL AND CHEMICAL PARAMETERS OF THE WATER – WELL FORM THE GALATI COUNTY AREA** *Ionelia Sandu, Liliana Irofte, Elena Bocioc, Liliana Irofte, Gabriel Murariu, Lucian Georgescu, Antoneta Ene*
S5 P37	**MICROBIAL FUEL CELLS WITH DIFFERENT MICROBIAL ECOSYSTEMS - ENERGY PRODUCTION AND NITRATE REMOVAL EFFICIENCIES** *Ana Cucu, Iulian Tanase, Athanasios Tiliakos, Ioan Stamatin, Adrian Ciocanea, Sanda Budea, Alexandru Anton Ciucu*
S5 P38	**OPTICAL AND PHOTOCATALYTICAL PROPERTIES OF ZnO/CdS COMPOSITES PREPARED BY FACILE APPROACHES** *Anca Dumbrava, Gabriel Prodan, Florin Moscalu*
S5 P39	**QUALITY FACTORS MEASURED ON SUN WINE SORTIMENTS** *M. Ivanescu, D. Enache, M. Belc, M. I. Oancea Stanescu*

SECTION 6 Topics in Physics Education Research

Invited Lectures

S6 L1	**HEURISTIC TYPE METHODS USED IN THE STUDY OF PHYSICS AND CHEMISTRY** *Madalina IVANESCU, Gabriela - Mihaela MICU, Eugenia NEDELCU*
S6 L2	**SPECIAL EXPERIMENTS IN HIGH SCHOOL PHYSICS** *Ion Bararu*

Oral presentations

S6 O1	**HOW EARTHQUAKE RELATED DATA CAN BE USED IN SCHOOLS FOR PHYSICS LEARNING AND DISASTER PREPAREDNESS?** *Dragos Tataru, Bogdan Grecu, Bogdan Zaharia, Nicoleta Brisan, Speranta Tibu, Dan Costin*
S6 O2	**DIGITAL STORYTELLING AS A CREATIVE TEACHING METHOD IN SCIENCE EDUCATION** *Paula Crăciun, Adrian Robu, Mădălin Bunoiu, Dana Crăciun*

Posters

S6 P1	**AN INTERDISCIPLINARY APPROACH OF PHOTOSYNTHESIS** *C. Iancu, C. G. Chilom*
S6 P2	**SENSITIVE IN SITU-MONITORING OF SOLUTION CONCENTRATIONS VIA POLARIMETRIC CHAIN WITH SECONDARY FARADAY MODULATOR** *Cristina Kuncser, Andrei Kuncser, Ştefan Antohe*

ABSTRACTS

S0 – PLENARY SESSION

SO 01

MAGNETIC DIPOLE DISCHARGES

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By applying a strong magnetic field transverse to the electric field between a cathode and anode of a glow discharge, electrons are confined, which increases the ionization efficiency. Such cross-field discharges have received much attention as efficient plasma sources for various applications. The present work describes perhaps the simplest cross-field discharge consisting of a permanent magnet as a cold cathode and the chamber wall as the anode. The magnet's equator is biased strongly negative, which produces secondary electrons due to the impact of energetic ions. The emitted electrons are highly confined by the strong dipolar magnetic field and the negative potential in the equatorial plane of the magnet. These electrons ionize near the sheath and produce further electrons, which drift across field lines to the anode while the nearly unmagnetized ions are accelerated back to the magnet. A steady state discharge is maintained at neutral pressures above 10^{-3} mbar. This is the principle of magnetron discharges, which commonly use cylindrical and planar cathodes rather than magnetic dipoles as cathodes.

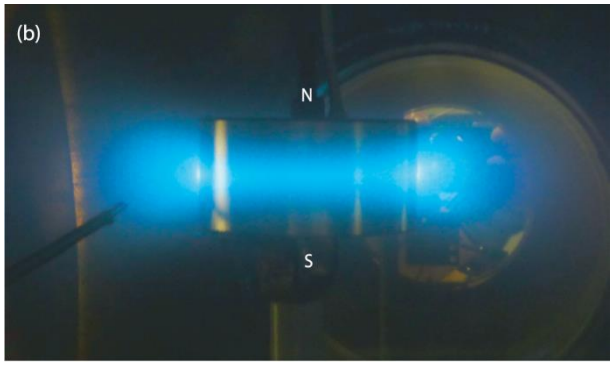

Fig. 1. Plasma ring in the equatorial plane of a cylindrical permanent dipole magnet biased at –400 V in Argon at $p \cong 5 \cdot 10^{-3}$ mbar (Nd magnet, 5 cm diam., 2,5 cm length and 0,4 T max).

The experiments have been performed at University of California Los Angeles and reproduced at the University of Innsbruck using similar plasma devices of approximately 40 cm in diameter and 100 cm in length. The discharge properties have been investigated in steady state and pulsed mode. Different magnets and geometries have been employed. The role of a background plasma has been investigated. Various types of instabilities have been observed such as sheath oscillations, current-driven turbulence, relaxation instabilities due to ionization, and high frequency oscillations created by sputtering impulses. [i, ii]

Fig. 1 shows a possible configuration: The secondary electrons emitted due to impact of energetic ions on the magnet's surface are energized in the sheath. Following the magnetic field lines, being nearly parallel to the side walls of the magnet, the electron energy is largest in the mid-plane where a luminous plasma ring appears as shown in Fig. 1. The field lines end again on the magnet surface where the electrons are reflected by mirror forces and the sheath electric field.

This work was supported in part by NSF/DOE Grant DE-SC0004660 and in part by the Austrian Science Fund (FWF) under Grant No. 19901. Additional supports by the University of Innsbruck and the CEEPUS Network AT-0063 are acknowledged.

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SO 02

ELECTRONIC PROPERTIES OF Fe/LiF(LiBr)/Fe MAGNETIC TUNNEL JUNCTIONS

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The structural, electronic and magnetic properties of Fe/LiF(LiBr)/Fe(001) magnetic tunnel junctions, MTJs, are theoretically studied by means of first principles Green's function technique. LiF and LiBr alkali halides crystallize in a rock-salt type structure having lattice constants of 4.02 Å and 5.5 Å, respectively. Both compounds epitaxially fit bcc Fe structure. LiF and LiBr, are insulators with direct band gaps of 13.6 eV and 8 eV, respectively. The geometry of Fe(001)/nLiF(LiBr)/Fe(001) heterostructures is presented in Fig.1.

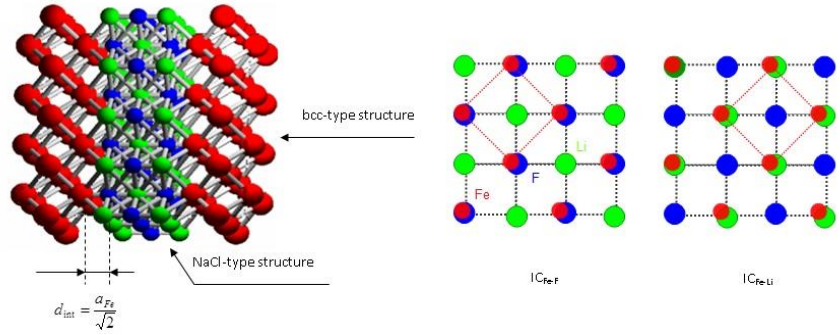

Fig.1

Total energy calculations evidenced that ones Fe/LiF(001) interfaces with Fe atoms located atop F and Fe/LiBr(001) interfaces with Fe atoms located above Li and Br sites are the most stable ones. The interfacial iron's magnetic moments are of ≅ 3 μ_B, being enhanced over the bulk value. No exchange coupling is evidenced in case of Fe/nLiF/Fe heterostructure, while in case of Fe/nLiBr/Fe one, there is a small ferromagnetic coupling, decreasing exponentially with barrier thickness. The predicted tunneling magnetoresistance (TMR) of Fe/nLiBr/Fe MTJ, for n > 10, is of $3 \cdot 10^4$ %, while this is only $4 \cdot 10^2$ % in Fe/nLiF/Fe MTJs – Fig.2. Spin dependent transport properties of Fe/nLiBr/Fe MTJ are characterized by a resonant tunneling mechanism.

The effects of Li-F and Li-Fe interdiffusion were studied in correlation with the evolution of tunneling magnetoresistance.

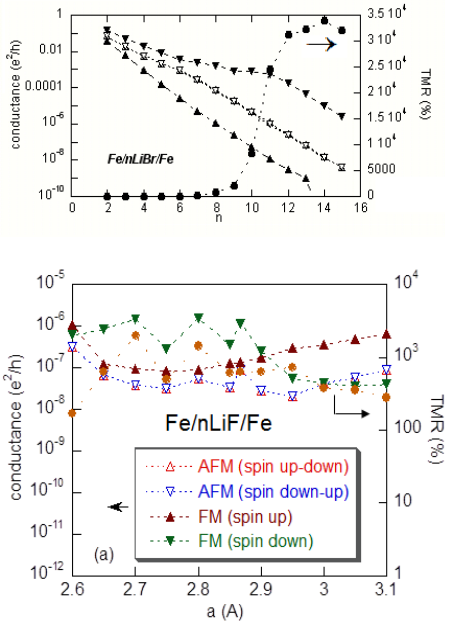

Fig.

This work was supported by the Romanian Ministry of Education and Research (UEFISCDI), grant no. PN-II-ID-PCE-2012-4-0028.

SO 04

ELECTRICAL PROBES - A BRIDGE BETWEEN THE LOW- AND THE HIGH-TEMPERATURE PLASMA DIAGNOSTICS

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Keywords: Langmuir probe, special probes, low- and high-temperature-plasma

In the year 2016 we shall celebrate 90-th anniversary of the classical paper by I. Langmuir and H.M. Mott-Smith describing the theory of collectors in gaseous discharges [i]. It was not the first article by I. Langmuir and his colleagues, describing the probe diagnostics, but it summarized the effort that lasted several years. At that time it was "*a new method of studying electrical discharges through gases at rather low pressures*". Since that time the probes were used at wide range of pressures including the atmospheric one, in plasma generated by direct current, radio-frequency, laser beam, electron beam, in tokamaks, in plasmas creating conducting or non-conducting layers and in many other applications. The original idea presented by I. Langmuir in [**Error! Bookmark not defined.**] was broadened and several new probe designs were introduced that do not work on the Langmuir probe principle.

The lecture will acquaint the audience with basics of the Langmuir probe, the emissive probe and the ball pen probe with the stress being given on the common application of these types of electric probes in the low-temperature as well as in the high-temperature plasma. E.g. the Langmuir probe has been developed first for studying the "electrical discharges at rather low pressures", i.e. for the low-temperature plasma, and it is nowadays frequently used not only for diagnosing the hot plasma in tokamaks at a negligible neutral pressure, but also for getting information on hot plasma generated by torches at the atmospheric pressure. Thanks for the ability of the emissive probe to directly measure the plasma potential with a reasonable accuracy, the emissive probe was used in hot plasmas first for measurements of the fluctuations of the plasma potential in the edge plasma of tokamaks CASTOR and ISTTOK.

The ball-pen probe, on the other hand, has been developed in 2004 for studying the plasma potential fluctuations in the hot, magnetized plasma, and its discovery was a great success. Examples of such applications include measurements of transport coefficients in the edge regions of the CASTOR tokamak and fast measurements of plasma potential, electron temperature and density, investigations of fluctuations, ELM filaments and turbulent transport in the scrape of layer of the ASDEX upgrade tokamak. The comparatively straightforward use, rugged construction, and simplicity of the BPP lead to its application in low-temperature magnetized plasma. Recently, the limit of operation of the ball-pen probe in such conditions based on the B/p similarity parameter [ii].

In addition, the lecture will give information on the special probes that are solely used either in the low-temperature or in the high-temperature plasma. As for the former it will be the plasma impedance probe, plasma oscillation probe, the ion flux pulsed and the RF probe and the hairpin probe. As for the latter it will be the Mach probe, the Gundestrup probe, the ion-sensitive probes, Katsumata probe and the tunnel probe.

Acknowledgments. The author wishes to acknowledge the partial financial support by the Czech Science Foundation in frame of the grant No. 15-00863S.

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SO 05

PERSPECTIVES FOR NUCLEAR PHYSICS APPLICATIONS AT ELI–NP

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for the ELI–NP team

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The Exteme Light Infrastructure pan–European initiative is in the phase of implementation. The Extreme Light Infrastructure – Nuclear Physics (ELI–NP) facility is part of this initiative and it is under construction on the Magurele Physics Platform. ELI–NP will comprise two state–of–the–art systems: a high–power laser system consisting of 2 x 10 PW lasers and a high brilliance gamma beam system. The facility was designed to use extreme electromagnetic fields for nuclear physics research.

In parallel with the installation of the main systems, the ELI–NP scientific team is designing the experimental setups to be operated with the ELI–NP beams. Based on the physics cases described in the ELI–NP White Book [1] and the discussions within the international scientific community that has developed around the facility, the scientific team of ELI–NP identified the main directions of research with high–power lasers and gamma beams and proposed the experimental setups needed for the accomplishment of the physics cases. Technical Design Reports with detailed descriptions of the experimental setups were prepared and are presently undergoing a scientific and technical evaluation process.

The outstanding features of the laser and gamma beams at ELI–NP provide the premises for the development of a broad range of advanced applications in material science, life sciences, nuclear safety. The high brilliance, quasi–monochromatic and energy tunable gamma beam is ideal for non–destructive testing of large objects with application in aeronautics or automotive industries, archeological artifacts and art objects analysis, or for identification and localization of special nuclear materials inside containers and radiation–shielded boxes. The high–power laser system open new perspectives in the development of compact particle accelerators for laser–driven nuclear research and applications in technology and medicine. Materials behavior in intense radiation fields is of high interest for space science, fusion reactors and high–power accelerators development, or biological science research.

[1] ELI–NP White Book, http://www.eli-np.ro/documents/ELI-NP-WhiteBook.pdf

Keywords: high–power lasers, gamma beams, nuclear physics

SO 06

CONFORMATIONAL TRANSITIONS OF NUCLEIC ACIDS UNDER EXTERNAL FORCES: EXAMPLES AND A STOCHASTIC PATH INTEGRAL THEORY FOR THEIR KINETICS

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I will present molecular dynamics simulations of several examples of conformational transitions that nucleic acids and their complexes undergo upon the application of external forces and/or torques: (1) DNA supercoil relaxation by topoisomerases, (2) the condensation of DNA by dendrimers and, time permitting, (3) RNA unfolding. Then I will showcase the use of the formalism of stochastic path integrals to deduce the kinetics of these transitions from simulation trajectories or experimental single molecule recordings of the transition, under other conditions that those that are actually simulated or recorded.

SO 07

TRANSPORT PROPERTIES OF NANOWIRES

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During the last years the weight-center of research in the field of nanotechnology shifted from the discovery of new nanostructures and methods of preparation of such nanostructures to the development of application targeted nanoobjects. The first key element of the process is to control the parameters (e.g. morphology, composition, and structure, electric and optic properties) of these low dimensional building blocks directly from the preparation step. The second key element is to manipulate and integrate precisely tailored nanostructures into various functional devices.

By template based fabrication approaches one can finely tune the morphological and dimensional properties of the nanostructures, this leading to new potential functionalities generated by their size. Our paper reviews the concept of template fabrication and its potential in obtaining nanostructures or nanostructured materials with controlled morphology and/or high aspect ratio. Several types of templates are discussed including the most important characteristics in terms of material, geometry and obtaining method. We present our results in the preparation of metallic, semiconductor and complex structure nanowires. The presentation points out the possibilities of fine tuning properties such as magnetic, optical emission or electronic transport directly from fabrication step.

ABSTRACTS

S1 – Materials Physics

- *Semiconductors, Dielectrics and Organic Materials*
- *Spintronics, Magnetism and Superconductivity*
- *Crystal growth, Surfaces, Interfaces and Thin Films*
- *Polymers and Amorphous Materials*

S1 L1

MULTIFERROIC AND MAGNETOELECTRIC METAL-ORGANIC FRAMEWORKS

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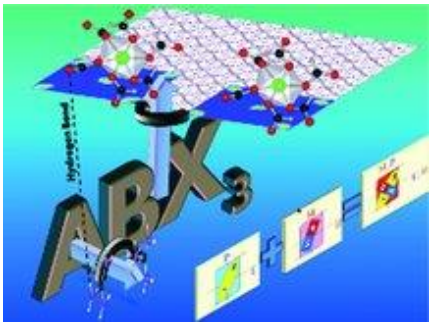
Ferroelectric materials, whose spontaneous polarization can be switched by an external electric field, have a wide range of applications in device electronics. Recent discoveries of ferroelectricity in organic solids have been limited to some well-known polymer ferroelectrics or a few low molecular mass compounds. Computational approaches based on density functional theory represent a valuable tool in order to predict or suggest new organic ferroelectrics with large values of ferroelectric polarization. In particular, the modern theory of polarization is used and symmetry analysis gives an important help for gaining insights into the mechanisms responsible for the ferroelectric polarization. Here we will focus on the description of the ferroelectric and magnetic properties of complex organic-inorganic systems, such as metal-organic frameworks (MOFs). In particular, MOFs with a perovskite topology show promising new routes for the cohexistence of ferroelectricity and magnetism, *i.e.* multiferroicity, as well as, their couping, *i.e.* magnetoelectricity.



Keywords: multiferroicity, magnetoelectricity, metal-organic frameworks

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S1 L2

ZnO NANOWIRES IN ORGANIC LIGHT EMITTING DIODES

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National Institute for Materials Physics, Bucharest-Magurele 077125, Romania

Covering ZnO nanwires (NW) with conducting polymers like PEDOT or PEDOT:PPS, can influences the charge transport in the Organic Light Emitting Diodes structures. These nanowires grown by electrochemical deposition on glass/ITO at -0.9 V, minimize the concentration of the oxygen vacancies, responsible for the green emission which can be superimposed with the phosphorescence of the organometallic compound.

The coating process of ZnO NW with conducting polymers can effectively enhance the optical and electrical properties without changing the morphology. The exponential behavior of the I-V characteristics shows a more prominent *p-n* junction for the structures with ZnO NW.

An increasing of the hole current density was observed in the samples with high concentration of ZnO NW, which makes the current injection more balanced and consecutively enhances the electroluminescence efficiency. The exponential factor of the I-V characteristics increases with the applied potential, indicating the existence of the trapping levels and creation of high charge density in the vicinity of the emissive layer.

S1 L3

THE VIBRATIONAL CHEMISTRY OF THE SPIN-CROSSOVER PHENOMENA. NEW CASE STUDIES.

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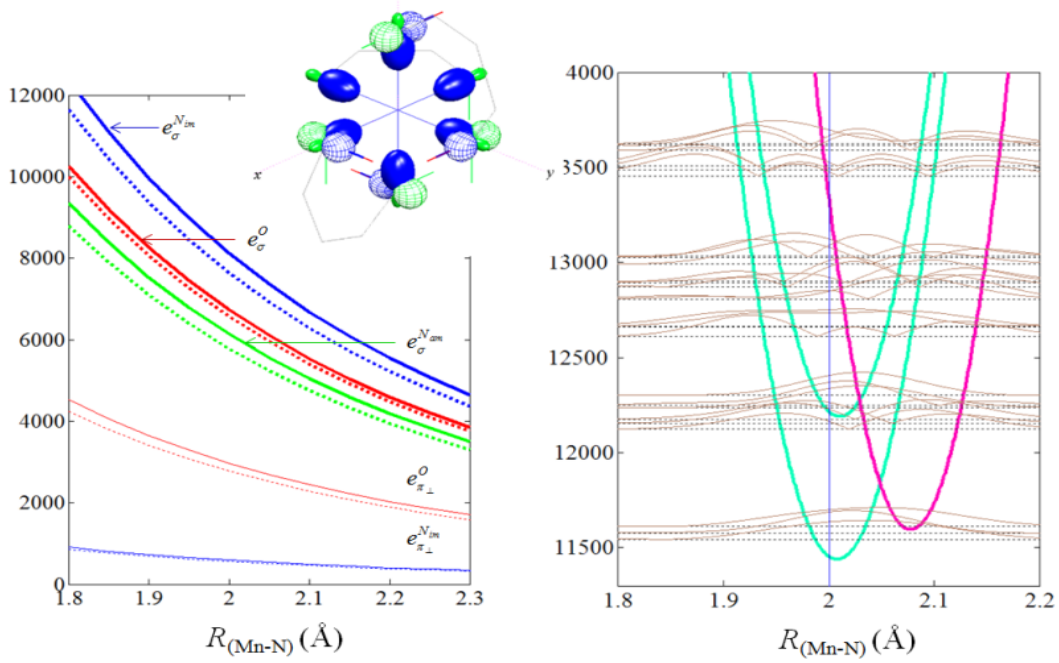
The spin crossover phenomena, known for a limited series of configurations, d^4-d^7 of transition metal complexes is a challenging subject both for academic studies, being due to subtle balance of ligand field, spin-orbit and vibronic couplings, and also for application purposes in the frame of spintronics desiderata [1]. Having as primary goal the magnetic anisotropy of compressed vs. elongated Mn(III) octahedral complexes, we serendipitously entered the field of spin conversion identifying systems with unusual spin behavior [2], obtaining systems similar to those initially discovered by G. Morgan et al.[3]

Taking the challenge we advanced deeper into the topic, with models and calculations. Thus, we determined the bond-length dependence ligand field parameters and with this advent we explicitly modeled the interplay of the vibrational factors into the electronic levels, simulating the details of the spin crossing mechanisms (Synopsis 1).

Aside the Mn(III) complexes from ours [4] and Morgan's synthetic outcome [5], we considered also classical prototypes of Fe(II) spin transition, identifying the electronic and vibrational factors of the cooperativity and hysteresis.



Synopsis 1. a) the scheme of lone pairs determining the ligand field parameters and their variation with the bond length. b) The reaction coordinate dependence of all low-lying states of the Mn(III) complexes.

Aknowledgement*:* This work is supported by grant UEFISCDI PCE 14/2013 and Cost action 1305

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S1 L4

OPTICAL AND MORPHOLOGICAL PROPERTIES OF DYE-DOPED NANOSTRUCTURES

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Nanostructures, produced either as free-standing objects or embedded in a template, have proved to possess fascinating properties and are extremely useful, taking into account the increasingly technological necessities. Dye doping of nanostructures is extremely efficient for obtaining special optical properties. We produced two types of low dimensional structures with tailored optical properties, dye-doped nanorods grown in polymer template membranes and dye-doped nanofibers produced by electrospinning.

Firstly, we present our studies regarding the optical properties of dye-doped nanorods grown in etched ion track polymer templates. This type of membranes present parallel nanopores with diameters down to 10 nanometers and are suitable for the growth of semiconductor or metallic wires as well as insulating rods. We obtained potential tunable emitting nanostructures that can overcome the present limitations of solid state dye doped materials.

Secondly, by a simple technique such as electrospinning we synthesized dye-doped polymer nanofibers. Due to the posibility of combining the advantages of using polymers (low-cost, flexibility and abundance) with the optical properties induced by the dopants, the fabrication of devices based on polymers that incorporate various compounds draw more and more attention. The electrospinning process is a very efficient method of producing polymer nanofibers with special morphological properties. The variations of process parameters allow us to change the morphology of the dye-doped fibers and by that we can tune their emissive properties.

Although different in many aspects, both types of nanostructures present remarkable emitting properties.

Keywords: dye-doped nanostructures, templated nanorods, electrospun polymer nanofibers

S1 L5

MAGNETIC NANOPARTICLES FOR BIO-MEDICAL APPLICATIONS

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This presentation reports on the intensive efforts done in the last period to fully understand and characterize magnetic nanoparticles and specific relaxation phenomena of relevance for bio-medical applications. Peculiar issues related to the magnetic response of complex systems consisting of different types of nanoparticles as well as to multifunctional nanoparticles achieving both target-specific diagnostics and therapeutics, are emphasized together with proposed theoretical and experimental solving items. The importance of the suitable magnetic characterization of the systems is exemplified in case of nanoparticles subjected to heating procedures (under RF fields) for cancer hyperthermia. Potential new methodologies for the correct evaluation of the specific absorption rate (SAR) from real experimental data taking into account also environmental loss factors are proposed and the results are discussed as function of some relevant temperature-dependent physical parameters such as Neel and Brownian relaxation times, vascosity of the dispersive medium and particle size distribution. The issue of a correct theoretical evaluation of the absorption rate by nanoparticles of enough large size distribution in order to put in work different mechanisms of power absorptions is considered. The importance of the inter-particle interactions on the magnetic relaxation process is exemplified in case of magnetic fluids of different volume fractions. The dependence of the specific absorption rate on the volume fraction of nanoparticles is also analyzed, both experimentally and theoretically, for a proper implementation in the bio-heat transfer equation.

Keywords: magnetic nanoparticles, magnetic relaxation, hyperthermia

Acknowledges: The financial support through the exploratory research project PCE IDEI 75/2011 is highly acknowledged. Nicusor Iacob was supported by the strategic grant POSDRU/159/1.5/S/137750, ”Project Doctoral and Postdoctoral programs support for increased competitiveness in Exact Sciences research” cofinanced by the European Social Found within the Sectorial Operational Program Human Resources Development 2007 – 2013. Some of the magnetic fluids investigated in this work were provided by Prof. Dr. Ladislau Vekas from the Laboratory of Magnetic Fluids - Center for Fundamental and Advanced Technical Research, Timisoara (Romania).

S1 L6

INVESTIGATION ON THE PROPERTIES OF SOME N DOPED SiC NANOSTRUCTURED THIN FILMS

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Ionized nitrogen doped Si-C thin films at 200°C substrate temperature were obtained by Thermionic Vacuum Arc (TVA) method. To increase the energy of N, C and Si ions, -400V, -600V and -1000V negative bias voltages was applied on the substrate. The 200nm thickness carbon thin films was deposed on Si and glass substrate and then 400nm, 600nm and 1000nm N-SiC coatings on carbon thin films was deposed. To characterize the structure of as-prepared N-SiC coatings, TEM, HRTEM and XPS techniques was performed. The crystallinity of N-SiC thin films increase with increasing of acceleration potential drop, i. e. with energy of N, C and Si ions.

It was measured the electrical conductivity in a constant current mode. To justify the dependence of measured electrical conductivity by the temperature, we assume a thermally activated electrical transport mechanism.

Keywords: SiC nanostructures, TVA method, TEM, HRTEM, XPS, electrical conductivity.

Acknowledgement: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project number 160/2013, PN-II-PT-PCCA-2011-3.2-1453.

S1 L7

IMAGE DIPOLES IN METAL SURFACES: FROM QUANTITATIVE EVALUATION OF SURFACE ENHANCED RAMAN SCATTERING EFFECTS TO POLARIZATION STRENGTHENING AT FERROELECTRIC-METAL INTERFACES

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A simple model supposing the interaction of electric dipoles with their images in a metal surface exhibits a wide variety of properties, starting from a consistent amplification of the polarizability of the initial dipole to the formation of permanent dipole moments and hysteretic behavior, much as in the case of the 'polarization catastrophe' in ferroelectrics.

The increase of molecular polarizability is directly connected to the Raman effect, thus this model offers the basics for a quantitative explanation of the Surface Enhanced Raman Scattering (SERS) effect [1], different from the usual explanations of electromagnetic (EM) enhancement [2] due to the excitation of surface plasmons or to the chemical mechanism [2,3]. The basic difference between the proposed model and the usual EM enhancement theory is that the actual model supposes that the molecule is polarized by the simultaneous action of the external field and by its own image in the metal, whereas the 'standard' EM enhancement supposes the excitation of plasmons in the metal, and the field produced by these plasmons strengthens the incoming EM field. In order to achieve a consistent SERS amplification factor, the distance from a molecular dipole to the metal layer should be on the order of magnitude of typical molecular dimensions, defined as $V_p^{1/3}$, where V_p is the 'polarization volume' of the molecule, connected to its polarizability in absence of the metal surface $\alpha_0 = 4\pi\in_0 V_p$: thus, only metals which are not separated from the analyzed media by a native oxide layer (which often exceeds by several orders of magnitude $V_p^{1/3}$) are effective for SERS. This is the case of Au or Ag substrates. Furthermore, the presence of concavities on the metal surface also increases the amplification factor, thus nanostructured surfaces provide more SERS amplification. One direct consequence of these evaluations is that nano-fabrication efforts aiming to match the typical nanostructuring lengths with the plasmon wavelengths in the metal are useless: one just need nano-cavities with radii as close as possible to $V_p^{1/3}$. By taking into account also the statistics of molecular adsorption/desorption processes on the metal surfaces, the dependence on the fourth power of the intensity of the incident EM field is obtained, together with a temperature dependence as $1/T$. A time-dependent theory allows one to quantify the observed shifts between the plasmon frequencies in the metal and the maxima of SERS amplification factors.

Other effects which may be foreseen by such theory of image dipoles include the realization of a permanent dipole moment and hysteretic behavior for non-polar molecules, the strengthening of the dipole moment for polar molecules, and the conversion of rotational degrees of freedom into vibrational ones. As for practical applications, apart for the ability to provide quantitative SERS analyses, this model may be used to explain the stabilization of single domain states in ferroelectric thin films (or even that of the ferroelectric state itself), whereas the ability of noble metals to promote

molecular dissociations around them may have applications in biochemistry, water purification and cancer treatment.

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S1 L7

UNIVERSAL FERMI LIQUID CROSSOVER AND QUANTUM CRITICALITY IN A MESOSCOPIC SYSTEM

A. J. Keller[1], L. Peeters[1], C. P. Moca[2,3], I. Weymann[4], D. Mahalu[5], V. Umansky[5], G. Zaŕand[2], and D. Goldhaber-Gordon[1]

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Quantum critical systems derive their finite temperature properties from the influence of a zero temperature quantum phase transition. Quantum phase transitions and quantum criticality are essential ingredients for understanding unconventional high-T_C superconductors and the non-Fermi liquid properties of heavy fermion compounds. However, the microscopic origins of quantum phase transitions in complex materials may be debated, such that it is contentious to validate what should happen in the vicinity of a quantum critical point. Here we demonstrate experimentally, with support from numerical renormalization group calculations, a universal crossover from quantum critical non-Fermi liquid behavior to distinct Fermi liquid ground states in a highly controllable quantum dot device. Our device realizes the non-Fermi liquid two-channel Kondo state, which results from a spin-1/2 impurity being exchange-coupled equally to two independent electronic reservoirs. Arbitrarily small detuning of the exchange couplings results in conventional screening of the spin by the more strongly coupled channel, far below a Fermi liquid scale T^*. We extract a quadratic dependence of T^* on gate voltage close to criticality and validate an exact conformal field theoretic description of the universal crossover between strongly correlated non-Fermi liquid and Fermi liquid states.

S1 O1

PREDICTION OF ALMEN INTENSITY IN SEVERE SHOT PEENING ON COMMERCIALLY PURE TITANIUM TO SURFACE NANOCRYSTALLIZATION USING ARTIFICIAL NEURAL NETWORK

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Material failures, in most cases occur on their surfaces, since surface modification is one of the most effective techniques to improve the strength of materials. Nanocrystallization is one of the effective approaches to improve the mechanical properties of the materials and components surface. Severe plastic deformation (SPD) methods such as equal channel angular pressing (ECAP), high pressure torsion (HPT) and constrained groove pressing (CGP) are have been increased in importance due to superior mechanical properties evolution and nanostructured grains build up. Besides, severe shot peening (SSP) has been using as a SPD method in recent years and applied converting microstructure to nanostructure just below the surface. Almen intensity is the most effective parameter of SSP process. Artificial neural network (ANN) are widely used in different science and engineering problems to predict and optimize nowadays. In this paper the abilities of ANN to predict the Almen intensity have been investigated. In order to network's training the back propagation (BP) algorithm is employed. Data of experimental tests on commercially pure (CP) titanium specimens are used to networks training. Surface coverage, peening time and air pressure are regarded as input parameters and the Almen intensity is considered as an output parameter. Obtained average error in prediction of Almen intensity is less than 1.6 % and the value of Pearson correlation coefficient (PCC) is more than 0.99 %, so they are acceptable. Comparison of obtained predicted and experimental values confirms that the networks are tuned finely and the ANN can be used to predict the SSP effective parameters such as Almen intensity.

S1 O2

μ_3-OXO TRINUCLEAR IRON CARBOXY-CLUSTERS AS EFFECTIVE ALTERNATIVE SOURCES FOR THEIR OXIDE NANOPARTICLES

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Iron oxide nanoparticles are interesting for both fundamental and applied research due to a set of properties characteristic for this class of materials: environmental stability, biocompatibility, magnetic properties and large availability from the primary resources all over the planet. The iron oxides are required in different areas such as: drug delivery, magneto-caloric refrigeration, electrochemistry, catalysis, etc[1,2]. For industrial and biomedical applications, it would be desirable to control in an exact manner the shape and size of iron oxide nanoparticles directly by the preparation

process. As precursor for the preparation of such nanoparticles are mainly used metal salts. The use of iron coordination compounds for this purpose was less studied.

Therefore, starting from iron coordination compounds (μ_3-oxo trinuclear carboxy- clusters), we prepared metal oxide nanoparticles by using different methods such as calcination, microwave and ultrasound irradiation, solvothermal and thermal decomposition method. By variation of reaction parameters such as the nature and concentration of the precursors, solvent type, various additives, the reaction temperature and time, it was possible to achieve the control over the shape, size and crystallinity of the nanoparticles. Either amorphous or crystalline oxide nanoparticles with desired well-defined shapes, such as cubic, spherical, nanowires and hedgehog-like were obtained. There were also prepared mixed metal oxide nanoparticles which have been preserved metals ratio of precursor. The particles were analyzed using a wide array of complementary techniques: spectral methods (FTIR, Raman, Mössbauer, DLS), diffractometry (WAXD and SAXS), magnetometry, microscopy (TEM, AFM) and thermal analysis.

Acknowledgments: This work was supported by a grant of the Ministry of National Education, CNCS – UEFISCDI, project number PN-II-ID-PCE-2012-4-0261, contract no. 53/2.09.2013.

Keywords: iron carboxy-clusters, iron oxide, iron-chromium oxide, nanoparticles.

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S1 O3

INFLUENCE OF ELECTRO-CODEPOSITION PARAMETERS ON TiO_2 NANOPARTICLES INCLUSION INTO NICKEL MATRIX: STRUCTURE, MORPHOLOGY AND CORROSION RESISTANCE

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Nanocomposites consisting of ultrafine particles of pure metal, ceramic and organic material in a metal matrix have long attracted the attention of science and technology. The electro-codeposition method consisting in the incorporation of particles during electrolytic deposition has the advantages of a uniform deposition on complex surfaces, low price, good reproducibility, homogeneous distribution of particles, capacity of waste continuous processing and reduction. This work provides some results of our experimental novelty in using 10 nanometer size of titanium oxide as dispersed phase during nickel electrocrystallization to obtain Ni/nano-TiO_2 nanocomposite coatings on stainless

steel support. The surface morphology of nanocomposite coatings was characterized by scanning electron microscopy (SEM). The composition of coatings and the incorporation percentage of TiO2 nanoparticles in the Ni matrix were studied and estimated by using energy dispersive X-ray analysis (EDX). X-ray diffractometer (XRD) has been applied in order to investigate the phase structure as well as the corresponding relative texture coefficients of the nanocomposite coatings. The electrodeposited nanocomposite coatings obtained were evaluated for their thicknesses (Fig. 1), roughness, nanohardness and corrosion resistance.

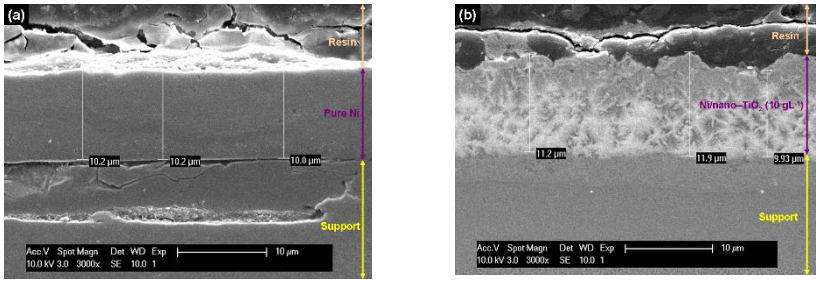

Fig. 1. Cross sectional scanning electron micrographs for coating thickness measurement of (a) - pure Ni and (b) - Ni/nano-TiO_2 ($10gL^{-1}$) nanocomposite coatings obtained at a current density of $40mA/cm^2$ and a co-deposition time of 15 min

The results show that the concentration of nano - TiO_2 particles added in the electrolyte affects the inclusion percentage of titania into nanocomposite coatings, as well as the corresponding relative texture coefficients, the roughness and thickness indicating an increasing tendency with the increasing concentration of nano-TiO_2 concentration in electrolyte. By increasing the amount of TiO_2 nanoparticles in the electrolyte their incorporation into nickel matrix also increases as well as the nanohardness and corrosion resistance.

Keywords: Ni / nano-TiO_2 composite coatings, Electron microscopy, Nanoindentation, Xray diffraction

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S1 O4

TRIBOLOGICAL NANOSTRUCTURED MULTILAYER THIN FILMS FROM COMPOUND MATERIALS CHARACTERIZED BY AFM AND RBS

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The tribological properties of a coating are strongly influenced by its composition as also by its roughness and nano or micro structure. Recent researches showed that nanostructures improve the tribological behaviour of a deposited material.

Nanostructured multilayer thin films with tribological properties were deposited by reactive and standard DC magnetron sputtering. One package and respectively five packages of three compound layers were successively deposited, in one single coating cycle, starting from Ti, TiB_2 and WC targets, using N_2 as reactive gas for the entire sputtering process. The same structures of packages from three layers were then made using N_2 only during the sputtering process for the Ti target.

Surface topography and hardness of the coating surface layer were investigated by Atomic Force Microscopy combined with nanoscratch hardness test. Composition of each sample was determined by Rutherford Backscattering

The characterizations showed that the sample with one package of three successively deposited constituent layers and lower percentage of N_2 had the lowest average value of the roughness and the highest value of the hardness. When N_2 was used as reactive gas for the entire sputtering process the measured roughness had significant increased value and the hardness measured by nanoscratch had lower value.

S1 O5

FRETTING-CORROSION BEHAVIOR OF Ni/WC HYBRID COATING SYSTEM FABRICATED BY ELECTRODEPOSITION

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Ni/WC hybrid coating systems were developed by electrodeposition method from a standard nickel Watts plating bath containing WC nanoparticles (mean diameter size of 60 nm). The

tribocorrosion (fretting - corrosion) performance of Ni/nano-WC hybrid coating systems and pure Ni coating were comparatively assessed with a linear reciprocating ball-on-flat sliding wear test under wet conditions. The corrosion resistance was measured by open circuit potential and electrochemical impedance spectroscopy without and under fretting conditions. X-ray diffraction, energy dispersive spectroscopy, and scanning electron microscopy were used to analyze the microstructure and morphology of the coating layers.

The open circuit potential (OCP) measured before, during and after the fretting tests as a function of time (Fig. 1) was used to evaluate the wet wear (tribocorrosion) behaviour, at room temperature in the solution that simulates the primary water of Pressurized Water Reactors (PWRs). Nanoindentation was used to measure surface hardness and the hardness profile of the coating systems.

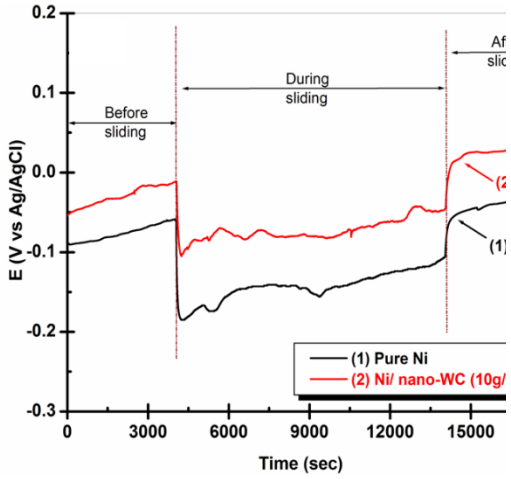

Fig. 1. Evolution of the OCP recorded before, during and after fretting tests of pure Ni and Ni/WC nanocomposite coatings at 1 Hz, 200 μm, 10000 cycles for the normal forces of 5N.

EDX analyzes have proved that WC nanoparticles were successfully incorporated into Ni matrix resulting in a hybrid metal nano ceramic coating system. Presence of nano-WC particles into nickel matrix transforms surface morphology from regular pyramidal to irregular global and changes the crystallizations of nickel matrix to smaller and thinner crystallites. Ni/nano-WC hybrid layer revealed a higher nanohardness value in comparison with pure Ni coating. The friction coefficient of Ni/nano-WC hybrid coating is smaller in wet conditions under similar experimental conditions as compared with pure nickel coatings, proving an enhancement of wear and corrosion resistance. The dimension of the wear track corresponding to Ni/nano-WC hybrid coating is smaller compared to the pure Ni one.

Keywords: electrodeposition, hybrid nanostructured composite coatings, WC nanoparticles, fretting-corrosion.

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S1 P1

AN ANALYTICAL - NUMERICAL MODEL FOR THE MOBILITY OF InGaN/InN/InGaN HIGH ELECTRON MOBILITY TRANSISTOR (DHEMT)

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An analytical - numerical model for the mobility of InGaN/InN/InGaN high electron mobility transistor (DHEMT)development. Salient futures of the model are incorporated of fully and partially occupied sub-bunds in the interface quantum well [1]. In addition temperature dependent of band gap , quantum well electron density , threshold voltage, mobility of electron[2] , dielectric constant , polarization induce charge density in the device are also take in to account. To calculate the 2DEGs mobility in InN-based HEMTs,the different scattering mechanisms such as dislocations scattering due to the large lattice mismatch, impurity scattering by remote donors and due to interface charge, interface roughness in InGa(Al)N/InN heterointerfaces, alloy disorder scattering due to penetration of the 2DEG wave function into the barrier and phonons scattering are considered.. The dependency of 2DEGs of mobility for both SHEMTs and DHEMTs on sheet carrier concentration is shown in Fig. 1. The sheet carriers generated in InN-based double channel are found to be higher than the reported values for the conventional single channel HEMTs . The calculated model results are in very good agreement with existing experimental data for high electron mobility transistors device.

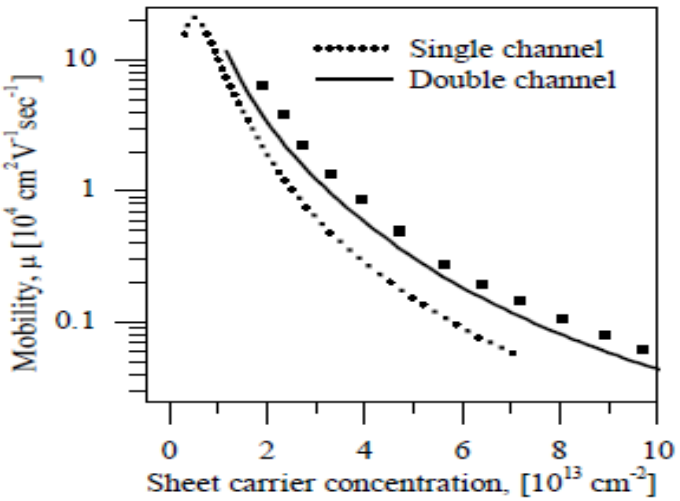

Figure 1 The dependency of 2DEGs of mobility for both SHEMTs and DHEMTs on sheet carrier concentration. Dot is the experimental data from Ref.[3]

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S1 P2

MAGNETIC PROPERTIES OF FERROFLUIDS WITH THE Fe_3O_4 AND $CoFe_2O_4$ NANOPARTICLES PROBED WITH POLARIZED MUONS

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The ferrofluid with Fe_3O_4 magnetic nanoparticles of 4.7 % vol. concentration in D_2O and the ferrofluids with $CoFe_2O_4$ magnetic nanoparticles of 0.5% and 3% vol. concentration in H_2O have been studied by using polarized muons. The relaxation rate and precession frequency of muon spin have been measured in the temperature range of 26-300 K in transverse to muon spin external magnetic field with sample cooling in the absence (ZFC) and in the presence (FC) of external magnetic field.

The relaxation rate of a muon spin in the Fe_3O_4/2DBS/D_2O was found to be much higher than in D_2O. A significant shift of the muon spin precession frequency in the Fe_3O_4/2DBS/D_2O was observed. It was shown that the shift of the muon spin precession frequency as a function of the external magnetic field can be described by the Langevin function, similar to magnetization of a paramagnetic substance. The mean magnetic field in the studied medium, determined by the polarization of the magnetic nanoparticles in an external field, was measured. The mean nanoparticle size was estimated.

It was shown that in the 0.5% $CoFe_2O_4$ concentration sample the precession frequency of the muon spin is the same as in pure H_2O. However the relaxation rate of the muon spin in this sample for both FC and ZFC measurements is larger than in H_2O.

The relaxation rate and the precession frequency of a muon spin in the ferrofluid with 3% concentration of $CoFe_2O_4$ nanoparticles depends on the cooling conditions of the sample, and they both differ significantly from the similar data for H_2O. The present results show that magnetic nanoparticles of cobalt ferrite have a high magnetic anisotropy. The mean magnetic field created by a single-domain nanoparticles in the ferrofluid has been found.

The work was performed in the Dzhelepov Laboratory of Nuclear Problems of JINR and the B.P. Konstantinov Petersburg Institute of Nuclear Physics.

Keywords: ferrofuids, magnetic nanoparticles, single-domain, μSR-method

S1 P3

INFLUENCE OF BENT-CORE AZOCOMPOUNDS ON FLUORESCENT PEPTIDES

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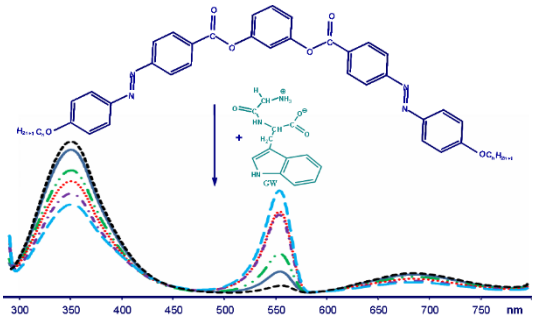
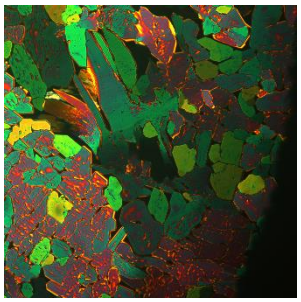
Due of potential applications as optical storage materials, bent-core liquid crystals containing azobenzene moieties present an increased practical interest, in particular as display devices. Moreover, the molecules which contain an azo linkage group have been explored due to their photochromism and photoisomerization potential.[1-3] Since the investigated compounds have optical properties characteristic to liquid crystals, the interaction with fluorescent peptides, such as glycyl-tryptophan or proteins might enhance their utility. Although the amino acids are also used to design novel enzymes, drugs and vaccines, fewer applications are described as analytical tools in the characterization of other organic compounds.[4,5] Therefore, we consider here that some optical properties of fluorescent peptides could be altered by the banana-shaped mesogens, and that they could bring new insights in the properties of these compounds.

Herein, the influence of alkyl terminal long chain on the optical properties of the investigated bent-shaped molecule compounds is studied. Usual techniques like NMR, IR and UV-vis spectroscopy were used for structural characterization. The liquid crystalline behavior was confirmed by differential scanning calorimetry (DSC) and optical polarizing microscopy (POM). The thermogravimetric study showed that the banana-shape derivatives have a good thermal stability, since the degradation of the compounds begins over the isotropization temperature.





The tryptophan-containing peptides could serve to synthesize new materials stating from the azo compounds with fluorescence properties. Hence, the present work provides a way of exploring complex systems in order to obtain such new materials with special optical properties.

Keywords: fluorescence, thermogravimetric analysis, liquid crystals.

Acknowledgements

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S1 P4

THE STABILITY OF HALF-METALLIC PROPERTIES FOR THE Zr_2CoIn FULL-HEUSLER COMPOUND

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The half metallic compounds are materials with metallic character in one of the spin channel and semiconducting character in the other spin channel (e.g. with an energy band gap at Fermi level [1]). Since half-metallicity was first predicted, numerous materials were studied by theoretical *ab initio* calculation and experimental verifications. Among the half-metallic materials, the Heusler compounds [2] received great attraction from scientific community due to their high Curie temperature.

We report results of density of states, bandstructure and magnetic bulk properties for the half-metallic Heusler alloy, Zr_2CoIn, investigated by means of *ab initio* calculations, within the Density Functional Theory framework.

The structural optimization was performed and the equilibrium lattice parameter calculated for ferromagnetic phase was 6.71 Å. The bandstructure of Zr_2CoIn for *optimized lattice parameter* presents *metallic properties* in majority spin channel and *semiconducting character* in minority spin channel.

The total moment per formula unit for Zr_2CoIn compound follows the Slater–Pauling rule for ternary 2:1:1 full-Heusler compounds with Hg_2CuTi-type structure (18-electron-rule) and it is equal to $2\mu_B$ at equilibrium lattice constant. The stability of the half-metallicity has been investigated by changing the lattice constant.

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S1 P5

COMPARATIVE STRUCTURE ANALYSIS OF WATER-BASED FERROFLUIDS OBTAINED BY DIFFERENT METHODS: SMALL-ANGLE NEUTRON SCATTERING INVESTIGATIONS

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Investigation of colloidal systems, which are consist of magnetic nanoparticles dispersed into a liquid medium, constitutes a specific trend in condensed matter science by enabling the use of magnetic particles in a wide range of technical applications and in medicine [1,2]. Manufacturing of new ferrofluids with the specified properties for biomedical purposes involves the development of new methods of synthesis of magnetic nanoparticles involves the development of new methods of synthesis of magnetic nanoparticles.

The basic requirement to ferrofluid in this case is biocompatibility of the liquid which is the basis of the colloid. For this reason, a mixture of water and agarose (polysaccharide, $C_{12}H_{18}O_9$) is used as the liquid carrier.

Data on the structure of magnetic fluids prepared by three different methods of magnetite nanoparticles synthesis [1,3,4] that have been studied by small-angle neutron scattering are compared in the work. The size estimated by SANS of magnetite nanoparticles contained in the corresponding systems and evaluated aggregation degree of considered magnetic liquids are presented in the work.

Keywords: ferrofluid, magnetic liquid, small-angle neutron scattering.

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S1 P6

FINE STRUCTURE OF Co^{2+} ENERGY LEVELS IN $KZnF_3$ CRYSTAL

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Transition-metal ions doped into ionic lattices are materials of technological interest due to their properties, especially as solid-state lasers. Lasers based on the $3d^3/3d^7$ ions doped in $KZnF_3$ are interesting for their tunability and their possibilities for high temperature performance [1, 2]. Co^{2+} belongs to this group, and his high efficiency as a dopant in $KZnF_3$ was demonstrated [1, 3].

Optical properties of fluoroperovskites have been studied by various authors [4-6]. These compounds can be described by the general formula AMF_3, where M is a divalent metal ion surrounded by six nearest-neighbor fluorine ions. In the doped compounds, the Co^{2+} ions substitute for M and occupy octahedral symmetry sites.

The aim of this paper is to model the crystal field parameters and simulate the fine structure of fine optical energy levels scheme of Co^{2+}:$KZnF_3$ system. The crystal field parameters were modeled in the frame of Exchange Charge Model (ECM) of the crystal field theory [7], taking into account the effects of the covalent bond formation between the Co^{2+} and F^- ions. The obtained parameters were used for simulating the fine structure of the system energy levels scheme, by diagonalization of the full matrix of the Hamiltonian, in the base of 100 wave functions of Co^{2+} ion. The electron-phonon interaction in $^4T_{2g}$ excited state is investigated in the frame of the Ham theory, with the Jahn-Teller stabilization energy calculation. The comparison of the calculated parameters with experimental data gives a satisfactory agreement, which confirms the used model and method.

Keywords: Exchange Charge Model, crystal field parameters, Co^{2+}.

Acknowledgements

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S1 P7

PROPERTIES OF ITO THIN FILMS DEPOSITED BY MAGNETRON SPUTTERING

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Keywords: ITO thin films, magnetron sputtering, optical properties.

Indium tin oxide (ITO) is one the most used transparent conductive oxides (TCO) as electrodes for solar cells or in electrochromic devices [1-4]. In this study ITO thin films were prepared on (100) Si and glass substrates by pulsed DC or RF magnetron discharge. For characterization, the surface elemental composition was determined using X-ray photoelectron spectroscopy (XPS). The film structure was derived from X-ray diffraction (XRD) data, while the optical properties were determined by UV-Vis spectro-photometry. The thickness of the deposited layers was measured using an interferential device AvaSpec 2048 (within the 250-1000 nm wavelength range).

Depending on the deposition conditions, some samples were crystalline (see Fig.1) . All the samples exhibit nearly the same transmission behavior. The transmittance mean values in the UV - Vis - near IR spectral range are about 80%. The electrical conductivity is low, while the surface elemental composition is almost the same like in the target.

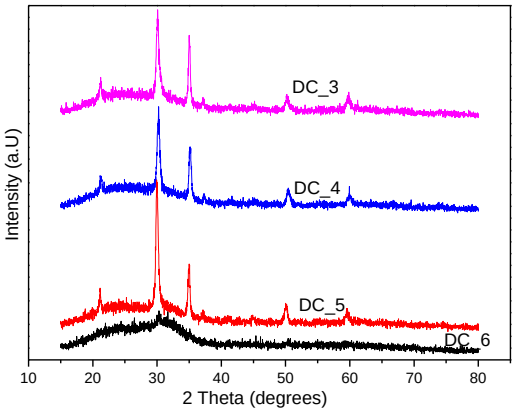

Fig.1: XRD patterns of ITO_DC films

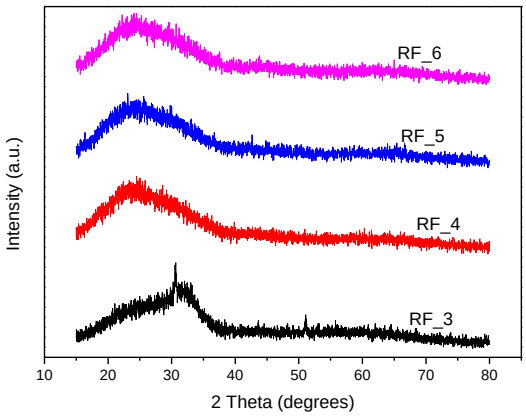

Fig.2: XRD patterns of ITO_RF films

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S1 P8

NANOSTRUCTURED Mo-B-C COATINGS

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Nanostructuring is a recognized way of preparing novel materials with properties significantly different from their bulk constituents [1]. Nanocomposite thin films, multilayers and nanolaminates were proven in many cases to be superior to conventional protective coatings due to their improved fracture toughness and wear resistance [2-4]. Moreover composite architecture is a step towards independent control of toughness and hardness.

X_2BC boron and carbon based nanolaminates exhibit a unique combination of high stiffness and moderate ductility [5]. However their synthesis temperature above 800°C impedes effortless applicability as a coating system. This temperature can be substantially reduced by a suitable choice of preparation method [6]. In this paper we report on microstructure and mechanical properties of Mo-B-C layers prepared by magnetron sputtering.

DC magnetron sputtering was used to prepare 1-2 μm thin layers on rotated hard metal and steel substrates with optional Mo interlayer. Various deposition parameters were tested. Microstructure of layers was studied using a Tescan LYRA 3XMU SEM×FIB scanning electron microscope (SEM), a Philips CM12 STEM transmission electron microscope (TEM, see Fig. 1) and a JEOL 2100F high resolution TEM. Thin lamellar cross sections for TEM observations were prepared using a focussed ion beam (FIB) in SEM. The microstructure observations were correlated with mechanical properties characterized by means of nanoindentation experiments using a Hysitron dual head TI950 triboindenter.

Figure 1. TEM image of partly crystalized nanostructured Mo-B-C layer on a steel substrate.

Special thanks go to Czech Science Foundation for financial support (Proj. 15-17875S).

Keywords: hard coating, local microstructure, electron microscopy

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S1 P9

ANALYSIS AND CONDITION MONITORING OF AGED OR RECYCLED POLYMERIC INSULATION MATERIALS FROM ELECTRIC AND ELECTRONIC ITEMS

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The management of increased volumes of electrical and electronic wastes requires a better use of incorporated plastics, avoiding destructive technologies, such as the combustion but improving their recyclability. Among different problems, the separation of plastic wastes and establishing their degradation level after usage and reprocessing are of crucial importance for subsequent applications of the recycled materials. The paper presents our results illustrating the possibilities of rapid discrimination between different widely used plastics (polyethylene, polystyrene, PVC, ABS, epoxy resins) based on their ATR-FTIR spectra hence enabling waste sorting as a main step of recycling. DSC and chemiluminescence methods are proposed for condition monitoring of these materials, based on either isothermal or non-isothermal measurements. The effect of reprocessing is highlighted by increased values of initial chemiluminescence intensity (I_0) as well as by reduced values of oxidation induction time (OIT) as compared to the initial, un-processed material.

S1 P10

EFFECT OF HEAT TREATMENT ON MANGANESE FERRITE OBTAINED BY ULTRASONICALLY ASSISTED HYDROTHERMAL METHOD

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Manganese ferrite represents a material that has been intensively studied because of its applicative potential and for fundamental point of view. Four powder samples of manganese ferrite (denoted by S1 – S4) have been synthesized by ultrasonically assisted hydrothermal method using $Fe(NO_3)_3 \cdot 2H_2O$ and $Mn(NO_3)_2 \cdot H_2O$ as precursors. The hydrothermal synthesis in microwave field, with immersed sonotrode in the reaction environment and ultrasounds applied directly to the working environment was used. Sample S1 was obtained at 80°C and the next three samples were subjected to heat treatment at 400°C (sample S2), 700°C (sample S3) and 1000°C (sample S4). The samples have been morphological and structural analyzed by SEM and XRD. Also temperature dependence of electrical resistivity of samples measured over the temperature range 30 – 300 °C.
Both XRD analysis and electrical measurements show that at temperatures larger than 200 °C $MnFe_2O_4$ (with spinel structure) begins transformation into $FeMnO_3$ (with perovskite structure) along with secondary compounds as Mn_2O_3 and Fe_2O_3. The results recommend using of $MnFe_2O_4$ with spinel structure in experimental investigations or in various applications at temperatures below 200 °C.

Keywords: $MnFe_2O_4$, ultrasonically assisted hydrothermal method, heat treatment, X-ray diffraction

Acknowledgments
This work was supported by the strategic grant POSDRU/159/1.5/S/137750, Project "Doctoral and Postdoctoral programs support for increased competitiveness in Exact Sciences research" cofinanced by the European Social Found within the Sectorial Operational Program Human Resources Development 2007 – 2013

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S1 P11

GROWTH OF HIGHLY (110)-, (001)- AND (111)-TEXTURED IRIDIUM THIN FILMS ON MgO SINGLE-CRYSTAL SUBSTRATES

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Integration of ferroelectric thin films for high frequency capacitors in small chip-scale package still represent a complex issue. One of the main technological challenges is to find a suitable electrode material with low electrical resistivity, good thermal stability, high resistance to oxidation and good adhesion both to substrate and ferroelectric film. Iridium is one of the densest and the most corrosive resistant metal known which stops oxygen diffusion without getting to resistive. It was of interest to obtain a defined texture of Ir thin film in order to achieve a homogeneous texture of the ferroelectric thin films knowing that the physical and electrical properties are strongly related with crystallographic orientation. The growth of iridium thin films on MgO single-crystal substrates of (001), (110) and (111) orientations was investigated. The thin films were obtained by dc sputtering at 600 ^oC substrate temperature. Highly (001)-, (110)- and (111)-textured Ir thin films with different surface morphology were obtained on (001), (110) and (111)MgO, respectively. The iridium films present notable atomic-scale smooth surfaces. The surface morphology and texture differences of iridium thin films can be explained by the competition between the low-energy film/substrate interface and the low surface energy of film and the lattice matching between the two materials. The results of our study sugest that the Ir thin film can be successfully used at the same time as bottom electrode material and template layer for growth of ferroelectic thin films with controlled and improved properties.

Keywords: iridium, ferroelectric, electrode, texture

Acknowledgements: This work was funded by UEFISCDI, project number 21/Ro-Fr/2014.

S1 P12

UV-INDUCED FORMATION OF GOLD NANOPARTICLES IN PHOTOPOLYMERIZABLE GLYCOMONOMERS

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Nowdays, polymeric materials are significant components of every field of human activities, being a part of our daily life. Through the incorporation of metal nanoparticles (NPs) within the polymer matrices versatile materials with interesting electrical, optical, or mechanical properties useful for applications in optics, catalysis, sensor design, photoimaging and patterning, and as antimicrobial coatings can be achieved. An elegant and accessible way for the obtaining of such materials is represented by the *in situ* synthesis of noble metal NPs created during the polymerization process, method that offers a greater control over the particles size and their distribution. Taking in consideration these aspects our group taken in study the hybrid nanocomposites with Au NPs starting from different photoactive urethane carbohydrates. Given the importance of the organic matrix for the control of the size/shape of the Au NPs, we also incorporated in the formulations other monomethacrylates with a –SH group or cationic/anionic functionalities in order to study the influence of the monomers on the characteristics of the in situ formed Au NPs and on the properties of the final materials. These hybrid materials were investigated by UV–vis and fluorescence spectroscopies, TEM microscopy, EDX, XRD, and SAXS analyses. The fluorescence of such optical coatings based on glycopolymer/Au NPs may be explored in constructing biosensors or imaging applications.

Keywords: glycomonomers, gold nanoparticles, photopolymerization, hybrid polymer comoposite.

Acknowledgments. A. L. Chibac is thankful for the financial support offered by European Social Fond—"Doctoral and postdoctoral programs—support for increasing research competitiveness in the field of Exact Sciences"—ID POSDRU/159/1.5/S/137750, Sectorial Operational Programme Human Resources Development.

S1 P13

FABRICATION OF CHITOSAN/XANTHAN MULTILAYER FILMS ON POLYLACTIC ACID SUBSTRATES

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This work aims to investigate the fabrication and properties of multilayers from biopolymers on corona treated polylactic acid substrates.

The corona treatment of the substrates was done in a point-to-plane three-electrode corona discharge system consisting of a corona electrode (needle), a grounded plate electrode, and a metal grid placed between them. A voltage of 5 kV was applied to the corona electrode and 1 kV to the grid. The samples were charged at a temperature of 30 °C for 5 minutes.

Chitosan/xanthan multilayer films were formed by two technics - alternative dipping of the corona charged polylactic acid substrate into chitosan and xanthan polyelectrolyte solutions or by alternative spin coating of these solutions. Fot these purposes 0.1% chitosan solution and 0.05% xanthan solution in acetate buffer (pH 4.5 and ionic strenght 100 mM) were used. . The binding of the biopolymers was irreversible over the time of the deposition.

The films were examined by FTIR spectroscopic and laser refractometric measurements. Morphological investigation of the surface was carried out by microscopic method.

The FTIR spectra of the films with multilayers indicated the presence of chitosan and xanthan. The intensity of the typical bands was found to increase as the number of the deposited layers grew.

The refractive index of the multilayers was investigated by the method of the disappearing diffraction pattern using a laser refractometer at wavelengths of 405 nm, 532 nm and 635 nm with an experimental uncertainty of $\pm 5.10^{-4}$. As the evanescent field penetration depth is less than 1 μm, the measurements of the refractive index were performed in a surface layer with a thickness of about 1 μm. According to the Lorentz-Lorenz equation for the complex multilayer system, the average layer thickness was calculated.

Acknowledgements

This study was financial supported by Project NoDFNI B-02/7 of Bulgarian National Scientific Fund .

Keywords: polylactic acid, multilayer films, transmittance spectra, refractive index

S1 P14

STRUCTURAL INVESTIGATIONS OF CIGS THIN FILMS DEPOSITED BY MAGNETRON SPUTTERING TECHNIQUE

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Copper indium gallium selenide (CIGS) thin films with various thicknesses (750 – 1200 nm) were deposited by RF magnetron sputtering method. To simplify this procedure for deposition of chalcopyrite-type thin films, only a single CIGS sintered target was used.

Deposition conditions for this study were: Ar pressure $p = 4 \times 10^{-4} – 4.3 \times 10^{-4}$ Torr, deposition rate r_d = 1.6 – 1.7 Å/s, 100 mm diameter target (CIGS circular disk of 99.99% purity).

The CIGS layer deposited on Mo coated glass substrate, with a thickness of 500 nm. Next, a CdS layer of 60 nm was deposited by thermal vacuum evaporation technique. The top transparent contact electrode, ITO, was subsequently deposited by RF magnetron sputtering method. Atomic force microscopy (AFM) and scanning electron microscopy (SEM) investigations showed that the surface morphology changes depending on the deposition techniques and it is influenced by the increase in thicknesses of the layers..

Profilometry measurements showed evidence of changes in the step of the deposited layers, due to the interdiffusion from the level of each deposited layer or that will be deposited. From X-ray diffraction (XRD) measurements it was found that all films were polycrystalline. CIGS films have a tetragonal structure with (112) plane parallel with the surface of the substrate, and the grain size is influenced by thickness. The influence of thickness on the samples electrical and optical properties was also studied by quantum efficiency measurements.

S1 P15

INFLUENCE OF PRECURSOR CRYSTALLINITY ON PHOTOCATALYTIC PERFORMANCE OF CdS/ZnS COMPOUNDS

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Hydrothermal synthesis is an appropriate method for obtaining calcogenic compounds used for photocatalytic water splitting that are active in the visible range of solar spectrum for photocatalytic water splitting reaction using solar radiation. CdS/ZnS based photocatalysts were

[1] Married as Garoi

obtained by Zn^{2+}exchange from ZnS with Pd^{2+} and Cd^{2+} in hydrothermal environment at 200℃. The product was characterized by powder X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive X-ray (EDX), transmission electron microscopy (TEM) and UV–visible spectroscopy (UV-VIS). Photocatalysis experiments for hydrogen evolution were conducted in the presence of sulfide ions under visible light. The size of photocatalyst nanoparticles and the efficiency of water splitting reaction increases with increasing of ZnS crystallinity used in the hydrothermal process.

Keywords: photocatalysis, ZnS/CdS, water splitting

Aknowledgements
This work was carried out through the Partnerships in priority areas - PN II program, developed with the support of MEN - UEFISCDI, project no. PN-II-PT-PCCA-2013-4-1708, and partially by the strategic grants POSDRU/159/1.5/S/137070 (2014) and POSDRU/159/1.5/S/134378 of the Ministry of National Education, Romania, co-financed by the European Social Fund – Investing in People, within the Sectoral Operational Programme Human Resources Development 2007-2013.

S1 P16

PROPERTIES OF TRANSPARENT CONDUCTING TI-DOPED IN_2O_3 THIN FILMS PREPARED BY RF MAGNETRON SPUTTERING

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Transparent conductive oxide (TCO) films of Titanium doped Indium Oxide (ITiO) was deposited by the dual target type radio frequency magnetron sputtering (RFS). In order to investigate the possible application of In_2O_3 films as a transparent conducting oxide (TCO), ITiO films were prepared by RF magnetron sputtering method. The effects of doping concentration on the structural and electrical properties of In_2O_3 films were mainly studied experimentally. Doping of Ti was performed with 0.5 wt% to 5.0 wt%, and the substrate temperature was 300˚C. The applied pure Ar gas pressure was at 10 mTorr during the deposition. And the supplied RF power was 300 W for 30 minutes. The optimum growth conditions were obtained for the films doped with 2.5 wt% of Ti, which exhibit a resistivity of 1.14×10^{-4} Ω-cm associated with a transmittance of 82% for 570 nm in film thickness in the wavelength rang of the visible spectrum as shown in Fig. 1. However, a high doping concentration with 5.0 wt% of TiO_2 may induce high defect density and limit the growth of small grains.

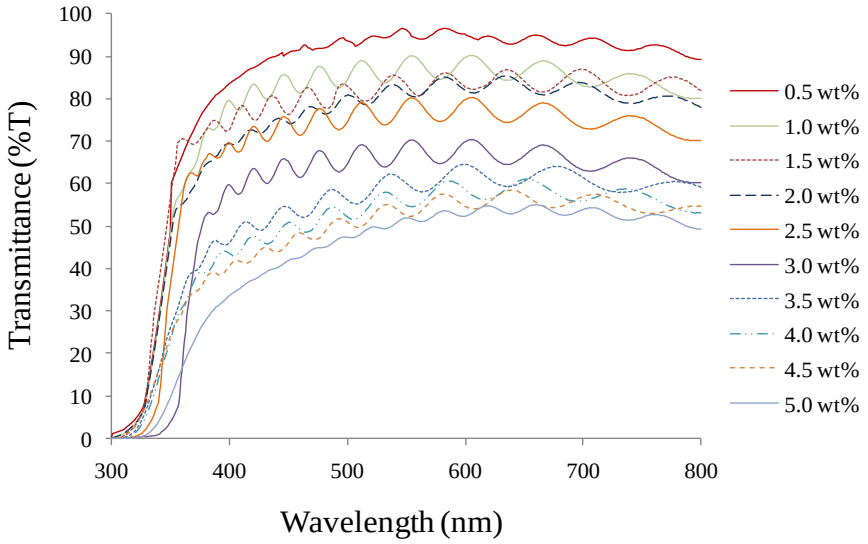

Fig. 1 Optical transmittance spectra of the ITiO film with different Ti doping amounts.

Keywords: Transparent conducting oxides, Titanium doped Indium Oxide, Resistivity

Acknowledgements

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S1 P17

DEPOSITION OF POLYELECTROLYTE MUTILAYER FILMS MADE FROM CHITOSAN AND XANTHAN ON BIODEGRADABLE SUBSTATE: EFFECT OF PH AND IONIC STRENGHT

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The aim of the present work is to investigate the effect of pH and ionic strenght on the deposition of chitosan/xanthan multilayers on preliminary corona charged substrates from polylactic acid. The multilayer films were formed by alternative dipping the substrate into chitosan and xanthan polyelectrolyte solutions. For this purpose 0.1% chitosan solution and 0.05% xanthan solution in acetate buffers with pH 4; 4.5 and 5 and ionic strenghs 0; 0.01; 0.1 and 1 mol/l were used. The film properties were investigated by FTIR, AFM, laser refractometry and some physico-chemical methods. It was found that the binding of the polyelectrolytes to the substrate was irreversible over the time of the deposition. The investigated parameters were found to depend on both pH and ionic strength of the polyelectrolyte solutions. This behaviour was attributed to changes in charge density of the polyelectrolytes and screening effect of the counterions.

Acknowledgements

This study was financial supported by Project No DFNI B-02/7 of Bulgarian National Scientific Fund.

Keywords: Polyelectrolyte multilayers, chitosan, xanthan, pH, ionic strengh, refractive index, AFM

S1 P18

MATERIALS MICROSTRUCTURE CHARACTERIZATION USING HIGH RESOLUTION NEUTRON DIFFRACTON

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The neutron diffraction has a great potential for the characterization of the microstructural parameters of various constructional materials due to some important advantages of the method: high penetration power of the neutrons, good spatial resolution, applicability for multiphase materials (composites, ceramics, alloys, etc.), non-destructive character of the method, possibility to study materials microstructure and defects (microstrain, coherently scattering crystallite size, dislocation density, etc.). In combination with the time-of-flight (TOF) technique at pulsed neutron sources, this method allows to determine lattice strains along different (hkl) directions simultaneously, i.e. to investigate mechanical anisotropy of crystalline materials on a microscopic scale. In current work several typical examples of materials microstructure studies performed on Fourier Stress Diffractometer (FSD) [1] at the IBR-2 pulsed reactor in FLNP JINR (Dubna, Russia) were given.

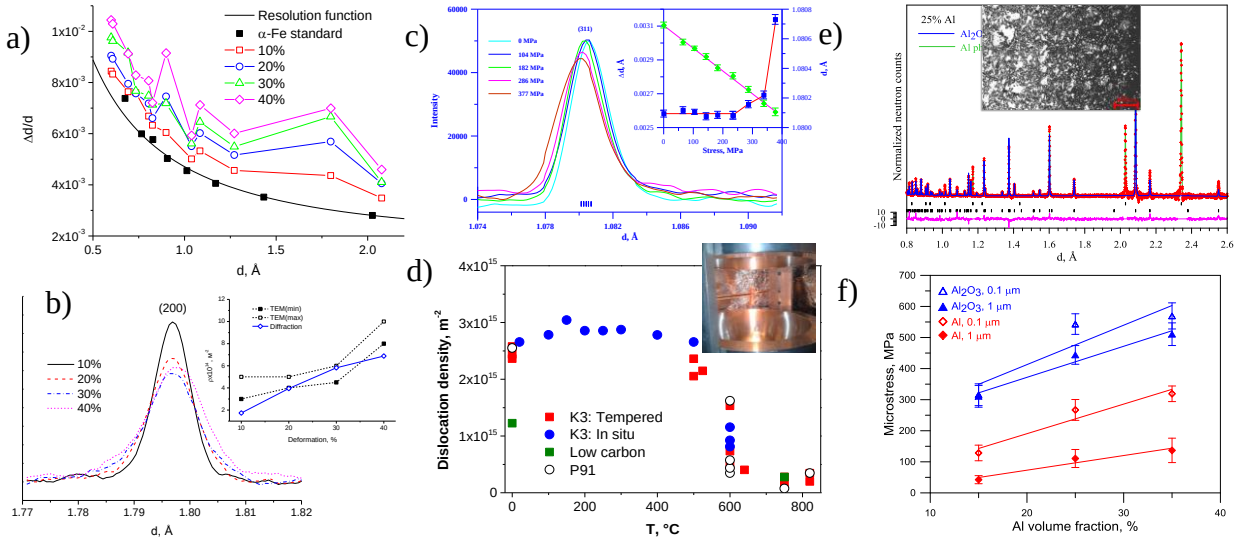

Fig. 1. a) Resolution function for 16Cr-15Ni-3Mo-1Ti austenitic steel specimens at different degrees of plastic deformation. **b)** The shape of diffraction peak (200). Inset: dislocation density by neutron diffraction and TEM [2]. **c)** Austenite (311) peak shape and width (inset) vs. applied uniaxial load [3]. **d)** Dislocation density in ferrite-martensite steel vs. tempering temperature. Inset: studied specimen in mirror furnace. **e)** The neutron diffraction pattern from the Al_2O_3/Al ceramic matrix composite with 25% vol. Al phase and metallic inclusions size ~1 μm [4]. Inset: microscopic image of composite microstructure. **f)** Residual microstress in the Al_2O_3/Al composites with fine- and coarse-grained microstructures.

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Keywords: *neutron diffraction, microstructure, peak broadening, dislocation structure*

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S1 P19

ABOUT STRUCTURAL ORDERING OF PROTEINS IN WATER SOLUTION

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The results of structural ordering of quasi-monodisperse apoferritin and ferritin in water solution are presented. It is well known that ferritin (apoferritin with iron nucleus) plays a key role in iron metabolism activity in living organisms. The interest in studying ferritin (apoferritin) arises because it is very likely to be a candidate for cancer and biological age marker [1]. Some apoferritin constructions could also be used as a vaccine against influenza diseases [2].

We studied water solutions of apoferritin with the help of SAS X-Rays and neutrons. Three instruments have been used for the experiments: BM29, ESRF, Grenoble, France; installation Rigaku, Laboratory of Advanced Studies of membrane proteins, MIPT, Russia; and YuMO spectrometer, IBR-2, Dubna, Russia [3]. We obtained invariants such as radius of gyration, volume, and the intensity extrapolated in zero angle of value of modulus scattering vector. The exclusive chromatography for cleaning of the protein was used. We demonstrated that in water solutions the proteins interact with each other even at low concentrations. Also, we recovered the form-factor and the structural factor from the SAS curves. It follows that the distance between individual protein assemblies is about 250Å for some of the highest concentrations. This allowed us to suggest a model of structural ordering for protein molecules in solution. Finally, we studied the sensitivity of SAS curves to fluctuations in protein structure by computational methods of molecular docking.

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Keywords: iron metabolism, proteins, proteins interaction in solution, apoferritin, small angle scattering

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S1 P20

MORPHOLOGICAL AND COMPOSITINAL INVESTIGATIONS OF TiO_2:Ag; TiO_2 :N_2 AND TiO_2:Ag+N_2 COATINGS OBTAINED BY MAGNETRON SPUTTERING DEPOSITION METHOD

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The purpose of this work is to make first morphological and compositional investigations of TiO_2:Ag; TiO_2:N_2 and TiO_2:Ag+N_2 coatings by standard and reactive magnetron sputtering in RF and DC.

Three types of samples were prepared for measurements in order to further determine proper concentrations of doping materials: first sample is deposited by standard RF and DC magnetron sputtering from TiO_2 and Ag targets; second sample is made by RF magnetron sputtering of TiO_2 using N_2 as reactive gas and the third sample is obtained by reactive RF and DC magnetron sputtering from TiO_2 and Ag targets using N_2 as reactive gas.

The surface topography of the coatings was investigated by Atomic Force Microscopy and the composition by Rutherford Backscattering Spectrometry.

The AFM characterizations prove that the roughness have significant lower value for the coating un-doped with Ag. The RBS measurements show a higher concentration of Ag, which means a much higher rate of sputtering for Ag than for TiO_2. Further experiments will employ higher RF power for sputtering of TiO_2 and lower DC power for sputtering of Ag in order to evaluate their photo-catalytic and self-sanitizing properties.

S1 P21

RECENT RESULTS FROM THE GRAINS REFLECTOMETER AT IBR-2 REACTOR

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GRAINS reflectometer is a new multinational reflectometer at the IBR-2 reactor with the horizontal plane of the sample. This instrument can conduct an experiment on the reflection from the interface with the liquid samples. The aim of our study was to test the use this reflectometry for the study of liquids and liquid nanosystems. And also explore colloidal systems (feroflyuids) at the interfaces with the solid, as well as air. This study is due to the fact that it has been shown earlier contrast structural characteristics at the interface and in the bulk solution. As an object of study were chosen ferofluids with different method of preparation and concentration. These magnetic systems are primarily interested in the study of its use as a multiple techniques and biomedical applications. But at this stage there is a question about how to prepare more stable and more concentrated solutions. The study of these systems at the interface will enable the understanding of destabilization of the magnetic fluid in the future will lead to the possibility of preparation of magnetic systems with the given parameters, which can save a lot of years. On the reflectometer it was received reflection from the interface for these systems at the boundary with the silicon. Results. that predominantly adsorb to the boundary polydisperse magnetic particles coated with a surfactant. We studied the influence of gravity on the adsorption properties of the system (was measured in different geometries). And it shows that the effect increases with increasing concentration, that is increased in size and weight aggregates. A reflection from the water air interface for the study of capillary waves at the interface. These are correlated with the data obtained on the X-ray reflectometry.

Keywords: neutron reflectometry, adsorption of magnetic particles, magnetic fluids, GRAINS reflectometr.

S1 P22

THERMOANALYTICAL AND INFRARED STUDIES OF VERY DEGRADED WOODEN ARTEFACTS CONSOLIDATION WITH A RADIATION-CURING RESIN

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Wood artefacts conservation by gamma irradiation is a technique with perspective of increased use. Highly degraded wood is impregnated with a standard unsaturated polyester resin in liquid state which is then polymerized *in-situ* by gamma ray irradiation. Moreover, the disinfection of artefacts can be done based on the biocide effect of gamma irradiation and the application of a dose that does not affect the physical-chemical properties of the material. The consolidation by radiopolymerization has two distinct phases: an impregnation step and a polymerization step. Firstly, impregnation consists in the diffusion of unsaturated polyester oligomers dissolved in a reactive solvent, such as styrene, into the pores of a deteriorated artefact. Secondly, in the presence of gamma radiation, the free radicals from styrene molecules will interact with the free radicals on polyester, creating styrene bridges between the linear polyester oligomers. The result of this radiation-curing is the formation of a three-dimensional macromolecular structure that fills the pores of the artefact, ensuring increased mechanical resistance to the artefact.

For identifying the changes in the wood structure as well as the success of the consolidation method, we correlated the infrared spectroscopy results and the thermogravimetric ones. In order to obtain them the Bruker Vertex FTIR/FT-Raman spectrometer and the TG/DSC - Netzsch STA 409 PC Luxx Simultaneous Thermal Analyzer with TG/DSC-S sample carrier have been used. Vibrational spectra ensured information about changes in the molecular structure of different wood type components through biological or photophysical decay and *in situ* polymerization by irradiation and, on the other hand, the thermal analysis showed changes of chemical composition and thermal stability of wooden cultural heritage objects due to gamma irradiation consolidation and natural ageing.

Acknowledgement: This work was supported by an IFA-CEA grant, contr. no. C3-05/2013.

Keywords: radiopolymerization, wood artefacts, gamma irradiation, thermal analysis

S1 P23

ASSESSMENT OF THE METAL CONTAIN IN THE INSULATING POLYMERIC MATERIALS FROM ELECTRICAL ROTATING MACHINES USING ICP-MS.

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The insulators used for electrical rotating machines may undergo modification of the chemical structure in engine operation conditions. These modifications can occur because the metal ions migrate from the bulk metal to the insulator, or can favor the migration of ions. The insulating materials examined in these experiments are the polyesters, glass fabric materials imbued with epoxy resins and the alkyd melamine epoxy used as lacquer for the copper wires. In order to asses, the metal content we used the ICP-MS technique for the materials removed from the electrical rotating machines.

Key words: insulators, electrical machines, metal contain

S1 P24

THE STUDY OF OXIDATIVE STRESS ON THE POLYMERS USED AS INSULATORS FOR ELECTRICAL ROTATING MACHINES

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The purpose of this study is to determine the changes of ability to oppose the oxidative stress of insulating materials from the electrical rotating machines. The insulating materials examined in these experiments are the polyesters, glass fabric materials imbued with epoxy resins and alkyd melamine epoxy used as lacquers for the copper wires covering. The oxidation process makes all

types of insulation brittle and/or tends to cause delamination of the polymeric material and, therefore, the deterioration of the insulators may shorten the lifespan of the rotating machine. For this purpose, the materials were examined by the isothermal chemiluminiscence (CL) technique in order to establish the oxidation induced by the use as insulators for the electrical rotating machines. The kinetic parameters used for the characterization of the materials are induction period, maximum oxidation rate, half-period of ageing, maximum CL intensity, maximum degradation time, and activation energy.

Key words: oxidative, polymers, electrical machines

S1 P25

NUCLEATION OF PALLADIUM NANOSTRUCTURES IN PLATINUM-NICKEL MATRIX

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In order to prepare nanostructured films (Pd + Ni – Pt on Si or glass substrates) for use in the anode and cathode parts of fuel cells, the method of Thermionic Vacuum Arc (TVA) was used in a three electronic guns configuration. The nanostructured Pd + Ni – Pt films were characterized by Transmission Electron Microscopy (TEM), electron diffraction, Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray Spectrometry (EDXS) and galvanomagnetic analysis. The effectiveness of the catalytic reactions is increased by the transfer of electrons between the palladium cores and the Ni – Pt matrix. This study aims at increasing the economical efficiency of catalysts used in hydrogen fuel cells.

Keywords: nucleation, matrix, Pd + Ni – Pt, Si or glass substrates, TEM, SEM, electron diffraction, EDXS, TVA, galvanomagnetic analysis, fuel cells

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S1 P26

APPLICATION OF SOME CARBON-TUNGSTEN BASED NANOSTRUCTURES IN DIVERTORS COATING FROM FUSION REACTOR

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The material choice for tokamak fusion reactors has allways been a compromise based mainly on experience with individual materials such as carbon fiber composites (CFCs), Beryllium, Aluminum or Tungsten. The key for coating different parts of the tokamak is forseen to be the proper combinations of these elements. One of the most remarcable results is presented by C-W combination, who needs to be able to resist long time during the thermo-nuclear plasma exposure inside ITER. For this reason we need to synthetize a material with the right coatings design, in order to have excellent tribological properties, while the structure, composed by complex nanocrystals, is surrounded by amorphous structures with a strong graphitization tendency, allowing the creation of adherent and wear resistant films.

For these reasons, the C-W structures (thin film) were characterized by Transmission Electron Microscopy (TEM), electron diffraction, Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray Spectrometry (EDXS) and galvanomagnetic analysis. Also we have investigated the ions interaction of D(^{2}H) and T(^{3}H) with the C-W thin films to evaluate the absorption and desorption values of the material and the stoping power range of ions in material. The TVA method is suitable for the synthesis of thin films because of its low cost and the simple variation of concentration.

Keywords: tokamak, divertor, C-W thin films, H absorbtion/desorbtion, TVA, TEM, SEM, electron diffraction, EDXS, galvanomagnetic analysis.

S1 P27

THE STUDY OF GMR EFFECT ON THIN LAYERS OF CuCoFe

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Thermionic vacuum arc was successfully used to prepare high quality nanostructure thin films with different fields of applicability. One advantage of this deposition technique was the ability to have a controlled range of thicknesses starting from few nanometers to hundreds of nanometers. The purity of the thin films was insured by a high vacuum pressure and a lack of any kind of buffer gas inside the coating chamber. Six multilayer samples were deposited on glass sublayer, and half of them were thermally treated for an hour at 300^0C.The samples were investigated using scaning and transmision electron mycroscopy while SEM and The magnetic properties were first studied by measuring the electrical resistance behavior for a magnetic field between 0,8 si 1,1 T, at different values of the sample temperature and using a nondestructive optical method called Magneto-Optical Kerr Effect (MOKE). The magnetoresistive effect obtained for the studied samples varied from 4% to 30%.

Keywords: magnetoresistive effect, thermionic vacuum arc, Magneto-Optical Kerr Effect (MOKE).

S1 P28

LATTICE DYNAMICAL AND THERMODYNAMICAL PROPERTIES OF WURTZITE BN AND InN

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The group-III nitrides are of utmost importance since these are considered as third generation semiconductors. Phonon excitations play significant role in non radiative electron relaxation process, electronic transport, thermodynamical properties, device engineering and design and other properties of interest for material characterization. The present work deals with the study of phonon dispersion, phonon density of states, specific heat and anisotropy for wurtzite phase of BN and InN. The study is based on theoretical approach by using de Launey angular force constant model. The results show larger optical frequencies at zone centre for BN as compared to InN. The calculated results are in good agreement with existing experimental results at zone centre and predict the complete phonon dispersion throughout the Brillion zone.

S1 P29

HYDROPHILIC VERSUS HYDROPHOBIC OLEATE COATED MAGNETIC PARTICLES

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The Magnetic nanoparticles (MNPs) in colloidal suspensions were prepared using ferric and ferrous salt precursors according to classical chemical route of co-precipitation in alkali reaction media [1]. Oleate ion from oleic acid was used to develop hydrophobic coating shell for ferrophase stabilization in hydrophobic medium (P1); sodium oleate was used to yield hydrophylic coating of MNPs in colloidal aqueous suspension (P2). XRD analysis revealed typical spinel structures in both samples with all characteristic peaks while VSM shown dominant superparamagnetic properties. Polydispersed but fine granulated iron oxide with rather symmetrical particle shape resulted from TEM data for P1 while some asymmetrical structures appeared in P2. SAXS investigation of the two diluted suspensions (Fig. 1) evidenced average values of about 7 nm (P1) and respectively 10 nm (P2) in good agreement with TEM measurements and ensuring good stability in suspension. The interpretation of different particle symmetry was based on coating shell arrangement differences, i.e. single oleate layer in hydrophobic colloidal MNPs compared to double oleate layer in hydrophilic MNP sample. In this latter case coated particle interaction seems to be favored resulting in some clusters with character of mass fractals (2.4 fractal dimension) as shown from SAXS data analysis. Various applications in technical and biomedical field could be designed based on the MNP samples stabilized with oleate since its biocompatibility was demonstrated in literature [2].

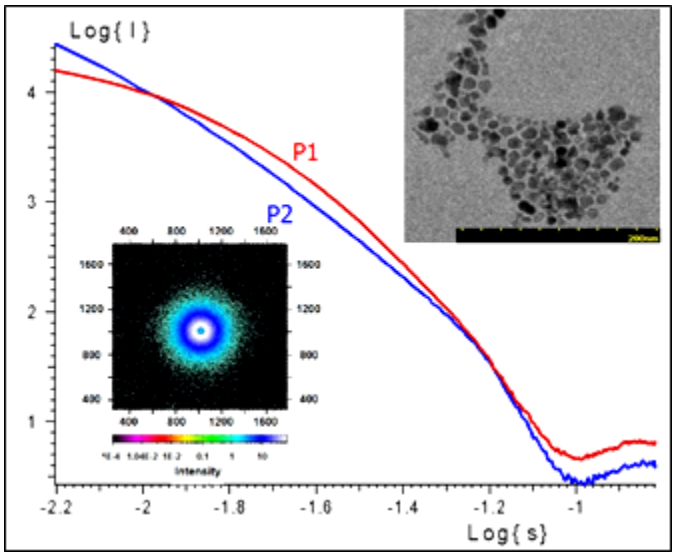

Fig. 1. Microstructural investigation on MNP samples

Key words: magnetic nanoparticles, iron oleate interaction, stable suspensions
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S1 P30

FERROELECTRIC TRANSITIONS IN $Ba_{1-x}Sr_xTiO_3$ SOLID SOLUTIONS

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Barium titanate-based ferroelectric materials have been extensively studied and successfully used in electrically controlled devices [1]. Among these, $Ba_{1-x}Sr_xTiO_3$ (BST) solid solutions have received special attention in the last years for their moderate dielectric loss and large tunability in microwave domain [2]. In addition, theirs transition temperatures can be tailored by strontium content and, hence, the electrical properties are adjust in order to fulfill the requirements of the specific applications. In this work, we report on the structural and ferroelectric transitions of barium strontium titanate solid solutions. Morpho-structural and dielectric properties of the $Ba_{1-x}Sr_xTiO_3$ samples with *x* strontium content between 0.1 and 0.75 will be presented. A special emphasis will be put on the BST samples with Curie point near room temperature. The experimental data will be discussed and compared with some previous results [3-6]. Moreover, based on our new output and some literature data, the phase transitions diagram [6] of the $BaTiO_3$ - $SrTiO_3$ system has been improved.

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S1 P31

SIZE DEPENDENT EFFECT ON THE FREE VIBRATION ANALYSIS OF NANOBEAMS WITH INTERNAL VISCOUS DAMPING

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The experimental observations have shown that the mechanical properties in nano length scales are dependent on the internal microstructure and the geometry as well. Internal viscous damping is associated to the viscosity of the structural material and is proportional to velocity. In this study, the modified couple stress theory is employed to investigate the effect of the internal viscous damping and size dependency on the vibration characteristics of nano-beams. The equations of motion for the vibration analysis are established and solved analytically for simply supported and clamped-free boundary conditions. Results are presented in terms of material damping coefficient. The effects of length scale parameter, internal viscous damping coefficient, boundary conditions and geometrical parameters on the damped natural frequencies are evaluated. The results indicate that the vibration characteristics of nano-beams are size-dependent and as the beam thickness for constant length scale parameter decreases, the difference between the classical and non-classical results increases. Also damping effect is dominant in upper vibration modes.

S1 P32

IMPROVING THE HYDROPHILIC PROPERTIES OF TiO_2 THIN FILMS BY DOPING

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We made attempts to improve hydrophilic activity of TiO_2 thin films by doping with different amounts of Nb and Cr. Films surface composition, structure and morphology were derived from X-ray Photoelectron Spectroscopy, X-ray Diffraction and Atomic Force Microscopy data, respectively. Surface wettability investigation showed that, by increasing the Nb amount in the titania films, results in a decrease of contact angle values from 40 deg. to nearly 0 deg. thus indicating a super-hydrophilic conversion under UV illumination. The optical band gap shifts towards higher energies, so these films can not be activated with visible radiation. In the case of Cr-doped TiO_2 films we have seen a significant red shift of the TiO_2 absorption edge, but the doped films did not show promising hydrophilic properties. To improve them, we have deposited Pt islands on their surface.

Keywords: Titanium dioxide, Hydrophilic activity, Wettability

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S1 P33

INTERACTION ENERGIES IN SOLUTIONS OF DIPOLAR ORGANIC COMPOUNDS

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Abstract:

The interaction energies between the components of dipolar solutions can be estimated on the bases of solvatochromic correlations which allow separating different types of interactions by their supply at the spectral shifts of the electronic absorption bands, spectral shifts induced by the modifications of the solvent nature. In the theory of the simple liquids, the dependence of the spectral shifts on the macroscopic parameters of the solvents allows to estimate some microscopic parameters of the spectrally active molecules.

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S1 P34

SpECTRAL MEANS TO ESTIMATE THE ENERGY OF INTERNAL INTERACTIONS IN LIQUIDS

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The spectrally active molecules are used as probes for measuring the amplitude of the internal electric fields in liquids. These molecules are introduced in pure liquids, or in mixtures of pure liquids, in very small concentrations ($10^{-3} - 10^{-5}$ mol/L). For this reason, the solutions are considered as being equivalent with independent subsystems made by one spectrally active molecule and an infinite number of solvent molecules arranged in solvation shells. In order to estimate the internal energy in liquid solutions, the hypothesis of the additivity of the molecular pair energies is adopted and the average number of the possible molecular pairs is estimated. If the nature of the intermolecular forces

is known, the total energy due to the internal forces can be computed. The experimental data from electronic absorption spectra are compared with those estimated on the bases of theoretical estimations.

S1 P35

MAGNETIC AND ELECTRICAL PROPERTIES OF $Ca_2Fe_{1-x}Ni_xMoO_6$ DOUBLE PEROVSKITES

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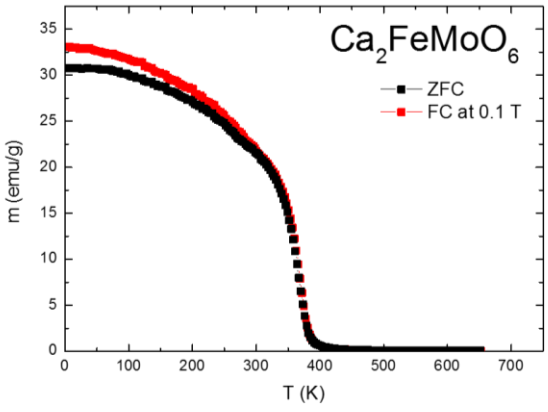
The Ca_2FeMoO_6 double perovskite is ferrimagnetically ordered, the Fe^{3+} and Mo^{5+} magnetic moments being antiparallely oriented. No presence of Ca_2NiMoO_6 compound has been reported. The above double perovskite was shown only in the strontium based system.

The $Ca_2Fe_{1-x}Ni_xMoO_6$ double perovskites have been prepared by solid state reaction. Solid solutions were obtained up to x = 0.2. Somewhat higher cobalt content (x = 0.5) can be substituted in Ca_2FeMoO_6. The $Ca_2Fe_{1-x}Ni_xMoO_6$ ($x \leq 0.2$) compounds crystyallize in a monoclinic-type lattice, having $P2_1/n$ space group. The lattice parameters increase as the nickel content is higher. From the composition dependence of the lattice parameters, a Ni^{2+} valence state is suggetsed. Thus, the nickel substitution leads to the formation of Ni^{2+}-Mo^{6+} pairs that replaced the Fe^{3+}-Mo^{5+} ones.

The saturation magnetizations, at 4 K, decrease from 3.48 μ_B/f.u. (x = 0), with a rate of 0.6 μ_B per substituted Ni atom. The presence of Ni^{2+}-Mo^{6+} pairs involves a decrease of magnetization with a rate of 1 μ_B per substituted Ni atom. The antisite effects as well as the cluster glass behaviour – Fig.1 – can explain the smaller rate for decreasing magnetization, as experimentally observed.



The $Ca_2Fe_{1-x}Ni_xMoO_6$ compounds show a metallic behaviour. The resistivities increase as the nickel content is higher. The above dependence can be correlated with the evolution of the number of Ni^{2+}-Mo^{6+} pairs. The magnetoresistivities were analysed considering both the intergrain tunneling contributions as well as the intragrain ones.

This work was supported by the Romanian Ministry of Education and Research (UEFISCDI), grant no. PN-II-ID-PCE-2012-4-0028.

S1 P36

EFFECT OF SUBSTRATE TEMPERATURE ON THE STRUCTURAL AND MORPHOLOGICAL PROPERTIES OF SILVER THIN FILMS DEPOSITED BY DC MAGNETRON SPUTTERING METHOD

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Silver (Ag) thin films are ideal reflecting and conducting electrodes for thin film solar cells. Silver thin films have been prepared by several techniques [1, 2]. In this investigation Ag thin films were deposited on silicon substrates by DC magnetron sputtering method under different substrate temperatures of 100-500ºC. The effect of substrate temperature on structural and morphological properties of the Ag films was studied by different analysis such as XRD, AFM and SEM.

The XRD results show that the crystallization of the Ag films improved by substrate temperature until 200°C and then by increasing of temperature from 200°C-500°C the crystallization decreased. The AFM images exhibited that the surface morphology of the films effectively influenced by substrate temperature and the RMS roughness of films increased by substrate temperature variation to 200 °C and then decreased by the temperature augmentation from 200°C -500°C. The Ag film prepared at substrate temperature of 200 °C has a maximum roughness. The AFM results confirm the results obtained by XRD.

Also, the SEM analysis was employed for morphological studies and measuring of particles size. It was found that the size of particles varied between 29-140 nm. The maximum size of particles is belonging to Ag films prepared at substrate temperature of 200 °C. The SEM results confirm the results of XRD and AFM. In conclusion, we can observe that the optimum substrate temperature for preparation of Ag films in our experiment is 200 °C.

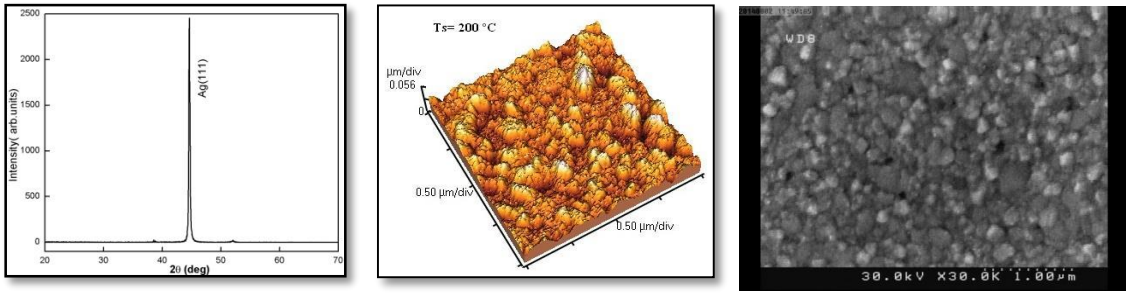

Figure1. The XRD, AFM and SEM images of Ag films prepared at substrate temperature of 200 °C.

ACKNOWLEDGEMENT

This work was supported by Islamic Azad University, Karaj Branch, Karaj, Iran.

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S1 P37

SYNTHESIS AND CHARACTERIZATION OF VA-MWCNTS COATED WITH SILVER THIN FILMS

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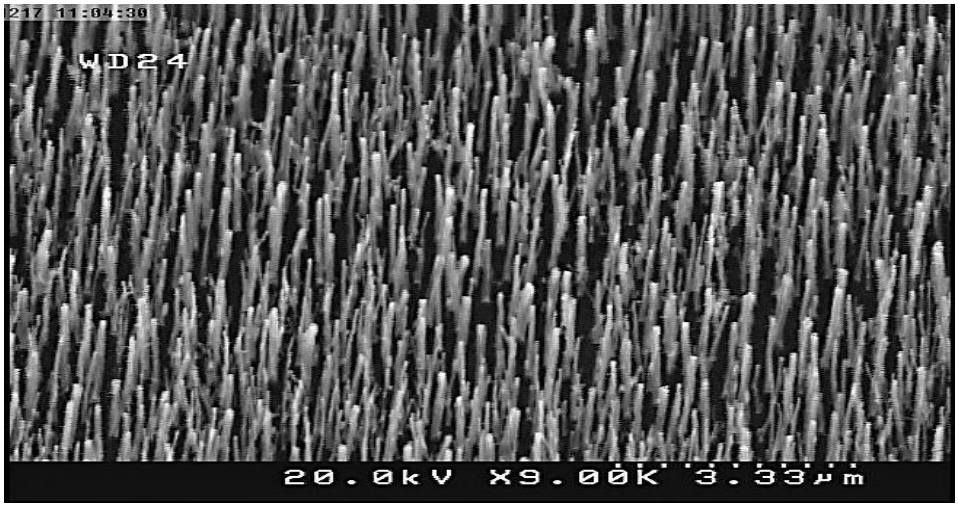
Due to the unique circumstances and characteristics of carbon nanotubes and properties of silver, Ag/MWCNT can be a good promising hybrid metal containing material in the field of composites. To this end, we synthesized Vertical Aligned Multi-Walled Carbon nanotubes (VA-MWCNT) using plasma enhanced chemical vapor deposition (PECVD) on silicon wafer through a thin nickel catalyst layer at a temperature of 650 °C. Silver Nano layers were deposited on the surfaces of VA-MWCNTs via DC magnetron sputtering with thicknesses of 20, 35, 60, 85 and 100 nm. Formation of silver layers on the surfaces of carbon nanotubes can attribute to different fundamental to industrial applications such as increasing antibacterial activity and biosensors. Influence of different growth conditions on the structure and composition of these layers were investigated by field emission scanning electron microscope (FESEM) and atomic force microscope (AFM) and X-ray diffraction, respectively.



FESEM Image of the prepared sample.

Keywords: PECVD, VA-MWCNT, DC sputtering, Silver thin films.

Acknowledgment: The second author, S. M. Borghei acknowledges full support from the Karaj Branch of Islamic Azad University, Karaj, Iran.

S1 P38

SOLVATOCHROMIC STUDY OF TWO PYRIDAZINIUM YLIDS BINARY SOLUTIONS

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The wavenumbers in the maximum of intramolecular charge transfer (ICT) visibile band of two pyridazinium ylids binry solutions was correlated with Kamlet and Taft empirical parameters. A linear solvation energy relationship (LSER) allow to separate the contributions of each type of interactions to the total spectral shift. The supply of universal and specific interactions to the total spectral shifts was calculated. The Hildebrand's solubility parameter values, δ_H, are characterized by the energy needed to separate the solvent molecules and δ_H^2 was used as a measure of the enthalpy or Gibbs energy.

Keyword: pyridazinium ylids, intramolecular charge transfer (ICT), , Hildebrand's solubility parameter, LSER.

Acknowledgment

This work was supported by the strategic grant POSDRU/159/1.5/S/137750

S1 P39

THE ITO THIN FILM PRODUCTION ADJUSTABLE SURFACE RESISTANCE AND TRANSPARENCY

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In this research, surface resistance and transparency of the indium tin oxide thin films were investigated. Indium tin oxide (ITO) is special semiconductor due to high optical transparency even in infrared region and high electrical conductivity properties [1,2]. It has been widely used in electronic and optoelectronic device applications such as organic photovoltaic and organic light-emitting diodes (OLEDs) [3-5]. It is known as a wide band gap semiconductor. RF magnetron sputtering technique was performed for the deposition of the ITO thin films on the glass substrates. Optical and surface morphological properties of produced thin films were investigated by UV-Vis spectrophotometer and atomic force microscopy (AFM). Our results show that ITO thin films with adjustable surface resistance and transmittance are suitable for industrial applications.

Keywords: ITO, transparent conducting oxide, thin film.

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S1 P40

AN INVESTIGATION ON SURFACE PROPERTIES OF A Sn-Doped GaAs THIN FILM PRODUCED BY TVA

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In this research, a Sn-doped GaAs thin film was deposited on a glass microscope slide under a high vacuum condition by means of the thermionic vacuum arc (TVA) method. The TVA plasma is an electrical discharge fired between a hot filament as cathode and a material to be evaporated as anode of a plasma diode. Surface properties of the produced sample were analyzed with an optical tensiometer and atomic force microscope (AFM). Contact angle measurements were realized to calculate the produced film's surface free energy. In order to understand the surface features of the deposited thin films, AFM analysis was carried out by non-contact mode at ambient condition. Structures are homogeny and nano-structured.

Keywords: thermionic vacuum arc, thin film, morphological properties, surface free energy.

S1 P41

OPTICAL, MORPHOLOGICAL AND SURFACE FREE ENERGY CHARACTERIZATION OF AN Al-Doped GaAs SEMICONDUCTING FILM

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In this study, an Al-doped GaAs film was deposited on a glass microscope slide by means of the thermionic vacuum arc technique. TVA technique is an original technique for thin film deposition in high vacuum conditions. The originality of the technique comes from the fact that no buffer gas is needed and the growing film is bombarded with energetic ions of the material to be deposited during deposition. The optical properties of the produced film were determined using a spectrophotometer. In order to understand the surface features and size distribution of the produced film, an AFM was used. Contact angle measurements of several testing liquids carried out by an optical tensiometer were used to characterize the sample in terms of wettability. The formation of microstructures were monitored clearly by the AFM device. TVA technique appeared as a suitable and promising technique for the production of AlGaAs films.
Keywords: Al-doped GaAs, optical properties, surface free energy, thermionic vacuum arc.

S1 P42

The Influence on Surface Properties of Mo Doping in GaN Growth Process

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Mo doped GaN thin film was produced by Thermionic Vacuum Arc (TVA) technique. TVA technique is based on the electron-induced evaporation and does not use a buffer gas such as argon, neon, or helium. We present a new deposition method for GaN thin films that produces in a very short production time. Physical properties of sample were analyzed with atomic force microscope (AFM), Uv-Vis spectrophotometer and optical tensiometer. The UV-Vis spectrophotometer result showed that produced film has a high transmittance in the visible region and near infrared region. Contact angle measurements of several testing liquids were used to characterize the produced film in terms of wettability. Our analysis showed that the TVA method present important advantages for optical and industrial applications.
Keywords: GaN thin film, thermionic vacuum arc, surface properties, surface free energy.

S1 P43

EFFECT OF POLYMER STRUCTURE ON THE ELECTRO-OPTIC PROPERTIES OF QUATERNIZED POLYSULFONES

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The frequency-dependent dielectric properties and conductivity of new functionalized polysulfones, obtained by chemical modification of chloromethylated polysulfones with different pendant groups are investigated.

The dielectric constants have low values, being dependent on the chemical characteristic of samples, in relation with the charge transfer complex and free volume and, consequently, with packing of the polymer chains and of the polarizable groups per volume units. Increasing of the dielectric constant with temperature represents a consequence of polarization enhancement and of a more intense oscillation of the molecules present in the films, while decreasing in the dielectric constant with increasing frequency is due to dielectric dispersion, as a result of the molecules lagging behind the alternation of the electric field, at higher frequency [1].

Two relaxations processes - γ and β - appear at different temperatures, being attributed to the differences between the pendant groups of polysulfones. Modification of electrical conductivity with temperature and frequency is dependent on the structural parameters of the samples. Thereby, the

linear dependence of conductivity with frequency around room temperature is due to electronic conduction via a hopping process. Consequently, the electrical conductivity of the studied samples can be explained in terms of band conduction mechanisms, through bandgap representation.

On the other hand, this study analyzes the possibility of using quaternized polysulfones with chelating groups in applications as reduction of heavy metal pollution in ecosystems [2].

The specific properties of new functionalized polysulfones recommend them for environmental applications and, also, as possible candidates in electrotechnical industry.

Keywords: dielectric properties; relaxations processes; functionalized polysulfones; metal-polymer complex

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S1 P44

FUNCTIONAL PROPERTIES OF COMPOSITE SYSTEMS OF ZnO NANOPARTICLES / POLYMER FIBERS

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Last century researches on synthesis and characterization of intelligent nanostructured systems known an increased development.

The aim of this study was to obtain and characterize nanostructured systems based on metal oxides and polymers which reveal piezoelectric and photocatalytic properties typical to intelligent materials with possible applications in electronics and medicine.

ZnO nanoparticles / polymeric fibers composites were obtained by electrospinning method using celulose acetho-butyrate (CAB). In CAB solution, part of -H atoms from free OH groups are replaced by acetyl groups (R1) and buhyryl groups (R2). Using a method described in literature [1,2], we prepared a CAB solution of 35 % (w/v) in a mixed solution of 2-methoxyethanol/DMF/ 2:1 (v/v) with a water contain of 2 % (vol.) in which was added zinc acetate of 17 %. The solution was electro-spinning using a laboratory installation for high intensity electro-spinning. In order to form and grow the ZnO nanocristals on CAB network, we used NaOH dipping technique followed by washing and

dipping in ammonia zincate solution then thermally treated at 125°C for 30 min. Finally, an uniform layer of nanofibers with zinc acetate was obtained.

SEM (Scanning Electron Microscopy), EDX (X-ray Diffraction) studies revealed that ZnO nanocrystals forms themselves on CAB nanofibers uninfluenced by dipping times in ammonia zincate, the particles size being independent by dipping times.

Thermally treatment cause well defined or agglomerated trend ZnO nanoparticles formation.

Functional properties study of ZnO/ polymer fibers composite systems revealed piezoelectric and photocatalytic properties which give them intelligent material characteristics with potential application of sensor and actuator.

Keywords: piezoelectric properties; photocatalytic properties; electrospinning; metal-polymer nanostructured composite.

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S1 P45

DIELECTRIC SPECTROSCOPY OF PARAELECTRIC $BA_{1-X}SR_XTIO_3$ CERAMICS

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Solid ferroelectric ceramic of solutions $Ba_{1-x}Sr_xTiO_3$ for the whole substitution range present scientific and technological interest and applications [1-3]. DRAM memories in high frequency communications are important because of theirs permittivity variation with the applied field. This ceramic have important applications as oscillators, filters, antennas, dielectric resonators and substrate for hybrid integrated circuits. The ferroelectric transition temperature of such ceramics can be adjusted with the composition over a broad temperature range. $Ba_{1-x}Sr_xTiO_3$ solid solutions with $x = 0.20$ and some other compositions were prepared by conventional solid-state reaction and sintered in air at temperatures between 1300 and 1450 ^oC for several time intervals 1, 2, 4, 8 hours.

X-ray diffraction and scanning electron microscopy were used for morphologic and structural characterization. Dielectric spectroscopy of paraelectric ceramic $Ba_{1-x}Sr_xTiO_3$ with x=0.2, in paraelectric phase were investigated on a wide frequency 10^{-2} Hz - 1 MHz range and on a large temperature interval – 120 ^oC - + 150 ^oC.

The relaxation time at LOW, MIDDLE and HIGH frequencies were of the order of 100 s, 10^{-6} s and 10^{-8} sec. The activation energy found in Arrhenius representations of BST- 20 at 10^4 H, 0.43 eV in ferro and 0.63 eV in the paraelectric phase.

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S1 P46

MCSA USED FOR FAULT DETECTION AND IDENTIFICATION IN SINGLE-PHASE CENTRIFUGAL PUMPS - AN INTRODUCTORY STUDENT EXPERIMENT

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[1] *Texas A&M University of Corpus Christi*
[2] *OVIDIUS University of Constanta*

The importance of this study derives from the importance of the method itself, as MCSA is one of the most important methods for motor diagnosis in the industry today. This paper presents the development results, student perception and future refinements of a laboratory experiment used for detecting different faults in impeller pump induction motors by means of the Motor Current Signature Analysis technique. This experiment will provide the students with knowledge about current sensing, waveform and harmonics, computerized data acquisition systems and Fourier transforms, and uses relatively inexpensive equipment. After this laboratory exercise, students should be able to understand and apply Motor Current Signature Analysis and to easily identify the most common induction motor faults, such as broken rotor bars, airgap eccentricity, shorted stator turns, bearing misalignment, bearing faults, load faults etc. Described in the paper are all the details about the pump test stand, experimental setup, test procedure and data interpretation.

ABSTRACTS

S2 – Laser, Plasma and Radiation Physics and Applications

- *Laser Physics and applications*
- *Plasma Physics and applications*
- *Optoelectronics and photonics*
- *Applied and non-linear optics*
- *Ultrafast phenomena and applications*

S2 L1

LASER BEAM SCATTERING ON TiOx NANOPARTICLES IN HOLLOW CATHODE PLASMA JET

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The basis of nanotechnology is the synthesis of nanoparticles with a size ranging approximately from 1 to 100 nm. The most widespread techniques of gas-phase nanoparticle synthesis using evaporation of solid material are: pulsed laser ablation, spark discharge generation, inert gas condensation and ion sputtering. Gas-phase methods are based on achieving the supersaturation necessary to start nucleation.

In this work we analyse the growth process of TiO_x nanoparticles in the plasma of the hollow cathode plasma jet deposition system, Fig. 1. The common method of obtaining the detailed size distribution of nanoparticles is the layer analysis after the deposition [1]. Sometimes only the information about the presence of nanoparticles combined with it's dependence on parameters of the deposition system may be valuable since it is available just at the moment of experiment. The laser beam scattering can bring such quick information.

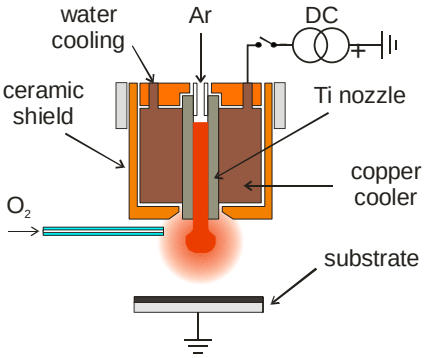

Fig. 1: The hollow cathode plasma jet system.

Two lasers with wavelength 446 and 661 nm were used. The signal was detected by one of three detectors: photodiode, optical spectrometer and digital photo camera.

Vertical and horizontal polarization of lasers was used for determination of the scattering type. An example of the dependence of intensity of vertically polarized light scattered to the angle of 160° on the oxygen flow is shown in Fig. 2.

Maps of the scattering intensity were measured under different discharge parameters. Dependencies of the signal intensity on the O_2 flow rate and wavelength will be discussed and compared with theoretical calculation based on Mie scattering model [2].

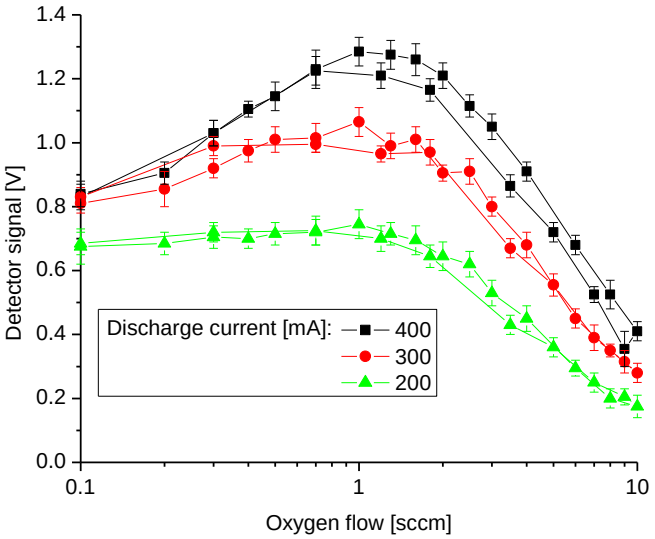

Fig. 2: The dependence of intensity of vertically polarized scattered light on the oxygen flow.

Keywords: plasma jet, TiOx, laser scattering
Acknowledgements: The partial financial support by the Czech Science Foundation, grant No. 15-00863S and by Charles University Grant 268115 is gratefully acknowledged.

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S2 L2

SYNTHESIS AND CHARACTERIZATION OF THIN FILMS

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The mechanical properties of new hard coatings based on a multilayer structure have been investigated at the nanometre scale. A multilayer structure of nitrided layer/TiN/ion iplalantation on steel substrate, has been deposited by Physical Vapor Deposition and Ion Beam Assisted Deposition. The nanomechanical properties have been determined measuring nanoindentation, friction and wear.The microstructure of obtained nitrided layer showed differences with regard to the presence or absence of a white layer, its thickness and its ε/γ′ phase ratio (XRD) and nitriding depth. In the present investigation the subsequent ion implantation was provided with N^{2+} ions. This paper describes the use of the nanoindentation technique for determination of hardness and elastic modulus.The results are analyzed in terms of load-displacement curves, hardness, Young's modulus, unloading stiffness and elastic recovery. The analysis of the indents was performed by Atomic Force Microscope. The analyzed AE signal was obtained by a scratching test designed for adherence evaluation. Coating is often in tensile stress with greater microhardness. The stress determination follows the conventional $\sin^2\psi$ method, using a X-ray diffractometer. The film deposition process exerts a number of effects such as crystallographic orientation, morphology, topography, densification of the films. The evolution of the microstructure from porous and columnar grains to densel packed grains is accompanied by changes in mechanical and physical properties. A variety of analytic techniques were used for characterization, such as scratch test, calo test, SEM, AFM, XRD and EDAX. The three basic points that are considered fundamental to studies of friction are the surface area and nature of the intimate asperity contacts, the surface adhesion and shear strength, and the nature of deformation and energy dissipation occurring at the asperity junctions. The optimization procedure for coated parts could be more effective, knowing more about the fundamental physical and mechanical properties of a coating, their interdependence and their influence on the wear behaviour. Therefore, by properly selecting the processing parameters, well-adherent films with high hardness can be obtained on engineering steel substrates. All these results indicate that the multilayer combines ultrahard behaviour with good tribological and wear properties.The experimental results indicated that the mechanical hardness is elevated by penetration of nitrogen, whereas the Young’s modulus is significantly elevated.

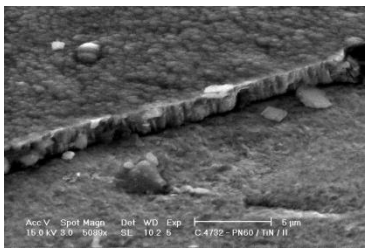

Figure 1. Surface morphologies of coating.

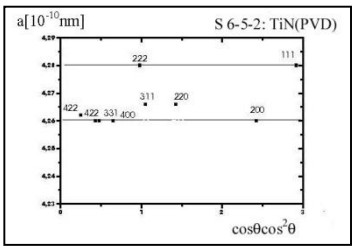

Figure 2. The Cohen-Wagner plot

Keywords: atomic force microscopy, crystal structure, residual stress

*Acknowledgments***:** The authors would like to thank to The Scientific Council of Serbia supported this work by grant.

S2 L3

HIGH-PEAK POWER PASSIVELY Q-SWITCHED Nd:YAG/Cr^{4+}:YAG LASERS FOR SUCCESFUL IGNITION OF AN AUTOMOBILE ENGINE

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A promising solution for reduction of fuel consumption and decreasing the noxes exhausted by a car engine is the laser ignition [1, 2]. Extensive research has been done in the last years in order to realize a laser-spark device [3, 4]. However, due to various technical problems, related in principal to the realization of a laser with dimensions close to an electrical spark or to the installation of it on a real engine, such a task was very challenging. Therefore, only recently automobile engines were ignited by laser sparks [5, 6]. In this presentation we review our work performed for building a laser spark with small size and pulse characteristics suitable for engine ignition, and report successful ignition of a Renault automobile engine with a laser spark.

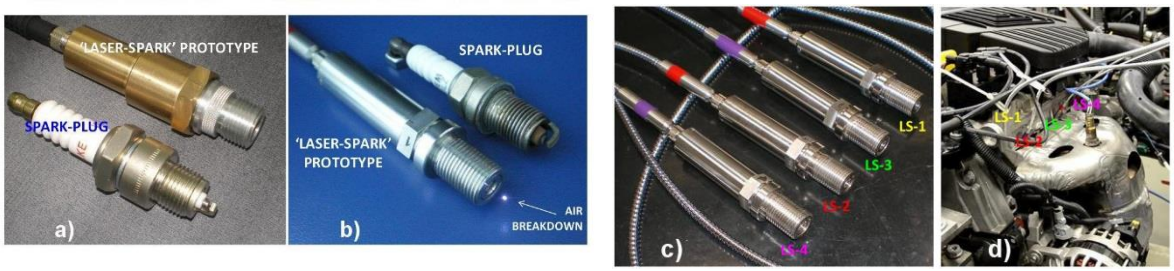

Fig. 1. a), **b)** Laser-spark prototypes developed in our laboratory. **c)** The four laser-sparks system and **d)** The Renault engine operated by laser sparks (LS).

The first laser-spark prototype built in our laboratory is shown in Fig. 1a. Ignition was performed with this device in a static combustion chamber filled with methane-air mixture gas. Through further design and improvements, a laser-spark tool similar to a classical spark plug was realized (Fig. 1b).

This laser delivered pulses with energy up to 4.0 mJ and 0.8-ns width; repetition rate could be increased up to 100 Hz. A sapphire window was used to transfer the laser beam into each engine cylinder. In the next step, an integrated system consisting of four laser sparks that was powered and controlled by computer was built (Fig. 1c). This laser-spark system was mounted on a test-bench K7M (1.6 MPI, gasoline) Renault car engine (Fig. 1d) and it was used to successfully ignite and run the engine. A better stability in terms of maximum pressure and a significant decrease of CO and HC were measured for various points of engine speed and load. Further experiments aim better characterization of engine performances under laser ignition.

Acknowledgements: This work was financed by the National Authority for Scientific Research and Innovation, UEFISCDI, Bucharest, Romania, project 58/2012 (PN-II-PT-PCCA-2011-3.2-1040).

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S2 L4

OPTIMISATION OF MECHANICAL PROPERTIES OF NANOLAMINATE COATINGS

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Recently, there has been an increased interest in boron and carbon based films with X_2BC composition. Theoretical ab-initio models predict unusual combination of high stiffness and moderate ductility for these types of films when X=Ta, Mo or W. The aim of the present work was to prepare thin Mo_2BC films at different deposition temperatures using magnetron sputtering technique and to evaluate the dependence of their mechanical properties on the deposition parameters. The film structure and composition were studied using X-ray diffraction technique, XPS and Ruthefor Backscattered Spectroscopy combined with Elastic Recoil Detection Analysis. The microstructure of layers was studied using a Tescan LYRA 3XMU SEM×FIB scanning electron microscope (SEM), a Philips CM12 STEM transmission electron microscope (TEM) and a JEOL 2100F high resolution TEM. The quasistatic and dynamic nanoindentation response of the films was studied using wide range of testing conditions. The friction coefficient, sratch and wear resistance of the coatings were studied using nanoscratch and nanowear tests. The fracture toughness of the coatings was evaluated using nano and microindentation techniques. The modulus mapping capability was applied to obtain quantitative maps of the storage and loss stiffness and the storage and loss modulus. The modulus mapping combines the in-situ imaging capabilities with the ability to perform nanodynamic

mechanical analysis. In Fig. 1 an example of the modulus mapping results obtained on nanocomposite MoBC coating is shown.

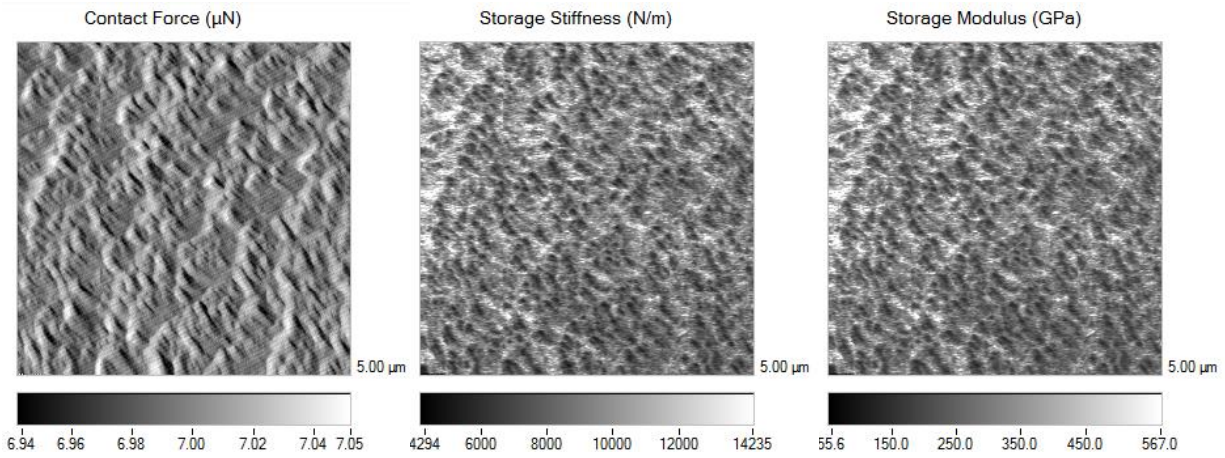

Figure 1. Example of modulus mapping results on nanocomposite MoBC film on a WC substrate. The maps of the contact force (on the left), storage stiffness (in the middle) and storage modulus were obtained with oscillation amplitude of 2.8µN and oscillation frequency of 300Hz on area of 5x5µm^2.

The Czech Science Foundation is acknowledged for the financial support of this work (Project 15-17875S).

S2 L5

COMPOSITES OF CARBON AND TITANIUM BASED NANOSTRUCTURES DEPOSITED BY TVA METHOD FOR INDUSTRIAL APPLICATIONS

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The field of carbon-based materials and coatings has enjoyed strong and growing interest from all kinds of applications. In particular, the addition of titanium coatings have attracted the most attention in recent years, mainly because they offer a wide range of exceptional properties for a wide range of demanding applications.

In this paper, we attempt to highlight some of the most important developments in the present state of the art in scientific research and industrial practices that involve titanium and carbon-based carbon films in different combination. Hence, we will focus our attention mainly on the most important developments of the last year. We will also summarize the recent research on their significant properties and wear mechanisms.

Acknowledgements. This work was supported by CNDI–UEFISCDI, project 78/2013, PN-II-ID-PCE-2012-4-0059.

S2 L6

DIFFERENT APPLICATION OF THERMIONIC VACUUM ARC (TVA)

Suat PAT

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In this study, new applications of thermionic vacuum arc (TVA) system are introduced. TVA is an anodic plasma generator. Thick, thin and ultra thin nano layered coatings can be produced by this method. One application is gallium compounds depositon process. Gallium compounds are used in Laser , photovoltaics, LED's, high power LED production, transistors and etc. For these deposited products, doped and impuritites atoms are very important because of these impurities gains interesting properties to GaN and GaAs compounds. Different doped GaAs and GaN can be produced by TVA method as a ultra fast deposition process according to other chemical and physical deposition methods. Other way to deposit film is reactive-thermionic vaccum arc (R-TVA) process for metal oxide thin film production. Gas flowing rate is an important parameters for the depositon process. Another application is metal oxide thin film production for electronic and nano electronics structure. These film has a high transperancies and lower electrical resistivities.

Keywords: TVA; doped semiconductor thin films; R-TVA; metal ozide thin fil production

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S2 L7

FUNCTIONAL MULTICOMPONENT HARD COATINGS

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Nowadays the high-entropy alloys (HEA) with more than 5 elements, in almost equiatomic concentrations, represent a new class of alloys with remarkable properties, such as high hardness, high strength, increased corrosion resistance and high thermal stability [1]. Taking into account their superior qualities and nanocomposite structure, various HEA nitride or carbide coatings are now under development [2,3], exhibiting promising tribological performances. Stoichiometric and overstoichiometric carbide HEA coatings - (CuTiYSiZr)C, (CuTiYCrNb)C and (TiYCrNbAl) were deposited by reactive magnetron sputtering method, at different substrate temperatures. The coatings were characterized for their elemental and chemical composition (AES, EDS, XPS, Raman spectrometry), phase composition and grain size (XRD), microhardness, adhesion (scratch-test), surface roughness (AFM), tribological performance (pin-on-disk), and corrosion resistance in saline solution 0.9%.

The stoichiometric and overstoichiometric (CuSiTiYZr)C coatings were amorphous, while (AlCrNbSiTiC)C and (CuTiYCrNb)C coatings were crystalline, even if the grain sizes of the overstoichiometric coatings decreased to 3 nm. The surface and in-depths coating morphology was correlated with their tribological performance, assessed in terms of friction coefficients and wear rates. Compared to the stoichiometric coatings with columnar structures, the overstoichiometric ones present finer, denser, and almost glassy structures. The existence of the free-carbon phase in overstoichiometric coatings, evidenced by Raman and XPS analyses, determined a reduced surface roughness, with a reduced coefficient of friction (< 0.2) and low wear rates (of about 10^{-6} $m^3N^{-1}m^{-1}$). The increase of carbon content in the coating to about 80% determined an accentuated decrease of the surface roughness (RMS < 2 nm), resulting in a further decrease of the friction coefficient. The tribological characteristics similarities noticed for all the investigated overstoichiometric coating indicated that the amorphous carbon phase plays a major role, out-shadowing the nature of other elements, as well as their number.

The highest microhardness, the best tribological behavior and the highest corrosion resistance was observed for the (AlCrNbSiTiC)C coatings. We ascribed this to the almost ideal valence electron concentration (VEC) of 8.4, being known that high hardness in carbides and nitrides originates from specific bonding states between p and d orbitals, resisting shearing strain or shape change [4].

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Keywords: hard coatings, carbide of high entropy alloys, magnetron sputtering

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S2 L8

TERNARY COMPOSITE FILMS INTERACTION WITH HIGH POWER LASER BEAM

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Beryllium, carbon and tungsten are presently the materials used in fusion technology, as for example in Joint Experimental Torus (JET) experiment at Culham, UK. Special requirements of these materials have to be simultaneously satified, as for example high temperature resistance, low influence on the fusion plasma and low retention rate of the nuclear fuel used.

The first wall of the fusion devices is intensely bombarded by ionized particles, neutrons, photons and has to support thermal action of the fusion plasma. These effects are simulated by producing Be/C/W film composites using thermionic vacuum arc method (TVA) [1] and irradiating them directly or indirectly using high power lasers. The indirect irradiation of the composite layers was performed by directing the laser beam parallel to the sample surface, very close to it. Due to the air breackdown, the samples interacted with the laser produced plasma. In this way, it was simulated the fusion plasma effect on the composite layers formed during operation.

The high power laser is a multi-terawatt laser amplifier system, 0.025 - 360 E-12 s pulse duration, up to 400 mJ pulse energy, 10 Hz maximum repetition rate, 1E12 - 1E14 W/cm^2 power density. The laser pulses were programmed to have durations and power densities compared with the fusion plasma instabilities. The influence of direct laser irradiation and plasma produced by laser in air atmosphere has been investigated by different techniques: scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD) and Raman spectroscopy.

The changes of the material morphology, structure and chemical bonding were highlighted. It was found that femtosecond laser irradiation with a 800 nm wavelength could produce sp^2 - sp^3 transition into graphite layer. XPS and Raman measurements performed on the surface and in depth suggested the process as being related with big laser power densities (tens of J/cm^2) and respectively big photon adsorption rate per atom (thousands) and a rather indirect photon adsorption related process.

Keywords: thermionic vacuum arc plasma, laser produced plasma, high power laser irradiation

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S2 L9

ATMOSPHERIC PRESSURE DIELECTRIC BARRIER DISCHARGE FOR PRODUCING POLYETHYLENE GLYCOL-LIKE FILMS

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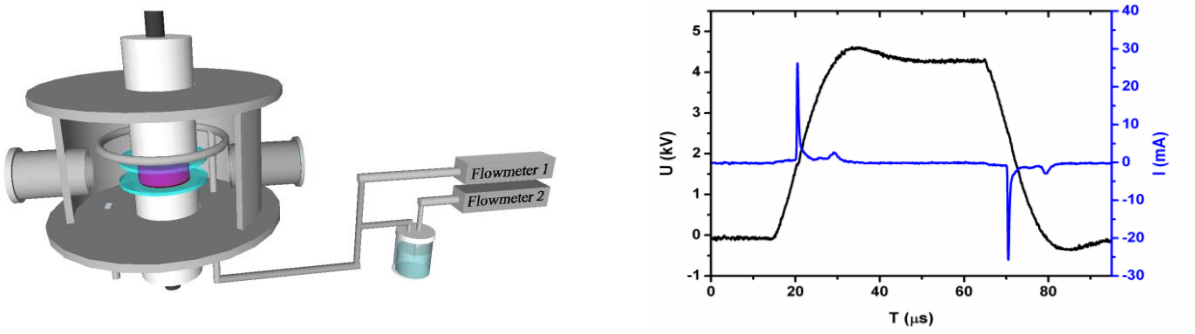
This study focuses on the production of polyethylene glycol-like films (PEG) by discharge polymerisation in a plasma at atmospheric pressure. The plasma source consists of a dielectric barrier discharge (DBD) which operates in helium gas flow with a glass-like dielectric. The films were characterized by Atomic Force Microscopy (AFM) operating in tapping mode, contact angle measurements, Fourier transform infrared spectroscopy, UV-VIS spectroscopy and X-ray photoelectron spectroscopy (XPS).

The discharge used in order to obtain polymeric surfaces by plasma polymerization in atmospheric pressure conditions is characterized by well-defined current pulses, with pulse duration of a few microseconds (Figure 1). The typical discharge current signals shows the homogeneous (diffuse) mode in which the discharge are operating.



(a) (b)

Figure 1. (a) Experimental set-up, (b) temporal evolution of applied voltage and the current through plasma.

XPS analysis of the PEG films revealed peaks corresponding to the chemical C-C bonds, C-O bonds and C-O-C bonds, which are in good agreement with the chemical formula. The wetability of the PEG films showed a super-hydrophilic character (the contact angle are smaller than 10°). The topography of polymer films shows a granular structure with diameters smaller than 1 μm. The value of the root mean square roughness (R_{rms}) is 6,9 nm immediately after the polymerization and increases to 15,5 nm after one week. This kind of surfaces obtained under these plasma condition can be very well used in medical applications like biosensors, biochips, drug delivery etc.

Keywords: plasma polymerization, atmospheric pressure, polyethylene glycol (PEG), thin films.

This work was supported by European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007- 2013 (grant POSDRU/159/1.5/S/ 137750). It was also supported by the CEEPUS Network AT-0063.

S2 O1

LASER INDUCED TRIBOLOGICALMODIFICATIONS OF COMPOSITE LAYERS OBTAINED BY TVA

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Thermionic Vacuum Arc (TVA) technology is a very useful tool for obtaining thin films, having a wide applications range, the layers being compact and crystallographic ordered. The absence of any buffer gas (base pressure of 10-6 Torr) ensures high purity of the layers. Due to plasma localizations, up to three TVA plasma sources can be simultaneously ignited while performing the coatings. These structures are used for films with special features like magnetic properties, superior thermal and mechanical properties, etc[1-4].

In this work, we present a study on the morphological and structural, as well as tribological properties changes due to the layer - laser interaction under the ablation threshold. Mixed films containing W-Fe-Ni were produced using three independent evaporators. Silicon wafer substrates of 10 mm x 10 mm were placed on 300 mm in diameter stainless steel holder. The distance between the evaporators and the sample holder was about 150 mm, while the center of the substrates was kept constant at 20 mm, in total 148 samples being produced and analyzed..

The composition variation of 1 μm thickness coating layers prepared by TVA method, was analyzed using low value excitation energies (<50 KeV) and the method called micro-beam X-ray fluorescence (μXRF) [5].

The layers were directly irradiated using a nanosecond LASER having the spot widened so the hole surface could be irradiated. The pulse power was 3.5 W, the wavelength: 355nm, the total exposure time, being 5s. The laser influence on tribological properties of the films were studied by measurements using a ball-on-disc tribometer made by CSM Switzerland, with normal force of 0.5 N, a sapphire ball with a diameter of 6 mm, a dry sliding distance of 15 m, and linear speed of 20cm/s. The films become more brittle after laser irradiation but their friction coefficient improved.

Keywords: TVA, XRF, Tribology, Composite Layers

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S2 P1

THE TRANSPORT OF DIRAC FERMIONS THROUGH A ONE-DIMENSIONAL QUANTUM WIRE

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This paper deals with a theoretical study of the relativistic transport through a 1D quantum wire composed by two different materials, using the complete (1+3) dimensional Dirac equation with restricted linear motion along the wire.

In this way we can study the electron motion without loosing information about the spin orientation. Since the Dirac spinor remains with 4 components, the polarization effects have to be better highlighted such that our results could be used as a starting point for further developments in the optoelectronic devices field.

Keywords: Dirac equation, quantum wire, transfer matrix.

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Acknowledgments

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S2 P2

STUDY ON THE AXIAL DISTRIBUTION OF THE STORED MICROPARTICLES IN AN ELECTRODYNAMIC TRAP BY USING SOFTWARE IMAGE PROCESSING

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Microparticles under study, consisting by micrometer sized grains of Al_2O_3, has been stored by using a linear electrodynamic trap similar to that presented in [1]. In order to view the stored microparticles a laser beam is directed to the longitudinal axis of the electrodynamic trap. The scattered light can be observed by an optical photodetector oriented perpendicular to the direction of the laser beam. By recording the signal provided by the optical sensor the data on the stored microparticles motion characteristics can be gathered (e.g. [2]). However, a single photodetector does not allow investigating simultaneously the variation of the scattered light intensity by microparticles placed in different regions of the electrodynamic trap. Instead of a conventional photodetector a web camera can be used [3], [4]. That records a video image of the stored microparticles. The basic concept of the processing method used here has been already described in [3]. Each frame of the recorded video image is saved as a bitmap file. The image contained by each bitmap file is then analyzed by using an appropriate software package. We describe the algorithm steps necessary to convert qualitative information embedded in an image into a numerical set of data which expose the stored microparticles distribution characteristics, both in space and time. The microparticles density was considered to be proportional to the intensity of the scattered light. As an example the axial distribution of the stored microparticles and its evolution over time under several experimental conditions are presented. The limitations of the method are also discussed.

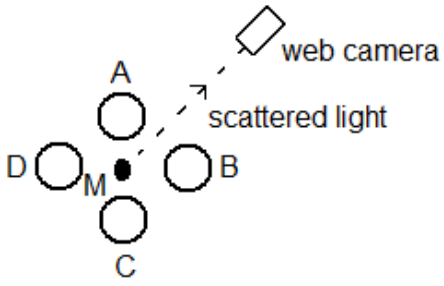

Fig. 1 Block diagram of the experimental setup. A, B, C, D - electrodynamic trap electrodes, M - stored microparticles. Incident laser beam is oriented perpendicular to the figure.

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S2 P3

APPLICATION OF IONIZING IRRADIATION FOR BIOPOLYMER DEGRADATION

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Degradation of natural polymers such as amylose and amylopectin exposed in solid state to accelerated electron beam is presented. Effects of irradiation on polymers were investigated by gel permeation chromatography, Fourier transform infrared spectroscopy and scanning electron microscopy. Quantitative evaluation of the radiation degradation in amylose were determined through radiation-chemical yield of degradation, degradation rate constant and half value dose of the number-average molecular weight and weight-average molecular weight. The results proved that electron beam degradation of investigated biopolymers is based on a complex mechanism of the radical-induced scission of the glycosidic bonds, which leads to the reduction of their molecular weight and formation of different lower molecular weight radiolytic products.

Keywords: electron beam, polymer, scission

Acknowledgements. This work was supported by project Nucleu (2015) and IIN (Electron Accelerators Laboratory of the National Institute for Lasers, Plasma and Radiation Physics).

S2 P4

IONIZING IRRADIATION GRAFTING OF NATURAL POLYMERS HAVING APPLICATIONS IN WASTEWATER TREATMENT

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In this work, graft copolymerization of acrylamide onto potato starch induced by ionizing radiation processing as free radical initiator and no additional chemicals was investigated. The resulted graft copolymers were characterized by both residual monomer and intrinsic and apparent viscosities. Flocculation performances of the grafted copolymers were evaluated by combining with classical electrolyte in order to remove the organic load of synthetic dairy industry wastewater. Also, the toxicity and biodegradability of grafted copolymers were performed. The results proved that the grafting occurred in each particular case, and the level of grafting was influenced by the monomer-to-starch ratio. The flocculation study revealed that all synthesized graft copolymers were efficient

for properties like turbidity, chemical oxygen demand and fatty matter in suspension. At the same time, the synthesized copolymers were proved to be non-toxic for aquatic environments and potential biodegradable in aqueous medium. Consequently, ionizing irradiation grafting is an effective tool to synthesize „green" copolymers having ecofriendly approaches.

Keywords: electron beam, starch, grafting, biodegradability

Acknowledgements. This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project number 64/2012.

S2 P5

NUMERICAL INVESTIGATION OF THE PARAMETERS AFFECTING ON INSTABILITY LOW CURRENT VACUUM ARC

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The main purpose of this study was set to clarify the physical mechanism of current instability of a low current vacuum arc for volatile materials. To investigate the parameters affecting to the stability arc current of compound cathode, the cathode spot model is applied. It was concluded that the current below that no real solution is instability arc current region. It is considered that the electron returning to the sheath region from the plasma one dominates over positive ions. As a result, electric field at cathode surface becomes imaginary solution.

To study the parameters affecting to the stability arc factors, the parameter scan of cathode materials and ion current fraction by numerical analysis, it was found that the critical current of the stable current is highly dependent on the thermal conductivity of the cathode material as shown in Fig.1. This is a very important result for the development of cathode materials for low-surge vacuum interrupters. Finally, it can be concluded that the results obtained by this study clearly demonstrate the physical mechanism of current instability occurrence.

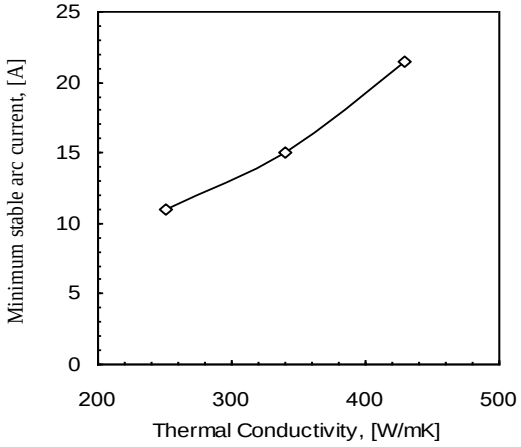

Fig. 1. Thermal conductivity vs Stable arc current

Keywords: Cathode spot model, instability current, Compound Cathode, Vacuum arc

Acknowledgements

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S2 P6

FORMATION OF NANO β-SiC BURIED LAYER IN THE SILICON BY METHANE IMPLANTATION INTO Si AND INVESTIGATION OF DOSE EFFECTS ON THE QUALITY OF β-SiC LAYER BEFORE AND AFTER ANNELING.

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The methane with 90 keV energy in a range of (0.4-4.1) $\times 10^{18}$ ions /cm^2 was implanted into the silicon substrate using Kaufman ion source. The temperature during implantation and post annealing treatment were fixed at 570^{o}C and 980^{o}C respectively. The Fourier transformed infra-red (FTIR) analysis showed that, a bond between carbon and silicon was created after implantation, leading to the formation of an amorphous hydrogenated silicon carbide (a-SiC:H) structure. Subsequently, the amorphous phase was transformed to the crystalline phase (β-SiC) due to post-annealing treatment. The investigation revealed that to achieve better condition of β-SiC crystalline phase formation, a dose of 1.2×10^{18} methane ions/ cm^2 was required. The Rutherford Backscattering Spectroscopy (RBS) analysis showed that carbon diffusion into silicon increased in proportion to the methane dose after post annealing. At higher doses, carbon thin layer was grown on the silicon surface with graphite like structure as confirmed by Raman spectroscopy. The scanning electron microscopy (SEM) micrographs showed the formation of the blisters due to pull out of the hydrogen after annealing treatment. The amount of blisters was decreased as the methane dose increased.

Keywords: Methane , SiC, Ion Implanation, SEM

S2 P7

PROPERTIES OF Mg_2Si THIN FILMS OBTAINED BY THERMIONIC VACUUM ARC (TVA) METHOD

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Magnesium silicide (Mg2Si) has attracted much attention of today's science and industry since it is an environmentally-benign and economically profitable material due to abundance of Si and Mg in the Earth's crust. This light-weight low density, high hardness, low thermal expansion coefficient, high elastic modulus and indirect-gap narrow-band semiconductor has promising properties to be used in various electronic and mechanical applications.

This work presents the results of research of morphology, structure and wettability of thin Mg_2Si films on silicon, glass and on special material OLC 45 grown by Thermionic Vacuum Arc (TVA) technology. TVA method offer convincing advantages for multi-component depositions, such as: high rate of deposition, low thermal energy transfer, very stable discharge conditions, no cathode' impurities and very good adherence.

The surface free energy was determined by means of Surface Energy Evaluation System indicating a hydrophobic character and the morphology by SEM, structure by BF-TEM image performed by Philips CM 120 ST TEM system and elemental analysis by EDX.

Acknowledgements. This work was supported by CNDI–UEFISCDI, project 78/2013, PN-II-ID-PCE-2012-4-0059.

Keywords: Mg_2Si thin films, wettability, TEM, SEM, EDX

S2 P8

SURFACE AND MECHANICAL CHARACTERIZATION OF C-AG NANOCOMPOSITE THIN FILMS OBTAINED BY THERMIONIC VACUUM ARC TECHNOLOGY

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Metal containing DLC films with properties intermediate between DLC and metal carbides have been shown to improve the adhesion and hardness as well as the wear properties. In this respect, silver-containing diamond-like carbons have attracted a lot of attention in the field of antibacterial coatings due also to promising antibacterial and mechanical properties.

This paper is focused on the mechanical behavior and stability of C-Ag nanocomposite coatings prepared by Thermionic Vacuum Arc technology. Silicon (100) wafers and microscopy glass were

used as substrates of the film. Each substrate was ultrasonically cleaned in ultrasonol bath for 15 min and then blown-dried with air. The film structure was characterized by FISHERSCOPE HM 2000, Olympus Confocal Microscope and Atomic force microscopy (AFM)

The results (3.84 GPa on Si substrate and 5.6 GPa on glass substrate) show that the films' hardness could be significantly increased, and the wear resistance as well. This is due to the microstructure of the films comprising nanocrystalline grains in an amorphous carbon matrix. The incorporation of silver into DLC films (Ag-DLC) is of great interest as it offers the possibility to reduce the internal stress and to enhance the wear properties for industrial coatings.

Acknowledgement: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project number 160/2013, PN-II-PT-PCCA-2011-3.2-1453.

S2 P9

IR EMISSION FROM $^4I_{13/2}$ ENERGY LEVEL OF Er^{3+} ION OF $Y_{0.98}Er_{0.02}FeO_3$ PUMPED WITH 1064 NM LINE

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In different laser materials pumping of the Er^{3+} ion in the $^4I_{11/2}$ state by the 980 nm laser may lead to the emission in the infrared region (IR) from the first excited $^4I_{13/2}$ state and simultaneously to the emission in the visible region (Vis) generated by the upconversion process from the upper energy states $^2H_{11/2}$, $^4S_{3/2}$ and $^4F_{9/2}$ [1, 2]. To enhance the emission in the Vis range, usually Er/Yb codoping is used as an efficient combination. However, enhancing emission in the IR range and suppression of the upconversion processes still remains a delicate task.

In our work we propose a different pumping scheme of the Er^{3+} second excited state $^4I_{11/2}$ in order to obtain emission from $^4I_{13/2}$ (Fig. 1). We used 1064 nm laser line of YAG:Nd for pumping $^4T_{1g}$ state of Fe^{3+} ion in the octahedral coordination of yttrium orthoferrite

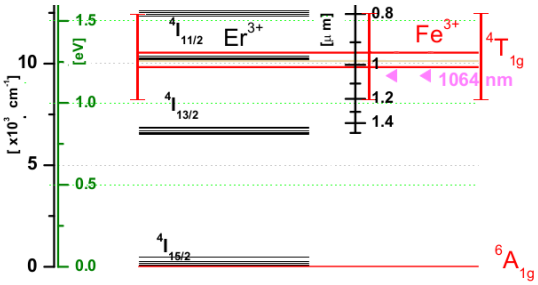

Fig.1 Scheme of pumping Er^{3+} through Fe^{3+} ion.

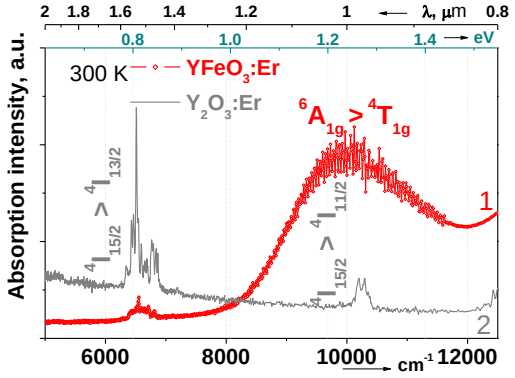

Fig.2 Absorption spectra of $YFeO_3$ (1)

$Y_{0.98}Er_{0.02}FeO_3$ solid solution. Photoluminescence spectra of this compound show an emission band on the transition $^4I_{13/2} \rightarrow ^4I_{15/2}$ of the Er^{3+} ion (Fig. 3). We assume that the Fe^{3+} ions act as sensitizers and absorb the excitation radiation and further transfer energy to the Er^{3+} ions. Energy transfer may take place due to the good overlapping of the $^4T_{1g}$ and $^4I_{11/2}$ bands (Fig. 2). The emission intensity is poor, probably this is caused by the specific Fe^{3+} ion-lattice interaction. Further work will be focused on the investigation of the correlation between the iron concentration and emission intensity and identification of the energy transfer mechanism in the examined system.

and Y_2O_3 (2) doped with Er^{3+} ions.

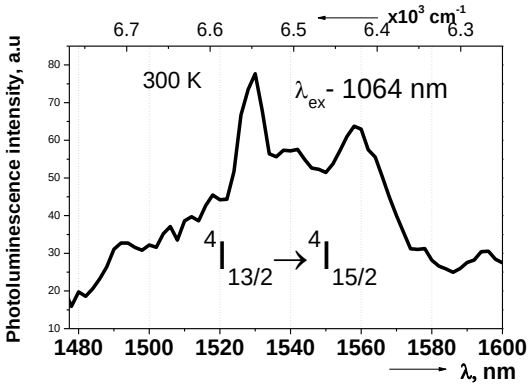

Fig.3 Photoluminescence spectra of $Y_{0.98}Er_{0.02}FeO_3$ under 1064nm excitation.

Reference:

[1] A. N. Georgobiani, A. N. Gruzintsev, T. V. Nikiforova, C. Barthou, P. Benalloul, Inorg. Mater, 38, 10, p 1199, 2002.

[2] F. Vetrone, J.C. Boyer, J. A. Capobianco, A. Speghini, M. Bettinelli, Chem. Mater. 15, p 2737, 2003.

Aknowledgements:

The author thanks Prof. S. Klokishner for the discussion of the results; This work was carried out through the Partnerships in priority areas - *PN II program*, developed with the support of MEN - UEFISCDI, *project no. PN-II-PT-PCCA-2013-4-1708;* S*trategic grant POSDRU/159/1.5/S/137070 (2014)* of the Ministry of National Education, Romania, co-financed by the European Social Fund – People; Partially supported by the Academy of Sciences of Moldova, *Project for Young Researchers CSSDT 14.819.02.16F*

S2 P10

SOLITON REGIME OF PROPAGATION OF OPTICAL PULSES UNDER THE INFLUENCE OF THIRD ORDER OF LINEAR DISPERSION AND DISPERSION OF NONLINEARITY

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In recent years actively are studied the effects resulting from the propagation of broad-band femto and attosecond optical pulses in nonlinear dispersive media. For such laser pulses the condition $\Delta\omega \approx \omega_0$ is satisfied. One of the most commonly used equation, for describing the evolution of optical pulses, is the nonlinear Schrodinger equation (NSE). It is derived for narrow-band pulses ($\Delta\omega << \omega_0$) and works very well for nano and picosecond laser pulses, but in the femto and attosecond region it is necessary to be used the more general nonlinear amplitude equation (NAE).

In the present paper it is presented a theoretical model of the propagation of broad-band optical pulses. In the frames of ultra-short optics the influence of the effects of dispersion and nonlinearity are significant. This requires the inclusion of additional terms in NAE that govern the third order of linear dispersion and the dispersion of nonlinearity. In our work losses and Raman scattering of the medium is neglected.

We found an exact analytical soliton solution of NAE. The soliton is possible to be observed as a result of the dynamic balance between the effects of higher order of dispersion and nonlinearity. We compared our solution with the numerical simulations of NAE for broad-band pulses.

The obtained results are important, not only form a fundamental point of view, but also for the better understanding of the nature of broad-band optical pulses.

Keywords: nonlinear amplitude equation, soliton solution, broad-band optical pulses

S2 P11

MATRIX ASSISTED PULSED LASER EVAPORATION OF TiO_2 FOR DYE SENSITIZED SOLAR CELLS

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The influence of energy/fluence and number of pulses during matrix assisted pulsed laser evaporation (MAPLE) of titanium dioxide (TiO_2) thin films grown on soda lime glass covered with a conductive layer of fluorine-doped tin oxide (FTO) was investigated. It was found that the properties of such transparent conductive oxide TiO_2/FTO electrodes depend on this parameter. The TiO_2 films that were deposited at distance of 5 cm, in air to the pressure of 10^{-3} mbar and at room temperature, exhibited a good optical transmittance in the visible range. In addition, the films were homogenous, smooth, adherent, and without cracks or any other extended defects, being suitable for opto-electronic device applications, such as dye sensitized solar cells (DSSCs).

Keywords: TiO_2 thin films, MAPLE, DSSCs.

S2 P12

APPROXIMATE SOLUTION OF THE NONLINEAR AMPLITUDE EQUATION INCLUDING THE RAMAN EFFECT

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In the present work is considered the evolution of ultra-short optical pulses in nonlinear dispersive media. For these pulses the influence of Raman effect cannot be neglected. The most of the well-known theoretical models, describing the behavior of laser pulses, are based on the use of the nonlinear Schrödinger equation in which is added a term responsible for the Raman effect. The experiments confirmed the numerical results for nanosecond and picoseconds pulses, but in the femtosecond and attosecond region a significant deviations are observed.

In our work is found an approximate solution of the nonlinear amplitude equation in which is included a term that governs the Raman effect. It was used the small parameter method. For a small parameter we assume the coefficient τ_R, which gives the ratio of the nonlinear response of the medium and the initial pulse duration.

The results are important for ultrafast optics and technologies based on the Raman effect.

Keywords: Raman effect, ultra-short optical pulses, nonlinear amplitude equation

S2 P13

SPR ASSISTED WITH CHIRAL LIQUID CRYSTAL AND HIGH REFRACTION PRISM

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Surface plasmon resonance (SPR), highly sensitivity to the surrounding media, is widely used in a bio/ chemical sensor applications. We have integrated chiral liquid crystals (LC), optically active materials with a large birefringence of the refractive index, in Kretschmann configuration with a high reflection prism, with dispersion commensurate with dispersion gradient of the metal. It is studied how helical pitch, tilt angle and number of periods, keeping the LC layer thickness constant, combined with the high refraction prism influences the SPR and increases the accuracy of measurements. The impact of large birefringence of the LC on the sensitivity has been studied as well. Our theoretical model is performed by Maxwell equations solver based on 4x4 method.

Keywords: surface plasmon, SPR, liquid crystal, high refraction prism

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S2 P14

APPLICATION OF POROUS COPPER PLATES IN PEM FUEL CELLS

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The performance of a Proton Exchange Membrane Fuel Cell (PEMFC) is strongly influenced by the gas diffusion layer's (GDL`s) interdependent properties such as gas and water transport including, as well, the micro and macro substrates. To avoid electrode flooding the GDL must be design with adequate combination of hydrophilic and hydrophobic characteristics. A copper based GDL, which represents the aim of this paper, can be a good alternative to achieve this characteristics, instead of using the usual Toray based GDL. The GDL copper plate was obtained as result of a thermal treatment in Ar-H_2 gas mixture. For the porous structure achievement we used a combination based on copper filings with different amounts of naphthalene. By using this type of porous GDL we manage to solve two issues: gas transport from the flow-field channels to the catalyst layer and the water removal, fact confirmed by the running tests.
Keywords: PEM fuel cell, GDL, carbon black, catalyst layer, water management, gas channels

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S2 P15

COMPARATIVE DISCUSSION ON TWO GLOBAL MODELS FOR OPTICAL PROPERTIES OF BI_2O_3

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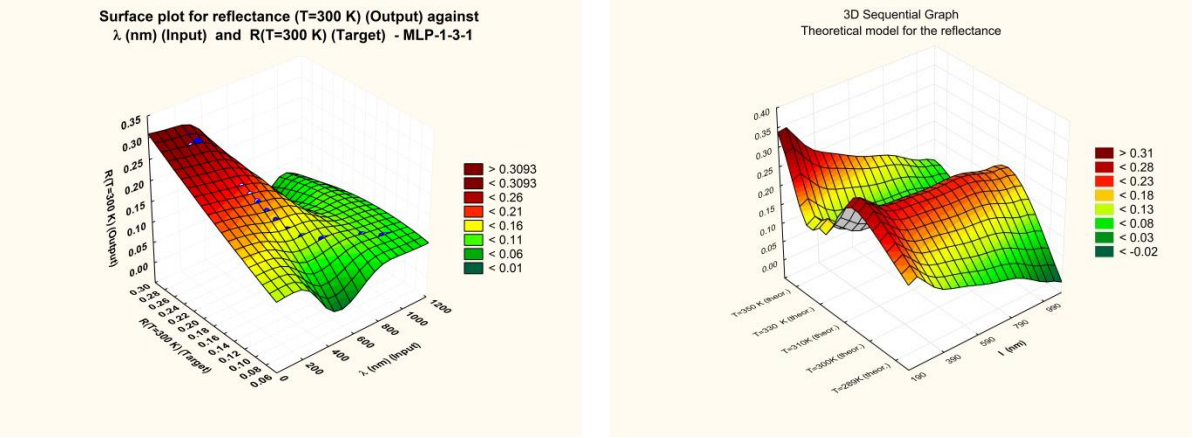
[3] *Vasile Alecsandri National College Galati*

Theoretical research methods have been presenting a growing importance in the last decade. The investigations of the optical proprieties of various types of samples are, by this, a great area of continuous research, because of the significant applicative impact of the optical proprieties in the fields of industry and health. The rising impact factor of related literature journals could be consdered as a direct proof.

The aim of this paper is the studying from a statistical point of view two diifferent global effective representations, in order to obtain a general model that includes temperature dependence of the optical properties. The main method is based on the Kramers-Kronig transformation type. This a extension of our previous studies, in order to obtain better and the simplest models In this respect, the optical properties of Bi_2O_3 were estimated by Kramers- Kronig analysis using different analytical approaching methods for a series of changed configurations. A novelty of the present study is due to the implementation of an entire MAPLE software approaching tool in order to succeed in reaching the huge volume of complex computations.

This phase was implemented for comparison. By adapting the learning rate and by considering a series of different layers structure, we succeed in reaching better results than the previous.



Neural network results for measured reflectance global model (right) and the analyticla model for global model of measured reflectance (left)

Keywords: numerical computation, optical properties, Kramers-Kronig transformation

ABSTRACTS

S3 – Nuclear and sub-Nuclear Physics and Applications

- *Nuclear and subnuclear sciences and Engineering*
- *Advanced detection systems*
- *Accelerated particle beams*
- *Nuclear Techniques and applications*
- *Nuclear Safety and Radiation Protection*

S3 L1

CALCULATION OF NUCLEAR MATTER IN THE PRESENCE OF STRONG MAGNETIC FIELD USING LOCV TECHNIQUE

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In the present work, we are interested in the properties of nuclear matter at zero temperature in the presence of strong magnetic fields using the lowest order constraint variational (LOCV) method employing *AV*18 nuclear potential. Our results indicate that in the absence of a magnetic field, the energy per particle is a symmetric function of the spin polarization parameter. This shows that for the nuclear matter, the spontaneous phase transition to a ferromagnetic state does not occur. However, we have found that for the magnetic fields B & 1018 G, the symmetry of energy is broken and the energy has a minimum at a positive value of the spin polarization parameter. We have also found that the effect of magnetic field on the value of energy is more significant at the low densities. Our calculations show that at lower densities, the spin polarization parameter is more sensitive to the magnetic field.

Key words: Nuclear matter, magnetic field, magnetic properties.

S3 L2

PRESSURE EFFECTS ON OXIDE FERROELECTRICS: STRUCTURAL STUDIES

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The oxide ferroelectrics has become a subject of extensive scientific research due it shows interesting ferroelectric, pyroelectric, piezoelectric and nonlinear optical properties for an application in various electric devices, such as transducers, actuators, capacitors or ferroelectric random access memory. The polar phase in oxide ferroelectrics can be changes well by the application of high pressure, which is direct method of controlled variation of physical properties by means of variation of interatomic distances and angles.

My talk covers the experimental results of studies of different types of oxide ferroelectrics. I report about pressure effects on crystal structure of $PbTiO_3$, $NaNbO_3$ and $Ba_4Gd_2Fe_2Nb_8O_{30}$ ferroelectrics, which was studied by means of neutron and X-ray diffraction, Raman spectroscopy. The most emphases are directed on pressure induced evolution of ferroelectric or antiferroelectric phases in such oxide materials.

As sequentially, the classical ferroelectric $PbTiO_3$ has a tetragonal structure at ambient conditions. A structural phase transition into the cubic phase was observed at T= 747 K. It is found that the phase transition temperature decreases upon applying the high pressure with the coefficient dT_C/dP=–65 K/GPa. The behavior of the temperature dependence of spontaneous stress under the pressure confirms the hypothesis on the presence of a tricritical point on the P – T phase diagram of $PbTiO_3$ and indicates a gradual change in the character of the phase transition from the first to second order at high pressure pressure.

The antiferroelectric $NaNbO_3$ has an orthorhombic structure with Pbcm symmetry. Pressure induced phase transition has been observed at high pressure P=1.6 GPa and room temperature. The complex P-T phase diagram of $NaNbO_3$ are disscused.

At ambient pressure, the crystal structure of $Ba_4Gd_2Fe_2Nb_8O_{30}$ compound is described by the bronze-type tetragonal symmetry with space group P4/mbm. At pressure P~1.8 GPa in such ferroelectric the structure phase transition have been observed. The orthorhombic structure model with Pba2 space group for high-pressure phase of those compounds have been proposed.

As final remarks, the high pressure structural studies of the ferroelectrics are essential in order to reveal formation mechanisms of ferroelectric state upon variation of interatomic distances. Such experimental information is important for first principles calculations and theory development describing properties of these unusual compounds as function of structural parameters.

The work has been supported by the RFBR grant N 14-02-00948-a.

S3 L3

ROSPHERE – A DEDICATED IN-BEAM FAST TIMING HPGe-$LaBr_3$(Ce) ARRAY

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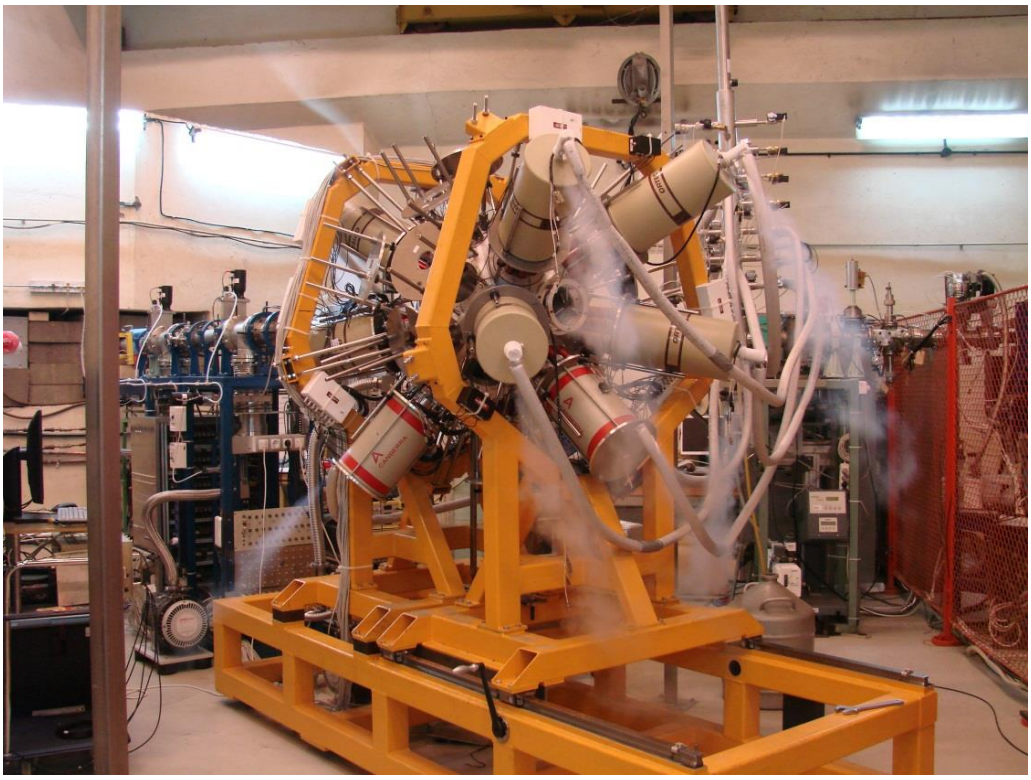
The ROSPHERE 4π array, consisting of HPGe and LaBr3(Ce) detectors, was built and installed at the TANDEM Laboratory of the "Horia Hulubei" National Institute for Physics and Nuclear Engineering in Bucharest, Romania. The combination of high-purity Germanium detectors with $LaBr_3$(Ce) scintillators in a relatively high-efficiency array provide the ideal tool for measuring the lifetimes in the range from tens of picosecond to nanoseconds for excited nuclear states populated in-beam. The recent experiments performed with the ROSPHERE array showed that using the in-beam fast timing technique one can get access to key transition probability values in atomic nuclei. A

description of the array and several selected physics results obtained using ROSPHERE will be presented.



S3 L4

SANS INVESTIGATION OF MAGNETIC ELASTOMERS POLYMERIZED IN TRANSVERSAL AND LONGITUDINAL MAGNETIC FIELDS

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The synthesis and the study of structure and physical properties of ferroelastomers materials combining the functional properties of highly elastic polymers and ferromagnetic substances should be considered as a perspective way to provide the understanding of construction principles of a wide class of materials for electronics, electrical engineering, medicine, aero- and cosmic industries. Also from the fundamental point of view it is needed a comprehensive analysis of the relationship between the macroscopic and microscopic properties of the disperse magnetic phase structures behaviors.

The aim of this work is the small-angle neutron scattering (SANS) examination of subtle structural features of polymeric matrix and of the ensemble of embedded ferroparticles as resulted

from the conditions of preparation of ferroelastomers by the variation of concentration of particles and the strength of a longitudinal and transversal external magnetic field, applied during the polymerization process.

The samples were investigated by small angle neutron scattering at the Membrana-SANS and YuMO-SANS spectrometers in function at WWR-M (Gatchina) and respectively IBR-2 (Dubna) reactors.

Keywords: magnetic elastomers, SANS, structure

S3 O1

ENERGY LEVEL MEASUREMENT OF Ar^{36} AND Ar^{37}, BY SHELL MODEL CODE OXBASH AND FITTING THE RESULT WITH EMPIRICAL DATA

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Abstract

Modern nuclear shell-model calculations incorporate many or all of the multi nucleon configurations that arise under the assumption that the valence protons and neutrons of the nucleus simultaneously occupy several different, partially filled, single-particle quantum states. In this study the energy level of $^{36}_{18}Ar$ and $^{37}_{18}Ar$, Two isotopes of Argon nuclei, were measured by nuclear shell Model code , Oxbash, and among model spaces and interactions in Oxbash code library the 'SD' model space and 'W' interaction expose the better fitting with empirical data concerning to these isotopes.

Key words: Shell model, Ar, Oxbash code.

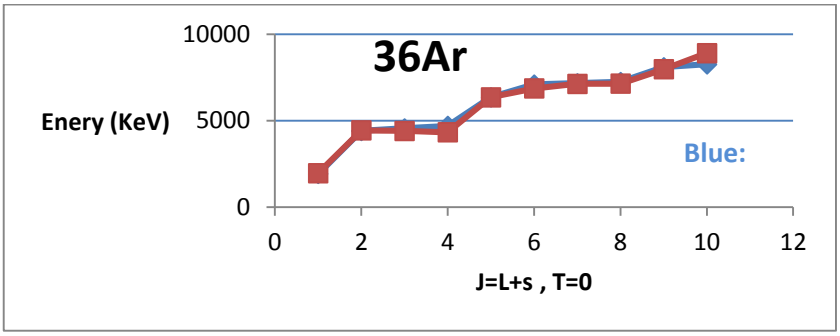

Figure 1 : Comparison of experimental data in red points and Oxbash calculation in blue points for ^{36}Ar.

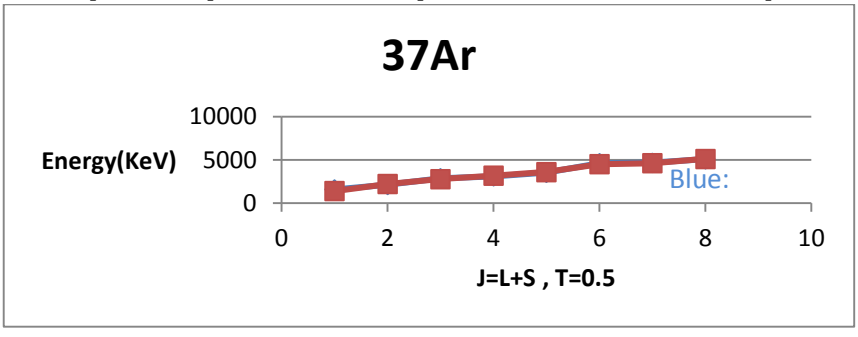

Figure 2 : Comparison of experimental data in red points and Oxbash calculation in blue points for ^{37}Ar.

Acknowledgement: We wish to thank Professor B. Alex Brown from the Department of Physics and Astronomy and National Superconducting Cyclotron Laboratory, Michigan State University for providing us the OXBASH code.

S3 O2

USE OF CR-39 TYPE RSKS SOLID STATE NUCLEAR TRACK DETECTORS IN ASSESMENT OF THE RADON RISK EXPOSURE IN TWO LIMESTONE CAVES IN ROMANIA

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Radon is a naturally occurring radioactive gas continually generated from rocks and soils, representing a risk factor for human health.

Solid state nuclear track detectors (RSKS) were used to evaluate radon alpha-activities in two limestone caves from Romanian South Carpathians (Polovragi and Muierilor caves). The aim of this evaluation was to identify the values that could be a potential long-term health risk for the tour guides.

The measurement protocol was made in compliance with quality assurance and control programs proposed by HPA-NRPB. The detectors were placed along the main galleries of the caves for about three months, in two different seasons: winter (November-March: 2012/13 and 2014/15) and spring (March-June 2013), respectively.

The results of the 2012/2013 campaign revealed variable radon concentrations: in Polovragi Cave, for winter period values between 400 and 2178 Bq m-3 with 1166 Bq m-3 average concentration and for spring period, between 1187 and 3060 Bq m-3 with 2591 Bq m-3 average concentration. In Muierilor Cave, for winter period values vary between 485 and 1846 Bq m-3 with 1527 Bq m-3 average concentration and for spring period, between 180 and 2597 Bq m-3 with 1366 Bq m-3 average concentration. The repeated measurements in these caves in the second campaign (2014/2015 winter) showed similar results. Seasonal fluctuations of radon concentration were carried out, still for Polovragi cave but in this spring we will also have results for Muierilor cave spring season. Results for Polovragi cave show higher values in spring and lower values in winter. The mean annual effective doses for radon exposure to tour guides will be estimated after completing the results for all seasons. For Polovragi cave an annual minimum of 3.2 mSv/year was estimated for tour guides exposure during the time spent in this cave. The gneisses and micaschists from basement with significant proportions of micas and the granitoids from Lainici-Păiuș terrane are thought to be related to the radon values from these caves. The rather high uranium content found in Muierilor speleothems as compared to other caves in Romania (0.6-1 ppm) may be correlated with the high radon levels in these caves.

Keywords: radon, cave, annual dose, geology

S3 O3

BRONZE AGE SILVER ARTIFACTS FROM ROMANIA – AN ARCHAEO-METALLURGICAL STUDY USING A PORTABLE XRF SPECTROMETER

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Bronze Age silver artifacts were found only in Extra-Carpathian region of Romania, the most spectacular aspect being the presence of "exotic" alloys as auriferous silver and high-content copper silver alloy. The first case is the silver axes from Persinari hoard - see Al. Vulpe in *Prehistoire du Bas Danube/Prehistory of the Lower Danube*, XV, 1997. Their composition varies around Ag = 80%, Au = 17%, Cu = 3%. Because the axes are broken it was possible to investigate their bulk structure. The microscope examination revealed a mixture of silver alloys nuggets also including few gold nuggets, suggesting an incomplete melting. Auriferous silver was also identified in a metallic disc of Vulchitrun type – see Dorel Bondoc, Bogdan Constantinescu *"A Vulchitrun-type disc discovered at Calarasi",* SCIVA, 54-56, 2003-2005. Its diameter is 30.4 cm, with a prominence in the centre - an *umbo* or *omphalos* with a middle of bronze, plated with silver and gold. The XRF analysis results are: Ag = 72%, Au = 24.5%, Cu = 3.5% for the silver foil and Au = 86.4%, Ag = 13%, Cu = 0.5%, Sn traces for the alluvial gold foil. A strange silver-copper alloy was identified in a dagger found at Poduri, central Moldavia – see Bogdan Constantinescu et al *„Considerations on the provenance of Poduri dagger as resulted from compositional analysis"*, SCIVA, 61, 2010: Ag = 70%, Cu = 30%, Pb traces. A comparison with other Bronze Age artifacts realized from similar „exotic" alloys in Eastern Mediterranean and Middle-East area is discussed. A special case is the silver hair-rings dated Early Bronze Age – Yamnaya Culture (Pit Grave Culture or Ochre Grave Culture) 3600 – 2300 BC found in South of Romania. One of them – from Aricestii Rahtivani (Prahova County) - seems to be the first gilded artifact in Europe. All the analyses were performed both in-situ (in museums) and in our Institute laboratories using a portable XRF Spectrometer XMET 3000TXR+ with Rhodium anode produced by Oxford Instruments – approximately 50 microns in depth analyzed in the artifacts.

Keywords*:* XRF, portable spectrometer, silver, archaeological artifacts

Acknowledgements*:* Funding from the Romanian National Scientific Research Agency ANCS grant PN-II-ID-PCE-2011-3-0078 is gratefully acknowledged.

S3 O4

V0 PHYSICS AT LHCB

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On behalf of LHCb collaboration

The focus of this research is the study of V0 hadrons decaying to dominant channels $\Lambda \rightarrow p^+\pi^-$, $\overline{\Lambda} \rightarrow p^-\pi^+$ and $K_S \rightarrow \pi^-\pi^+$, produced in proton-proton collisions at CERN's Large Hadron Collider in 2013 at the center of mass energy of $\sqrt{s} = 2.76$ TeV at LHCb experiment.

Such analysis is important for the understanding of the lights flavor production and hadronization process, also necessary for tuning of Monte Carlo (MC) event generators (like Pyhtia).

The analysis results contain no bias samples of real and MC simulated data, over which a common selection criteria of cuts is applied in order to obtain the invariant mass distributions and extract the raw yields.

To test the fit models for MC and data, the sideband subtraction method is used for comparison. In addition, difference in distributions of some kinematic variables like rapidity, pseudorapidity, transverse momentum (p_T), Fisher Discriminant (FD) is presented from which we can obtain the acceptance region and the re-weighting value for the MC samples.

Keywords: softQCD, MC tunning, minumum bias

S3 O5

ISOSPIN DYNAMICS IN NECK FRAGMENTATION REACTION MECHANISM

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We have analyzed the dynamics of the reactions 124Sn+64Ni, 112Sn+58Ni and 124Xe+64Zn which are considered by the CHIMERA experiment at LNS.We have performed numerical simulations within a microscopic transport model, Stochastic Mean Field (SMF) based on Landau-Vlasov equations at beam energies of 35AMeV and 45 AMeV respectively.Neck fragmentation appear in context to unstable regimes of nuclear matter which triggers the exponential growth of initial fluctuations of the nuclear system by spinodal decomposition. By using two different parameterizations with density of the symmetry energy we have studied the dynamics of isospin degree of freedom when amplifications of the unstable isoscalar fluctuations and surface instabilities determine the dynamics of neck fragmentation at Fermi energy. We have observed the coexistence of different fragmentation phenomena which are responsible to the nuclear fragmentation : dynamical emission which occur at short timescales and induced fission on longer time scales.

Acknowledgments: M. Marciu was supported by the strategic grant POSDRU/159/1.5/S/137750, "Project Doctoral and Postdoctoral programs support for increased competitiveness in Exact Sciences research" cofinanced by the European Social Found within the Sectorial Operational Program Human Resources Development 2007-2013.

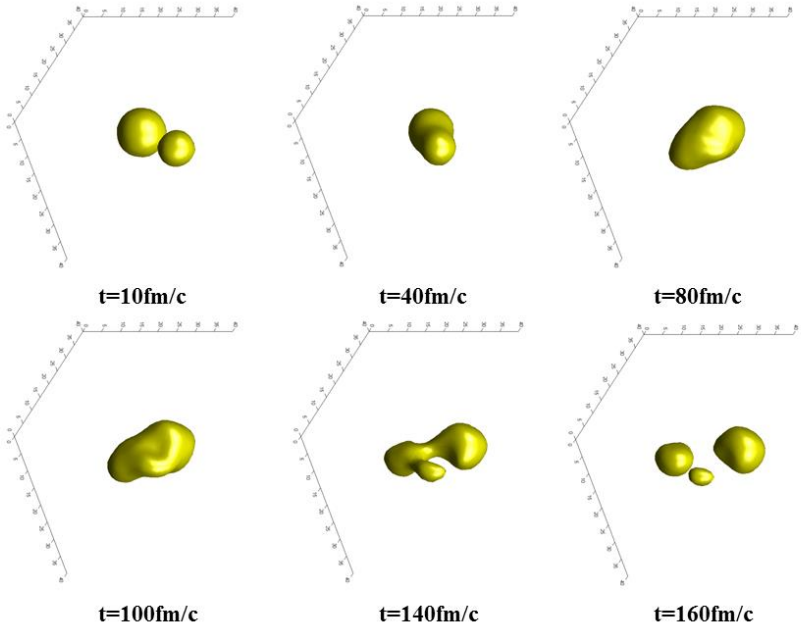

Fig1. The evolution in time of the collision 124Sn+68Ni
at beam energy of 35AMeV and impact parameter b = 6fm(asy-stiff EOS).

S3 O6

DESIGNING AND IMPLEMENTING TEST BENCHES FOR RADIATION HARDNESS QUALIFICATION OF READOUT ELECTRONICS FORM THE LHCb RICH PHOTODETECTORS

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The electronics that will be used in the futures upgraded LHCb RICH sub-detector chain must withstand to a total ionization dose of 40 Krad/year. Qualifying an electronic device as suitable for LHCb detector nominal conditions of temperature fluctuations, magnetic field, and especially radiation, will rely on data collected during the irradiation procedure with customized data acquisition test benches.

Among various electronic component tested within the LHCb Upgrade Program, the MAROC3 together with an FPGA-KINTEX7 are checked for radiation hardness. Customized test benches with dedicated software applications for online monitoring of chip parameters were developed.

The MAROC3 is generic read-out chip for 64 channels multi-anode photomultiplier tubs and it considered to be the backup solution for CLARO application specific integrated circuit (ASIC) in front-end boards of the RICH sub-detectors. The MAROC3 acronym stands for "**M**ulti **A**node **R**ead**O**ut **C**hip" and it is designed at LAL-OmegaMICRO in 0,35 µm SiGe technologies with the power consumption of 3 mW/channel. Until now, the MAROC3 undergone two preliminaries irradiation tests, one with a 13 MeV proton beam and the other with a 50 KeV X-Ray beam. The tests were carried out using irradiation facilities form IFIN-HH and chip functional parameters were monitored on-line and off-line using test bench architecture form figure 1. The entire data acquisition system was controlled, through a graphical user interface developed in LabVIEW.

The digital boards of RICH photo-detectors will be designed around an FPGA from KINTE7 family of Xilinx. This FPGA family is implemented with a 28 nm high-k metal gate (HKMG) technology having a performance that reaches up to 2800 GMAC/s; and up to 478000 logic cells and the peak transceiver speed of 12.5 Gb/s. For evaluating the radiation hardness of this technology a lidless chip was chosen and a test board was designed for it together with the test bench architecture as in figure 2 for on-line monitoring during irradiation.

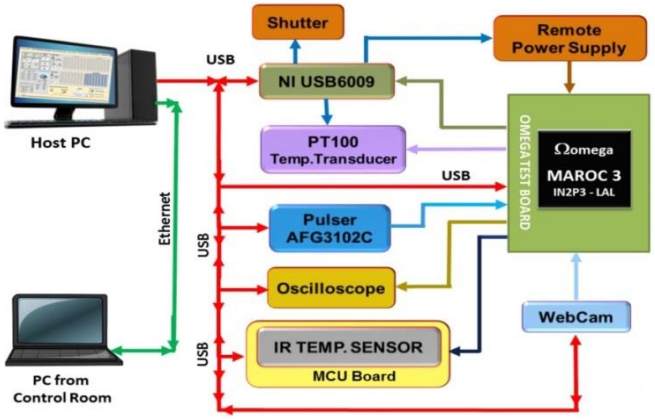

Figure 1 Test bench architecture for MAROC3

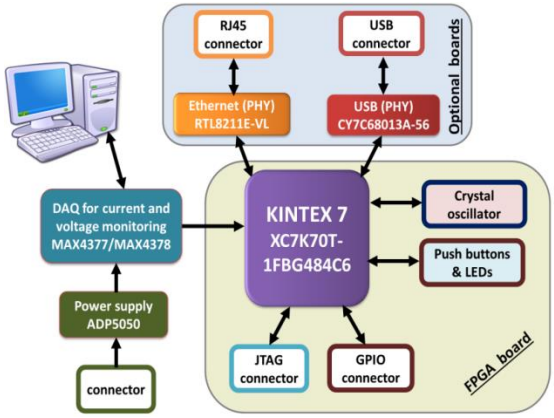

Figure 2 Test bench architecture for KINTEX7

S3 O7

RARE RADIATIVE DECAYS AT LHCb@CERN

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The rare radiative decays of b-hadrons are favorable for searching New Physics (NP) signatures. In the Standard Model (SM) [1] decays of type $b \rightarrow (d, s)\gamma$, involve flavour changing neutral currents (FCNC) which are described at leading order by one-loop dia- grams, "penguin diagrams". Since new particles can enter in the loop, observables such as branching fractions, CP and isospin asymmetries and the photon polarization in $b \rightarrow (s, d)\gamma$ transitions are very sensitive to NP effects. Ratio of

branching fractions and asymmetries benefits from cancellation of form factors, being theoretically cleaner. Sizable effects on the dynamics of these transitions with respect to SM predictions can be identified as NP signatures [2], as detailed in the followings. The helicity of the photon emitted in the $b \rightarrow s\gamma$ quark transition remains one of the last untested predictions of the Standard Model (SM) in the realm of B physics [3]. Radiative decays of polarized Λ_b baryons represent an attractive possibility to measure the helicity of the photon emitted in the $b \rightarrow s\gamma$ quark transition and thus to subject the Standard Model to a stringent test at existing and future hadron colliders. The most abundant mode, $\Lambda(1116)\ \gamma$, is experimentally very challenging because of the long decay length of the $\Lambda(1116)$. We want to show that the experimentally more accessible $\Lambda_b \rightarrow pK\gamma$ decays proceeding via Λ resonances may be used to extract the photon helicity for sufficient Λ_b polarization.

Keywords: radiative decays, photon helicity

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S3 P1

CBM TIME OF FLIGHT SUBDETECTOR, SMALL POLAR ANGLES ARHITECTURE

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One of the main subdetector of the Compresed Baryonic Matter (CBM) experiment at FAIR is Time of Flight (TOF) wall. In order to minimize the number of components, the CBM - TOF wall has a modular configuration. The basic units are called modules. They are mechanically and electrically independent structures placed in a space frame. The modules contain the MRPC - Multigap Resistive Plate Counters and the associated electronics. The modules designed by us for the most inner zone of the CBM-TOF wall are based on strip readout MRPCs, developed by our group from Hadron Physics Department. Strip readout MRPCs provide simultaneously the time of flight and 2-dimensional position information. Our design for the configuration of the modules of the inner zone is based on three types of modules: two M1, two M2 and four M3. For an uniform coverage of the active area with such MRPCs, a stable and precise mechanical structure was designed for each module.

In this contribution we report the design of the M2 module, one of the most demanding mechanical structures of the system.

Keywords: FAIR, CBM-TOF Wall, Multigap Resistive Plate Counters (MRPC)

S3 P2

XRF AND MICRO-PIXE AS INVESTIGATION TOOLS FOR ANCIENT BRONZE METALLURGY – THE CASE OF PRE-MONETARY SIGNS TYPE "ARROWHEADS" FROM HISTRIA

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The main metallurgical problem of ancient bronze alloys (Cu-Sn-Pb mainly but also Cu-Sb-Pb or Cu-As-Pb and other combinations) was to have a good homogeneous micro-structure at least in the range of few microns, that means to avoid elemental segregations – concentrations of a specific element (e.g. Pb) in a micro-region. If X-Ray Fluorescence (XRF) analysis gives the general elemental composition (approx. 30 mm diameter of investigated area), micro-Proton Induced X-ray Emission (micro-PIXE) is an excellent tool to investigate the alloys microstructure, especially segregation phenomena. We investigated pre-monetary signs type arrowheads (VII-VI-th Century B C) found in Dobroudja, especially in Histria area (Histria, Constanta, Floriile, Sinoe, Glogovita, Cogealac) – both supposed emitted by Histria and by "barbarian" neighbors (Getae, Scyths). XRF analysis with a portable spectrometer XMET-3000X+ with Rhodium anode suggested four types of allos: Cu-Sn-Pb ("normal" bronze), Cu-Pb, Cu-Sn-Sb-Pb and Cu-Sn-Mn-Pb. A discussion on possible provenance from geological point of view for alloys containing Manganese and Antimony (Ukraine, Caucasus, North-West Hungary) is discussed. As concerning elemental segregations, using 3 MeV protons micro-probe elemental maps at AN2000 accelerator of LNL INFN Legnaro, cases of Cu-Pb (see Figure 1), Cu-Mn, Cu-Fe, Cu-Sn, Cu-Sb are presented and discussed.

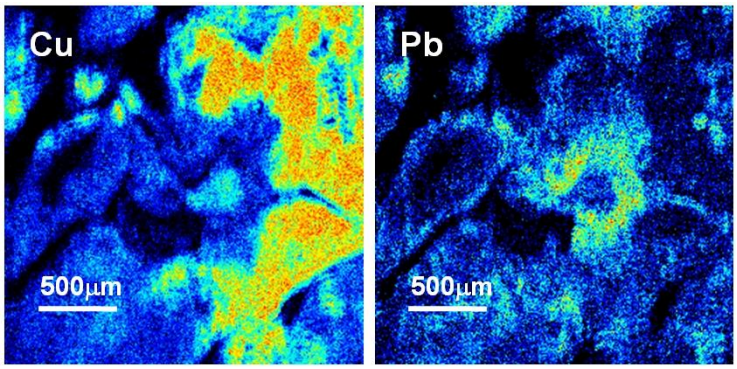

Figure 1. Micro-PIXE elemental maps

Keywords*:* XRF, micro-PIXE, bronze, archaeological artifacts
Acknowledgements: Financial support by Romanian National Scientific Research Agency ANCS grant PN-II-ID – PCE – 2011 – 3 – 0078 and EU programme ENSAR – INFN, LNL - Legnaro is gratefully acknowledged.

S3 P3

EFFECTIVE EQUATIONS FOR THE DYNAMICS OF BOSE-EINSTREIN CONDENSATES

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The first part of this contribution briefly overviewes the fundamentals of Bose-Einstein condensation and surveys a series of results concerning the effective equations which describe the dynamics of elongated and oblate Bose-Einstein condensates. In the second part, we show how one can construct effective one- and two-dimensional polynomial and non-polynomial Schrödinger equations which describe the longitudinal (transversal) dynamics of high-density cigar-shaped (pancake-shaped) Bose-Einstein condensates. The polynomial equations [1] do not account for the interplay between the radial and the transversal modes of the condensate, but can accurately describe the dynamics of ef- fectively longitudinal (transversal) nonlinear waveforms through the rescaled effective nonlinearity in the case of cigar-shaped (pancake-shaped) condensates. Complementary, the non-polynomial equations [2] have been shown to capture accurately the interplay between the radial and the transversal modes of a condensates, and have been used succesfully to model quantitatively pattern-forming dynamical instabilities.
Keywords: effective polynomial equations; effective non-polynomoal equations; dynamics of Bose-Einstein condensates
References:
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S3 P4

EFFECT OF MAGNESIUM OXIDE PARTICLE SIZE AND THE FILLER CONTENT ON MAGNESIUM POTASSIUM PHOSPHATE CEMENT PROPERTIES

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The radioactive aluminium waste generated by the VVR-S nuclear reactor decommissioning after nearly 15 years from shut-down is represented as low and intermediate radioactive waste and is divided as activated and contaminated aluminium metal. To realize a conditioning matrix for radioactive aluminum is necessary to study alternative cementitious systems such as magnesium potassium phosphate cement.

This paper presents the influence of magnesium oxide and the filler content on properties of magnesium potassium phosphate cement, such as: fluidity, setting time, pH, and compressive strength (in fresh and hardened state). In this study were used two types of MgO with different specific surface area and different types of filler (fly ash and red mud).

The mechanical tests for samples of MKPC will be correlated with XRD characterization data.

The studies in this paper were carried out on the engineering properties of the resulting paste or mortar and attempted in order to obtain an optimized formula of magnesium potassium phosphate cement based on the raw materials available.

Keywords: magnesium oxide, aluminium radioactive waste, conditioning matrix, XRD

S3 P5

MINIMIZATION OF RADIOACTIVE WASTE VOLUME BY SUPERCOMPACTION

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National Institute for Research and Development for Physics and Nuclear Engineering –Horia Hulubei

Treatment and conditioning processes are used to convert radioactive waste materials into a form that is suitable for its subsequent management, such as transportation, storage and final disposal. The main aims of the treatment and conditioning of radioactive waste are to minimize the volume of waste requiring subsequent storage or disposal, and to reduce the potential hazard of the waste which can be safely handled during transport, storage and final disposal.

The supercompaction is the process used to conversion of the radioactive waste into a stable, compacted solid form as a cylindrical pellet. A characteristic of the compaction is that it reduces the volume of waste but the amount of radioactivity remains the same.

During the refurbishment of NIPNE Magurele, the Radioactive Waste Treatment Facility purchased and installed a supercompaction facility operating under a force of 2000 tones which compresses the material contained in the standard drum of 220 l. The drum is perforated from the lateral side, at the same time at several points, after that the drum is paced in a metal mold, and compressed by the piston. A compressed form, reduced by its high with the diameter of the metal mold, as a cylindrical pellet is obtained. The volume reduction factor is approx. 5-10 and depending of materials can reach 20.

This paper describes the results of the first radioactive waste compaction campaign performed from March to April 2015 at NIPNE DMDR Magurele, in order to enhance the efficiency and safety of storage of radioactive waste. The campaign involved evidence, gammaspectrum measurement, dose rate measurement, compaction, re-packaging, and temporary stored of radioactive wastes which have to be disposed in Baita Bihor repository.

S3 P6

HEAVY METALS ACCUMULATION IN DIFFERENT PARTS OF TREES

Ioana – Daniela DULAMA[1], Claudia STIHI[2], Cristiana RADULESCU[2], Ion V. POPESCU[1,2,3,4], Gheorghe Valerica CIMPOCA[3], Lucica Grigora TOMA[1], Ioan Alin BUCURICA[1], Raluca STIRBESCU[1], Dorin LET[1], Elena Daniela CHELARESCU[4]

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Abstract. The concentrations of several heavy metals including Mn, Cu, Zn, Cd and Pb in soil, tree leaves, bark and moss samples, collected from ten collection points, disposed along national road 72 or county road 720, between Targoviste and Moreni, Dambovita County, were investigated. The samples were collected in autumn of 2011, 2012 and 2013 and were analyzed by Flame Atomic Absorption Spectrometry (FAAS) and Energy Dispersive X-ray Fluorescence (EDXRF) Spectrometry. The linear regression of heavy metal concentrations in leaf and bark samples and heavy metal concentrations in soil and moss samples was used to determine the accumulation source of heavy metals. The obtained results reveal that the tree leaves accumulate heavy metals from soil and the bark accumulate heavy metals from air.

Keywords: heavy metals, leaves, bark.

S3 P7

THE POSSIBILITIES OF SMALL ANGLE NEUTRON SCATTERING SPECTROMETER YUMO FOR SOFT MATTER INVESTIGATIONS

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[e] *Research Center Juelich, Germany*

The possibilities of the modernized spectrometer YuMO at high flux IBR-2 pulsed reactor due to automation of separate units are shown [1]. Main unique devices due to modernization are presented [2, 3]. The wide q-range, absolute scale and dynamic q-range was shown [4]. Standard configuration of the spectrometer include thermobox connected with liquid thermostate are presented.

Advantages of the upgraded spectrometer are shown. The main applications of spectrometer are presented.

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S3 P8

INVESTIGATION OF NATURAL AND ARTIFICIAL RADIOACTIVITY IN GRAPHITE FROM VVR-S NUCLEAR REACTOR DEPOSIT BY GAMMA-RAY SPECTROMETRY

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Decommissioning activity of a nuclear reactor is known to produce a large quantity of material that undergo to radiological characterization. Waste produced during a reactor operation can be restrictive or unrestrictive released from regulatory control, or require geological disposal. The radiological characterization and releasing of materials under authorization are very important processes within the management of radioactive waste. To this end, accidental radioactive contamination must be investigated, as result of the activities during the facility decommissioning. Graphite, together with concrete used as biological reactor shield, represents the majority of waste in the reactor operation history. In the nuclear technology, graphite is a specific material used due to its neutrons moderator and reflector qualities, the high temperature stability and structural strength.

The aim of this paper was to investigate the presence of natural and artificial radionuclides in virgin graphite material stored in the warehouse belonging to the 2 MW VVR-S research nuclear reactor of IFIN-HH at Magurele (shut down in view of decommissioning, in December 1997). For the radioactivity analysis, graphite samples (mass 75-95 g) were measured by high resolution, low background gamma-ray spectrometry in the GamaSpec laboratory of IFIN-HH [1]. Activity concentrations of ^{60}Co and ^{137}Cs (artificial radionuclides), ^{226}Ra, ^{238}U, ^{232}Th, and ^{40}K (natural radionuclides) were determined. Their values were found to be in the following ranges: 2.1-11.9 Bq/kg for ^{60}Co, 2.8-4.3 Bq/kg for ^{226}Ra, and 2.1-3.0 Bq/kg for ^{232}Th. In the case of ^{137}Cs, ^{238}U, and ^{40}K, detection limits were only assessed (0.7-2.3, 11-25, and 14-40 Bq/kg, respectively). The presence of ^{60}Co in graphite is probably due to a contamination during reactor decommissioning works.

All the activity concentration values obtained were found to be below the radionuclide exclusion levels given by the Romanian norms [2]. ^{238}U, ^{232}Th, and ^{40}K radioactivity results were in accordance with U, Th and K concentration values previously determined by Instrumental Neutron Activation Analysis (INAA) on this material.

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S3 P9

RADIOACTIVITY LEVELS IN PARAFFIN AND WATER SAMPLES FROM THE DECOMMISSIONING VVR-S NUCLEAR REACTOR BY GAMMA-RAY SPECTROMETR

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The decommissioning activities of a nuclear reactor, involves a large volume of radioactive waste that have to undergo to radiological characterization. Waste produced during the reactor operation can be restrictive or unrestrictive released from regulatory control, or require geological disposal. Radiological characterization plays an important role in the decommissioning process of nuclear facilities that ensures protection of the environment and radiation safety. The radiological characterization is a key element for planning, controlling and optimizing the dismantling and decommissioning activities including the residual materials and waste management.

In this paper, we proposed to examine radioactivity levels of water and paraffin samples coming from the 2MW VVR-S research nuclear reactor of IFIN-HH at Magurele (shut down in view of decommissioning, after forty years of operation, in December 1997). The samples with mass of about 0.5 kg each were measured by low background gamma-ray spectrometry based on HPGe Ortec detector in the GamaSpec laboratory of IFIN-HH [1].

A total 11 radionuclides were determined in 60 paraffin samples coming from the biological shielding of the VVR-S reactor: ^{60}Co, ^{137}Cs, ^{152}Eu, and ^{241}Am artificial radionuclides, as well as ^{234}Th, ^{214}Pb, ^{214}Bi, ^{228}Ac, ^{212}Pb, ^{208}Tl, and ^{40}K natural radionuclides. Activity concentrations below detection limits, or close to them, were found for ^{152}Eu, ^{241}Am, ^{234}Th, ^{228}Ac, ^{212}Pb, ^{208}Tl, and ^{40}K. Relatively low radioactivity values were obtained for ^{60}Co (0.2-7.2 Bq/kg), ^{137}Cs (0.2-10 Bq/kg), ^{214}Pb (1.4-14 Bq/kg), and ^{214}Bi (1.3-13 Bq/kg). For all radionuclides determined in the paraffin samples the activity concentrations are lower than the exclusion levels given by the Romanian norms [2]. The presence of ^{60}Co and ^{137}Cs in some of the samples is probably due to a radioactive contamination produced during the reactor decommissioning operations.

Water samples investigated were collected from six locations of the VVR-S decommissioning nuclear reactor, as follows: four spent nuclear fuel storage ponds, reactor cooling pond and reactor tank for contaminated water. ^{137}Cs, ^{134}Cs, and ^{60}Co artificial radionuclides were measured. The highest ^{137}Cs activity concentration (3320±130 Bq/kg) determined in one of the water samples (fuel storage pond) is due to fuel leakage from a cracked fuel assembly. It is four times higher than the exclusion level (800 Bq/kg) given by the Romanian norms [2]. For the rest of samples, ^{137}Cs activity concentration was situated bellow the exclusion level, in the range of 22-772 Bq/kg. Detection limits of 0.7-5.0 Bq/kg were determined for ^{134}Cs, besides a value of 15±2 Bq/kg. For ^{60}Co, activity concentrations in the range of 0.8-690 Bq/kg were found. The radioactivity levels of ^{134}Cs and ^{60}Co in the investigated water samples are lower than the exclusion levels of 500 Bq/kg and 1000 Bq/kg, respectively.

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S3 P10

RADIATION MONITORING EXPERIMENT USING TLD FOR THE TR19 CYCLOTRON AREA IN IFIN-HH

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In 2012 IFIN-HH has implemented the investment project CCR (Radiopharmaceuticals Research Centre) dedicated to the study of radiopharmaceuticals, both for medical imaging and targeted therapy, in view of their future implementation in medical practice. The project consists of a more than 1330 m² state-of-the-art center comprising one of the newest generation of cyclotrons (TR19) and a highly specialized radiopharmaceutical facility.

The core of CCR is represented by a TR19 cyclotron (Advanced Cyclotron Systems Inc.), a versatile and fully automated and computer controlled machine. This cyclotron accelerates negative ions (H-), on a vertically arranged plane, up to 19 MeV energy, and is provided with two external beam lines and dual extraction capabilities. The main use is for the production of positron emitting

radionuclides namely ^{18}F, ^{15}O, ^{13}N and ^{11}C. The pharmaceuticals labeled with these radioisotopes are used for positron emission tomography (PET) imaging. The cyclotron has an associated radiochemistry facility that contains chemistry modules housed in adequately shielded hot cells meant for the synthesis of the pharmaceuticals labeled with these positron emitters.

During cyclotron operation, some radioactive nuclides are produced by beam activation of the cyclotron materials and surrounded air molecules. The activity varies from place to place inside the cyclotron room and some background activity could be remarkable in the places outside the cyclotron room, in the working area. The principal aim of occupational protection and safety can be stated as the achievement and maintenance of an acceptably safe and healthy working environment. Therefore the mapping of the produced radioactivity in the cyclotron area is important for radiation protection purposes.

The radiation levels were measured in the facility at different locations namely cyclotron vault, control console, radiochemistry laboratory, beam extension room and the stack using a comprehensive computerized monitoring system. The radiation levels were observed to be well within the prescribed limits.

TLD (thermoluminescent dosimeter) manly LiF: Mg, Cu, P are commonly used for the radiation dose measurements to determine the ambient dose equivalent, which are part of passive systems of environmental radioactivity monitoring. In this work TLD chips were distributed for a period of 87 days in 12 points of interest according to the map of the cyclotron area and were read out to determine the corresponding activities.

The readings were listed and the activity mapping for the different irradiation conditions will be given and discussed.

Keywords: Radiation measurements, TLD dosimeters, TR19 cyclotron

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S3 P11

RECENT ACTIVITIES ON THE TR19 CYCLOTRON AT IFIN-HH

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The TR19 cyclotron was commissioned in 2012 as a part of the first major project in Romania dedicated to the study of radiopharmaceuticals, both for medical imaging and targeted therapy. The accelerator (Fig. 1) was designed, custom-built and tested for IFIN-HH by Advanced Cyclotron System Inc. (ACSI), in Richmond, Canada. It is a versatile and fully automated and computer controlled machine able to deliver proton beams at energies between 14 and 19 MeV and current up to 300 microAmps. The dual beam construction of the cyclotron allowed equipping the machine with a specifically conceived 6 m long external beam line, ending in a separate bunker (the experimental hall). Recently was installed the Secondary Beam Line that will allow for a second pathway to conduct the proton beam from the cyclotron to a solid target station. The cyclotron has an associated radiochemistry facility that contains chemistry modules housed in adequately shielded hot cells meant for the synthesis of the pharmaceuticals. This work reports the main recent activities:

- the development of the cyclotron route for the production of Tc-99m with proton beams at 15 MeV as an alternative to the reactor based technology. Because of the recent worldwide shortage of reactor-produced 99Mo/99mTc, there is a growing interest in exploring alternative technologies such as accelerator activation of Mo with protons via the $^{100}Mo(p,2n)^{99m}Tc$ reaction.

- the design of the irradiation extension in the experiment hall from TR-19 cyclotron. To attain our research program objectives a new irradiation infrastructure composed of a commuting magnet, four beam lines and a system for beam diagnosis is ongoing. This new capability of irradiation will represent an unique facility in Romania with the following potential: Neutron activator for nanostructure activation for brachytherapy and for activation of nanoparticles for industry, Thin Layer Activation/Ultrathin Layer Activation for wear/corrosion studies, Positron source in line with the cyclotron for accelerating slow positrons, Irradiation for electronic device testing, Experimental physics, dosimetry, etc.

Fig. 1 TR19 cyclotron with two beam lines on one side of the machine. The top beam line is used for nuclear physics research activities in the second bunker. The bottom beam line houses a solid target station designed to accept up to 300 uA of proton beam.

Keywords: TR19 cyclotron

References: I. Ursu, L. Craciun, D. Niculae, N.V. Zamfir. "*The Radiopharmaceuticals Research Center (CCR) of IFIN-HH at start",* R. J. Phys., V 58, Nos. 9–10, P. 1327–1336, Bucharest, 2013

S3 P12

PRACTICAL TEST BENCH USED FOR TESTING PHOTOMULTIPLIER TUBES, TYPE MAPMT

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The RICH subdetector of LHCb is an identification particle system that carries-out the identification of the charged particles using photo detectors for Cherenkov radiation. The present RICH system uses hybrid photon detectors (HPDs) and during the UPGRADE phase of LHCb, they will be replaced with multi anode photomultipliers (MaPMTs). In order to be familiarize with this kind of photodetector we build in our laboratory a test bench, and we use this setup to prepare for the Upgraded-LHCb construction, which will involve hundreds and thousands of tests of MaPMTs and their read-out and transmission boards.

The test bench consist from a dark- box in which MaPMTs are placed with electronic circuits for reading and interpreting the output signal. Until now, we manage to make some test like: signal amplification, gain uniformity, dark current measurements, dark counting of thermionic emission of single electrons and charge measurements. In the near future tests will be carry out with application specific integrated circuits (ASICs) designed at LAL-OmegaMICRO.

In figure 1 is illustrated the proposed test bench for carry out test on MaPMTs.

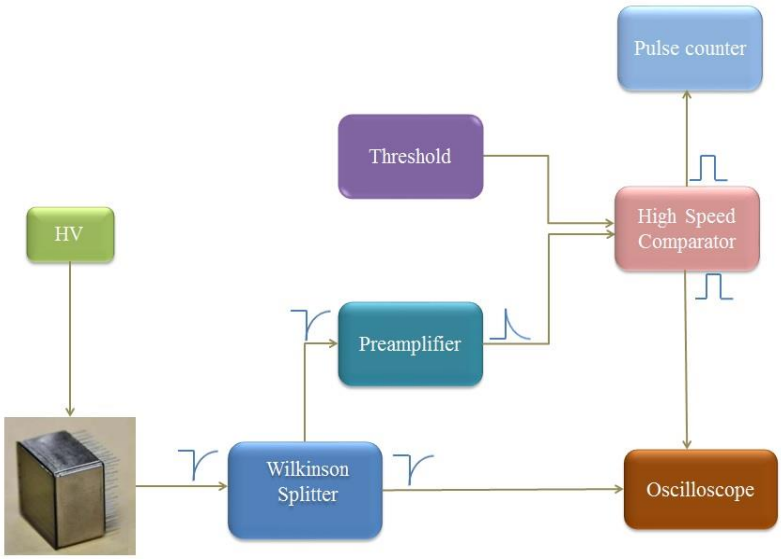

Fig.1 Test bench architecture for MaPMTs

S3 P13

IN-BEAM GAMMA-RAY SPECTROSCOPY OF ^{67}GE USING ROSPHERE

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High-precision gamma-ray spectroscopy is a key tool used in order to describe the decay properties and level structure of atomic nuclei. The aim of this work is to present the experimental set-up installed at IFIN-HH and its characteristics. In the mixed configuration, the ROSPHERE array is composed of 14 HPGe detectors of about 50% efficiency and 11 $LaBr_3$(Ce) scintillation detectors, which makes it suitable for in-beam gamma-ray spectroscopy and lifetime measurements. It will also be presented a detailed spectroscopy of ^{67}Ge nucleus populated via the fusion-evaporation reaction ^{58}Ni(^{12}C,2pn)^{67}Ge produced at the 9 MV tandem accelerator facility from IFIN-HH, Romania. We propose a more complex level scheme for ^{67}Ge, than what was previously known, based on the current experimental data.

S3 P14

MODELLING OF THE MAGNETIC NANOPARTICLES INFLUENCE ON ELASTOMER MATRIX FROM SAS DATA

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Magnetic elastomers (ME's) represent a specific class of smart materials responding in a complicated way to the changes of external conditions. ME's are composed of magnetic nanoparticles and a low magnetic permeability polymer matrix. These composites are quite new, and the work on understanding their properties in dependence on the synthesis processes, composition, mechanical and magnetic fields, etc. is nowadays extensively progressing with regard to nano- or microtechnology.

The paper provides a comparison analysis of SAS experimental data processing results using several modeling approaches for the mathematical description of the elastomer matrix behavior in function of the particle concentration and magnetic field application during the preparation process.

Keywords: smal angle scattering, magnetic elastomers, nanoparticles

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S3 P15

NEUTRON DIFFRACTION INVESTIGATION OF RAIL WHEEL STEEL TEXTURE

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Keywords: rail wheel steel, crystallographic texture, neutron diffraction

Study of the factors controlling the structure and properties of rail wheel steel is a very important task because it allows optimizing of steel composition and temperature regimes for mechanical properties improvement. The production technology of the rail wheels includes such operations as forging, press forming and rolling that can result in texture formation. The subsequent temperature treatment (annealing, quenching and tempering for rim) can also influence texture changing. Besides, texture formed as a result of railway wheel usage influences on their strength and operating life. Neutron diffraction is a powerful nondestructive tool for global texture investigation in the volume of the material.

In this work the crystallographic texture for a set of wheel steel samples with different regimes of thermo-mechanical treatment and with and without doping by system Al-Mg-Si-Fe-C-Ca-Ti-Ce has been measured by neutron diffraction. The texture measurements have been carried out by neutron diffraction using time-of-flight technique at SKAT diffractometer situated at IBR-2 reactor (Dubna, Russia). The three complete pole figures (110), (200), (211) of α-Fe phase in $5^\circ \times 5^\circ$grid have been extracted from a set of 1368 spectra measured for each sample (Fig.1). We had for texture investigation four samples from the wheel rim and four samples from the transitional zone between the wheel hub and disk. Namely in this transitional zone cracks sometimes appear under fatigue cycling tests.

The resolution of SKAT texture spectrometer is rather high $\Delta d/d = 5\times10^{-3}$ at $d = 2.5$ Å and $2\theta = 90^\circ$. This resolution allows to have non-overlapped diffraction peaks for α-Fe phase of the steel. It was used the local peak fit procedure for the PFs extraction .

It was concluded that the steel modification and some changes in the heat treatment modes of the rail wheels from the experimental (modified) and the conventional (non-modified) steel lead to reorientation of texture component.

ABSTRACTS

S4 – Cross-disciplinary Applications of Physics

- *Nonlinear dynamics, complex systems and applications*
- *Biological complexity and genetics, Biophysics and bioengineering*
- *Econophysics*
- *Physics of Social Systems*

S4 L1

PHASE SYNCHRONIZATION IN COHERENT EXCHANGE RATE SERIES

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Investigation of phase synchronization [1] of the relative phase function (RPF) of the complex cross coherence function (CCCF) of couples of series may evidence connected processes embedded herein [2]. Particularly phase synchronization is suitable for estimating distinct time shifts in separate frequency bands to subsequently disentangling long-term business cycles from short-term speculative transactions [3]. The revealing of such time shifts is of ultimate importance to disclosing connections that help forecasting techniques [4].

Here the connectivity among exchange rate series collected at the same calendar times is assessed. The method relies on the theory of CCCF of couples of time series particularly on how RPF is scaling with frequency. The time shifts are considered as indicator for connectivity if there is a certain level of phase synchronization as indicated by the mutual phase coherence function (PCF). In the case of perfect synchronization the probability density is a Delta distribution and therefore PCF is unity at any frequency; the other extreme case is the complete lack of synchronization when the probability density is constant and consequently RPF is zero.

The paper is presenting the theoretical justification of the technique, a bootstrap analysis using aggregate series, and the calibration procedure. Finally, the method is applied to analyze the connectivity among exchange rates, particularly the ones involving the Romanian currency. However, eleven currencies grouped in 55 exchange rate series were investigated and – where the case – the relative gaps were evaluated in terms of time advances or lags. The method is suitable to finding temporal shifts smaller than the sampling rate; a proper calibration with synthesized series using Mathematica facilities as described in [5] allows a resolution as low as fractions of day provided that the conditions of coherence and statistical significance are fulfilled. The exchange rates were acquired from the site Forex Trading and Exchange Rates Services and correspond to the interval 1 Jan. 1999-31 Dec. 2014 (5844 points).

The influence onto the computational results of the long run point-to-point correlations are discussed in terms of fractional Brownian motion characterized by the Hurst exponent: anti-persistent series with $H<1/2$, pure random walk series with $H=1/2$, and persistent series with $H>1/2$ [6]. The weird existence of relevant time shifts between the short-term processes – cycles of several days – that characterize the dynamics of exchange rate series were found as well as distinct bands of connectivity.

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S4 L2

MATHEMATICAL ASSESMENT OF POST RAIT ^{131}I SCINTIGRAPHY WITH TUMOR MARKERS LEVELS IN THYROID CANCER

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Abstract: Stimulated serum Tg levels on thyroid hormone (T4) withdrawal are usually well correlated with ^{131}I imaging results. Changes in thyroglobulin (Tg) and/or Tg antibody (TgAb) determination methods can disrupt the serial monitoring of DTC patients. After total thyroidectomy and radioiodine ablation therapy in patients with differentiated thyroid carcinoma (DTC), thyroglobulin (Tg), anti-thyroglobulin antibodies (Anti TgAb) and post-therapeutic ^{131}I scan (whole body scan-WBS) are essential for the risk stratification and for further management. Mathematical assessment of the investigation results with different imaging modalities (CT, ^{131}I SPECT/CT, ^{18}F FDG PET/CT) are needed to exclude false negative/false positive Tg or WBS.

S4 O1

PHONON DYNAMICS OF Fe_2SiO_4 AND Mg_2SiO_4 SILICATES

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The spinel form of magnesium-iron orthosilicate, $(Mg, Fe)_2SiO_4$, is believed to be one of the most abundant minerals in the mantle's transition zone. The olivine-spinel phase transition and crystal structure of silicate spinel have been extensively investigated for understanding possible phase transformations and crystal chemistry of the orthosilicate. The knowledge of the properties of all phases of silicates is of great importance for earth sciences, since it determines crucial geophysical properties of the earth's interior such as possible phase transitions and thermodynamics of rock-forming minerals. These properties play crucial role in the interpretation of the geophysical data and thus have a large influence on our knowledge of the earth's interior. An understanding of the elastic properties of silicate will be helpful to the interpretation of seismological data, in particular the variation in the depth range of transition zone of earth's interior. The spinel phase of magnesium-iron orthosilicate is found to be stable in ambient conditions and therefore phonon dynamics of this stable phase of orthosilicates have been investigated in the present study. The lattice dynamics and thermodynamic properties of the Mg_2SiO_4-spinel were the subject of several experimental and theoretical studies in the past. But the theoretical study of the lattice dynamics for its Fe-end counterpart is still lacking. It is therefore, in the present investigation, the lattice dynamics of spinel phase of Mg_2SiO_4 and Fe_2SiO_4 silicates has been studied by using lattice dynamical simulation

method based on de Launey angular force (DAF) constant model. The calculated results are compared and analyzed with exiting experimental results.

Keywords: Zone centre phonons, lattice dynamics, orthosilicates, spinel phase

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S4 O2

NEUTRON TIME-OF-FLIGHT QUANTITATIVE TEXTURE ANALYSIS

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The metallic alloys, as well as many natural or industrial materials, are nearly always polycrystalline materials. Therefore their physical or mechanical properties exhibit very often an anisotropy which is mainly due to the presence of preferred orientations or crystallographic texture described by an ODF (Orientation Distribution Function). Both aspects, characterizing the texture from one side and correlating it to the properties from the other side, are then essential in understanding and improving the metallic materials behavior.

An important step of texture analysis is pole figures processing and orientation distribution function (ODF) reconstruction. The ODF could be reconstructed from the pole figures that are obtained from experimentally measured neutron time-of-flight diffraction spectra.

We present details of neutron time-of-flight diffraction spectra processing. The spectra were measured at SKAT spectrometer at pulsed reactor IBR-2 We also presenting examples of the quantitative texture analysis for the different metallic and non-metallic materials.

S4 O3

MEASURING FOLDING MECHANISM IN CHAOTIC DYNAMICS

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One of the most characteristic features emerging when dealing with nonlinear systems is the appearance of chaotic dynamics. There has been a considerable amount of work to establish what are the conditions for a nonlinear system, dissipative or conservative, to display chaotic dynamics and what are some suitable quantities to characterize it.

We study the asymptotic distance between trajectories d_∞ in order to characterize the occurrence of chaos. We show that this quantity is quite distinct and complementary to the Lyapunov exponents, and it allows for a quantitave estimate for the folding mechanism which keeps the motion bounded in phase space. We study the behaviour of d_∞ in simple unidimensional maps. Near a critical point, d_∞ has a power law dependence on the control parameter. Furthermore, at variance with the Lyapunov exponents, it shows jumps when there are sudden changes on the available phase-space.

S4 O4

THE TEST OF BIO-COMPATIBILITY « IN VIVO » OF DENTAL ACRYLATS, THROUGH PHYSICAL METHODS

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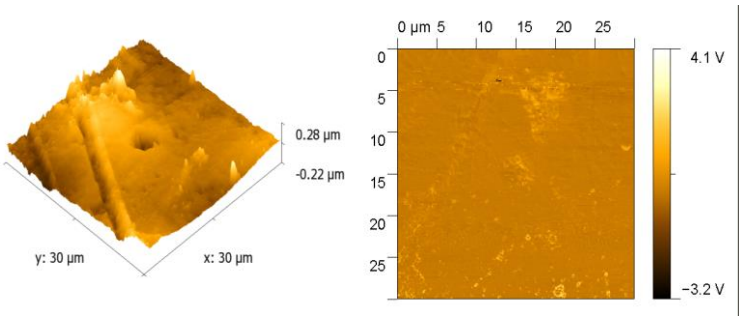
We accomplished a study concerning the surface state of acrylic prosthetic bio-materials both optimized and non-optimized. We studied their compatibility on test animals.
The morphology and roughness of the surfaces in case of acrylic prosthetic bio-materials were analyzed by atomic force microscope (AFM), and we obtained the qualitative information regarding the chemical uniformity from phase AFM images.

Keywords: bio-compatibility, acrylic materials, roughness

Roughness of acrylic surface

Sample	Rrms (nm)
Duracryl	47,5
Duracryl+Palaseal	13,1

Image of acrylic type Duracryl: a) Topography 3D-morphology Duracryl (30µm x 30 µm); b) Phase image of Duracryl sample.



S4 P1

NANO LAYERED ANTIBACTERIAL METAL COATINGS

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In this paper, nano layered antibacterial metal coatings on PET substrates has been produced. Antibacterial test procedures were used gram negative and gram positive bacteria. PET materials are more important the electronic tools and optoelectronic.

As metal coatings, nickel, zinc, silver, aluminium were coated PET using plasma arc deposition methods. Field emission scanning electron microscopy (FESEM), Energy dispersive x-ray spectroscopy (EDX), X-ray diffractometers were used.

According to obtained results, metal coatings shows different behaviour against gram negative and gram positive bacteria. Some coatings are strongly effect the bacterial structure, but some metal can not use antibacterrial surface.

Keywords: Antibacterial properties; metal coatings; FESEM; XRD

S4 P2

FRACTAL DIMENSION OF THE TRAJECTORY OF A SINGLE PARTICLE DIFFUSING IN CROWDED MEDIA

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Using Monte Carlo simulations we have modeled the diffusion of a single particle in two- and three-dimensional lattices with different crowding conditions given by distinct obstacles size and density. We have introduced a new time-scale fractal dimension, d_m, which is related to the anomalous diffusion exponent [1], α. This allows us to relate the well-known length-scale fractal dimension of the random walk, d_w, to the new one introduced here as a time-scale fractal dimension.

$$d_w = \frac{1}{2 - d_m} \tag{1}$$

It is important to note that the new time-scale fractal dimension, d_m, presents similarities to the fractal dimension of the protein backbone, d_f, computed from the log-log plots of the backbone length with number of residues that yield the $(1/d_f\text{-}1)$ slope [2].
All registered data emphasize that diffusion process is anomalous and diffusing particle describes fractal trajectories.
Moreover, the 3D simulations consider similar conditions to those used in the previous FRAP [3] experiments in order to reveal the relationship between the length and time-scale fractal dimensions. Our results reveal long-range correlation in the root mean squared displacements of diffusing particle confirming that the deterministic nature of the crowded system determines the dependence of the particle trajectory on the system parameters resulting in its fractality.

Key words: diffusion, random walk, crowded media, fractal dimension, long-range correlation

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S4 P3

BEHAVIOUR OF GELATIN, STABILIZED WITH NATURAL ANTIOXIDANTS, IN DIFERENT BIOLOGICAL FLUIDS

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Abstract. Gelatin is a biomaterial widely used in medicine. The main area of its use is production of pills coating. This material is not toxic or allergic.

In this study, it has been investigated the behavior of gelatin stabilized with natural antioxidant materials (rosemary extract, grape skin extract (*Capsunica variety*), ascorbic acid) in three synthetic fluids (gastric juice, intestinal juice, blood plasma).

Migration rate of antioxidant material from gelatin (quantified by Folin-Ciocalteu method, eliminating interference caused by proteins) in biological fluids is very high for ascorbic acid and very low for rosemary extract. The most "aggressive" biological fluids on gelatin are gastric and intestinal juices.

S4 P4

MOLECULAR ORIENTATION IN AMLODIPINE BESYLATE

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Amlodipine (Fig. 1.) belongs to a new-generation of drugs. It is known as long-acting dihydropyridine-type calcium channel blockers, inhibits the movement of calcium ions into vascular smooth muscle cells and cardiac muscle cells. Like other medications in this group, amlodipine lowers blood pressure by relaxing the muscles controlling the diameter of blood vessels in the body. Amlodipine is used in the management of hypertension and coronary artery disease [1]. It is on the World Health Organization's List of Essential Medicines, the most important medications needed in a basic health system [2].

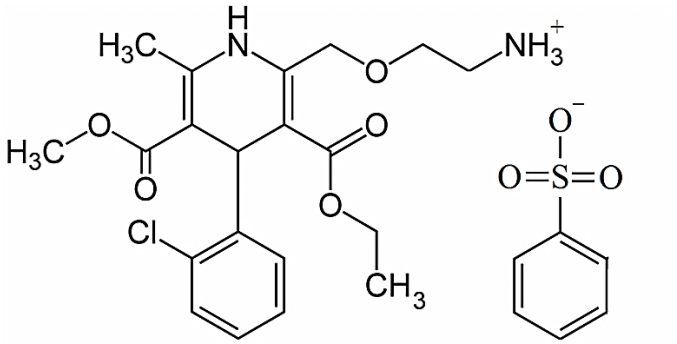

Fig. 1. Structural formula of amlodipine besylate

Amlodipine is molecular crystal and no phase transitions in the temperature range from 77 K up to the melting point at 450 K have been observe. Nevertheless we cannot exclude a phase transition at lower temperatures. It is known 3 polymorphic forms of amplodipine: besylate, maleate and mesylate.

The aim of the study is to determine the molecular dynamics of the methyl and NH_3 groups in amlodipine besylate as a function of temperature by neutron scattering and NMR methods.

In work has been shown comparison experimental results and calculated by “Monte-Carlo” method.

Acknowlegements:

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S4 P5

STUDY ON BIOACTIVITY OF PHOSPHOCALCIC GLASSES

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This study demonstrates the properties of bioactive glass of 3 phosphocalcic samples from ternary system $CaO-SiO_2-P_2O_5$. For their synthesis was used sol-gel technique. The elemental composition of the initial samples was demonstrated by the X-ray fluorescence analysis using sequential wavelength dispersive spectrometer ARL Advent X Intelli Power [1]. Study of bioactivity was performed after immersing the samples in human liquid stimulant for 3-14 days [2].

Phosphocalcic glasses bioactivity was confirmed by X-ray diffraction analysis using X-ray difractometer Rigaku – Ultima IV and infrared spectroscopy analysis, by FTIR spectrometer Bruker - Vertex 80 [3].

By the analysis performed was observed the synthesis of hydroxyapatite in phosphocalcic glasses sample [4].

Keywords: phosphocalcic glasses, WDXRF, XRD, FTIR

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S4 P6

REVERSIBLE TO IRREVERSIBLE COMPONENT OF WATER HYSTERESIS LOOP FROM POROUS MEDIA

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The non-linear phenomena described by hysteresis loops have been studied using a large number of models. In order to characterized the pressure of water versus water quantity from porous media we used the phenomenological Preisach type models [1-2]. This model is described by two independent statistical distributions.

The soil capacity to retain water is described by hysteresis behavior of soil-water characteristic curves. In general, for soil water hysteresis phenomena there are two theories; domains independent and dependent. The independent domain theory is based on two states equilibrium concept but do not take in account the complicate sequence of interconnected pores. Instead in the domain theory, soil is assumed to be a system made up of pores, each of which empties or refills in jumps transition. To overcome these shortcomings we included in model the reversible component in order to collect the information from intermediary states of drying and wetting processes. This component was used as part of soil-water characteristic curves [4].

The identification of model parameters were done using First order reversal curves (FORC) method based on FORC diagram. FORCs are scan curves within hysteresis area.

We developed a model based on [2-3] that describe the intermediary states of drying or wetting processes as a reversible component. In full paper we will present the mechanism to evaluate the proportion of reversible to irreversible parts and the effects responsible for the shape of the hysteresis loop.

Acknowledgment

This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectored Operational Program for Human Resources Development 2007-2013 [grant POSDRU/159/1.5/S/137750, project "Doctoral and Postdoctoral programs support for increased competitiveness in Exact Sciences research"].

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S4 P7

NEUTRON AND THERMAL ANALYSIS OF ETHER COMPLEX LITHOCHOLIC ACID DERIVATIVE IN DMSO

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The properties of a new molecular gels in dimethyl sulfoxide (DMSO) are reported [1-2]. Lithocholic acid derivatives (heptyloxyphenylolithocholic acid – 7OPhOLCA) in DMSO were synthesized with concentrations (*C*) from 0,015g/ml to 0,025g/ml [3]. They forming gels thanks to strong hydrogen bonds between thionyl group (S=O) and hydroxyl group.

Thermal situation of 7OPhOLCA/DMSO in the range of temperatures from -20°C to 60°C was characterised by using differential scanning calorimetry (DSC) (Fig.1.*A*). While second heating at a temperature of -3,3°C following melting crystals which form typical needle, to untransparent gel phase. In second cycle of cooling it was found phase transition between crystal phases (Cr1 - Cr2) in -6°C (enthalpy ΔH=25,87J/g). Moreover, in the temperature range 0°C - 60°C in both cycles are high-energy structural transition in the gel phase.

Additionally the structure of the 7OPhOLCA in DMSO in the gel phase was investigated by small angle neutron scattering (SANS). It was shown that 7OPhOLCA in the DMSO presence form a stable gel phase with repeat distance d = 44.4 Å (Fig.1.*B*). At T=20 °C the studied material demonstrates a power-law type scattering with the exponent values within the range P_S = 3.8 ÷ 3.9 while at T=10 °C it exhibits scattering according to Porod law with P_S = 4 . It's remarkable that repeated measurements performed at T=20 °C after 2 weeks storage at room temperature corresponds to the scattering from the diffusive fractal structure with P_S = 4.2 .

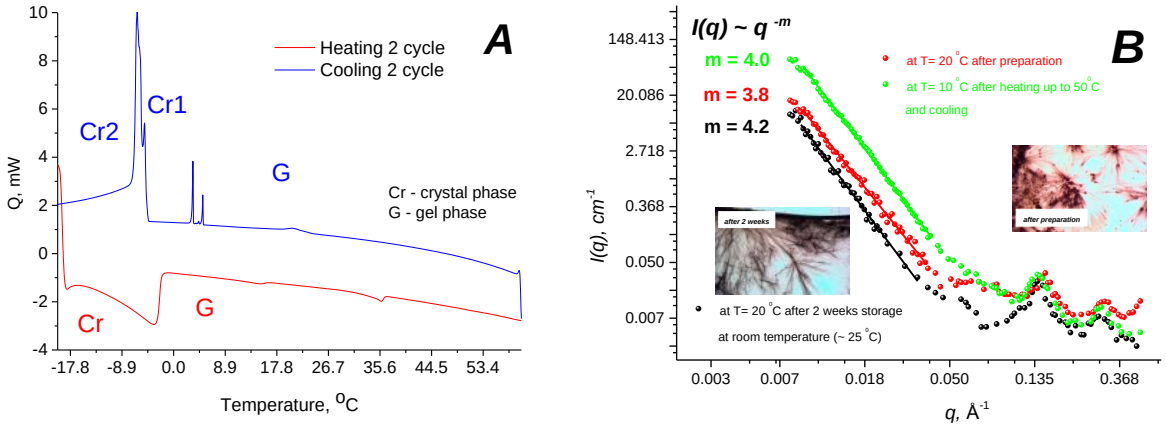

Fig.1. 7OPhOLCA in DMSO with *C*= 0,015g/ml: ***A*** DSC thermograms and ***B*** SANS curves at different *T*, °C.

This work was supported by the Poland – JINR (Dubna) Programme № 45/12/2015.

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Keywords: gelators, thermal analysis, small angle neutron scattering, fractal structure

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S4 P8

WILLAMOWSKI-RÖSSLER MODEL OF CHEMICAL REACTIONS

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Chemical systems can exhibit chaotic behavior, fact which is very important for chemical processes and for biological structures because. From this point of view capability the deliberate control of these phenomena has a great practical impact despite the fact that it is very difficult; this is the reason why theoretical models are useful in these situations.

In order to have instabilities in a chemical reaction it is absolutely necessary that it is an autocatalytic nature; this implies that the reaction takes place far from thermodynamic equilibrium. The kinetics of the autocatalytic reactions is described by nonlinear differential equations. The nonlinear nature of these equations can lead to the spontaneous generation of oscillations and chaos. To determination of the conditions in which a chemical system has an oscillatory or chaotic behavior is important for theoretical and practical purposes in the field of chemistry.

In full presentation we analyzed the dynamics of the Willamowski-Rössler system of autocatalytic reactions. Also we will show conditions in which the system is in a steady state and in which it has an oscillatory or chaotic behavior based on the Lyapunov Exponents. The behavior of the chemical system can be controlled through the modification of control parameters. Afterwards we performed the synchronization of two chaotic Minimal Willamowski-Rössler (MWR) systems using an adaptive feedback method. Using three controllers for the three differential equations we are able to quickly obtain the synchronization. By reducing the controllers from three to one, which is desired from practical point of view, in order to obtain the synchronization, the controller must be applied in the first or in the third equation.

The transient time until synchronization depends on initial conditions of two systems, the strength and number of the controllers.

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Acknowledgment

This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectored Operational Program for Human Resources Development 2007-2013 [grant POSDRU/159/1.5/S/137750, project "Doctoral and Postdoctoral programs support for increased competitiveness in Exact Sciences research"].

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S4 P9

A SIMPLE OPTICAL PROCEDURE FOR ESTIMATING YEAST CONCENTRATION IN AQUEOUS SUSPENSIONS

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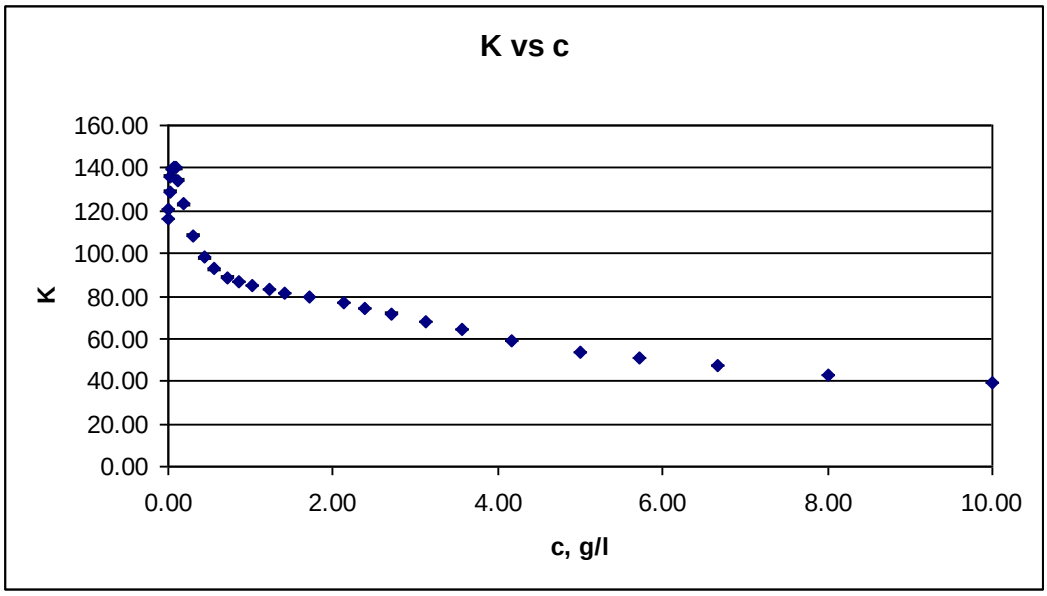
A coherent light scattering experiment on aqueous suspension of *Saccharomyces cerevisia* yeast with a concentration that covers five orders of magnitude was performed. The scattered far field was recorded using a CCD. A computer code for image processing was used to calculate the far interference field speckle contrast (SPK).

The figure below presents the variation of the average SPK with the yeast concentration. We notice that the average contrast presents an increasing trend in the very small concentration range, up to $4.8 \cdot 10^{-2}$ g/l followed by a plateau. From $4.8 \cdot 10^{-2}$ g/l to 10 g/l the contrast exhibits a decreasing trend. This concentration range is within the range of yeast concentration at the beginning of controlled beverage fermentation. This suggests a very fast procedure for monitoring the yeast concentration, hence for monitoring the fermentation process in aqueous solution, by assessing the variation of the yeast concentration during fermentation.



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S4 P10

THE INFLUENCE OF THE STORAGE CONDITIONS ON *DAHLIA* TUBERS STRUCTURE EVIDENCED BY IR AND RAMAN SPECTROSCOPY

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Inulin, a polydisperse energy storage polymer in plants of the *Compositae* and *Lilialiaceaes* families, is a fructan consisting almost entirely of linearly beta-1,2-linked fructose units with a terminal alpha1-beta2- linked glucose molecule. Inulin belongs to the so-called nondigestible oligosaccharides (NDOs), which are carbohydrates that after ingestion enter the colon where they are fermented by the microbiota. Therefore, in foods they serve as a source of soluble dietary fiber, providing less energy than digestible carbohydrates. They are widely used as ingredients with specific physicochemical and nutritional capabilities in a wide range of foods and drinks [1].

It was reported [2] that inulin is present in *Dahlia* tubers, its content being of approximately 38-53% from its dried weight. It is stored in the vacuoles of the cells from tubers as colorless crystals, and the diabetic sugar obtained after a special treatment is frequently prescribed for diabetic and consumptive patients, and has been given to children in cases of wasting illness. *Dahlia* is one of the most important flowers cultivated in the world. In Romania is an increasingly important crop for private farmers who sell cut flowers at local markets [3]. This specie is herbaceous, perennial, geophyte, rustic, which belongs to the *Asteraceae / Compositae* family. It is known [4] that IR and Raman spectroscopic methods are successfully applied to the analysis of valuable plant substances. These methods allow the obtaining of spectra that contain fingerprint bands of individual components.

The aim of the present work was to acquire information about the chemical composition, including primary and secondary metabolites, of different *Dahlia* tubers preserved in different conditions. Primary metabolites are the plant constituents, which are essential for the life of the plants.

The main representative compounds of this group are proteins, lipids and carbohydrates. Secondary metabolites are unique to individual plant species, often occur in low concentration and are not vital to plant cell survival [4]. The IR and Raman spectra of the tubers were recorded before and after keeping them in different substrates, and the inulin signature was evidenced besides the changes of chemical composition induced by different storage conditions. The investigated samples belong to the *Dahlia hybrida* species and consist of three varieties of "cactus" type: *'Kennemerland', 'Purple Gem', 'Tsuki Yori No Sisha'*, which were kept during the winter at 5-8°C, in the following substrates: sand, sand + sawdust (70% + 30%), and peat + sawdust (70% + 30%).

Keywords: IR and Raman spectroscopy, inulin, *Dahlia* tubers, storage conditions.

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S4 P11

THE THERMODYNAMIC PARAMETERS OF SOME COMPOUNDS WITH PHARMACO-THERAPEUTICS ACTION

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Abstract: A series of thermodynamic parameters (such as: free energy, entropy, enthalpy, volume, mass) and QSAR properties of molecules (dipole moment, polarizability, refractivity, energy values HOMO and LUMO) can be determined using molecular modeling programs. The computed parameters are indicators in predicting therapeutic action in the human body. Quantum-mechanical calculations made by us can provide useful information about the stability, reactivity and structure of some pharmaco-therapeutic compounds.

Acknowledgment
This work was supported by the strategic grant POSDRU/159/1.5/S/137750

S4 P12

WAVES FORMATION IN THE COSMIC BOSE EINSTEIN CONDENSATION MODEL

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Abstract Waves formation processes are discussed in the BEC (Bose-Einstein Condensation) cosmological model . We used a variational method to describe the dynamics of aplatised condensates of cold Dark Matter with negative dark energy, folowing the Morikawa quantul liquid model of early Universe. The spherical wave formation in the DM gas can explain the phasae transition between slow sedimentation process of the Dark Matter BEC and the rapid collapse to bosons stars.

Key words: Bose-Einstein condensates (BEC), Dark Matter, Collapse process .

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S4 P13

LIFE EXPECTANCY ANALYSIS DEPENDING ON VARIOUS SOCIO-DEMOGRAPHIC INDICATORS

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Life expectancy analysis presenting a subclass of data analysis problems is one of the tasks of current interest today. Considering the data from digests “Regions of Russia: socio-economic indicators” provided by Russian Federal State Statistics Service and setting the target period of time (2002-2012) we narrow the task and suggest an iterative method of solving this problem.

The suggested method is based on constructing a regression model of dependence of the target variable on the selected indicators. And the regression model itself is being build by applying decision trees, in particular, classification trees.

Keywords: data analysis, life expectancy, classification trees

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S4 P14

A NUMERICAL APPROACH FOR OPTIMISATING THE EFFICIENCY OF A SPECIFIC HEAT ENGINE.

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Different forms of disordered energy transformation into mechanical energy (or other forms of ordinated energy) played over time a major interest. In our days, when the mankind energy crisis requests rapid solutions, it could be considered that every attempt with encouraging results is welcome.

In this paper are presented preliminary aspects that make summary of efforts over time in order to succeed in optimization a closed cycle sort engine capable of operating at small temperature differences.

In order to reach this aim a numerical approaching was made in order to succeed in evaluating the equation of motion and the engine efficiency.

In the last section also presents the comparison of numerical simulations and the obtained experimental data.

The encouraging results allow to consider further optimisation possibilities.

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Keywords: numerical computation, heat engine, Stirling engine

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S4 P15

THE ANNUAL DYNAMICS OF PHYSICO-CHEMICAL PARAMETERS FOR WATER QUALITY ANALYSIS. CASE STUDY - GRINDU AREA

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This study aims to determine groundwater quality which is used to supply potable water transport network in the Grindu village situated in the floodplain Danube, downstream of Galati. Therefore we determined the concentrations of eleven indicators (pH, conductivity, turbidity, chemical oxygen demand (C.O.D.) chlorides, free residual chlorine, ammonium nitrite, nitrate, iron and manganese) from three locations representative sampling such as drilled, treatment plant output and tank, in the five years of monitoring. It is the first time it is addressed groundwater quality for drinking water supply network in the Grindu village.

The investigations on physical-chemical indicators monitored showed significant exceeding of the maximum permissible values regulated by law. The biggest overruns were identified for total hardness and concentrations of ammonium nitrate, but in general there was a trend towards improvement of the water quality over the past two years monitored.

Keywords: *groundwater quality, drinking water parameters Grindu area*

S4 P16

NEURAL NETWORKS USING IN THE STUDY OF TRANSPORT PHENOMENA IN COMPLEX SYSTEMS. CASE STUDY - THE FREEZE FRONT MOVING

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The study of transport phenomena is a current topic in the literature. In general, this kind of processes could be considered every time when thermodynamic systems are not in balance /equilibrium i.e. the structures have non-uniform parameters' value (temperature, density, etc.).

The nature of biological systems on the non-equilibrium states is very specific. For studying these transport processes, were performed a large series of investigation methods: numerical modelling, finite element methods or tank-type models, etc.

The present work presents a broad approach to the problem of freezing front evolution with the help of neural networks MLP and RBF type. They were considered a total of 20 different structures and, at the end were kept for discussion only the first 10 most suitable networks. In this respect, the last section discusses the top 3 best models using MLP neural networks type.

Keywords: automated neural network, freezing process, transport phenomena,

S4 P17

RELEVANCE OF JOINING PROCESS BETWEEN VARIABLES OF DATA COMMUNICATION AND WEIGHTED ENTROPY LEVELS

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Abstract. A very important part in the analytical chain of data content is the one of vocal sound signal recording and processing, both from phonetical and enviromental acoustic transmission points of view. Regarding the speaking act, no matter is the form of the speech, free speaking or conversation deed, all these shapes of communication are revealed in coherent sequences which are composed by lexical units that generate semantic structures exclusively through a proper phonetical support. This study aims to underline the way in which some parametric vocal clusters repartition, that reveal an obvious association level, is mirrored in informational weighted entropy distribution.

S4 P18

THE IMPORTANCE OF VOCAL PARAMETERS CORRELATION IN THE MODELING OF INFORMATIONAL PROCESSES

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For the analyze of communication we need to study the main parameters that describe the vocal sounds from the point of view of information content transfer efficiency. In this paper we analyze the physical quality of the ,,on-air" information transfer, according to the audio streaming parameters and from the particular phonetical nature of the human factor. Applying this statistical analyze we aim to identify and recording the correlation level of the acoustical parameters with the vocal ones and the impact which the presence of this cross-correlation can have on the communication structures improvement.

ABSTRACTS

S5 – Engineering and Industrial Physics

- *Physics of energy transfer, conversion and storage*
- *Environmental Physics*
- *Sensors and Device Physics*
- *Micro- and Nanoelectronics*
- *Microelectromechanical systems*
- *Instrumentation and Metrology*
- *Imagining, Microscopy and Spectroscopy and their applications*
- *Instrumentation, processing, fabrication and measurement technologies*
- *Applications of fluid mechanics and microfluidics*

S5 L1

QUARTZ CRYSTAL MICROBALANCE TECHNOLOGIES USED IN REAL-TIME CHARACTERIZATION OF INTERFACES AND MOLECULAR INTERACTIONS

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Abstract: The high sensitivity and the real-time monitoring of mass changes on the sensor crystal make Quartz Crystal Microbalance (QCM) a very attractive technique for a large range of applications. Major advantages of the QCM technique used for liquid systems are that it allows a label-free detection of molecules. The ability to provide real-time monitoring of chemical contaminants in water samples can be used for a variety of applications: on-line monitoring of contaminants in process, recycle, and waste water; groundwater quality monitoring; detection of contaminants in streams, lakes and water supplies; monitoring dumping in off-shore waterways

In this paper we describe the technologies and their applications with a Quartz Crystal Microbalance (QCM). The sensitivity, selectivity, reproducibility and detection limit of QCM sensors have also been discussed. Quartz Crystals are used in Microbalances (QCM) as sensors to determine mass changes as a result of frequency changes began to be a good alternative analytical method in a great deal of applications such as biosensors, analysis of bimolecular interactions, study of bacterial adhesion at specific interfaces, pathogen and microorganism detection, study of polymer film-biomolecule or cell-substrate interactions, immunosensors and extensive use in fluids and polymer characterization. We are analyzed limits of detection, sensitivity, selectivity and reproducibility of Quartz Crystal Microbalance with different techniques and sensors.

The widespread use of the quartz crystal microbalance (QCM) can be attributed to its excellent sensitivity to the properties of liquid and soft solid materials with which it is brought into contact. This sensitivity arises from the coupling between the mechanical, shear oscillation of the crystal and its electrical response at frequencies close to resonance. This coupling depends on the details of the shear wave propagation into the material with which the QCM is in contact. For most liquid and soft viscoelastic materials, the decay length of this shear wave is on the order of 100 nm; so in these cases, the QCM is truly a surface-sensitive technique. This surface sensitivity is responsible for a wide range of applications in biology and electrochemistry, where the QCM is often used to sense material that is absorbed to the crystal surface from solution. The QCM has an RS-232 interface and comes with both Windows and LabVIEW software providing real-time display, analysis and storage of our QCM data. Supplementary, we have micro fluidic pump; Ultra-stable Rubidium Frequency Standard with 2ppb stability and 0.0001 Hz sensibilities. The ultra precise temperature meter measure "*in situ*" temperature, between 4 K and 700 K with 0.1 K. The paper presents results of research using the QCM in several areas of interest.

Keywords: Quartz Crystal Microbalance, Newtonian liquids, solid/fluid interfaces

S5 L2

ANALYTICAL TECHNIQUES FOR ANALYSIS OF IONIC IMPURITIES IN ELECTRICAL ROTATING MACHINES INSULATORS

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The insulation used in electrical rotating machines is a major component that influences their operation parameters. It is therefore essential to identify new methods of investigation and new technological processes to improve quality of the insulation.

Traces of transition metals have been found in the insulation of cables PE. These transition metals causes degradation of highly oxidative ionic impurities in insulation and affect its insulating properties and can lead to undesired electrochemical under electrical stress factor.

Traces of metal insulator transition can be determined only by means of high sensitivity and precision analysis, atomic and nuclear.

The paper contains a comparative study of elemental analysis methods to identify the most effective method of determining ionic impurities in insulation. It shows the theoretical foundation, practical development and implementation of the following analysis methods for determining metals distribution in insulator (Particle Induced X-ray Emission - PIXE, Energy Dispersive X-Ray Fluorescence - EDXRF, Inductively Coupled Plasma Mass Spectrometry - ICP-MS, Atomic absorption spectrometry - AAS). For characterization of the isolator is used quartz crystal microbalance technique (Quartz Crystal Microbalance - QCM).

Key words: stress factor, methods, electrical rotating machines.

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S5 L4

GRAPHENES – EXCELLENT SUBSTITUTES FOR NOBLE METALS IN CATALYSIS

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Graphene-based materials are increasingly used as carbocatalysts for reactions such as aerobic oxidations and acid catalysis.[1] To validate the concept of carbocatalysis and demonstrate its generality and potential, the challenge is to prove that carbocatalysts based on Graphene can compete as catalysts for reactions that are paradigmatically catalyzed by transition metals, and especially noble metals.

With this scope we prepared a series of Graphene materials that were subsequently evaluated as carbocatalysts in hydrogenation reactions. This includes GO that has been obtained starting from graphite by conventional Hummers oxidation to graphite oxide, followed by exfoliation by ultrasounds. Considering the instability of GO in the presence of reducing agents including hydrogen, we also tested reduced GO (rGO) obtained by thermal reduction of GO in water at 150 ^{o}C in autoclave. The other Gr-based materials tested were obtained by pyrolysis of natural biopolymers modified or not by the presence of Na_2HPO_4.

The synthesized materials were characterized by TEM, HR-TEM (Figure 1), AFM, XPS, adsorption of nitrogen at -196 ^{o}C, and chemisorption. Catalytic tests evaluated the performances of these pure graphenes in liquid phase hydrogenation of C=C bonds. Mechanistic investigations proved an *frustrated Lewis acid-base pairs* effect, that extend the applicability of pure graphenes in other reactions of interest.[2]

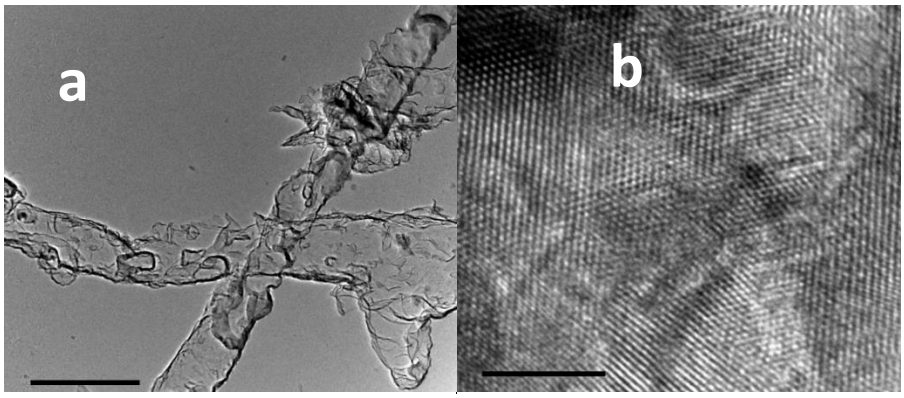

Figure 1. TEM (a, scale bar 500 nm) and HR-TEM (b, scale bar 5 nm) images recorded for (P)Gr showing the sample layer morphology from the contrast with the background an the characteristic wrinkles and the ordering and arrangement at the atomic level.

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S5 L5

METHODS OF PROCESSING PROFILES EXTRACTED FROM THE ELECTRON DIFFRACTION FIGURES OBTAINED ON TOOTH ENAMEL

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Electron diffraction pattern contains information about crystalline structure and amorphous phase of the material. The factors that lead to corruption of real information from sample are difficult to know a-priori. For example, data acquisition system can lead to corrupt information due to thermal effects. Also, operator skills can be very important to gain the exact condition of the instrument (electron microscope) to capture correct image. First, sample preparation can induce defects or artefacts that can lead to misinterpreted conclusions about the material. We know that nano-powder sample, for example, require an amorphous thin support. Usually this support is a thin film of amorphous carbon, or formvar, which is assumed to be transparent to the electron beam. Electron interaction with this substrate induce an important background in diffraction profile.

The model that we want to develop in this study is related to the sample substrate ready for viewing, the fact that the electron beam scattering on an amorphous substrate does not correlate with a scattered beams from the material. One problem is that the material can be partially crystallized so that we have a contribution to background noise coming from this component of the studied material. Note that this component of the noise is correlated with the contribution of crystalline material. Very broad lines corresponding to the amorphous material will be found in the same positions as the peaks of the crystalline material data. To separate these components we use statistical techniques, namely filters, signal processing (ICA) apply to diffraction profile.

Using ICA algorithm for data processing in the electron diffraction pattern has limited success due to effects that are difficult to predict, i.e. dynamical effect. It stands still recover partial information about the crystalline component or other components by the allure of noise due amorphous phase and show that separation of amorphous/crystalline components is difficult in very low intensities 'signal' conditions and because of the correlation between amorphous and crystalline phase of the material.

Keywords: electron diffraction, ICA, enamel, hydroxyapatite

S5 O1

THE STUDY OF HEAVY METAL CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM LOWER DANUBE EUROREGION

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The determination of the heavy metal concentration in water, soil and sediments is important for the evaluation of the environmental status of aquatic systems and quality of agriculture potential for any territory. The good environmental status of Danube River-Delta-Black Sea Coast system is important for the sustainable development of this transboundary region. This area is under intensive impact from the different anthropogenic sources. The study of heavy metal in different environmental objects was made for Danube Delta and potentially polluted sites on the territory of Republic of Moldova. The concentration of heavy metals was analysed in water and sediments from deltaic area and in soil samples from selected polluted sites.

The analysis of soil and sediments samples for the trace element determination was made by ISO and EPA methods of Atomic Absorption Spectrometry by flame and THGA technique (PerkinElmer, AAnalyst800). This analytical technique allows the determination of Cu, Zn, Fe, Mn, Pb, Cd, Al, Ni, Co, Mo, Cr, As in different environmental media.

The concentration of heavy metal in sediments from Danube Delta and Prut River showed a high concentration in some cases for lead (Pb), copper (Cu), zinc (Zn), cadmium (Cd) and arsenic (As) in the comparison with background concentration. Soil from polluted sites showed a exceeding of the Maximal Admissible Concentration (MAC) for Pb by more that 50 times (1599.0 mg/kg), for Cu by 556 times and for Zn by 8.8 times. Other heavy metals have a concentration at regional background level and did not exceed MAC. The comparison of heavy metal concentration in river sediments and soil from polluted sites showed that possible pollution sources of Pb, Cu and Zn exist in these areas. Cd and As have other pollution sources, not from the territory of Republic of Moldova. The obtained results can be used for the Environmental Risk Assessment procedure in studied area.

This study work is carried out in the frame of Romanian-Moldavian-Ukrainian cross- border cooperation (Project MIS ETC 1676) between Dunarea de Jos University of Galati, Institute of Zoology and Institute of Geology and Seismology, Academy of Sciences of Moldova, and Ukrainian Scientific Centre for Ecology of the Sea.

Keywords: trace elements, AAS technique, soil, ediments.

ENHANCEMENT OF CARRIER COLLECTION EFFICIENCY IN PHOTODIODES BY INTRODUCING A SALICIDED POLY SILICON CONTACT.

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Suppressing recombination on silicon contact interfaces is a topic being addressed for various applications such as photo sensors and solar cells. Although salicidation of the contacts enables low contact resistance, it is usually avoided for these applications as it increases the recombination rate on the contact interfaces. This study explores the use of salicided poly silicon buffer layer in photodiodes' contacts, acting to reduce the recombination rate at the silicide contact. The contact incorporates the advantage of low contact resistance due to silicidation with polisilicon interface that reduces recombination by creating carrier selective junction. The introduction of a polysilicon interlayer was found to increase the short circuit current and the fill factor (as presented in the figure below) and to decrease the dark leakage current.

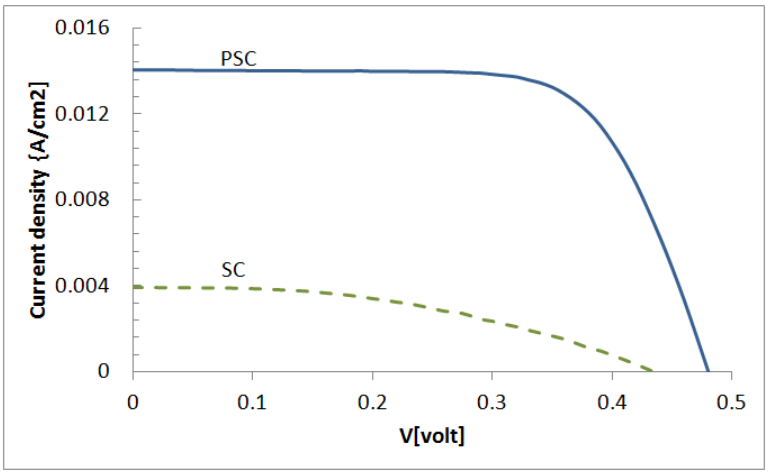

Figure 1: I-V curves under AM1 illumination of the two types of N/P diodes: a salicided contact (SC),and a polysilicon contacts (PSC).

The improvement in the light collection parameters was found to be more pronounced under high light intensity (1000 W/m^2) than under low light intensity (400 W/m^2). The benevolent effect of the polysilicon interlayer is expected to be noticed in devices that are sensitive to contacts' performance. This includes not only image sensors but also high efficiency silicon solar cells.

CLEANROOMS AND TECHNICAL CLEANLINESS IN TODAY'S INDUSTRY

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The term of "Technical Cleanliness" was created by the automotive industry for adressing the problems created by particles in this sector. Nowdays, Technical Cleanliness is used in several very important industry branches, like Electronics and LifeScience.

Contamination sensitive products produced for the microelectronics (integrated circuits, printed circuit boards, semiconductors), transportation (automotive, aviation, railway) and health care (pharmaceuticals and medical devices) industries have very strict demands for cleanliness in order to increase their performance, reliability, and lifetime.

Technical Cleanliness and Cleanrooms are connected because of the contaminating particles. When you asses the degree of Cleanliness of a product, you want a very small amount of the particles to come from the environment.

In this article are introduced the main steps in Technical Cleanliness, the importance of cleanrooms in this process and some practical examples of analysis.

Keywords: Technical Cleanliness, Particle contamination, Cleanrooms

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S5 O4

EARTHQUAKE PRECURSORS ASSESSMENT IN VRANCEA REGION THROUGH OPTOSPECTRAL SATELLITE AND IN-SITU MONITORING DATA

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Medium- to short-term earthquake prediction is becoming ever more essential for safeguarding man, but till now there have been no verifiable methods of reliable earthquake prediction developed. As one of the most seismically active area in Europe, Vrancea region in Romania presents a relatively high potential of seismic risk mainly due to the subcrustal earthquakes located at the sharp bend of the Southeast Carpathians. Earthquake prediction has two potentially compatible but distinctly different objectives: (a) phenomena that provide information about the future earthquake hazard useful to those who live in earthquake-prone regions and (b) phenomena causally related to the physical processes governing failure on a fault that will improve our understanding of those processes. Cumulative stress energy in seismic active regions under operating tectonic force manifests

various earthquakes' precursors. This energy transformation may result in enhanced transient thermal infrared (TIR) emission, as well as of local magnetic field variations, electromagnetic emissions over a wide range of frequencies, a variety of atmospheric and ionospheric phenomena, clear evidenced from optospectral satellite recordings. For seismic hazard analysis in Vrancea area, Romania have been selected the earthquake precursors detectable from space which can also be observed by ground-based monitoring experiments: surface deformation provided by GPS and SAR imaging, land surface temperature anomalies as possible precursors provided by time-series satellite which can be detected through satellites equipped with thermal sensors like MODIS (Terra/Aqua) and AVHRR (NOAA), Landsat TM and ETM, electromagnetic and ionospheric anomalies, radon gas emissions in the faults areas prior to earthquakes, as well as seismicity. The joint analysis of geodetic, seismological and geological information on the spatial distribution of crustal deformations is revealing new insights in the understanding of the kinematics and dynamics of the complex plate boundary system present in the Eastern Carpathians. Fusion of satellite (LANDSAT TM, ETM, SAR-ERS, ASTER), GPS and field data on Vrancea area including radon ($Rn^{222)}$ concentrations variation provides a better monitoring of different geophysical parameters and long-term deformation in relation with earthquake activity. Multispectral and multitemporal satellite LANDSAT TM/ETM, MODIS (Terra/Aqua) and AVHRR (NOAA) time-series data over 2000-2014 period have been analyzed for recognizing the continuity and regional relationships of active faults as well as for geologic and seismic hazard mapping. GPS Romanian network stations data revealed a displacement of about 5 - 6 millimeters/year in horizontal direction relative motion, and a few millimeters/year in vertical direction. Spatio-temporal radon ($Rn^{222)}$ concentrations variation as well as land surface temperature and latent heat flux are well correlated with seismic events of moment magnitude Mw >4.5. As Vrancea zone has a significant regional tectonic activity in Romania and Europe, the survey and joint analysis of geospatial and in-situ geophysical information of land surface and outgoing long-wave radiation reveal new insights in the field of seismic hazard assessment.

S5 O5

SEISMICITY OF THE ROMANIAN TERRITORY AND HIS CHARACTERISTICS

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The paper analyses more than 17,000 earthquakes distributed along the whole Romanian territory and highlights some seismogenetic areas such as Central and South Dobrogea, Campulung (different from what is known as Fagaras-Campulung seismogenic area), Sinaia, Getic depression, Hateg basin, the extension of intermediary earthquakes from Vrancea to the west and south and also the presences of subcrustal earthquakes in different region from Romania.

Concerning Vrancea and their intermediary extension the plot of depth versus magnitude outlined 6 levels of depths with high density of earthquakes at 10, 90, 110, 120 and 130 and 150 km similar to Vrancea s.s. The plot of hypocenters at each 6 levels mentioned above shows the dispersion of the earthquakes on a NE to SW direction on three parallel alignments. Many earthquakes with

magnitude between 5 to 5.9 M_w are situated at 130-140 km depth (35%), 15% at the next level of depth:100-110 km and 15% at 150-160 km depth. Earthquakes with magnitude between 6 to 6.9 M_w are situated at 130-140 km depth (25%), at100-110 km depth (15%),at 120-130 km depth (19%) and at 150-160 km depth (12.5%). Earthquakes with magnitude higher than 7 (M_w) generally occur at 150-160 km depth (67%), however due to the fact that most are historical and not well defined, we cannot be certain.

In the eastern part of the Moesian platform is outlined the intense seismic activity of the Dobrodjean sector in comparison with the Wallachian sector, especially in the lithospheric block between the Intramoesian and Capidava-Ovidiu faults.

Concerning the Intramoesian crustal fault, few seismic shocks were situated along this alignment, and much more events were located along the major fault Nehoiu-Smeeni-Dragalina. Along this fault occured the strong subcrustal earthquake on January 4, 1960 (M=5.4). Also another important crustal zone is the north-eastern part of the Focsani depression – especially its eastern limit, Peceneaga Camena fault, where is located the hypocenter of the 5.7 magnitude earthquake from 22 November 2014. We outline also the earthquakes from Cudalbi and Corabia zones.

Northern Dobrogea (North Dobrodgean Orogen) is characterized by an intensive seismicity in comparison with central (green schist area) and Southern Dobrogea, both belonging to the Moesian Platform. We highlight the active behavior of the Sf. Gheorghe fault (traced along Sf Gheorghe, Danube branch) and Peceneaga Camena fault.

The crustal earthquakes that occurred south of Timisoara (Banloc-Deta area) put into evidence a present-day ESE-WNW compression stress direction characterizing the Geto-Danubian Block of the Southern Carpathians. We also evidence the present day stress regime in the Southern Carpathians (the eastern part of the Banat region), between Mehadia and Orsova. Some of crustal earthquakes may be in correlation with Cerna crustal fault.

The study was partly funded by the project:
"Nucleu" of the National Plan for Research, Development and Innovation of the Romanian Ministry of National Education, Contract no**. PN 09-30/27.02.2009**

CORRELATION BETWEEN HEAVY METAL CONCENTRATIONS, DETERMINED BY XRF AND AAS ANALYTICAL METHODS, IN BIOINDICATOR SAMPLES

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Analytical methods, Energy Dispersive X-Ray Fluorescence (EDXRF) and Atomic Absorbtion Spectrtometry(AAS)[1-5] in two variants: Flame Atomic Absorption Spectrometry (FAAS) and Grafit Furnace Atomic Absorbtion Spectrometry (GFAAS), have been applied in this study of heavy metal concentrations in *vegetable plants* samples used as bioindicator. The concentrations of heavy metals Cu, Fe, Mn, Ni, Zn, Cd and Pb in 36 samples were determined. The samples were collected from agricultural area of the village Petreşti from Dâmboviţa County, which is located between Argeş and Neajlov rivers. The determined values of heavy metals concentrations showed that the plant *Brassica oleracea* is a very good bioaccumulator of heavy metals. The results were compared with the maximum admitted limit(MAL). The aim of this work was to perform a statistical interpretation of the heavy metals concentrations in *Brassica oleracea* samples, to determine the relationship between the metals concentration using the model of correlation and binare regression. A linear correlations between pairs of concentrations of the elements Cu-Fe, Fe-Zn, Zn-Cu, Fe-Ni, Fe-Cd, Cu-Cd, Cu-Pb and Cd-Pb was observed and anaysed.

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S5 O7

AN ANALYTICAL-NUMERICAL MODEL FOR THE TWO DIMENSIONAL QUANTUM WELL RESISTIVITY OF AlGaN/GaN TRANSISTORS

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An analytical- numerical model for the total drain source current and mobility of AlGaN/GaN based high electron mobility transistors has been developed that is capable to predict accurately the effects of depletion layer thickness on the resistivity in different temperature, gate source biases and two dimensional electron gas density . Salient features of the model are incorporated of fully and partially occupied sub-bands in the interface quantum well, combined with a self-consistent solution of the Schrödinger and Poisson equations. In addition traps effects in the surface[1], interface and buffer layers, current in AlGaN barrier and three dimensional electron gas mobility in the barrier of AlGaN[2] are also taking in to account. To calculate the total drain current, the both two dimensional electron gas channel (I_{2DEG}) and AlGaN barrier currents (I_{AlGaN}) have been calculated. So that in this model total mobility can be obtained as Ref.3. Fig. 1. shows the variation of total mobility verse gate source bias at 300 K for $Al_{0.15}Ga_{0.85}N$/GaN based HEMT. The calculated model results are in very good agreement with existing experimental data for high electron mobility transistors device.

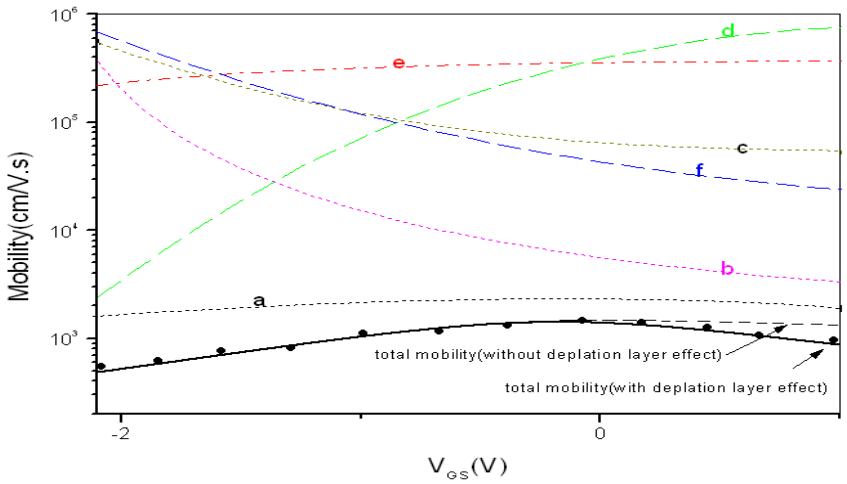

Fig. 1. Total mobility verse gate source bias at 300 K for $Al_{0.15}Ga_{0.85}N$/GaN based HEMT in comparison with existence experimental data .The different scattering mechanism in the figure labeled as (a) polar optical phonon, (b) interface roughness, (c) acoustic phonon (deformation potential and piezoelectric), (d) dislocation, (e) residual impurity and (f) alloy disorder respectively

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FTDT INVESTIGATIONS FOR FABRICATION THE SUB-WAVELENGTH METAL WIRE-GRID POLARIZER, QUARTER WAVEPLATE AND SUPERLENS

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The light propagation simulation for sub-wavelength metal wire-grid polarizer, quarter waveplate and superlens has been deeply investigated by using the Finite-Difference Time-Domeain (FTDT) method considering some key parameters for dielectric layers, metallic material and substrate. The results show that the Ag wire-grid has a high transmittance for the Transverse Magnetic (TM) mode, and both the grid period and the grid thickness have great impact on the performance of infrared (IR) polarizing components. The numerical simulation suggests that the designed IR wire-grid polarizer and quarter waveplate present advantages of broad-band, high TM polarization transmission efficiencies and high extinction ratios. Likewise, the waveguide structure simulated for IR superlens includes a layer of metallic elements in the form of H insulated from the semiconductor substrate and the conductive surface layer by dielectric layers. An electrical voltage applied on structure influences the strong coupling between the metallic elements and the conductive layer, and confines the electromagnetic radiation in the waveguide by varying the density of charge carriers, the refractive index and the phase. The waveguide can convert surface wave (SW) in propagating wave (PW) or reverse, function of SW propagation direction (D1 or D2).

Keywords: Infrared polarizer, quarter waveplate, sub-wavelength, superlens

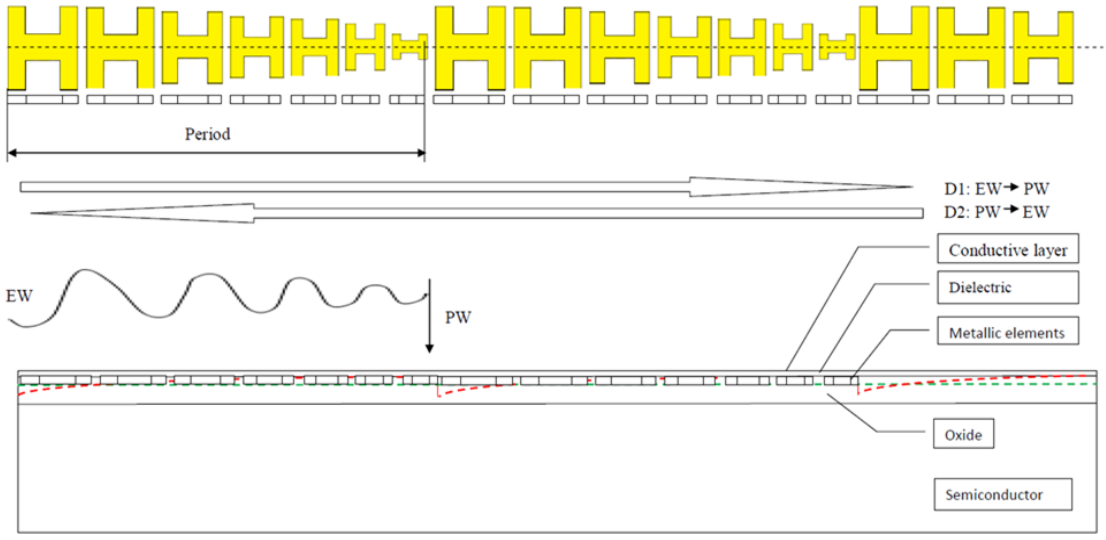

Fig.1 The waveguide structure for superlens

GAS DIFUSION LAYER AND REACTANT GAS CHANNEL INFLUENCE ON THE PERFORMANCE OF A HT-PEM FUEL CELL

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Abstract

Proton exchange membrane fuel cells (PEMFC) are highly efficient power generators, being used recently in a clean hybrid power supply system. Comsol Multiphysics, a comercial solver based on the Finite Element Method (FEM) was used for developing a three dimensional model of a high temperature PEMFC in order to study operation mode and performance of the fuel cell.The results showed that gas diffusion layer (GDL) porosity at low values of 0.1 – 0.3 and reduced GDL thickness affects negatively polarisation curve and water molar concentration distribution along the cell. An optimum value of gas channel width/GDL width ratio λ=0.65 was established in order to obtain the most desirable power density curve, minimum pressure drop along the anode GDL and highest velocity field distribution of the fluid along the cathode channel. Variations of water and oxygen molar concentration were also presented for seven values of ratio λ.

Keywords: proton exchange membrane fuel cell, polarization curve, gas flow velocity, molar concentration

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S5 P3

ANALYSIS OF SOURCE PROPERTIES FOR THE EARTHQUAKE SEQUENCES IN THE SOUTH-WESTERN CARPATHIANS (ROMANIA)

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The crustal seismicity in Romania is concentrated in front of the Carpathians Arc bend (Vrancea region) and at the contact between the extra-Carpathian platform regions and Carpathians orogen. The region investigated in this paper is characterizing the contact of the western side of the South Carpathians with the Tisza-Dacia region. Three earthquake sequences are analyzed: (1) a sequence of 14 events occurred on 24-31 March 2011 in the Haţeg region (main shock magnitude of M_L = 4.0), (2) a sequence of 35 events occurred on 8 – 11 September 2013 in the Haţeg region (main shock magnitude of M_L = 4.7) and (3) a sequence of 60 events occurred in the Caras-Severin area on 31 October – 15 December 2014 (main shock magnitude of M_L = 4.8). We apply empirical Green's functions deconvolution and spectral ratios techniques to determine the source parameters. Despite the relative small size of the events, high-quality waveforms for pairs of co-located events are available in different measuring sites. The new results, together with previous determinations, provide an useful database to investigate the source scaling properties in correlation with seismotectonics

modeling of the study region. Finally, source characteristics (location, seismic moment, source dimension, stress drop, focal mechanism, clustering) are discussed in connection with the seismotectonics features at the scale of the entire Carpathians and adjacent extra-Carpathians contact areas.

Keywords: earthquake sequence, source parameters

S5 P4

DETECTION OF EVENTS IN A MULTIDISCIPLINARY NETWORK MONITORING VRANCEA AREA

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This paper describes the modalities of detection of events in a multidisciplinary network that monitor seismicity, telluric field, magnetic field, electric-electrostatic field, radio LF waves, air ionization, radon concentration, solar radiation, infrasound, light and acoustic phenomena, meteorological parameters, air-earth temperatures, satellite data with application in seismic Vrancea area (bending zone of Carpathians mountains). The most part of data analysis is automatically done into a distributed structure. Methods used are general but the measured parameters have to be adapted to particularities of monitoring area. Vrancea is a complex zone characterized by intermediate depth earthquakes concentrated and distributed on several levels deep. Data acquisition is followed by their analysis (detection, effects evaluation) and automatic transmission of alerts to beneficiaries specialized in emergency situations (Inspectorate for Emergency Situations, organizations involved in managing special events). Network monitoring allows tracking of climate change and it sends information in real time. System structure, software and methods implemented are original (figure 1).

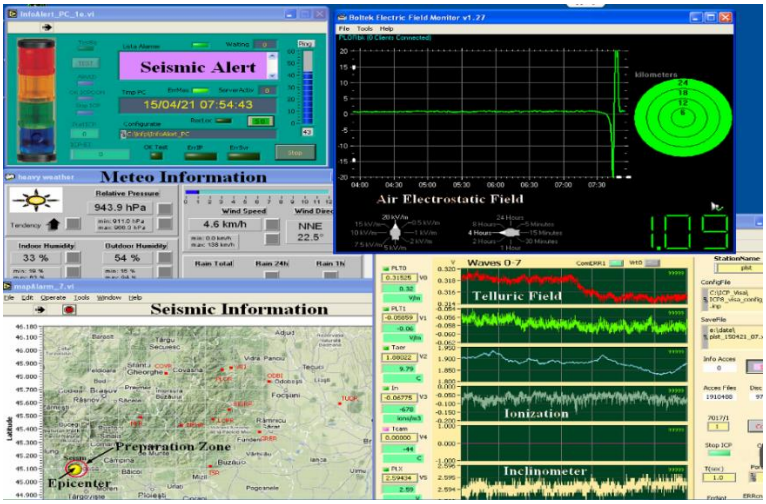

Figure 1 Multidisciplinary information (seismic, meteorological, telluric field, ionization)

Acknowledgements

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Key words: communicating in disaster**,** early warning, seismo-acoustic waves, alert network

S5 P5

INPUT PARAMETERS FOR THE PROBABILISTIC SEISMIC HAZARD ASSESSMENT IN THE EASTERN PART OF ROMANIA AND BLACK SEA AREA

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In this study we have used the most reliable and homogeneous seismic datasets at the European scale, covering historical and modern instrumental seismicity until present days for the Eastern part of Romania and the Black Sea Area. The catalogue was obtained as a compilation of 4 existing catalogues: ANSS-Advanced National Seismic System-USA, NEIC - National Earthquake Information Centre, World Data for Seismology Denver-USA, ISC-International Seismological Centre-UK and INCDFP – Romplus, Romania.

The seismic zonation of the Eastern part of Romania and the Black Sea Area was obtained using the distribution map of earthquakes and the map of the zones with active tectonics. There were established in this way fifteen crustal and one intermediate seismic sources: Vrancea intermediate (VRI), Vrancea normal (VN), Barlad Depression (BD), Predobrogean Depression (PD), Intramoesian Fault (IMF), North Dobrogea (BS1), Central Dobrogea (BS2) Shabla (BS3), Istanbul (BS4), North Anatolian Fault (BS5), Georgia (BS6), Novorossjsk (BS7), Crimeea (BS8), West Black Sea (BS9) and Mid Black Sea (BS10) (Figure 1).

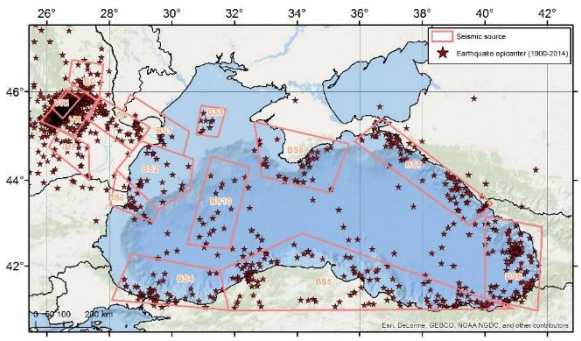

Figure 1. The seismic zonation of the Eastern part of Romania and the Black Sea Area

For each source we have compiled all the requested parameters for a probabilistic hazard assessment: geographical distribution, average depth, activity rate and Gutenberg Richter parameters (a, b, maximum possible and most probable magnitudes and intensities and their return periods). The b values have been mapped to emphasize the zones with low and high stress, for different periods of time.

Keywords: Seismicity, statistical parameters, Gutenberg-Richter, stress evolution

Acknowledgements:

This work was partially supported by the Partnership in Priority Areas Program – PNII, under MEN-UEFISCDI, DARING Project no. 69/2014, and FP7 FP7-ENV2013 6.4-3 Project number: 603839/2013, ASTARTE/PNII, Capacity Module III Project 268/2014.

S5 P6

THE INFREP EUROPEAN VLF/LF RADIO MONITORING NETWORK - PRESENT STATUS AND PRELIMINARY RESULTS OF THE CYPRUS MONITORING SYSTEM

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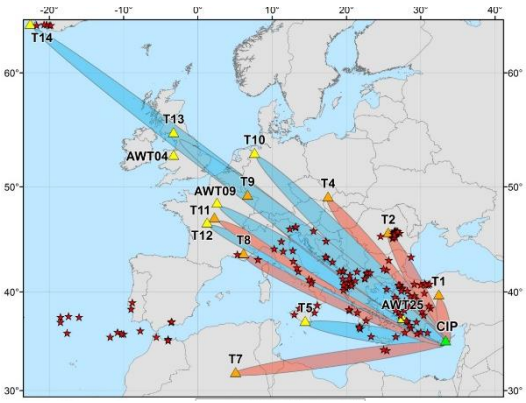
The paper presents the Cyprus (CIP) VLF/LF monitoring system, consisting in a radio receiver - made by Elettronika S.R.L. (Italy) and provided by the Bari University- and the infrastructure that is necessary to record and transmit the collected data. This system is a part of the international initiative INFREP. Through this initiative, originated in Italy, VLF / LF radio receivers are deployed in different locations in Europe. Each one is monitoring up to ten different transmissions of radio stations across the continent. Information on electromagnetic fields' intensities created by transmitters at each receiving site and gathered from this network are indicating the quality of the propagation along the paths between the receivers and transmitters (Figure 1). Studying the ionosphere influences on the electromagnetic waves' propagation along a certain path is a method to put into evidence possible modifications of ionosphere lower structure and composition as earthquakes' precursor.



The VLF / LF receiver installed in Cyprus was put into operation in March 2012. In May 2013, the receiver was relocated from European University Cyprus in Egkomi (Nicosia) (35.159067, 33.338705) to Hellas Sat Space Centre in Kakoratzia (Larnaca) (34.859130, 33.383907) S-W of Larnaca.

Figure 1. *The seismogenic zones crossed by the 5th Fresnel zone of the radio paths monitored by the CIP receiver and the European seismicity with Mw>6.0*

Changing the receiver site produced excellent monitoring data since the receiver was positioned in a remote area, away from the cities of Nicosia and Larnaca, thus minimizing interference from noise sources. The system has proved its utility in observing the ionospheric propagation of radio waves in the VLF/LF bands and the anomalies related to the preparatory stage of European seismicity with M>5.5 occurred during the last 2 years, including the Cyprus mb=5.5 earthquake from 15 April 2015.

Keywords: VLF / LF monitoring, seismo-electromagnetics, earthquake forecasting

Acknowledgements:

This work was partially supported by: the RO-CY Bilateral Project Capacity Module III Project 759/2014, the Partnership in Priority Areas Program – PNII, DARING Project no. 69/2014, by a grant of the RNASR, Program for research- Space Technology and Advanced Research - STAR, Project number 84/2013, and Nucleu Program PN 09-30, Project no. 03 01/2009.

S5 P7

EVALUATION OF THE DISPERSION OF THE POLLUTANTS RELEASED BY A WASTE INCINERATOR USING NUMERICAL SIMULATIONS

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The rapid increase of the industrial sector and urban development specific to the present human society is not only an expression of progress, but also a major concern for all of us, especially due to the continuous increase of all types of pollutants released into the atmosphere. Once the association between the existence of fine particles suspended in atmosphere and their negative impact on the human health has been proved clearly, the problem of the control of the toxic emissions has become of great scientific interest. In this context, the problem of obtaining information about the composition and dispersion of different resulted combustion residues is a first and fundamental step. The present paper deals with the problem of the dispersion of different components from flue gas released during the waste incineration process at the Pro Air Clean Ecologic Timisoara incinerator

plant. The transport process of the components is investigated numerically with the CloseView software. The input programme data are the concentration and the chemical properties of the components detected experimentally in the combustion chimney. Our study takes into account the effect that the height of the combustion chimney, the velocity and the direction of the wind has on the dispersion process. The concentration profiles are calculated for a geometry specific to the city map of Timisoara. This analysis provides relevant information on the distribution of the pollutants and the most exposed zones of the city.

Keywords: pollutants, dispersion, waste incinerator, numerical simulations

Acknowledgments
This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-ID-PCE-2011-3-0762.

S5 P8

THERMAL DEPOSITION OF TiO_2 NANOPARTICLES ON SnO_2:F ELECTRODES USED IN DSSC

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Abstract. The deposition method of TiO_2 nanoparticles on TCO material (transparent conducting oxide) is very important for a good yield of light conversion into electric current in dye-sensitized solar cells (DSSC).

In this paper, it is characterized the deposition method of several types of TiO_2 nanoparticles on a TCO material based on SnO_2:F. Their deposition was effected by heating at 400 °C. For characterization of TiO_2 nanoparticles before and after deposition it was used following techniques: atomic force microscopy (AFM), X-ray crystallography (XRD) and UV-VIS spectrophotometry.

This deposition method provides a good adhesion of TiO_2 nanoparticles on SnO_2:F electrodes without affecting the properties of these materials.

S5 P9

ACTIVE FAULTS FROM ONSHORE AND OFFSHORE OF THE BLACK SEA COAST

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The main purpose of the study is to decipher the seismicity of the Black Sea areal from a tectonic perspective. By analyzing the active faults from onshore and offshore Black Sea coast we aim to evaluate the tsunamogenetic potential.

In order to delimit the seismic sources, the following elements have been taken into account:
- depth of the earthquakes foci, which allows the separation of earthquakes in two major categories: deeper than 40 km depth and crustal, normal (less than 40 km deep);
- development of the earthquakes in zones with active tectonics (fault systems);
- establishment of the areas of active faults along which the earthquakes epicenters are aligned;

The studies on active tectonics have clearly shown the position of the seismic sources (connected to well defined active faults) which do not interfere and do not result in alternatives of other seismotectonic model constructions.

According to the distribution map of the earthquake epicenters and as well as to the map of the areas with active tectonics, ten seismic sources were identified in Iren-Adelina Moldovan (2015). This classification is very useful for seismic hazard analysis. Another way of looking at the seismic context is from a tectonic aproach, in which we are talking about active faults such as: Midia Fault, Razelm fault, Peceneaga Camena fault, Heraclea fault, Lacul Rosu fault, Vama Veche fault, Delfin fault or Capidava-Ovidiu fault. We characterize faults with the aid of: wide of the faults, depth, lenght and active lenght of the faults

The maximum possible magnitude of the seismic sources is evaluated from seismotectonics and geological information (such as length of the faults, possible apparition on surface, geomorphology, etc). Concidering international practice and IAEA recommendation or applying the maxim magnitude method observed or maxim intensity observed.

From the seismological point of view the earthquakes which are responsible for tsunami occur on thrust (associated to subduction zones), normal or inverse faults, have a magnitude higher than 6.5 (although USGS cited a tsunami at 5.1 magnitude, which we consider unplausable) and are shallow, at less than 20 km depth.

Reference

Iren-Adelina MOLDOVAN, Mihail DIACONESCU, Emilia POPESCU, Angela CONSTANTIN, Dragos TOMA DANILA, Anica Otilia PLACINTA**:** Input parameters for the probabilistic seismic hazard assesment in the eastern part of Romania and Black sea area.The study was partly funded by the projects:

1.Set-up and implementation of key core components of a regional early-warning system for marine geohazards of risk to the Romanian-Bulgarian Black Sea coastal area. MIS Code 641/2010,

2. DARING Project no. 69/2014 supported by the Partnership in Priority Areas Program – PNII, under MEN-UEFISCDI,

3.“Nucleu” of the National Plan for Research, Development and Innovation of the Romanian Ministry of National Education, Contract no**. PN 09-30/27.02.2009**

4. Assesment, Strategy And Risk Reduction for Tsunamis in Europe, Astarte, 603839/2013

S5 P10

INVESTIGATION OF EARTHQUAKE SIGNATURES ON THE IONOSPHERE USING TEC VALUES OVER THE EUROPEAN REGION

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Over the years NIEP (National Institute for Earth Physics) has developed a GNSS/GPS (Global Navigation Satellite System/Global Positioning System) network, which consists in 22 permanent stations situated in and around the Vrancea region and 2 more recently acquired but not yet deployed.

Data acquisition is made in real time (observation rate 1s), in RAW and RINEX data format using Leica GNSS Spider Software. The primary goal of the network is to provide surface velocity measurements for the region of Vrancea using GPS observations, and to relate these surface kinematic movements to solid Earth processes, but in the light of our new collaboration with Frederick University from Cyprus we have extended our knowledge and field of expertise.

So we started to investigate earthquake signatures that can be present in the ionosphere. We do this by using TEC values over the European region. For this purpose, we extract GPS data for a selection of some significant recent earthquakes and the GPS observed surface motion combined with other independent geophysical investigations, in our case TEC studies and ionospheric propagation of radio waves in the VLF/LF frequency range. These methods combined can support understanding and modeling of the ongoing processes in the study area

Keywords: GNSS, Ionosphere, TEC, VLF/LF, seismo-electromagnetics

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S5 P11

INFRARED SPECTROSCOPY AND DSC AS ANALYSIS TOOLS IN PRODUCTION AND DIAGNOSIS OF CARBON FIBERS (FROM PAN PRECURSORS)

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The paper deals with application of ATR-IR, transmission IR and DSC as analysis tools for carbon fibers (CF) produced from acrylonitrile precursors through a recently developed technology at ICPE-CA Bucharest. The products of different early and medium phases from oxidation (stabilization) up to graphitization were analyzed by IR and the conversion was estimated. The occurrence of core-skin effects produced in some cases was also highlighted. The results concerning the oxidative conversion of acrylonitrile as well as the diagnosis of CF degradation under different electrochemical treatments (cyclic voltammetry and anodization in electrolytic solutions of NaCl, HNO_3 and pH13) are presented and discussed. The obtained results shown a good resistance of CF under these stress conditions, their stability increasing with the graphitization temperature.

S5 P12

SATELLITE IMAGERY FOR ASSESSMENT OF BUCHAREST URBAN GREEN CHANGES

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Urban vegetation, known as green space that includes vegetated areas such as parks or forest stands, and isolated trees growing along streets, in street medians, or private property, is a critical issue for both a healthy population as well as for city economy. Urban vegetation cover in cities is constantly changing due to various natural and anthropogenic pressures. Natural forces for change include natural regeneration, vegetation growth and vegetation mortality from insects and diseases or old age. Anthropogenic factors that influence urban vegetation cover include tree planting and tree mortality or removal from either direct or indirect human actions such as development and air pollution. The combination of these factors through time determines existing and future vegetation cover levels. Accurate information is essential for estimation of changes in surface energy balance and atmospheric greenhouse gas emissions, and Urban Heat Island function at local and regional scale as well as urban land cover/use dynamics in frame of global warming. Through reducing air pollution, and providing

recreational places, green spaces play important functions in urban environments. With the rapid change of Bucharest metropolitan area in Romania, during the past decades, urban green was fragmented and dispersed causing impairment and dysfunction of these important urban elements. Climate variability and change can exert profound stresses on urban green environment, which are sensitive to heat waves, droughts, and changes in the frequency of precipitations. As future climate trends have been predicted to increase the magnitude and negative impacts of urban heat waves in metropolitan areas, there is an urgent need to be developed adequate strategies for societal vulnerability reducing. This study explored the use of time-series MODIS Terra/Aqua Normalized Difference Vegetation Index (NDVI) and Leaf Area Index (LAI), data to provide vegetation change detection information for metropolitan area of Bucharest in Romania. Training and validation are based on a reference dataset collected from IKONOS high resolution remote sensing data. The mean detection accuracy for period 2002- 2013 was assessed to be of 88%, with a reasonable balance between change commission errors (20.3%), change omission errors (25.7%), and Kappa coefficient of 0.71. Annual change detection rates across the urban/periurban areas over the study period (2002–2014) were estimated at 0.79% per annum in the range of 0.46% (2002) to 0.86% (2014).Vegetation dynamics in urban areas at seasonal and longer timescales reflect large-scale interactions between the terrestrial biosphere and the climate system. This paper demonstrates the potential of moderate-and high resolution, multispectral imagery to map and monitor the evolution of the physical urban green land cover.

S5 P13

IMPACTS OF CLIMATE AND ANTHROPOGENIC PRESSURES ON FOREST ECOSISTEMS IN ROMANIA FROM SATELLITE DATA

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Research on geosphere-biosphere-atmosphere interaction depends on scientific information about existing terrestrial vegetation, among which forestry has an important contribution. One of the main sources of systematic change on local, regional, or global scale is due to variations in the composition and distribution of forest vegetation. The assessment of forest ecosystems state as well as the influences of local and regional climate is closely related to land use/cover changes, being very different from region to region.

Climate changes and extreme events like as in temperature, precipitation, cloudiness, increasing dry seasons, droughts, accented frost, intense rain storms, might increase damage forest ecosystems. Another source of spatio-temporal changes in forest ecosystem may be due to anthropogenic influences. Land use/cover changes by human activities, such as deforestation, urbanization, and agriculture practice, influence climate. Land surface conditions affect the dynamics and thermodynamics of the atmosphere by influencing the water cycle and energy budget, may affect

local, regional, and possibly global weather and climate. Climate-induced changes at the land surface and extreme climate events (e.g., through more intense and higher frequency droughts, flood or cold) may in turn feed back on the climate itself, for example, through changes in soil moisture, vegetation, radiative characteristics, and surface-atmosphere exchanges of water vapor. Changes in climatic conditions, land use practices and soil and air and water pollution have large-scale adverse impacts on forest biomass quantity and quality.

Due to high variation in forest communities, forest structure and the fragmentation of the forested area in Romania, satellite based biophysical parameters information for forest state analysis and assessment of climate and anthropogenic impacts for economic and sustainable forest management needs have to meet particularly high quality requirements.

Understanding how land surfaces respond to climate change requires knowledge of land-surface processes, which control the degree to which interannual variability and mean trends in climatic variables affect the surface energy budget and by this forest vegetation.

Satellite remote sensing data in the visible and near-infrared (VNIR) optical wavelengths domains represent a useful source of information for biogeophysical parameters (leaf area index, canopy cover, clumping index, fraction of absorbed photosynthetically active radiation, chlorophyll content, net primary production, canopy water stress, etc.) estimation of forested areas.

Use of remote sensing to monitor the forest changes due to climatic or anthropogenic stressors is an excellent example of the value of multispectral and multitemporal observations. Fusion technique was applied to time-series multispectral and multitemporal satellite imagery (Landsat TM/ETM, MODIS and IKONOS satellite data) for forest areas Baneasa, Comana and Cernica-Branesti, placed in the neighbouring of Bucharest town, Romania, over a period 2002-2014. To evaluate the impacts of climate and anthropogenic stressors on biophysical properties of the investigated forest system, a set of biophysical variables have been estimated and several classifications of forest vegetation over tested area have been done.

S5 P14

AFM INVESTIGATION OF MORPHOLOGICAL MODIFICATIONS INDUCED BY DIFFERENT DECONTAMINATION TREATMENTS ON BACTERIA

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Atomic force microscopy (AFM) was used to compare morphological modifications induced by different chemical decontamination treatments on *Escherichia coli* and *Bacillus cereus*. *Escherichia coli* is an important Gram-negative bacteria used in clinical and environmental study. *Bacillus cereus* is a Gram-positive rod shape bacteria important in food industry and environmental study. The bacterial suspensions was treated with chemical substances utilized in surfaces decontamination (alcoholic solutions, chlorine solution, bis(aminopropyl)laurylamine) at sub-minimum inhibitory concentrations (MICs)

The surface topography of this bacteria attached on mica substrate was acquired in tapping mode under ambient condition. The results show that each type of treatment induces his one modification, from reducing cells dimensions to a wrinkled appearance of cells surfaces, collapse and cells destruction.

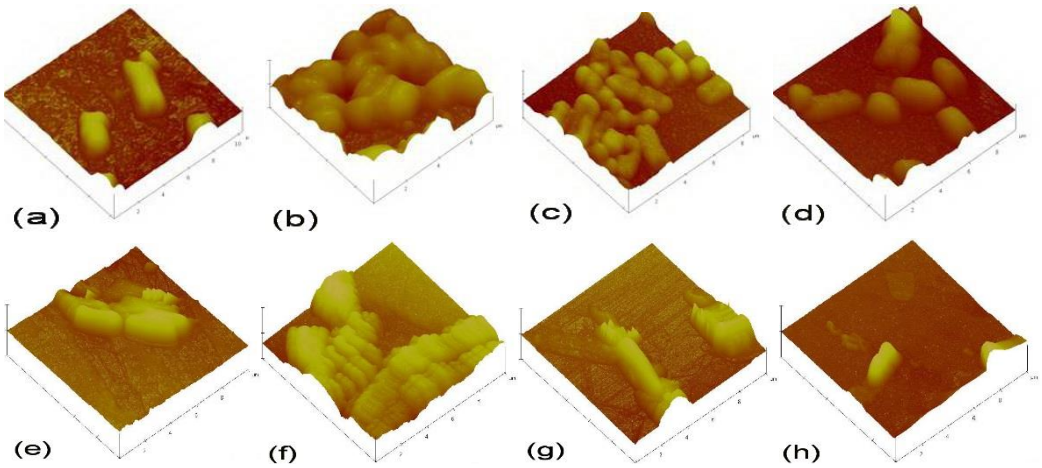

Figure 1. 3D high resolution AFM images of *Escherichia coli (a) untreated bacteria; (b) alcoholic solution 70%; (c) chlorine solution; (d) bis(aminopropyl)laurylamine* and *Bacillus cereus (e) untreated bacteria; (f) alcoholic solution 70%; (g) chlorine solution; (h) bis(aminopropyl)laurylamine* Image size 10x10 μm^2

Keywords: AFM, *Escherichia coli,Bacillus cereus,* decontamination treatment

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S5 P15

X-RAY STRUCTURE ELUCIDATION OF NEW BENZIMIDAZOLIUM HEXAFLUOROPHOSPHATES

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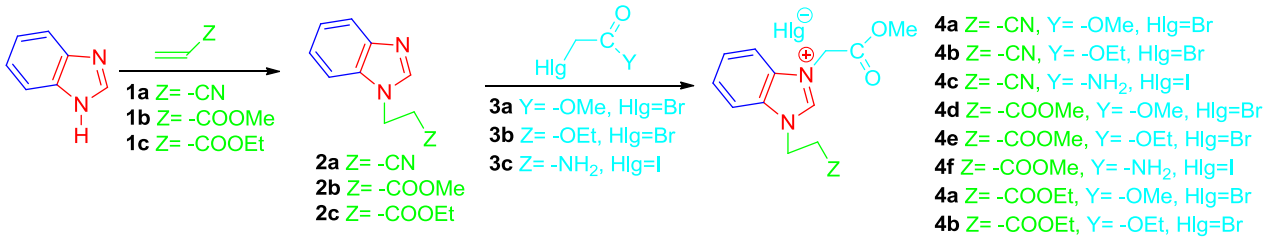
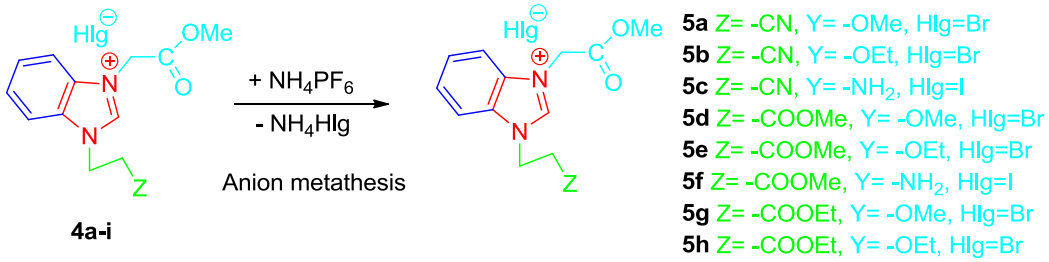
Dialkylimidazolium salts represent a class of ionic compounds with melting points lower than 100°C so called "ionic liquids".[1] The past decade has seen explosive growth of studies on ionic liquids for their diverse applications as: catalyst, liquid crystals, green solvent in organic synthesis, electrochemistry,[2] CO_2 storage devices;[3] The physical properties of the ionic liquids can be modified according to the nature of the desired reactions by altering the nature of their cations and anions.[5] Herein we report the structure elucidation of some new benzoimidazolium hexafluorophosphates **5a-i** obtained by anion metathesis from corresponding halides **4a-i**. Benzoimidazolium halides were obtained by quaternization of the corresponding benzoimidazole derivatives **2a-c** with activated halogenoderivatives according to **Scheme 1**.



Scheme 1.

Anion metathesis of the halogen anion was performed by treatment of the halides **4a-i** with aqueous solution of ammonium hexafluorophosphate and the replacement of the resulted ammonium halide according to **Scheme 2**.



Scheme 2.

The structure of the new compounds was proven by elemental (C, H, N), spectral analysis (IR, ^{1}H NMR, ^{13}C NMR, 2D-COSY, HMQC, HMBC) and X-Ray analysis. All the elemental and spectral data are in accordance with the proposed structure.

ACKNOWLEDGEMENT: *To CNCS - UEFISCDI,* ***grant PN-II-TE/ 0010 -79/05.10.2011*** *financial support and the* ***POSCCE-O 2.2.1, SMIS-CSNR 13984-901, No. 257/28.09.2010 Project, CERNESIM****, for the XRD and NMR experiments.*

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S5 P16

X-RAY STRUCTURE ELUCIDATION OF ACETOPHENONE DERIVATIVES

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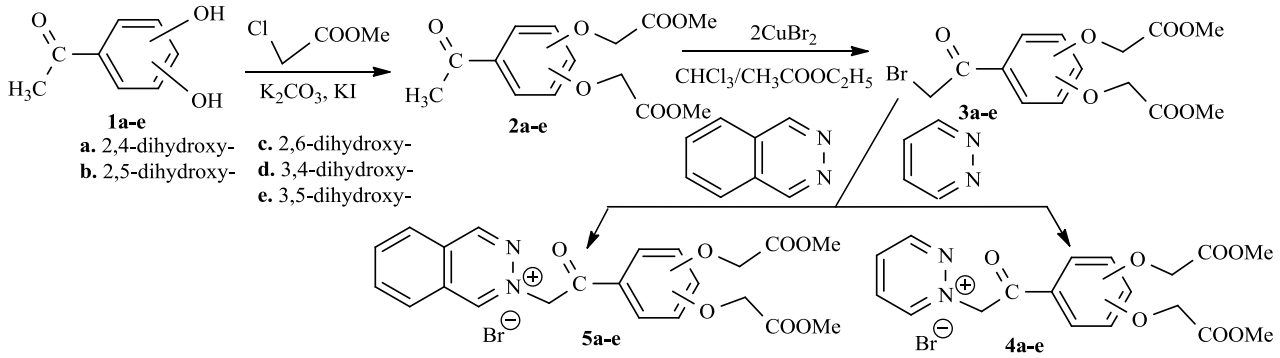
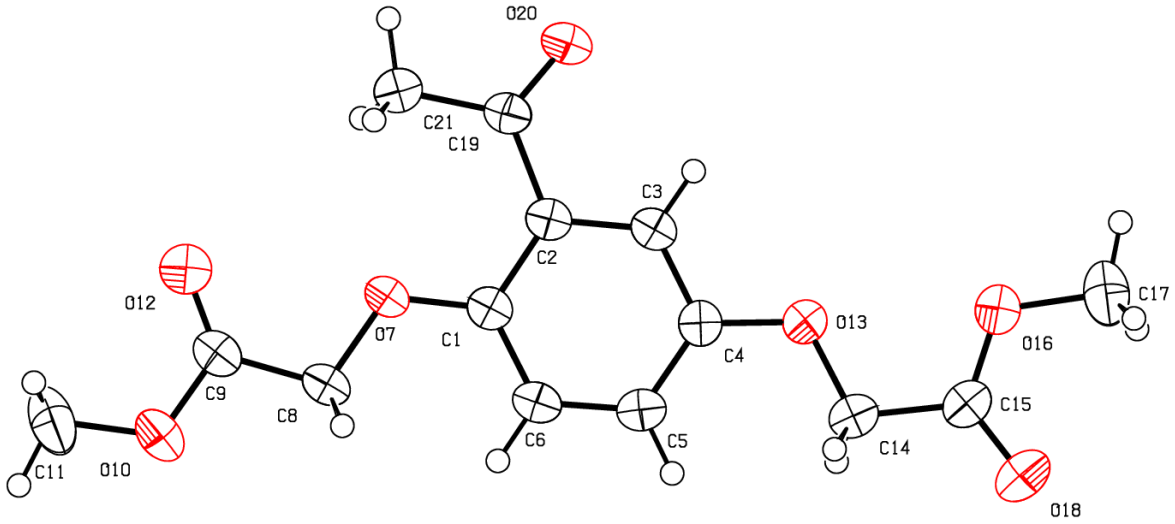
Encouraged by the promising results obtained previously in the field of dihydroxyacetophenone derivatives with antimicrobial and anticancer activity [1,2], we decided to aprofundate the studies concerning syntheses, cytotoxicity/ anticancer activity and, to bring supplementary clarifications which prove unambiguously the structure of compounds. The strategies adopted for the synthesis of our dihydroxyacetophenone derivatives **2-5** is facile and efficient. The preparation involves three steps: *O*-alkylation and α-bromination of dihydroxyacetophenone followed by an *N*-alkylation of 1,2-diazine derivatives, Scheme 1.



To establish unequivocally the structure of dihydroxyacetophenone derivatives **2-5**, the X-ray analysis was performed in the case of compounds **2b** and **2e**, Figure 1



ACKNOWLEDGEMENT:

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S5 P17

METROLOGY AND OPTICAL PROPERTIES OF SOME TRANSPARENT OXIDES THIN FILMS

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Transparent and conductive oxides thin films (ITO, SnO_2), with thickness values in the range 230 – 370 nm, were grown onto glass substrates using the RF magnetron sputtering technique. After deposition, the samples were annealed in air at temperatures up to 650 K. In this study, a stylus profilometer (Ambios, XP–2) was used to measure the thickness of the oxide thin films. Structural and optical properties of both as-deposited and annealed samples were investigated by XRD and GIXRD. The surface morphology of the obtained films was investigated by AFM and SEM techniques. Influences of post deposition thermal treatment on morphological properties of these oxides were discussed based on XRD measurements. Transmittance spectra, in double-beam configuration, were recorded in the 190 – 3000 nm wavelength range and, from these, optical constants (i.e. Drude damping coefficient, Drude frequency, complex permittivity, refractive indices, extinction coefficients) were obtained for these oxides of various thicknesses. High absorption coefficients and suitable optical bandgap values of 3.5 – 3.7 eV were obtained. The electrical conductivity was measured using the four points method. Current – voltage characteristics of the oxide thin films were recorded at temperatures ranging from 300 K to 480 K. An electrical analysis of the conduction mechanisms specific for different voltage ranges was also performed.

S5 P18

EARTHQUAKE TRIGGERING EFFECTS CAUSED BY WATER LEVEL FLUCTUATION AT 2 DAMS FROM EASTERN CARPATHIANS

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Earthquakes occurrences near the artificial water reservoirs are caused by stress variation due to the weight of water, weakness of fractures or faults and increasing of pore pressure in crustal rocks. Therefore these factors have an important role in terms of induced seismicity. The studies carried out in different regions of the world *(Chander, 1999; Asadollahfardi et al., 2013; Dojcinovski et al., 2014)* statistically estimated that over 75% of artificial water reservoirs influenced local seismicity.

[1] Married as Garoi

In the present study we aim to investigate how 2 dams lakes (Poiana Uzului and Izvorul Muntelui), located in the Eastern Carpathians influence local seismicity. In order to achieve the goal, we have selected from the seismic bulletins, computed within National Data Center of National Institute for Earth Physics, Romania, only crustal events occurred between 2010 and 2014 in a range of 50 km around each artificial lake.

Subsequently to improve the seismic monitoring around these sites we have applied waveforms cross-correlation techniques on the recordings of nearby seismic stations. Different spectral and waveforms analysis techniques were applied in order to detect and remove the artificial events from the selected dataset. On the refined data we investigate the seismicity distribution around each site, the relationship between the water accumulation and local seismicity as well as the magnitude frequency distribution.

We noticed that the induced seismicity is a very complex process exhibiting different features from one site to another. Was also emphasized the existence of a direct correlation between this type of seismicity and hydrological respectively tectonic characteristics of investigated regions.

Keywords: induced seismicity, cross-correlation, seismic waveforms, seismic energy

Acknowledgements:

This work was partially supported by: the Partnership in Priority Areas Program – PNII, DARING Project no. 69/2014, and Nucleu Program PN 09-30, Project no. 03 01/2009. Several techniques applied in the present study were developed within the international project FA7022-11-C-0015

S5 P19

FRACTAL PROPERTIES OF OSTEOBLAST-LIKE CELLS FROM HOLOGRAPHIC PHASE IMAGES

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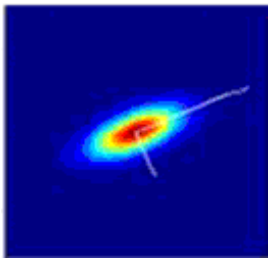
Various methods are currently in place to discriminate among slightly different features inside the same cells species [1], with applications for whole blood analyses or representative cell lines [2]. Particularly the holographic techniques become powerful tools dedicated to distinguishing among the morphological properties of biological objects translated into optical quantities, which can be easily detected and measured via phase, intensity, or polarization changes, in transmitted or reflected beams [3].

This paper proposes a method to statistically characterize the proprieties of osteoblast-like MG63 cells in cultures. Depending on the scope, the space of the relevant features of the digital holographic image (DHI) of the cell is partitioned in non-overlapping clusters or models, each dimension being a relevant feature [4]. Since in three-dimensional DHI space two objects with the same volume may have different areas, the boundary of the cell has information complementary to

its interior volume. In this respect, the cell descriptor includes information from the boundary, volume, and their dynamics as well. The analysis of the dynamic uses the technique of covering the volume and the surface of the cell with a rule unit with the same topological dimension as the measured quantity. The fractal dimension is an additional parameter of the descriptor as the limit of the ratio of the number of the units necessary to cover the object and the length of the unit in log-log scales [5].

The method consists in the following steps: taking the DHI of the cell (see figure), followed by appropriate filtering to enhance the visibility of the surface (volume), then computationally covering using the contraction rule and neighboring strategy; finally, the statistic over an appropriate number of cells allows to defining the models consistent with the descriptor.



Holographic image of

The method applied onto osteoblast-like cells revealed several models with different fractal properties. The correspondence with changes in cell morphology grown in osteogenic differentiation medium is discussed.

The work is supported by the grant PN-II-PT-PCCA no. 6/2012.

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S5 P20

CHARACTERISTICS OF THE MACROSEISMIC INTENSITIES OF THE 2014 VRANCEA CRUSTAL EARTHQUAKE

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Starting on November 22, 2014, a moderate size sequence occurred in the Vrancea seismogenic zone (Romania). The main shock of the crustal sequence occurred at 19:14:17 UTC (21:14:17 local hour) in the same day, in the area of Marasesti city, with M_L=5.7 and the epicenter located at north latitude 45.87° and east longitude 27.16°, and a focal depth of 39 km. The sequence

lasted for more than two months and a number of 230 earthquakes were recorded. Depths at which these aftershocks occurred ranged from 16-50 km. This earthquake was the largest event on crustal zone of Vrancea during the last hundred and twenty years.

The crustal seismicity of Vrancea seismogenic region is characterized by moderate earthquakes with magnitudes that have not exceeded M_W 5.9, with this value being assigned to an earthquake that occurred in historical times on March 1, 1894 (Romplus catalog).

Soon after the earthquake occurrence, in order to define the macroseismic field of ground shaking, the NIEP sent macroseismic questionnaires in all affected areas, to be able to assign macroseismic intensities. According to macroseismic questionnaires survey in the felt region, the intensity of epicentral area reached VI MSK, and the seismic event was felt in all the extra-Carpathian area. This earthquake caused general panic and minor to moderate damage to the buildings in the epicentral area and the northeast part of country. The main purpose of this paper is to evaluate the macroseismic effects produced by the main earthquake of the seismic sequence on November 22, 2014 using the MSK-64 intensity scale.

Keywords: Vrancea seismogenic zone, macroseismic intensity, seismic sequence

Acknowledgements: This work was partially supported by the Partnership in Priority Areas Program – PNII, under MEN-UEFISCDI, DARING Project no. 69/2014 and the Nucleu Program-PN 09-30, Project no. 03 01.

S5 P21

MIGRATION OF Cu IONS IN POLYETHYLENE XLPE INSULATION BY THERMAL STRESS

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Abstract: The aim of this work was to demonstrate the diffusion of Cu ions into the insulation material of a real cable, highly stabilized and crosslinked with silanes, through their catalytic effect on oxidative degradation as evidenced by a photo-thermal analysis technique (chemiluminescence) as well as by a thermal analysis one (DSC). The presence of the copper in the studied insulation material has been checked by Atomic Absorption Spectroscopy (AAS) and Particle Induced X-ray Emission (PIXE) techniques.

Keywords*:* DSC, *CL, AAS,PIXE*

S5 P22

HEAVY METALS CONTENTS FROM THE MUNICIPAL AND INDUSTRIAL SLUDGES IN DAMBOVITA COUNTY

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The present study was undertaken to experimentally evaluate the heavy metal (HM) quantity in two wastewater treatment plants from the Dambovita County. Heavy metals are very harmful because of their non-biodegradable nature, long biological half-lives and their potential to accumulate in different body parts. Metal transfer from sewage sludge to soil and subsequently to groundwater represents one of the most critical long-term hazards associated with the application of these wastes to soils. For this purpose were monitored more than 6 months, two wastewater treatment plants from this county. The analyses of Cd, Cr, Cu, Fe, Mn, Pb, Zn have been performed using Atomic Absorption Spectrometry (AAS) and Energy Dispersive X-Ray Fluorescence (EDXRF). The results of this study can be used for the management of effluent and sewage application in agricultural lands and crop production. The groundwater quality can be monitored and improved as well.

Keywords*:* wastewater, *sewage sludge, heavy metals, EDXRF, AAS*

S5 P23

GEOTECTONIC STUDY OF THE DOBROGEA (ROMANIA) AREA USING GNSS DATA

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The aim of this study is to investigate the present day tectonic activity in the Dobrogea area. This area is situated in the south-eastern part of Romania between the Danube river and the Black Sea. It is crossed by two important faults: the Peceneaga Camena fault and Sfantu Gheorghe fault and it is bounded by the Intra-Moesian fault in the south.

Using GPS measurements we computed the surface motion of the region. The data were collected in two styles: episodically (campaign style) and continuously (permanent style). The campaign style means that in each year a station has been measured 72 hours continuously. For this style we have data for a period of 13 years. For the permanent style the stations are measuring continuously (CGPS). In Dobrogea, the first permanent station installed was Histria (HIST) in 2003 and since then the CGPS network has grown to 20 stations. Seven of these permanent stations are maintained by the National Institute for Earth Physics. The other thirteen stations are part of the Geopontica network, developed and maintained by the National Reasearch and Development Institute for Marine Geology and Geoecology. The GPS data were processed in daily batches with the "precise point positioning" (PPP) strategy using the GIPSY software. From the resulting position time-series the horizontal and vertical motion vectors were calculated relative to a stable Eurasian reference frame.

The results of our study show that the Dobrogea area trends to move slightly southward relative to Eurasia at velocity rates of about 2.5 – 3.0 mm/yr. We speculate that this is a far-field effect of slab roll-back due to the subduction of the African plate under the Eurasian plate at the Aegean trench, way to the south.

Acknowledgements.

We are particularly thankful for the efforts of all people and (international) institutes involved in the process of data acquisition (campaign style). We also thank the National Reasearch and Development Institute for Marine Geology and Geoecology, National Center for Monitoring and Alarm to Natural Marine Hazards – Euxinus, for providing access to their data.

This work was partially supported by: Nucleu Program PN09 – 03 05 phase 16.04.2015.

Keywords: GPS, geodynamics, displacement.

S5 P24

EVALUATION OF TRACE ELEMENTS CONTENT IN EDIBLE MUSHROOMS BY ICP-MS

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The determination of heavy metals concentration in the fruiting bodies of mushrooms is essential in dietary intake studies, because this aliment is used in the diet of many countries. Different heavy metals are toxic, such as Cd, Ni, Hg, but in low concentrations many elements are essential for the human metabolism, such as Fe, Zn, Mn, Cu, Se, because they are enzyme activators. In the present study, trace elements (Mn, Fe, Cu, Zn, Cr) contents were determinate in the caps and stipes of ten

edible mushroom species using ICP mass spectrometer (iCAP Qc, Thermo Scientific). Wild mushrooms species *(Cantharellus cibarius, Russula alutacea, Russula atropurpurea, Russula cyanoxantha, Russula nigrescens, Macrolepiota procera, Macrolepiota excoriata, Boletus edulis, Armillaria mellea, Pleurotus ostreatus*) were collected from four sites of Dambovita County, Romania. After this study it was observed that mushrooms accumulate trace elements in different concentrations, in caps and stipes, depending on its species.

Keywords: wild edible mushrooms, heavy metal content, ICP-MS.

Acknowledgments

These mushroom samples have been collected in the frame of the project PNII – IDEI 624/2008, financially supported by UEFISCSU – CNCSIS and coordinated by Associate Professor Gabriela BUSUIOC. It is a good occasion to thank to Mr. Mihai DUMITRU, PhD in Geobotanics field, for the identification of macromycetes species analyzed in this work.

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S5 P25

FERRITE COMBUSTION CATALYST ON MULLITE SUPPORT

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This work describes a procedure to develop a combustion catalyst on mullitte support (natural or synthetic porous aluminum silicate). The mullitte support has high specific area, thermal and chemical stability, and it provides a good adherence of the active substance, in our case magnesium ferrite. The procedure permits to obtain a catalyst with a well-determined composition, with sub-micron structure and a specific surface area higher than that of the support. The procedure consists in the co-precipitation, in a colloidal mixture of polyvinyl alcohol deposited on mullitte, of the metal hydroxides that forms ferrite through the reaction between metals salts and ammonium hydroxide following by thermal dehydration of hydroxides, and ferrite synthesis through heat treatment. The gases liberated during the synthesis leave open channels and pores in ferrite mass, considerably increasing its specific surface area.

The developed catalyst, i.e. the ceramic support impregnated with active substance (magnesium ferrite) has been investigated with respect to its micro-structural and catalytic properties at the combustion of some reducing gases diluted in air.

Acknowledgements: This work was performed by financial support of the Project PN-II-ID-PCE-2011-3-0453, CNST-UEFISCDI.

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S5 P26

STUDY ON THREE NANO-GRAINED FERRITES AS CATALYSTS FOR ACETONE COMBUSTION

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The removal of volatile organic compounds (VOCs) from air is important for environmental and human health. We have chosen acetone as a VOC model because, among all the VOCs, it is a common organic solvent extensively used in the manufacture of plastics, fibers, drugs and other chemicals. Several technologies have been used to remove VOCs emissions. Catalytic combustion is the most promising method for release of VOCs.

Three nanograined oxide compounds, $CuFe_2O_4$, $MgFe_2O_4$ and $Ni_{0.5}Co_{0.5}Fe_2O_4$, with spinel-type structure, were prepared by sol-gel self-combustion method and tested for the catalytic combustion of dilute acetone in air (1 – 2 ‰). The crystal structure and phase composition of the samples were analyzed by XRD. X-ray diffraction measurements of the powders were performed at room temperature using CuKα radiation. The average crystallite size was evaluated. A scanning electron microscope was used to visualize the surface morphology. The BET specific surface area (S_{BET}) was determined from nitrogen sorption data using the BET equation. The elemental composition of the surface particles was examined with Energy Dispersive X-ray Spectrometer. Catalyst activity tests were conducted in a laboratory scale with a flow type set-up. The catalyst powder was placed in a quartz tubular micro-reactor, brought in an electrical furnace. The increase of the temperature was made in steps of 50ºC, from 50ºC to 550ºC. At every predetermined temperature, as a result of catalytic combustion, the gas concentration at the exit of reactor will be smaller than the inlet gas concentration.

Acknowledgements: This work was performed by financial support of the Project PN-II-ID-PCE-2011-3-0453, CNST-UEFISCDI.

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S5 P27

ADVANCED MICROWAVE ANTENNAS USING LOW-LOSS, HIGH DIELECTRIC PERMITTIVITY MATERIALS

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Low-loss, high-dielectric permittivity materials have an significant impact on microwave applications. On one side, the low dielectric losses result in microwave devices with high quality factor or low insertion loss. On the other side, high values of the dielectric permittivity lead to the decrease of the effective electromagnetic wavelength and, finally, to the device miniaturization.

In this work, dielectric antennas with axial symmetry are investigated. We previously showed that high dielectric constant materials, such as barium neodymium titanate, offer a significant size reduction and a fair quality factor for the ISM band antennas [1-2]. However, most of the time, a high dielectric permittivity material does not allow the development of wideband dielectric resonator antennas. In order to improve the fractional bandwidth, gain and antenna efficiency, antennas of non-homogeneous dielectric resonators are proposed. Zirconium tin titanate, barium neodymium titanate and calcium silicate were the materials considered in this research for the dielectric resonator antennas with improved characteristics. The proposed resonators exhibit either the shape of a truncated cone or a cylindrical shape.

Acknowledgement – This work was supported by a grant of the Romanian National Authority for Scientific Research, Programe for research- Space Technology and Avanced Research - STAR, project no. 240/2013 ADANSPACE.

Keywords: dielectric resonator antennas, antenna bandwidth, microwave dielectrics.

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S5 P28

TITANIA BASED NANOARCHITECTURES – KEY ASPECTS IN PHOTOCATALYTIC APPLICATIONS

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The important role of titania in the development of materials that possess improved performances in photocatalytic applications is well known. However, there is a continuous debate regarding the key parameters that decisively improve the photocatalytic performances. Recent publications report about the challenge to synthetize materials with controllable porosity, crystallinity or surface particularities, as well as to obtain differently shaped semiconductors or noble-metal nanoparticles; a large variety of nanostructures with fascinating geometries being achieved with the final goal of improving the photocatalytic performances. On the other hand, besides the benefits and promises shown by titania as photocatalyst, a few drawbacks and weaknesses can be found. Among them, the most representative one is the relatively large band-gap ($E_g \geq 3 - 3.2$ eV) that enables the absorption of less than 4-10 % of the solar radiation. In order to extend the absorbable light region to the visible domain and to increase the yield of absorption, the nano-coupling of titania with other semiconductors or noble metals like WO_3 or Au/Pt, respectively, was intensively used in the last decades.

Taking into account the above mentioned aspects, our interest is firstly focused on preparing in a controllable way, by various preparation methods, i.e. sol-gel, supercritical drying, hydrothermal, materials based on TiO_2, WO_3 and/or noble metals with different porosities, crystallinity and morphologies. Then, our purpose is directed to the assessment of their morphology and structure from the perspective of photocatalytic performances, the correlation of the most important aspects derived from the analyses performed being finally completed.

The information resulting from investigations performed on various nanostructures by means of UV-Vis, Raman, XRD, TEM, and SEM techniques revealed a quite complex image about the role played by the structural and morphological particularities such as the crystallites type and shape, their size and the contacts between heterogeneous nano-entities on the improvement of the photocatalytic performances of these materials.

Keywords: titania nanocomposites, photocatalysis, morphology, structure

Acknowledgments: This work was supported by the grants of the Romanian National Authority for Scientific Research, MNT ERA_NET nr.7-065/26.09.2012 and PN-II-ID-PCE-2011-3-0442.

S5 P29

CHARACTERIZATION OF CULTURAL HERITAGE MATERIALS USING ADVANCED ANALYTICAL TECHNIQUES

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Nowadays, preserving and protecting cultural heritage represents one of the major preoccupations of the European community, scientific research through the use of modern advanced analysis methods being indispensable for knowing and assessing national and universal cultural heritage. This knowledge is necessary for preserving and protecting artworks, archaeological items and historic monuments, for passing them on from generation to generation by adopting safe and efficient restoration and preservation treatments. The main instrumental analysis methods proposed for addressing the research thematic are infrared and Raman spectroscopy.

The aim of this paper is to present the recent activities and progress that IRASM has done in this field, basicaly on pigments and painting materials , leather and textiles. The non-destructive and non-contact characterization of the molecular structure of materials from cultural heritage objects was performed by FTIR/Raman spectroscopy using a Bruker Vertex 70 class equipped with a Raman RAM II module (LN2 Ge detector) with a RAMPROBE fibre.

The spectroscopic methods performance on materials of cultural heritage objects is an authentication chance for arts objects.

Acknowledgement: This work was supported by a grant of UEFISCDI, project TEXLECONS, contr. no. 213/2012.

Keywords: identification; characterization, IR and Raman Spectroscopy, authentication

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S5 P30

Al_2O_3 LAYER GROWN ON RuAl BOND COATS DURING HIGH TEMPERATURE OXIDATION

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Keywords: Thermal Barrier Coatings, high temperature oxidation, superalloys, RuAl alloys

Abstract. The main objective of this work is the development of new Ru-based Bond Coats (BC) as part of Thermal Barrier Coating Systems (TBC). Over the years, the most used BC alloys have been platinum-modified nikel aliminide (Ni-Pt)Al and McrAlY (M, metal) [1,2]. RuAl has been identified as a potential replacement for the more traditional bond coats because it has a high melting temperature and robust physical properties [3,4]. Because the oxidation behaviour of RuAl-based compounds is not vrey well known, this study intends to clear up some aspects regarding this matter. The work focused on preparation and microstructural characterisation of RuAl alloys subjected to oxidation.

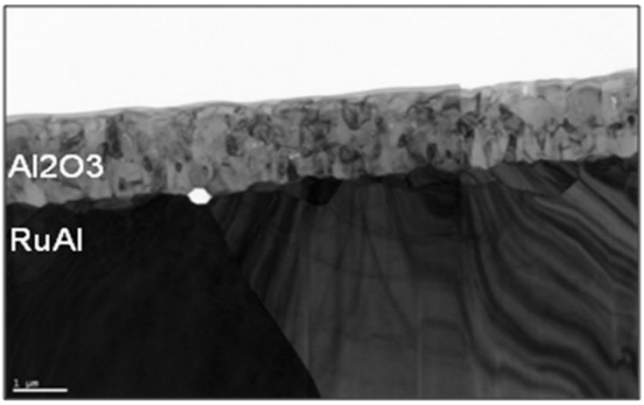

Fig. 1 TEM cross-section micrograph of RuAl oxidised for 10 h showing the dense, columnar, adherent, uniform alumina layer

We have prepared a RuAl 50/50 at% alloy in an induction furnace which was subsequently subjected to oxidation in an electric furnace, in air, at 1100ºC, for 10h and 100h.
The alloy was analysed before and after oxidation using advanced microscopy techniques (SEM, TEM).
The challenge of this research is to obtain an adherent and uniform layer of alumina after oxidation. The results so far suggest encouraging results (fig. 1)

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S5 P31

GENERATION OF COMPLEX THREE-DIMENSIONAL MICROSTRUCTURES WITH DIFFERENT FUNCTIONALITIES FOR SELECTIVE DEPOSITION OF METALS

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Complex three-dimensional microstructures with different functionalities were induced on copolyimide containing alicyclic sequences film surfaces by means of oxygen plasma treatment. The plasma power was ranged to be big enough to accelerate the plasma species towards the copolyimide surface and the exposure time was not very small in order to generate a roughness that still can be monitored by atomic force microscopy (AFM). To create a rectangular pattern, transmission electron microscopy (TEM) grid masks were placed on the samples before treatment.

Plasma-induced micropatterning with alternating hydrophilic and hydrophobic surface chemistries was evaluated by measuring the adhesion forces between the metal covered AFM tip and the copolyimide surfaces. These characteristics were influenced by the power of the oxygen plasma.

In order to fabricate three-dimensional metallic microstructures arranged in well-defined areas, thin metal layers were sputtered on these pretreated copolyimide films. The morphological aspects of the obtained complex structures were correlated with the surface modifications induced by plasma treatment conditions and the type of metal that was used for sputtering.

Acknowledgement:
The work has been funded by the Sectoral Operational Programme Human Resources Development 2007-2013 of the Ministry of European Funds through the Financial Agreement POSDRU/159/1.5/S/132397.

Keywords: microstructures, plasma treatment, adhesion force, sputtering

ORIENTATION DISTRIBUTION FUNCTION OF BIOTITE PALETS BASED ON OPTICAL, THIN SECTION AND MICRO-CT IMAGES IN AN OUTOKUMPU (FINLAND) BIOTITE GNEISS: COMPARISON WITH NEUTRON DIFFRACTION TEXTURE ANALYSIS

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Key words: Orientation Distribution Function, Texture

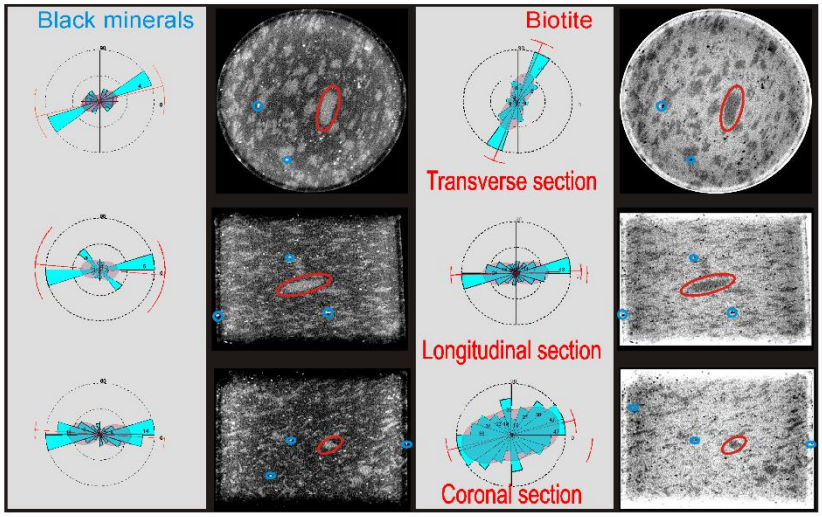

Figure 1 - Three tomographic sections of the Outokumpu gneiss as well as the rose diagrams illustrating the corresponding orientation distribution functions

Orientation Distribution Function (ODF) is a powerful descriptor currently used to characterize cristalographic texture or and other similar features of a large category of materials, including rocks and minerals. Consequently, ODF was used to evidence the degree of anisotropy regarding the distribution of biotite fraction in a fragment of biotite gneiss collected at a depth of 1820 m from the Outokumpu formation in North-eastern Finland. The sample has a cylindrical shape with a diameter of 2.8 cm and a height of about 2.2 cm. All image analyses were performed by using the PAROR programs (http://earth.unibas.ch/micro). Concurrently, three different images of the same sample were analyzed from this point of view, *i.e.* a set of thin sections, two opposite polished surfaces as well as a set of micro-CT sections parallel and perpendicular to sample axis.

In all case it was possible to evidence the presence of elongated biotite evidenced crystals whose longer axes were almost parallel. This peculator was observed in all perpendicular to sample axes surfaces as well as in the micro-CT longitudinal sections (Fig.1). The corresponding rose diagrams allowed estimating the degree of anisotropy in good correlation with biotite texture measurements performed by means of the SKAT texture diffractometer at the Frank Laboratory of Neutron Physics (JINR, Dubna, Russia).

S5 P33

INVESTIGATION OF SYNTHESIZED DIAMONDS, LITHIUM AND BORON NITRIDES USING SEM-EDX AND XRD TECHNIQUES

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This work provides results obtained by the application of X-ray based techniques for the micro-composition and structure characterization of new synthesized crystalline materials, such as diamonds, lithium and boron nitrides, obtained at Scientific and Practical Materials Research Centre, National Academy of Sciences of Belarus. The techniques employed in the frame of Romanian-Russian collaboration between Dunarea de Jos University of Galati and Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research (JINR), Dubna, Russia (Project no. 84/2015), are: scanning electron microscopy (SEM), SEM coupled with energy dispersive X-ray analysis (SEM-EDX) and X-ray diffraction (XRD).

Currently diamond powders having different characteristics are widely used in the manufacture of abrasive tools. The size and shape of grains of synthetic diamond powder, as well as its strength properties depend largely on the growth of the system. Diamond synthesis can be carried out in the presence of different composition of metallic melts, but the regularity: in the molten metal must include one or more elements that are catalysts for the process. The most commonly used for this purpose Ni, Fe, Mn and Co. The use of catalysts reduces the pressure of diamond synthesis to 5-6 GPa.

Application of SEM-EDX using a Quanta 200 FEI type scanning electron microscope for the investigation of micro-composition of crystalline samples allowed the determination of impurity content in diamonds (Al, O, Si, Ca), Li_3N (Na, Fe, Cl, Zr), and BN samples (Al, O, Mg), besides the transformation of lithium nitride into carbonate with increasing synthesizing pressure.

Electron microscopy highlighted the structural differences between the powder diamond samples with various grain sizes (160/125 μm, 500/400 μm, 400/315 μm and 250/200 μm), synthesized in different pressure and temperature conditions.

XRD technique using a DRON-3.0 diffractometer (Cu-K_α radiation) was employed for the evaluation of size and shape of crystalline phases, and lattice parameters, transformation of phases

during activation processes and grade of conversion of different phases (graphite to diamond) during the synthesis process.

On-going work is carried out using neutron activation analysis at JINR for the investigation of micro-composition of crystalline diamonds synthesized in different pressure conditions using different catalyst systems (Fe-Ni-C, Mn-Ni-C).

Keywords: diamonds, lithium and boron nitrides, SEM-EDX, XRD.

S5 P34

INVESTIGATION OF PRE-EARTHQUAKE IONOSPHERIC ANOMALIES RELATED TO GLOBAL M>5.8 EARTHQUAKES

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The last two decades a hard effort is put to analyze and possibly predict seismic events through monitoring of ionosphere. That was possible mostly through technological developments such as ground based techniques to study the bottomside ionosphere (ionosondes), satellite based instruments to carry out investigations of the topside ionosphere, as well as dense networks of GNSS receivers that enabled monitoring of the full extent of the ionospheric plasma via Total Electron Content (TEC) and ionospheric tomography techniques. These have enabled the systematic and effective monitoring of the spatial modification of the ionosphere with a high temporal resolution.

The most widely known long wavelength perturbations are travelling ionospheric disturbances which are associated to atmospheric internal gravity waves and also infrasonic waves propagating upwards, amplified by the exponential density decrease of the atmosphere. The significant number of scientific case studies that have been published generated evidence to support the Lithosphere-Atmosphere-Ionosphere coupling to emerge as a research topic on its own. Ionospheric anomalies prior to earthquakes (also known as ionospheric precursors) are caused by the anomalous electric field penetrating the ionosphere and creating irregularities in electron concentration. Typical ionospheric signatures associated with earthquakes are anomalous depletions and enhancements of Total Electron Content (TEC) in the vicinity of the epicenter position of the earthquake and abnormal deviations of the height of maximum electron concentration and of the critical frequencies within the different ionospheric regions.

Since not any individual precursor can be used as an accurate stand alone, for earthquake prediction, this means that it is necessary to integrate different kinds of precursors and analysis techniques. To this context, the aim of this study is to investigate pre-earthquake ionospheric anomalies that occurred before the global M >5.8 earthquakes during the period 1998 -2015 following a multi-instrument and multi-technique approach, using data obtained from ionosondeS (critical frequency of F2 ionopsheric layer) and from ground-based GNSS receiver network (TEC). In order

to identify possible ionospheric anomalies before the earthquake, the diurnal variations of hourly foF2 and TEC measurements 15 days prior and during the day of the earthquake are calculated and compared with the respective 15-day running mean as well as with the standard deviation around mean (±2σ) and the Cross-Correlation Analysis using both hourly foF2 and TEC observations is applied. Then, the morphology of ionospheric anomalies is examined by producing the spatial TEC and foF2 mapping over the examined area with a 15-minutes resolution using GNSS data and for the same 16-day interval. The spectral analysis is also applied on TEC observations for the same period which provides additional information about the characteristics of ionospheric precursors.

Keywords:
Ionospheric precursors, Earthquake, GPS measurements, Total electron content (TEC)

Acknowledgements:
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S5 P35

NONDESTRUCTIVE DEFECT ANALYSIS USING CT – 3D RECONSTRUCTIONS

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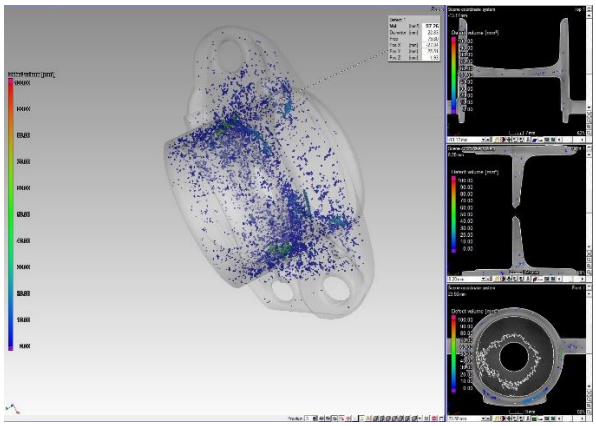
Traditionally, to determine the porosity within a part would require destructive testing. CT scanning is a nondestructive method, utilizing x-ray technology that can detect internal and external features and flaws without destroying the part, or applying any pressure or fixtures.



Industrial CT scanning is used to detect flaws inside a part such as porosity (void analysis), inclusions or cracks before a failure can occur. CT scanning allows you to inspect and locate problem areas inside a component, and find the point of origin of a failure without needing to disassemble the components.

Keywords: CT, defect analysis, 3D reconstructions

S5 P36

STATISTICAL ANALYSIS OF PHYSICAL AND CHEMICAL PARAMETERS OF THE WATER – WELL FORM THE GALATI COUNTY AREA.

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Water is a renewable resource, vulnerable, natural, but limited. The general attention for this precious resource is increasing in the last period.

The overall objective of this paper was to monitor the water quality in the South-eastern part of the country. For this aim, the study was made for 20 wells from Galati County, along the Siret River course. The study was made during an entire year and the sampling of water describe an area of over one hundred square kilometers, having Şerbăneşti village as a starting point, followed by villages Hanu Conachi, Tudor Vladimirescu, Vameş, Piscu, Independenta, Braniştea, Şendreni, Movileni, the final point being located in the Fileşti village.

The present paper presents the evolution of the well water quality by measuring thirteen parameters such as: pH, DO, salinity, pressure, conductivity, hardness, Ca2+, Mg2+, etc. basing on which could be detected any modifications of the water quality.

In the last part of the paper, are presented the main probable mechanisms which could explain the time modification of the observed parameters.

Keyword: water quality, physics process, time evolution

S5 P37

MICROBIAL FUEL CELLS WITH DIFFERENT MICROBIAL ECOSYSTEMS - ENERGY PRODUCTION AND NITRATE REMOVAL EFFICIENCIES

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Microbial fuel cells applications have mainly targeted wastewater treatment and processing, thus a great part of research efforts have focused on the scalability of MFCs and their incorporation

into the existing water treatment infrastructure. To this end, we investigated the potential of monochamber MFCs to reduce (and thus remove) high nitrate concentrations from wastewaters, with simultaneous energy production. MFC anolytes consisted of wastewater collected from a Wastewater Treatment Plant from Facai – Romania, having three different microbial cultures: i) from the active sludge of a wastewater treatment facility; ii) from the silt from a river basin that regularly accepts heavy loads of nitrates from the local agriculture and iii) from a silt of a river basin near an industrial zone of Bucharest. The systems are characterized, as individual units and in serial connection, according to their capacity for simultaneous organic matter and nitrate removal, as well as their capacity for current and power production.

Keywords: Microbial Fuel Cells (MFCs), microbial communities, energy production, nitrate removal

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S5 P38

OPTICAL AND PHOTOCATALYTICAL PROPERTIES OF ZnO/CdS COMPOSITES PREPARED BY FACILE APPROACHES

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Zinc oxide, a wide band gap semiconductor, is commonly used in photovoltaic cells and also in photocatalytic processes; but ZnO itself cannot absorb and utilize the visible region of the solar spectrum. In order to absorb the visible light and generate the electron–hole pairs, the zinc oxide should be coupled to a narrow band gap sensitizing semiconductor in composite materials [1, 2]. Cadmium sulfide is one of the most appropriate sensitizers because it has the same crystal structure as zinc oxide and its band gap is in the visible region, forming a type-II heterojunction with ZnO which facilitates a very fast interband charge transfer from CdS to ZnO [3]. The composite materials are advantageous because they can compensate for the disadvantages of the individual component, and induce a synergistic effect, such as an efficient charge separation and improvement of photostability [4]. Some superior or new properties can be realized by assembling different types of constituents into composites with controlled structure and interface interactions [5].

We have synthesized ZnO/CdS powders by a chemical method, using two experimental techniques. The structure and morphology were investigated by electron diffraction and transmission electron microscopy. The optical properties were studied using UV-Visible diffused reflectance spectroscopy and the catalytic activity was explored in the photodegradation of Congo red azo dye, under visible irradiation from a halogen lamp. The photocatalytic activity and the optical properties were compared with those of functionalized/capped CdS nanopowder obtained in the same conditions [6].

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S5 P39

QUALITY FACTORS MEASURED ON SOME WINE ASSORTMENTS

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A subject for modern viticulture is the presence of metals in wines. The dispersion of chemicals used in viticulture, such as fertilizer and pesticides that lead to environmental contamination and poor practice cellar, are important factors that directly affect the metal content of wines. Development of appropriate methods for the determination of metals in wines was performed using mass spectrometry with inductively coupled plasma (ICP-MS). This analytical technique is suitable for quantitative multi-element determinations at trace levels (µg/l). The performance criteria established for precision are in accordance with the law 311/2004. The experiments consisted of parallel analysis of 10 samples prepared separate, in separate flasks under conditions of repeatability.

ABSTRACTS

S6 – Topics in Physics Education Research

- *Physics curriculum design*
- *Active learning techniques*
- *Classroom teaching, demonstrations and laboratory experiments*

S6 L1

HEURISTIC TYPE METHODS USED IN THE STUDY OF PHYSICS AND CHEMISTRY

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Heuristic methods have a distinct importance in the study of physics, as they stimulate students' intellectual abilities in addition to maintaining and developing their cognitive interest, therefore creating motivation for learning.

Using heuristic methods, students – whether being themselves in the presence or under the guidance of their teacher – seek and find own solutions in dealing with and for different learning situations (through appropriating rules that may lead them towards the correspondent solutions) and afterwards try to redevelop knowledge and to reengage on the path already followed by science in order to find those solutions.

Thus, the student becomes a responsible active creating participant in science development for both society and self, and in the same time for general progress, instead of a simple beneficiary of it, spared of any effort.

a) ***The brainstorming*** is one of the most world spread methods whether it regards students' training, education, stimulating creativity, business, advertisement, etc., being given to it the significance of *storm of thoughts*, effervescence, influx of ideas, intense creativity.

The use of this method causes and requires active involvement of students, it develops the ability of living certain situations, of analyzing them, of making decisions that regard choice of the most appropriate solutions and it also exercises creative attitude and expression of one's personality.

Using brainstorming method optimises as well the development of interpersonal relationship – one can find that people around can be good, valuable, important. During activities in classes of physics and chemistry (lessons, laboratory activities, revisions, workshops), when using this particular method, there can be distinguished the following steps:

- the teacher defines the problem situation while the students issue as many ideas as they can – as possible solutions in solving the problem given; the talks are performed in a casual atmosphere, students being encouraged to use, as much as possible, the previous ideas that were issued and set forth by the group members, to correlate and coordinate them, in order to forge new causal links, all these leading them to superior ideas (when comparing to the initial ones), to a new final product.
- everything is recorded in writing on the blackboard, flipchart, or on video and audio recordings.
- there is a break of a few minutes left for the "emplacement" of ideas issued and received.
- selective systematization, critical appreciation of selective group solutions is done by the teacher in collaboration with students at different time intervals depending on the complexity of the problem.

Brainstorming limitations:

- does not replace long time/ classical research;
- it depends on the qualities of the moderator to animate and direct the discussion to the goal;
- it offers only possible solutions and not the actual implementation;

- sometimes it can be too tiring or demanding for some participants.

The use of this method in physics and chemistry classes, however, induces the expression of independence in the activity of thinking, realises the frame of creative teaching, increases learning efficiency and facilitates a good reverse connection.

b) ***The demonstration*** consists in a presentation - made by the teacher - of some objects or real phenomena (as substitutes of these objects) or some actions/ operations that are to be learned by the students, followed by directing learners, through speech, in perceiving them. Thus, new knowledge is acquired, learned truths are confirmed or the internal model of a new action is assumed.

Through demonstration a concrete sensorial standard is ensured in knowledge work, the intuitive reality of the students being conducted through the word of the teacher. The method has therefore an intuitive nature, which differentiates it from the logical demonstration based on reasoning.

For students, the teacher's demonstration is not only a way of assimilating knowledge but also a model of proof in scientific truths. The duty of the teacher is teaching students to use the method of demonstration in the learning process and not to simply accept ideas and theories without demonstrating them.

For instance, during an experiment work, the whole class of students may be asked to independently write down their own observations regarding the experimental phenomena, or to expound them.

Regardless of the learning situation, it is necessary that prior to the demonstration, students to be made responsive on what it is to be known or carried out, in order to stimulate their curiosity, their interest and desire for knowledge. Stirring active participation of the students during the demonstration involves creating optimal conditions for students to perceive the demonstration at its best.

S6 L2

SPECIAL EXPERIMENTS IN HIGH SCHOOL PHYSICS

Bararu Ion

Colegiul National "Mircea cel Batran" Constanta, Romania

The physics curricula should propose experiments in order to determine the correct understanding of certain phenomena. The actual curriculum has some difficulties from this point of view. One can notice the absence of the concern about this aspect. The fundamental experiments about classical physics are missing. A cause may be the understanding of the poor endowment of physics laboratories. Another one could be the lack of imagination of the authors of the curriculum.

In this study I proposed an essential experiment from electromagnetism: the highlighting of the Lorentz force. The experiment is a very simple one. There are few materials and very easy to obtain. We propose to drive the charged ions from electrolytic solutions around some electrodes introduced in solution. A direct current electric battery provides the electric field between the electrodes, while a strong magnet provides the magnetic field. A circular motion of the ions is the

effect of the action of the two fields. Their circular movement stimulate the liquid to move. The macroscopic movement of the liquid is very easy to be seen with the naked eye.

The experiment is suitable to be treated with the IBL method. It is a very good argument to stir the interest of the students for physics. I am convinced that this experiment must become mandatory for our educational system.

Key words: Curriculum, fundamental experiment, Lorentz force, Circular motion, IBL.

S6 O1

HOW EARTHQUAKE RELATED DATA CAN BE USED IN SCHOOLS FOR PHYSICS LEARNING AND DISASTER PREPAREDNESS?

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Seismology provides opportunities to teach many physics, math and technology concepts and skills to learners of all ages. These include research skills gain mostly, at school level, by doing investigative experiments or researching information. Seismology-related topics such as fundamental concepts from basic wave phenomena and energy, to the design of inertial instrumentation using mechanics, electricity and magnetism to structure of the inner Earth, plate tectonics, dynamic nature of Earth systems, could be successfully used to ilustrate such concepts. An understanding of earthquakes includes knowing about the types of waves that transmit energy from the hypocenter (place where events occur). Physics, more than other disciplines, underpins this understanding and helps design the instruments used to detect and record earthquakes.

Romanian Educational Seismic Network (ROEDUSEIS) [1] is an inovative educational project aiming, among other objectives, to contribute to science literacy and science education at different levels (K-12, undergraduate, graduate and public) using seismology as a vehicle for scientific learning and awareness of earthquake risk. The project is piloted in nine Romanian high-schools. Since the beginning of the school year 2014-2015, two of them have introduced an optional interdisciplinary course on seismology based on the educational materials developed in the framework of ROEDUSEIS project [2].

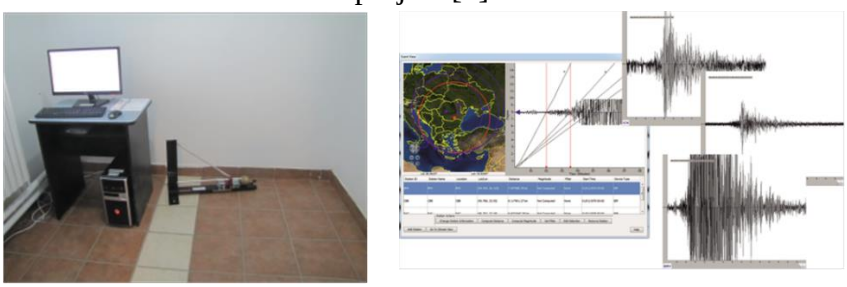

Fig.1 – left: Educational seismometer installed and recording in one ROEDUSEIS school; right- January 23, 2014 ML = 4.7 Vrancea earthquake recorded and located by ROEDUSEIS network

Based on the ROEDUSEIS experience and developments, this paper underlines the possible use of earthquake data and related investigation tools as meaningful resources for science teachers in order to make some principles of physics more accesible to children and also to improve scientific literacy and increase the disaster awarness.

Keywords: physics education, earthquake, disaster management, seismic risk

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S6 O2

DIGITAL STORYTELLING AS A CREATIVE TEACHING METHOD IN SCIENCE EDUCATION

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Modern society is based on science and technology and education in these domains should lead to the formation of the associated skills required by each citizen, by promoting active learning, critical thinking and emphasizing the fact that Science is part of the human culture and history being also a defining element, essential in the modern world.

In the context of this "new science education" the focus is placed on the connections between information, the receptivity to new concepts, a flexible structure to conduct the educational process, the achievement of theoretical knowledge with applied experience and personality development. It advocates for an education that combines rationality with intuition by promoting imagination and creativity. Hence, the scientific progress is anticipated.

Creativity is closely related to innovation in science and technology and it has deep roots in the scientific process, being a key, especially in problem solving. Written or oral stories, cartoons or videos are among the various elements which can stimulate creativity [1-3].

Digital storytelling is defined as “the modern expression of the ancient art of storytelling” [4] being a creative and effective method that can be used to explain complex aspects of social and natural phenomena encountered in daily life or to share personal experiences. Creating and presenting self-made stories involves acquirement of higher skills such as: research skills (analysis of the relevant information sources); writing skills (developing a script); organization skills (managing the purpose the materials and the time); technology skills (learning to use a variety of tools); presentation skills;

interpersonal skills (working within a group, roles); problem-solving skills (learning to make decisions and overcome obstacles at all stages of the project); and assessment skills (making an expertise criticizing their own and others' work) [1].
In this article, we describe why digital storytelling may be the bridge between science and creativity and provide concrete applications of digital storytelling in formal and non-formal education. We show the favorable attitude of students towards this way of teaching "for and through science" and their desire to participate as literate citizens in a globalized, ever changing, knowledge-based society.

Keywords: new science education, creativity, digital storytelling, 21st century skills.

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S6 L1

AN INTERDISCIPLINARY APPROACH OF PHOTOSYNTHESIS

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Abstract. By photosynthesis, plants are converting light energy into chemical energy. Photosynthesis is studied in physics and biology classes starting from the middle school, but it is not easily understood by the students. An alternative solution to study photosynthesis is the interdisciplinarity approach, using the specific language of several different disciplines. Interdisciplinarity permits the identification of real techniques, development of optimal solutions and techniques and fast implementation of results. In this paper, we will present, in an elementary way, some methods and physical means used in the study of photosynthesis by the middle school students.

Keywords: photosynthesis, accessory pigments, interdisciplinarity, middle school

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S6 L2

SENSITIVE IN SITU-MONITORING OF SOLUTION CONCENTRATIONS VIA POLARIMETRIC CHAIN WITH SECONDARY FARADAY MODULATOR

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The precise and in-situ measurement of the optical rotatory power (ORP) of chiral substances might present a major interest in many fields, as for example in chemistry (monitoring the enantiometric purity or monitoring reactions involving specific reactants), physics (liquid crystals and structuration of electro-optic media) and mainly bio-medicine (monitoring the level of some proteins in blood, etc.). Among the different methods to measure the optical activity, the principally simplest ones are based on the detection of the polarization plane rotation of the light when passing through the chiral medium. If very simple in principle, this method requires specific methodology for detecting very fine rotation angles below order of degrees. In case of solutions, the rotation of the polarization angle is proportional to the concentration of the optically active component, the light pathway, the wavelength and temperature (the proportionality coefficient known also as specific rotation, being specific to each chiral component). This paper is focused on a didactical description of a methodology for an in-situ monitoriztion of ORP in solutions by using the detection chain of a commercial MOKE magnetometer (Anderberg & Modeer Accelerator AB) provided with secondary Faraday modulator. The precision of the measurement is better than 1 milidegree and the measuring time window can decrease down to 10 msec, which allows in-situ real time monitoring of variations of concentrations in solutions of less than 0.1 mg/ml (even the propagation of the concentration gradient could be experimentally observed). Exemplifications of quantitative determinations and involved resolution limits will be provided in case of glucose and sucrose solutions.