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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
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5. Engineering and Industrial Physics

- Physics of energy transfer, conversion and storage
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- Sensors and Device Physics
- Micro- and Nanoelectronics
- Microelectromechanical systems
- Instrumentation and Metrology
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- 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

ABSTRACTS

S0 – PLENARY SESSION

SO 01

PHYSICO-CHEMICAL CHARACTERIZATION OF COMBUSTION PARTICULATE EMISSIONS USING LASER-BASED TECHNIQUES

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Combustion processes are responsible for most of the pollutants contained in anthropogenic emissions. Carbon, nitrogen and sulfur oxides, volatile organic compounds and polycyclic aromatic hydrocarbons (PAHs) are all found adsorbed on the surface of the carbon-based particulate matter (soot) also formed during combustion. To develop efficient measures for reducing exhaust emissions, it is necessary to investigate the mechanisms of formation and the surface chemical composition of such particulates. The adsorbed phase of soot can strongly affect the chemical and physical properties of the particle surface, playing an important role in many fields including combustion, health and climate. From the climate point of view, aerosol-cloud interaction represents the largest source of uncertainty in global climate models. Soot particles can be involved in cloud formation, one of the best examples is aviation-induced cloudiness, in form of contrail cirrus generated by injection of soot particles into the upper troposphere. The impact of these soot particles on cirrus formation depends on their ice nucleating potential. During the last years, different works have studied the ice nucleation potential of soot particles, but there are important discrepancies between the results reported. One of the main reasons behind these discrepancies is the lack of a complete characterization of the soot particles studied. Soot particles can have very different physico-chemical properties depending on their production conditions, e.g. different fuels or combustion techniques. Therefore a complete physico-chemical characterization is needed to link the ice nucleation potential measured with specific soot properties.
In this talk we will introduce the different techniques available at our laboratory to study the structure and chemical surface composition of soot particles. We use Raman and FTIR microscopy techniques to characterize the structure of soot particles, and two-step Laser Desorption/Ionization Mass Spectrometry (L2MS) and Secondary Ions Mass Spectrometry (SIMS) to determine their surface chemical composition. We will present the characterization of soot from various sources (laboratory, aviation, road traffic) to illustrate the performance of these techniques. Finally, preliminary results from a recently developed experiment dedicated to ice nucleation on soot will be presented.

SO 02

STUDIES OF THE PHOTOVOLTAIC RESPONSE OF NEW BIOLOGIC/POLYMERIC THIN FILMS STRUCTURES

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We investigate the photovoltaic response of new biologic/polymeric thin films structures deposited by spin-coating onto optical glass substrates covered with an indium tin oxide (ITO) thin film. Active layer, as a mixture between regio-regular polymer poly(3-hexylthiophene-2,5-diyl) (P3HT) and a fullerene derivative [6,6]-phenyl C61 butyric acid methyl ester (PCBM) in 1:1 weight ratio, was deposited by spin-coating. To improve the holes collection to anode a buffer layer as a mixture between poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate) (PEDOT:PSS) and chlorophyll-a (Chl-a) was deposited by spin-coating too, using different weight ratios (1:1, 1:2, 1:3, 1:4) for the two components. Chl-a was extracted from fresh spinach leaves and mixed with PEDOT:PSS from a stock solution. Collection of the electrons to cathode was improved by a lithium fluoride (LiF) thin film deposited by thermal vacuum evaporation (TVE). To complete the photovoltaic cell structures an aluminum (Al) cathode was deposited by TVE too. Electrical and photoelectrical measurements were performed in dark and solar simulator conditions, at room temperature. Parameters

characterizing a photovoltaic cell, external quantum efficiency (EQE), open circuit voltage (V_{OC}), short-circuit current (I_{SC}) and fill factor (FF), were determined and compare with results obtained for glass/ITO/PEDOT:PSS/P3HT:PCBM(1:1)/LiF/Al structures.
Keywords: P3HT, PCBM, chlorophyll-a, biologic
Acknowledgements: This work was partially supported by the Project 8SEE/2014.

SO 03

DENDRIMER INTERACTIONS WITH DNA AND NANOPORES: MOLECULAR DYNAMICS SIMULATIONS

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I will present the effect of electrostatics modeled in atomistic molecular dynamics simulations in a variety of contexts involving highly positively charged PAMAM dendrimers in interaction with nanopores and DNA strands. Topics addressed will involve: attractive hydration forces in DNA-dendrimer interactions with descriptions going beyond the Derjaguin-Landau-Verwey-Overbeek colloid theory [1], and dendrimer translocation trough protein nanopores driven by external electrical fields [2].

References:

[1] M. Mills, B. Orr, M.M. Banaszak Holl and I. Andricioaei, "Attractive hydration forces in DNA-dendrimer Interactions at the nanometer scale," J. Phys. Chem. B, 117, 973-981 (2013).

[2] E. Ficici, I. Andricioaei and S. Howorka, "Dendrimers in nanoscale confinement: The interplay between conformational change and nanopore entrance," Nano Letters 15, 4822-4828 (2015).

SO 04

TOWARDS NEW FRONTIERS OF NUCLEAR PHYSICS RESEARCH AT ELI–NP

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The research facility Extreme Light Infrastructure – Nuclear Physics under realization in Bucharest – Magurele has entered recently in the second Phase of its implementation. The main systems of the facility, the 2 x 10 PW high–power lasers system and the high–brilliance gamma beam system, are in advanced stage of their construction. Important milestones in the construction of the two systems have been reached at the end of the last year.

In parallel with the construction of the main research systems the definition and design of the experimental setups have reached at an advanced stage. The proposed physics cases cover a broad range of nuclear physics topics from fundamental to applied physics aspects. The unique features of the beams delivered at ELI–NP will allow for reaching new frontiers of knowledge. Some of the most relevant research topics proposed at ELI–NP are related to ion acceleration with high–power lasers, nuclear reaction studies in hot plasma, photonuclear reactions for astrophysics and for medical radioisotopes production, study of photofission processes and exotic nuclei, nuclear resonance fluorescence as a tool to reveal the intimate structure of the nuclei and for non–destructive active investigation of materials, industrial tomography with high–energy gamma rays.

An updated overview of the ELI–NP research facility will be given. The main setups for performing the Day one experiments at ELI–NP with high–power laser beams and gamma beams will be discussed.

Keywords: high–power lasers, gamma beams, photonuclear reactions, gamma–ray tomography

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SO 05

LOW-DIMENSIONAL CARBON NANOMATERIALS BY PLASMA CHEMICAL DEPOSITION: FROM BULK TO 0D AND BACK

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Nearly hundred years ago the infinite single crystal became the model of a solid by the pioneering work of Max von Laue. Single crystals, their growth and their structure – up to then mostly a topic for crystallographers – became a central topic of physics. One of the great pioneers of solid state physics, R. W. Pohl, early recognized the importance of lattice defects, i. e. deviations from the perfect single crystal, for the physical properties of a solid.

Nanotechnology is the realization of a vision that Nobel-prize winner R. P. Feynman presented in his famous talk There's plenty of Room at the Bottom: New effects and special properties occur in nanotechnology mainly for two reasons: on the one hand, quantum effects can play a significant role and on the other hand, nanoparticles possess a huge surface-to-volume ratio. These aspects can lead to new physical and chemical properties.

Specifically, nanostructured materials, where surfaces and interfaces determine essential properties, are a very interesting facet of this area. Here, one classifies nanostructured materials according to their spatial dimensions as zero-, one-, two- or three dimensional, depending on whether nanometer-sized clusters, filaments, or thin films are present.

Due to its ability to form sp^3-, sp^2- and sp-bonds, different forms of carbon exist (e.g. graphite, diamond, fullerenes, carbon-nanotubes and diamondlike carbon) that make carbon in itself an ideal element for nanostructuring. The addition of further elements like hydrogen expand the possibilities nearly infinitely. Common properties of most Carbon allotropes are e.g. chemical inertness and biocompatibility – other properties may be tailored to a very large extent like hardness, electrical conductivity, residual stress, wettability or elasticity.

In this presentation, we demonstrate the Plasma-CVD synthesis of a large variety of carbon-based materials and show some of their properties. Starting from the epitaxial growth of 3D single crystal diamonds, polycrystalline and nanocrystalline diamond films, we discuss the process parameters and plasma properties that enable the synthesis of these materials.

Furthermore, the deposition and properties of 2D carbon materials are discussed. Materials such as graphene or carbon nanowalls have gained a lot of interest in recent years due to their remarkable potential for diverse applications. One reason is the high surface-to-volume ratio that leads to applications in catalysis or fuel cells.

Finally, we demonstrate the properties of nitrogen-induced 0D point defects in single crystal diamonds. The so called NV centers have gained interest in the last years due to their ability to be used for magnetic field sensing based on Optically Detected Magnetic Resonance (ODMR). They are processed in ultrapure single-domain CVD grown diamond crystals and can be operated at room temperature. This results in solid-state sensors with a wide variety of applications.

Keywords: Carbon, Diamond, Graphene, Plasma-CVD

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

ANALYTICAL TECHNIQUES APPLIED IN THE STUDY OF IONIC IMPURITIES IN ELECTRICAL ROTATING MACHINES INSULATORS

Ion V. POPESCU[1,2], Claudia STIHI[2], Cristiana RADULESCU[2], Ioana Daniela DULAMA[2], Iulian BANCUTA[2], Anca GHEBOIANU[2], Mircea IGNAT[3],Gabriela TELIPAN[3], Bogdan VARATICEANU[4], Gh.Valerică CIMPOCA[1], Elena Daniela CHELĂRESCU[5]

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Traces of metals (Al,Mn, Fe, Ni, Co, Cu, Zn, Cr, Cd and Pb, have been found in the insulation of cables PE. These transition metals causes degradation of insulation, affect its insulating properties and can lead to undesired electrochemical processes under the electrical stress factor.Concentrations of these elements can be determined only by means of atomic and nuclear techniques of high sensitivity and precision. For elemental analyses we applied the Inductively Coupled Plasma Mass Spectrometry - ICP-MS technique.

Key words: insulator, methods, electrical rotating machines.
Acknowledgments:The research leading to these results has received funding from PN II 2013 (Partnership Programme) under the project PN-II-PT-PCCA-2013-4-0792 "High performance polymeric insulations for electrical rotation machines. Technology and modeling approaches", contract no. 262.

S1 L2

SPIN POLARIZED TRANSPORT IN Fe/NaBr(001) BASED HETEROJUNCTIONS

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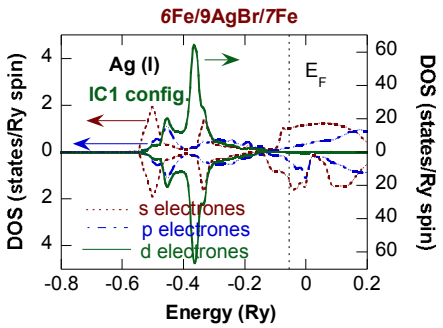
The electronic, magnetic and spin polarized transport properties of Fe/NaBr/Fe(001) heterostructures were investigated by means of ab initio surface Green's function technique for surface and interfaces. Two model interfaces were considered, IC1, with Fe atoms situated atop Na and Br positions and IC2 with Fe atoms sitting above the hollow between Na and Br sites. The total energy calculations showed that sharp Fe/AgCl(001) interfaces are possible. Due to location of iron Fermi level near the bottom of the NaBr conduction band, for both interfaces, there is a charge transfer between the magnetic slabs and spacer and thus formation of metallic induced gap states (MIGs) in the band gap of the barrier, as exemplified in Fig.1 for interfacial Ag(I) and Br(I) layers in IC1 configuration.



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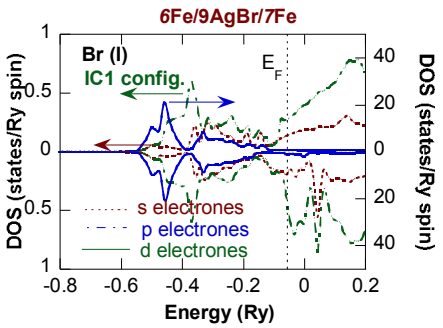
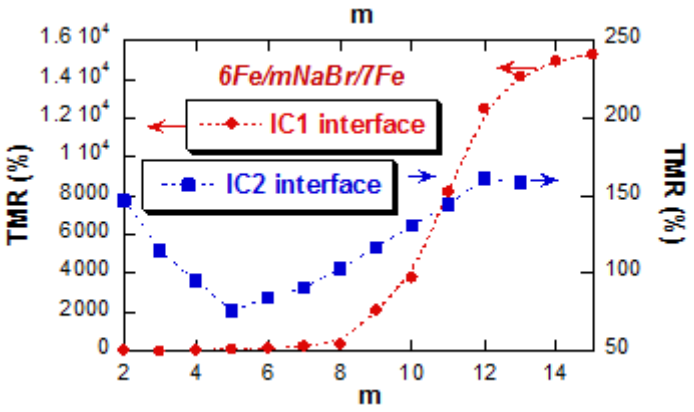


The conduction exponentially with the barrier thickness. High values of the tunneling magnetoresistance (> 10^4 %) can be seen in 6Fe/mNaBr/7Fe heterojuncions for spacer thickness m > 10 in the case of IC1 configuration. The propagating direct tunneling states along the NaBr spacer are of Δ_1 and Δ_5 symmetry. The highly magneoresisitive effect observed in Fe/NaBr/Fe(001) heterojunctions make this system of interest in the context of spin electronics.



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

S1 L3

ELECTROCHEMICAL DEPOSITION - A TOOL IN FABRICATING NANOSTRUCTURES WITH TAILORED PROPERTIES

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Electrochemical deposition is a centuries old technique with numerous applications nowadays due to the low costs of equipment and simplicity of operation. Its unicity comes from its extraordinary scalability and its ability of covering nonplanar surfaces.

Electrodeposition of semiconductors was discovered several decades ago and increased the attractivity of the field. Further, electrodeposition of conducting polymers was discovered and added another dimension to the technique.

When extreme miniaturization became a hot topic it was found that electrodeposition can be exceptionally usefull in the preparation of nanostructures with well defined morphologies. Both template and templateless methods of fabrication of nanostructures were developed[1–3].

The presentation will review electrodeposition based approaches in preparing nanostructures for specific applications. The way in which functionality is achieved will be described for several materials including metals, semiconductors and conducting polymers.

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[2] E. Matei, M. Enculescu, I. Enculescu, Single bath electrodeposition of samarium oxide/zinc oxide nanostructured films with intense, broad luminescence, Electrochim. Acta. 95 (2013) 170–178.

[3] C. Florica, E. Matei, A. Costas, M.E.T. Molares, I. Enculescu, Field Effect Transistor with Electrodeposited ZnO Nanowire Channel, Electrochim. Acta. 137 (2014) 290–297.

S1 L4

MAPPING THE SINGLE MOLECULE MAGNET BEHAVIOUR IN *f*-TYPE COMPLEXES

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The molecular magnetism has evolved in a largely complex field, where the need of theoretical orientation is necessary for analyzing the results and advancing towards property design through the rationales of structural causality. The lanthanide complexes are quite problematic, in computation and analysis. Working at the confluence of experimental and theoretical chemistry, we devised methodologies encompassing technical hindrances and making the interpretation transparent to the chemical intuition. With novel procedures exposed in [1] we present several case studies, selected from literature and our own chemical synthetic outcome. Here, we illustrate a prototypic case of a {CuTb} dinuclear presented by Kajiwara et al [2]. The authors assumed axial magnetic anisotropy described in simple way, with three ligand field (LF) parameters. Our first-principles analysis revealed a richer LF parametric scheme, which however confirms the assumed quasi-axial nature. Since in multi-parametric circumstance the LF becomes non-intuitive, we proposed a picturesque characterization trough color maps, as shown in panel (a) of Figure 1. The hearth-shaped area of strong LF is in line with the axial hypothesis. The panel (b) shows another orientation of the LF potential map (upper part) and its parallelism with the polar map of the magnetization in groundstate (lower part). The panel (c) illustrates another analysis breakthrough, the magnetization functions for the LF split states $^6F_6$ multiplet of the Tb(III) ion in molecule. The polar map insets in panel (c) are for the same molecular orientation given in (b). Our state-specific magnetization functions are powerful tools offering non-trivial insight in the properties of many states, opening the way towards the prospection of magnetic anisotropy in excited states and, possibly, mixed stimuli controls (optical and magnetic).

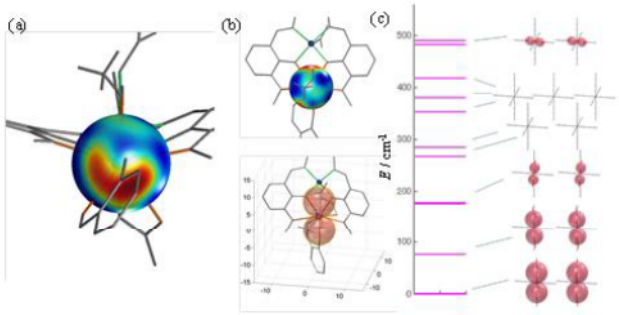

Figure 1. Synopsis of first-principle analysis of Ligand Field maps (panel a and upper b) and state-specific magnetization functions (panel c and lower b) for a CuTb binuclear [2] case.

The work is supported by UEFISCDI PCE 14/2013 project.

[1] M. Ferbinteanu, F. Cimpoesu, S. Tanase, *Struct. and Bond.* **2015**, *163*, 185-229.
[2] T. Kajiwara, M. Nakano, K. Takahashi, S. Takaishi, M. Yamashita, *Chem. Eur. J.* **2011**, *17*(1), 196-205.

S1 L5

OPTICAL PROPERTIES OF NANOFIBERS PRODUCED BY ELECTROSPINNING

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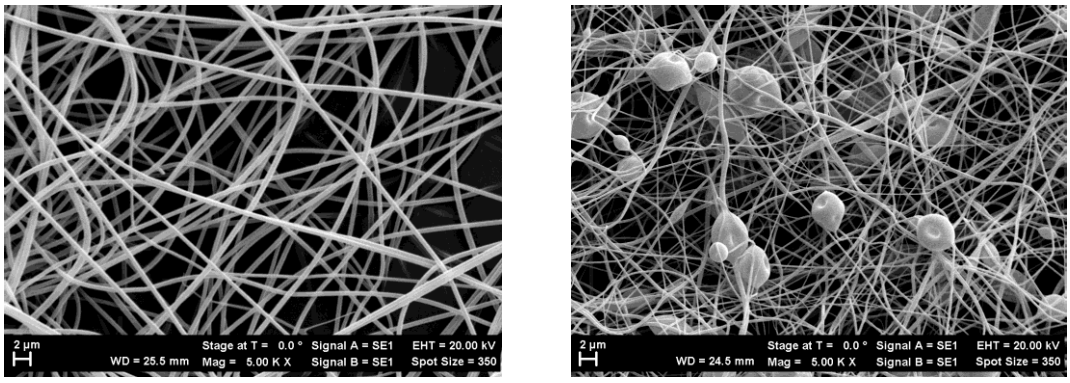
Manufacturing nanofibers by electrospinning is a simple method of obtaining materials that are cheap, flexible, scalable, functional and biocompatible. Besides the multiple applications in medicine, polymeric nanofibers obtained by electrospinning permit manipulation of light at nanometric dimensions when doped

with organic dyes or different nanoparticles. Optical active nanometrical fibers have attracted increased attention due to the extended range of applications, such as light sources, optical sensors or waveguides.

The advantages offered by the electrospinning technique when producing polymeric fibers are given by the simplicity of the method. Morphology control is allowed by the possibility of controlling all the process parameters (temperature, viscosity of polymeric solution, applied voltage, distance between electrodes, etc.).



SEM images of nanofibers of polyvinylpyrrolidone doped with Rhodamine 6G (a) and Coumarin 6 (b).

We present our studies regarding the optical properties of polymer nanofibers produced by electrospinning. Our main objective was to produce polymer nanofibers doped with different dyes and tailor their optical properties using the morphology control. The features of the electrospinning process allow us (by the process parameters such as applied voltage, distance from the anode to cathode, viscosity of the polymer solution etc.) to vary the geometrical parameters of the polymer nanofibers. That influences the optical properties of the material. The morphological properties were evaluated using scanning electron microscopy and the optical properties were determined by transmission, absorbtion, reflection and luminescence.

S1 L6

NEUTRON METHODS FOR THE INVESTIGATIONS OF MAGNETIC STRUCTURES

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Neutron scattering is a powerful tool for the investigation of polymers, biological objects and magnetism. We review polarized neutron methods for the investigations of magnetic films and microwires: Larmor precession [1], Zeeman spatial beam-splitting [1,2], neutron spin resonance [1,3], neutron channeling in planar waveguides [4] and neutron sonde microscopy [5,6]. Comparison of different methods for the direct determination of magnetic induction in thick films can be found in our article [1].

The method of Larmor precession is used for the direct determination of the magnitude and the direction of the magnetic induction averaged over the thickness of a thick magnetic film or a foil of the thickness of about 10 µm. The more common method of neutron depolarization allows extract additionally dispersion of the magnetic induction in the magnetic matter.

The Zeeman spatial beam-splitting accompanies the neutron spin-flip process which takes place at the boundary of two magnetically noncollinear media during the reflection and refraction of a polarized neutron beam in grazing incidence geometry. It is an unique effect which allows for the extraction of magnetic

induction magnitude near a single boundary inside a matter. Also this method can be used for the investigation of domains [2] and cluster nanostructures in magnetic films [7].

The neutron spin resonance can be used for the direct extraction of magnetic induction value in a single domain in a magnetically nonsaturated film placed in crossed permanent and oscillating magnetic fields.

A planar waveguide is a tri-layer structure with quantum well-like neutron optical potential. In the middle layer (called resonator or channelling layer) the neutron wave is resonantly enhanced and propagates along the interfaces and exits from the channel as a narrow (150 nm width) and slightly divergent (0.1°) microbeam. We used the neutron channeling for the direct determination of the magnetic induction in a weakly magnetic (about 10 mT) film.

Neutron sonde microscopy tool uses the polarized microbeam from a planar waveguide for scanning of local magnetic structures in bulk with a high spatial resolution about 2 μm. One-dimensional microstructures like wires, domain walls and vortices can be investigated.

Keywords: depolarization, Zeeman beam-splitting, neutron spin resonance, planar waveguides
This work was supported by the JINR-Romania Scientific Project No. 95/15.02.2016 item 47.

[1] S.V. Kozhevnikov et al., JMMM **402** (2016) 83.
[2] S.V. Kozhevnikov et al., Journal of Apll. Cryst. **45** (2012) 814.
[3] S.V. Kozhevnikov et al., Journal of Physics: Conference Series **340** (2012) 012084.
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[6] F. Ott at al., NIM A **788** (2015) 29.
[7] S.V. Kozhevnikov et al., arXiv:1601.08080.

S1 L7

ENERGY TRANSFER IN A THIN FILM OF CBP POLYMER DOPED WITH IRQ(PPY)2 PHOSPHORESCENT MOLECULES

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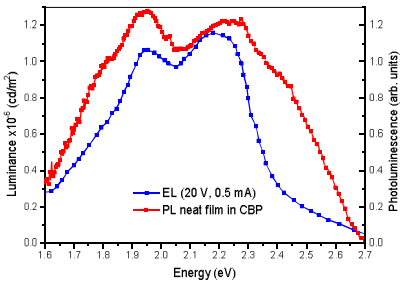
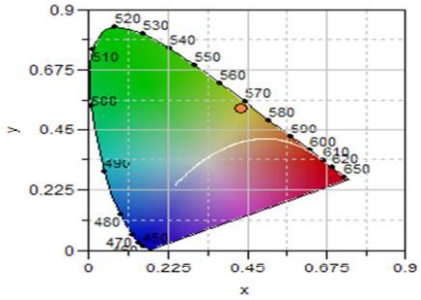
Organometallic compounds exhibit different electroluminescent properties when they are embedded into conducting polymer matrix, because of the host-guest interaction between the excitons produced in the polymer and those produced into organometallic compound. The quantum efficiency of guest molecules is enhanced in the selected organic host materials by energy transfer from host to guest.

These organometallic materials are used as phosphorescent materials and doped into host materials to avoid self-quenching of photoluminescence (PL) in neat films. In the case of $IrQ(ppy)_2$ organometallic compound, it is already known as an dual emitter compound which exhibits green and red photoluminescence [1]. When this compound is embedded in 4,4'-N, N'-dicarbazole -biphenyl (CBP), the internal quantum efficiency is expected to be higher due to the energy transfer interactions. The sandwich structure of the CBP:$IrQ(ppy)_2$ is completed with PEDOT:PSS as hole transport layer and a thin film of Alq_3 as electron transport layer, followed by aluminum cathodes.





A shift of about 0.1 eV can be observed between the photoluminescence at 2.3 eV coming from the triplet state of ppy ligand and the electroluminescence one situated at 2.2 eV. This is because of the charge transfer between the T_1 triplet state of CBP and T_1 triplet state of $IrQ(ppy)_2$. Concerning the second peak at around 1.94 eV, this is practically at the same energy between EL and PL, suggesting a more LC (ligand centered) emission from the quinoline ligand.

Keyword: semiconductors; OLED; electroluminescence

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S1 L8

GRAPHENE-LIKE LAYERS GROWN ON FERROELECTRICS

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Intensely studied applications nowadays are related to the fact that graphene may be regarded as a perfect semimetal with large carrier mobility, making structures involving graphene conduction channel suitable candidates for ultrahigh frequency field effect transistors [1]. Graphene bilayers under an applied perpendicular electric field exhibit a gap exploitable in logic applications [2]. Graphene field effect transistors prepared on high-quality single crystal lead zirco-titanate Pb(Zr,Ti)O3 (PZT) substrates exhibit up to tenfold increases in mobility, on the order of 105 cm2/(V·s), when compared to SiO2-gated graphene devices [3]. Resistance hysteresis is expected due to the screening by the graphene layers of the depolaization field due to the ferroelectric state of the substrate [4], but more often an intriguishing anti-hysteretic behaviour is observed [5], attributed to the complex surface chemistry of the ferroelectric, to adsorbed molecules prior to the graphene transfer or to interface states between the graphene and the ferroelectric layer. The origin of the anti-hysteresis is mitigated nowadays and this justifies efforts to synthesize graphene on ferroelectrics in ultraclean environments [6]. This contribution presents the first such efforts. Carbon layers grown on lead zirco-titanate (PZT) are weakly interacting with the substrate and exhibit nearly two dimensional character, up to a carbon surface density approaching that of graphene. The first feature is evidenced by X-ray photoelectron spectroscopy, and the second by angle resolved near-edge-absorption spectroscopy (NEXAFS). The binding energies and lineshape parameters of C 1s are similar to that of graphene. The dichroism of C K-edge NEXAFS shows the prevalence of in-plane sp2 bonds for layers whose effective coverage is below to the graphene surface density. The polarization state of the substrate, oriented outwards, is preserved upon carbon deposition. The surface Pb content is strongly affected by the carbon ad-layers, and this is explained by a ionization – migration mechanism of Pb2+ during carbon growth. Upon annealing up to the desorption of carbon, the surface Pb content is recovered.

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Keywords: graphene; ferroelectrics; sp2 bonding; 2D materials

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S1 O1

FINGERPRINTS OF MAJORANA FERMIONS IN SPIN-RESOLVED SUBGAP SPECTROSCOPY

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When a strongly correlated quantum dot is tunnel coupled to a superconductor, it leads to the formation of Shiba bound states inside the superconducting gap. They have been experimentally measured in a superconductor-quantum dot-normal lead setup. Side coupling the quantum dot to a topological superconducting wire that supports Majorana bound states at its ends, drastically affects their structure and induces supplementary in-gap states. The anomalous coupling between the Majorana bound states and the quantum dot gives rise to a particular imbalance in the spin resolved spectral functions for the dot operators. This is a clear fingerprint for the existence of Majorana fermions and can be detected experimentally in transport measurements. In terms of methods employed, we have used analytical approaches combined with the numerical renormalization group approach.

Acknowledgments: This work was supported by the Romanian National Authority for Scientific Research and Innovation, UEFISCDI, project number PN-II-RU-TE-2014-4-0432.
Keywords: Majorana fermion, Kondo effect, Shiba states, renormalization group

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S1 O2

ELECTRON-PHONON INTERACTION IN NANOSTRUCTURES AT SUB-KELVIN TEMPERATURES

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Ultrasensitive nanoscopic detectors for electromagnetic radiation consist of thin metallic films deposited on dielectric membranes. The metallic films, of thickness d of the order of 10 nm, form the thermal sensing element (TSE), which absorbs the incident radiation and measures the its power flux or the photons' energy. To achieve the sensitivity required for space born astronomical observations, the TSE works at temperatures of the order of 0.1 K. The dielectric membranes are used for the thermal insulation of the TSE and are of thickness $L - d$ of the order of 100 nm (see Fig. 1). In such conditions, the phonon gas in the detector assumes a quasi-two-dimensional distribution, whereas quantization of the electrons wavenumbers in the direction perpendicular to the film surfaces lead to the formation of quasi two-dimensional electronic sub-bands.

We analyze the heat power P between electrons and phonons at temperatures below 0.2 K, in detectors structures like in Fig. 1 ($d \approx 10$ nm and $L = 100$ nm). If we denote by T_e the electrons temperature and by T_{ph} the phonons temperature, we can write $P \equiv P^{(0)}(T_e) - P^{(1)}(T_e, T_{ph})$; $P^{(0)}$ is the power "emitted" by the electron system to the phonons and $P^{(1)}$ is the power "absorbed" by the electrons from the phonons. Due to the quantization of the electronic states and the quasi-two-dimensional distribution of the phonon gas, $P(d, T_e)$ (Fig. 2) and $P(d, T_{ph})$ (Fig. 3) show very strong oscillations with d, forming sharp crests almost parallel to the temperature axes. In the valleys between the crests, $P \propto T_e^{3.5} - T_{ph}^{3.5}$. From valley to crest, P increases by more than one order of magnitude and on the crests P does not have a simple power law dependence on temperature [1,2].

The strong modulation of P with the thickness of the film may provide a way to control the electron-phonon heat power and the power dissipation in thin metallic films. Eventually the same mechanism may be used to detect small variations of d or surface contamination.

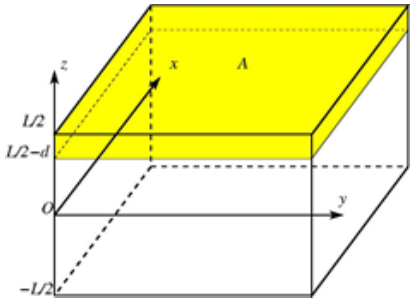

Fig. 1:
The schematic model of the system.

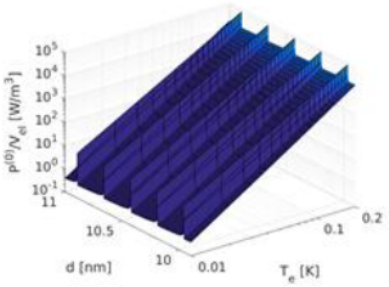

Fig. 2:
$P^{(0)}/V_{el}$ for $L = 100$ nm.

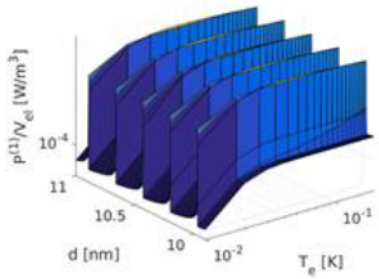

Fig. 3:
$P^{(1)}/V_{el}$ for $L = 100$ nm.

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S1 O3

ON THE PHYSICAL PROPERTIES OF RF-SPUTTERED ZNSE THIN FILMS FOR PHOTOVOLTAIC APPLICATIONS

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We report the effects induced onto physical properties of rf-sputtered zinc selenide (ZnSe) thin films by deposition time; working pressure and power, and substrate temperature were maintained constant. Our fabricated samples were deposited onto optical glass substrates in the 4 – 10 minutes deposition time range. With good mechanical and chemical properties, ZnSe thin films are suitable candidates as constitutive buffer layer in the architecture of photovoltaic cells for both terrestrial and space applications. Optical absorption spectroscopy showed a decreasing of bandgap value with the decreasing of deposition time; analyzes were performed using a Perkin Elmer Lambda 35 UV-Vis spectrometer, at room temperature. Optical properties of fabricated thin films were completed by spectroscopic ellipsometry investigations. Structural features were determined by X-ray diffraction; for all prepared samples a well-defined crystalline structure was noticed, confirmed by scanning electron microscopy (SEM) analyzes. The morphology of deposited thin films was determined by atomic force microscopy (AFM). To fully understand the deposition time induced effects onto physical properties of ZnSe thin films, van der Pauw measurements were performed in 30K – 300K temperature range; electrical parameters like charge carriers' mobility were calculated and discussed.
Keywords: ZnSe, thin films, rf-magnetron sputtering
Acknowledgements: This work was supported by Romanian Executive Unit for Financing Higher Education, Research and Innovation (UEFISCDI) by PN-II-PCCA program, grant no. 288/2014.

S1 O4

INDUCED EFFECTS OF WORKING PRESSURE ON THE PHYSICAL PROPERTIES OF RF-SPUTTERED ZNS THIN FILMS

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$A^{II}B^{VI}$ compounds proved to be suitable candidates for both terrestrial and space applications in the field of photovoltaic cells. With important results related with power conversion efficiency and time stability, especially CdTe thin films based structures, is still room to improve their performances by controlling their physical properties during fabrication. With a wide bandgap, good chemical and mechanical stability, zinc sulfide thin films can be successfully used as window layer in the architecture of photovoltaic cells.
Zinc sulfide (ZnS) thin films were deposited onto optical glass substrates by rf-magnetron sputtering using a working pressure in the range of 4×10^{-3} mbar – 1.6×10^{-2} mbar; working power, substrate temperature and time deposition were maintained constant. A decrease of bandgap energy value with the increase of working pressure was noticed by optical absorption spectroscopy, performed using a Perkin Elmer Lambda 35 UV-Vis spectrometer. All fabricated thin films showed a well-defined crystalline structure by X-ray diffraction investigations, confirmed by atomic force microscopy (AFM) and scanning electron microscopy (SEM) analyzes. Van der Pauw measurements in 30K – room temperature range were performed in order to determine the charge carriers' mobility.
Keywords: ZnS, rf-magnetron sputtering, photovoltaic cell
Acknowledgements: This work was supported by Romanian Executive Unit for Financing Higher Education, Research and Innovation (UEFISCDI) by PN-II-PCCA program, grant no. 288/2014.

S1 O5

RHEOLOGICAL PROPERTIES OF LIQUID CRYSTALS MIXED WITH NANOPARTICLES

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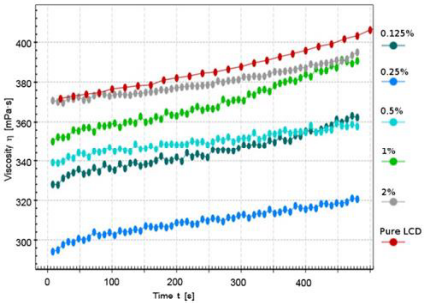

In this article, the shear properties of liquid crystal mixed with various nanoparticles are measured. The paper discusses rheological method for the determination of the shear modulus and loss modulus of the liquid crystals. Real and imaginary shear modulus and effective viscosity of the liquid crystal mixed with various nanoparticles are measured by the rheometric method at various frequencies and temperatures. It was shown that the nanoparticles play a crucial role in the viscoelastic properties of modified liquid crystals.

It was shown that these properties depend on concentration, sizes and distributions of nanoparticles.
Supported by RFBR №15-02-08204 and BSU №3822 and №3824.

S1 O6

INVESTIGATIONS OF THE FERRIMAGNETISM AND DISORDER IN THE HALF-METALLIC HEUSLER ALLOY $Mn_{2-x}Co_xVAl$

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Detailed investigations on the electronic and magnetic properties of the $Mn_{2-x}Co_xVAl$ (x = 0, 0.2, 0.6, 1.0) with ordered $L2_1$ structure have been performed. Polycrystalline samples have been examined by X-ray and neutron diffraction, magnetization measurements and valence band X-ray photoemission spectroscopy. The degrees of the B2 and $L2_1$ atomic ordering for the as-cast samples obtained from the intensity ratios of the X-ray patterns are higher than 0.84 and 0.52, respectively. The Curie temperatures decrease with Co content, ranging between 770 K (x = 0) and 254 K (x= 1). Additionally, electronic band structure calculations using the Korringa-Kohn-Rostoker (KKR) Green's function method have been performed. The substitutional disorder was accounted for by the means of the Coherent Potential Approximation (CPA). The site occupation considered in the calculations has been correlated with those obtained by the X-ray and neutron diffraction experiments. The measured valence band spectra are compared with those obtained by the KKR band structure method. As the Co doping is used to obtain a half-metallic fully compensated ferrimagnet (HMFi), our study may offer an insight on the evolution of the HMFi character with disorder and doping.
Keywords: Half-Metallic Ferrimagnets, Heusler alloys, Atomic disorder

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S1 O7

EFFECT OF STARTING POWDER PREMIXING ON THE INTERPHASE EXCHANGE COUPLING IN $Nd_2Fe_{14}B$+10wt%Fe NANOCOMPOSITES OBTAINED TROUGH MECHANICAL MILLING

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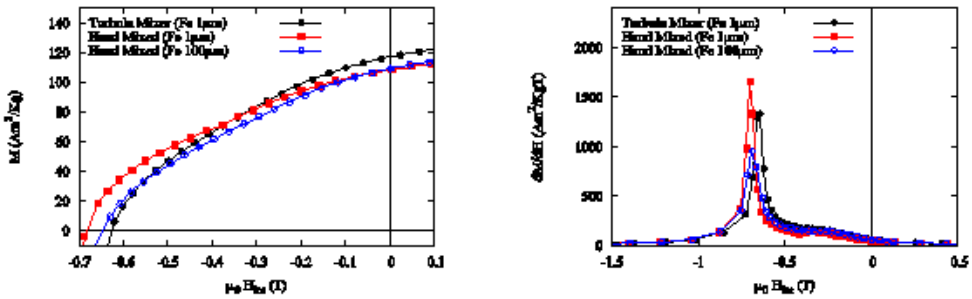
In order to study the effect starting powder premixing on the structure, microstructure and exchange coupling in hard/soft magnetic nanocomposites, $Nd_2Fe_{14}B$ powder was mixed with Fe powder, by hand and by using a Turbula Mixer. In the hand mixed powders we used two types of Fe powder, one with particle sizes lower than 100 μm and another with particle sizes lower than 1 μm, while the samples mixed using the Turbula Mixer contained only Fe particles of under 1 μm in size. The mixed samples were milled for 6 hours in a planetary ball mill, with a calculated impact energy of 77 mJ/ball and 10 KJ/g for the the entire process. Short time annealing was performed on the milled powder for 1.5 min at 700, 750 and 800°C. The structure and microstructure of the milled and annealed samples was studied trough X-ray diffraction, while the magnetic proprieties were investigated from demagnetization curves (up to 10 T) and *dM/dH* vs *H* plots. Good exchange coupling was obtained in all three cases. However, the interphase exchange coupling is better for composites made using smaller iron particles compared to the nanocomposites made with with 100 μm Fe powder, figure 1. This behaviour can be explain by the better dispersion of the $Nd_2Fe_{14}B$ and Fe phases in the nanocomposite. The highest energy product was recorded for the samples premixed with the Turbula Mixer $(BH)_{max}$=125

KJ/m^3.



(a) (b)

Fig. 1 Demagnetization curves, up to 10 T (a) and *dM/dH* vs *H* plots (b) measured at 300 K for milled and annealed at 800°C $Nd_2Fe_{14}B$+10%Fe nanocomposites

Keywords: Soft/hard magnetic nanocomposites, interphase exchange coupling, ball milling, short time annealing

Acknowledgement:

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S1O8

SUPERCONDUCTIVITY AND FERROMAGNETISM IN Pd DOPED Y_9Co_7

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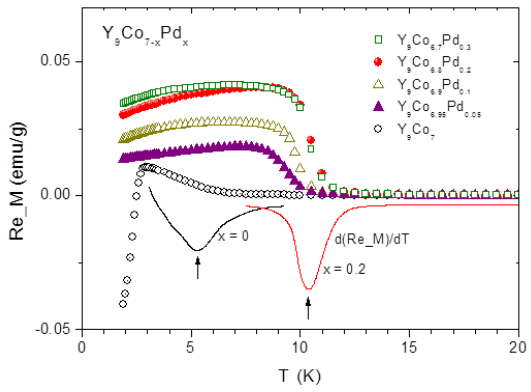

Fig. 1 Real part of the ac magnetization versus temperature (points) and temperature derivatives of the magnetization for selected Palladium content (solid lines).

The ferromagnetic superconductor Y_9Co_7 was chemically doped to yield the solid solution $Y_9Co_{7-x}Pd_x$ for $0 < x < 0.4$. The lattice parameter *a* does not depend on x, whereas *c* increases with increasing Pd content up to x = 0.2, the palladium solubility limit. The transition from ferromagnetism (T_C = 4.25 K) to superconductivity (T_{sc} = 2.4 K) was observed only for the parent Y_9Co_7 compound (shown in Fig. 1). For the lowest tested Pd doping level (x = 0.05), ferromagnetism is enhanced strongly (T_C = 9.35 K) and superconductivity is not seen above 1.8 K. The Curie temperature rapidly increases from 4.25 K to about 10 K for a Pd concentration of x = 0.1 and remains almost unchanged for $Y_9Co_{6.8}Pd_{0.2}$.

Keywords: superconductivity, magnetism, doping, intermetallics

Acknowledgments

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Princeton University was supported by the US Department of Energy, grant DE-FG02-98ER45706. Work at Los Alamos was performed under the auspices of the US Department of Energy, Office of Science, Division of Materials Sciences and Engineering.

S1 O9

SILVACO-TCAD SIMULATION OF INHOMOGENEOUS 4H-SiC SCHOTTKY BARRIERS DIODES

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Abstract: In this work, simulations of the current transport and potential distribution of inhomogeneous Ni/4H-SiC Schottky barrier diodes (SBD). height (SBH) are performed. As stated by Tung [Phys. Rev .B 45, 13509, 1992], a patch of low barrier height (BH) surounded by a high BH will pinch-off. We study the dependence of pinch-off on patch size, temperature, bias and doping level using Silvaco−TCAD Software. We demonstrate that the current is strongly influenced by the presence of barrier height inhomogeneity.
Keywords: 4H-SiC Schottky Barriers, Inhomogeneity, Simulation.

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S1 O10

ZINC OXIDE BASED EPITAXIAL, POLYCRYSTALLINE AND AMORPHOUS MULTILAYERS FOR TRANSPARENT ELECTRONICS

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The realm of oxide based transparent electronics is continuously expanding, oxides being a perfect alternative for nitride and silicon based thin film transistors (TFT) [1,2,3]. Oxide based TFT technology surpasses the silicon based one due to its high transparency in visible and the nitride based technology due to lower production costs [4,5,6,7]. One promising material for emerging in transparent electronics is zinc oxide, being until now presented in a few studies as integrated material in nano-devices [3,6,7,8].

Transparent electrodes can be achieved by wisely doping ZnO with aluminum (AZO), with conductivity comparable with the one of most expensive Sn:In_2O_3 (ITO). AZO can be an alternative for channel semiconductor by controlling anion/cation ratio during fabrication process [7]. Channels can be manufactured also by mixing ZnO, Ga_2O_3 and In_2O_3 resulting a suitable amorphous oxide semiconductor [1,2]. ZnO doped with lithium is highly resistive, and could be used as gate dielectric with potential ferroelectric properties [9,10].

In this work, the structural, optical, morphological and electrical properties of ZnO based epilayers, polycrystalline and amorphous thin films obtained by physical vapor deposition methods in the form of single layers, multilayers and structures, will be presented.

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Keywords: zinc oxide, heterostructures, transparent electronics

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S1 O11

NEW FUNCTIONALITIES FOR ELECTRONICS AND OPTOELECTRONICS DRIVEN BY NEW PHYSICS OF TWO-DIMENNTIONAL SEMICONDUCTORS MATERIALS

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The past year - 2015 - was the tenth anniversary of modern graphene and at present quasi two-dimensional semiconductor materials (2DSCM) are currently the focus of many studies thanks to their novel and superior physical properties that may shape the future electronic and photonic devices [1,2]. The field of research in 2DSCM has been enjoying spectacular growth during the past decade and many novel materials that had been initially considered to exist only in the realm of theory have been synthesized. These include layered metal chalcogenides, groups IV, III-VI and II-VI semiconductor analogues of graphene and others. For example, it has been shown [2,3] that almost every II-VI, III-VI and III-V semiconductors that typically crystallizes into the three-dimensional sphalerite , wurtzite or hexagonal lattices, such as ZnS, GaSe, can be

converted into atomically thin 2D crystalline frameworks. The unique features of 2DSCM , such as their reduced dimensionality, symmetry and appearance of topological insulator states, lead to the appearance of phenomena that are very different from those of their bulk material counterparts. The two dimensional nature of these materials also plays an entirely mechanical role as they are inherently flexible, strong, and extremely thin. This article reviews the recent progress made in 2DSCM and its nanostructures investigation. The state of art of different new scenario of engineering 2DSCM are revealed, in particular by intercalation. Some of new proposals for innovative electronic and optoelectronic devices are discussed.

The first part of the paper deal with some general consideration in the synthesis and characterization of 2DSCM, its classification and analysis of the main peculiarities. Similar to the graphene, 2DSCM are its two-dimensional and isostructural counterparts based on the typical layer-structured semiconductors, whose layers are bound by weak van der Waals forces.

The second part of the paper includes recent results [3,4] related to 2DSCM and nanostructures based on layered III-VI semiconductors. 2DSCM nanocomposites in the form of Ga, In, Cd and Zn chalcogenide nanolamellars with sizes of 10–30 nm are obtained by heat treatment III-VI semiconductors single crystalline plates in Zn and Cd vapor. Optical and photoelectrical properties of III-VI 2DSCM reveal a lot of peculiarities related to the transformation of electronic structure in the nanocomposites.

To ilustrate the potential of 2D materials for electronics in the last part of the paper we present the the recently results dealing with the performance of metal chalcogenides as well as of II-VI, III-VI and III-V semiconductors transistors, photodetectors, photovoltaic cells, and LEDs.

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S1 O12

OPTICAL AND STRUCTURAL PROPERTIES OF LATTICE MATCHED AND SLIGTHLY LATICE MISMATCHED MOCVD GROWN $In_xGa_{1-x}As$ EPILAYERS

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Since the lasttwo decades, InGaAs and related compounds are very attractive because of their superior optical and electronic properties. Especially, grown on InP substrates both the lattice matched and sligthly lattice mismatched $In_xGa_{1-x}As$ structures are commonly used in optoelectronic industry. In order to study this material, the structural and optical properties of varied Indium concentration $In_xGa_{1-x}As$ hetero epilayers are grown by Metal Organic Chemical Vapour Depositon(MOCVD) [1,2]. All the epilayers have been grown on (100) InP substrates utilizing Aixtron 200-4 RF/S horizontal reactor. After growth, thickness of the samples are measured via Scanning Electron Microscopy (SEM). Indium concentrations are measured by High Resolution X-ray Diffraction(HRXRD) [3] and then reflectance measurement is done with Cary 5000 UV-Vis-NIR Spectrophotometer in order to define refractive index(n) of the samples. Finally, thickness of the samples are confirmed with in-situ reflectance measurements.

Keywords: MOCVD, Spectrophotometer, HRXRD, SEM

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S1 O13

HIGH TEMPERATUR IMPACT ON AN AlGaN/GaN/BGaN HEMT PERFORMANCES, SIMULATION STUDY

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In this paper, we study the impact of high temperatur on some importants DC and AC characteristics of an AlGaN/GaN high electron mobility transistor (HEMT) with a BGaN back barrier. Using TCAD Silvaco, we extract, the electron mobility, the Drain current, the transconductance, the cut off frequency and the maximum occillation frequency after analysed the device at various temperature, all necessary material parameters are considired to predict the temperature effect, Small reduction in perfermances are obcerved in front of high temperatur variation thanks to numerous properties of the BGaN, such as high-temperature induced electrical conductivity and a high thermal resestivety.

This latest study is an additional of a privious work cited in the paper, in wich is demonstrated an AlGaN/GaN/BGaN HEMT with encouraged results.

Keywords: HEMT, BGaN, 2 DEG, temperatur.

S1 O14

ALL-CHEMICAL GROWTH OF ^{CSD}YBCO/ ^{PAD}CGO/^{ABAD}YSZ/SS SUPERCONDUCTING ARCHITECTURE

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We report on the fabrication by all-chemical deposition method of highly textured $YBa_2Cu_3O_{7-x}$ (YBCO) films using a 10 mol % Gd-doped CeO_2 (CGO) capping layer deposited by the new polymer assisted deposition (PAD) technique on top of yttria stabilized zirconia (YSZ) buffered stainless steel substrates by alternating beam assisted deposition (ABAD) (^{ABAD}YSZ/SS). PAD utilizes an aqueous polymer to bind metals in a complex that serves both to encapsulate the metals, in order to prevent chemical reaction and to maintain an even distribution of the metal in the solution. The main advantage of PAD technique is the very long stability of the precursor solution (years- essential for the scalability process) and it is environmentally friendly. An optimization study of the epitaxial growth of the PAD-CGO buffer layer on ^{ABAD}YSZ/SS for the fabrication of coated conductors is presented. Structural and morphological properties were investigated by X-ray diffraction (XRD) and atomic force microscopy. It has been demonstrated the efficiency of the PAD-CGO buffer layers for the growth of epitaxial YBCO from low-fluorine solution. The ^{CSD}YBCO/ ^{PAD}CGO/^{ABAD}YSZ/SS architecture was characterized by XRD and SEM analyses. Tc values of 91.1 K and Jc at 77K of 1 MA/cm^2 were obtained.

Acknowledgement The research leading to these results has received funding from the European Union Seventh Framework Programme [FP7/2007- 2013] EUROTAPES under grant agreement n° NMP-LA-2012-280432.

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S1 O15

THE STRUCTURAL DEFECTS FORMATION IN ELECTRON IRRADIATED CADMIUM TELLURIDE

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The study of the formation of structural defects and changes in the properties of irradiated semiconductors is of interest both in terms of increasing their radiation resistance, and ability to manage the properties of materials under irradiation. This is especially important for semiconductor compounds A_2B_6, because of their high sensitivity to radiation and insufficient study of these issues. Cadmium telluride (CdTe), belonging to the group of compounds A_2B_6, is used in the production of optoelectronic devices and solar cells. Cadmium telluride is also the base material for growing of many epitaxial films and superstructures.

The formation of structural defects in semiconductors during electron irradiation is possible in the conditions of electron irradiation with a high intensity ~10^{17}-10^{19} e/cm^2·s that is achievable, for example, in the transmission electron microscope (TEM).

The purpose of work was to study the influence of electrons with energy of 400 keV on the formation of structural defects in CdTe crystals. Samples were examined and irradiated in a JEOL 4000EX-II electron microscope operated at energy of 400 keV and beam densities of between $1\cdot10^{19}$ e/cm^{2}s and $4\cdot10^{19}$ e/cm^{2}s and in JEOL JEM-2100 electron microscope operated at energy of 200 keV.

It is shown that under electron irradiation the small dislocation loops in size of 3-10 nm and a density of ~ $6\cdot10^{10}$ cm^{-2}, as well as voids and fine particles of a new phase in size ≤10 nm are formed.

From electron microscopic images taken with high resolution it follows that dislocation loops are primarily located on the {112} and {111} planes and have Burgers vectors such as a/2<110> and a/3<111>, respectively. The formation of new phase fine particles during electron irradiation is also possible, such as they may result from the coalescence of point defects (including impurity atoms) generated by the electron beam. These features can be identified from an analysis of moiré fringe contrast as phase of CdTe (hexagonal or trigonal).

It should be noted that the impact of electrons on CdTe less efficiently than ZnS, which is explained by the difference in the stacking fault energy of CdTe and ZnS and is consistent with previous results under irradiation of A_2B_6 semiconductor crystals by electrons with an energy of 100 keV [1].

Regularities of structural defects formation in CdTe can be used to solve problems of management type, density and spatial distribution of defects in the crystal structure, which is important for the implementation of the limiting parameters of microelectronic devices.

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S1 P1

COMPLEX MORPHO-STRUCTURAL AND OPTICAL ANALYSIS OF BISMUTH OXIDE THIN FILMS

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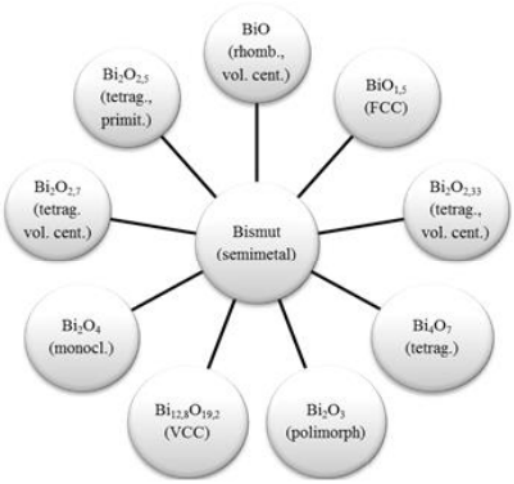

Fig. 1 Possible bismuth oxides

Upon primary thermal oxidation, pure bismuth thin films generally give raise to a mixture of non-stoichiometric oxides together with several crystalline forms of the stoichiometric oxide, namely Bi_2O_3. Such a complex composition and polymorphism is accompanied by polycrystallinity, which makes it very difficult to interpret the structural information and to correlate it with other type of properties, as those optical or electrical. This is why a thorough structural analysis is required in order to identify the most important features of bismuth oxide thin films crystallinity.

Here we propose a fundamental morpho-structural study of un-completely oxidized bismuth oxide thin films deposited on glass substrates, by means of transmission electron microscopy and atomic force microscopy.Also, a complex optical analysis of the films was performed, such that it was inferred that the films have around 1.5 eV energy bandgap and refractive index around 2.0, depending on the substrate temperature during the initial pure bismuth depositions (20 deg. C, 100 deg. C and 200 deg. C, respectively). Even though upon annealing these films are expected to change their structure, this intermediate-stage analysis is relevant for bismuth oxidation process in correlation with the crystallinity changes, which will determine the final structure and physical properties of the completely-oxidized films to be performed.

Keywords: bismuth oxide, transmission electron microscopy, energy bandgap, refractive index

S1 P2

Fe-FePt CORE – MULTI SHELL COUPLED MAGNETIC NANOCOMPOSITES

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Increased interest in magnetic nanoparticles was observed in the last decade by virtue of their various potential applications in fields ranging from ultrahigh-density recording and catalytic chemistry to biology and medicine [1–4].Iron/platinum based core–shell nanoparticles were obtained by the inverse micelles method in two stages. By thermal treatment in inert atmosphere, the amorphous Fe-oxide shell crystallize and an additional magnetically ordered FePt alloy shell is formed at the interface between the Fe oxide and the outer Pt shell (Fe@Fe3O4/Fe2O3@FePt@Pt). The properties of these composites nanoparticles are investigated by electron microscopy (TEM, HRTEM), X-ray diffraction (XRD), X-ray Photoelectron spectroscopy (XPS) and magnetic measurements (VSM). The thermally treated nanoparticles show high coercivities up to 0.8 T with saturation magnetizations up to 94 emu/g. The complex magnetic behavior of these multilayer coupled magnetic materials as a function of temperature and applied magnetic field is also discussed.

Keywords: iron/platinum, nanocomposites, magnetization

Acknowledgments

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S1 P3

XRD, RAMAN, PHOTOLUMINESCENCE AND SEM STUDIES OF MOLYBDATE-LEAD GLASSES AND CERAMICS GLASS

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The $xMoO_3 \cdot (100-x)[4PbO_2 \cdot Pb]$ glasses system, with x ranging from 5 to 50 mol%,were prepared and investigated. The influence of MoO_3 content on optical properties and structure of the $4PbO_2 \cdot Pb$ glass network was obtained using Raman and fluorescence spectroscopy (PL), X –ray diffraction (XRD) [1] . The morphology of the film was studied by Scanning Electron Microscopy (SEM) and EDX measurements. The fluorescence spectroscopy data shows the transition of Mo^{5+} and Pb^{2+} ion in dimer centers [2]. XRD diffraction patterns illustrate the fact that all glass samples obtained in our synthesis conditions are amorphous, exception making the sample containing 50% MoO_3, which is containing mainly the Pb_2MoO_5 and tetragonal PbO crystalline phase. Raman spectroscopy, also confirm formation of tetragonal PbO and Pb_2MoO_5 [3, 4].

Keywords: $xMoO_3 \cdot (100-x)[4PbO_2 \cdot Pb]$ glasses and vitroceramics, RAMAN spectroscopy, molybdate glasses.

Acknowledgements

This work was supported by the Ministry of Education and Research through PN 16-30 02 05.

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S1 P4

SYNTHESIS AND CHARACTERIZATION OF SrY_2O_4 SAMPLES DOPED WITH RARE EARTH IONS

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In this paper we investigate the luminescence properties of SrY_2O_4 samples doped with Rare Earth ions.

SrY_2O_4 crystallizes in the $CaFe_2O_4$ structure, with two non-equivalent Y sites, both Y sites are coordinated by six oxygen atoms and both have Cs symmetry [1].

The SrY_2O_4:Er (0.5%):Yb (5%) samples were synthesized by a sol-gel method and treated in air at different temperatures (1000ºC, 1100ºC, 1200ºC). The purity of the phase was checked by X ray diffraction. The samples were characterized by optical spectroscopy (diffuse reflectance, luminescence, decay measurements).

An example of spectra for diffuse reflectance is in Fig. 1. and for upconversion luminescence is in Fig. 2. Luminescence intensity increases with temperature of treatment.

Keywords: SrY_2O_4, Er-Yb, upconversion, sol-gel

Reference: V.H. Müller-Buschbaum, Z. Anorg. Allg. Chem. 358 (1968) 138.

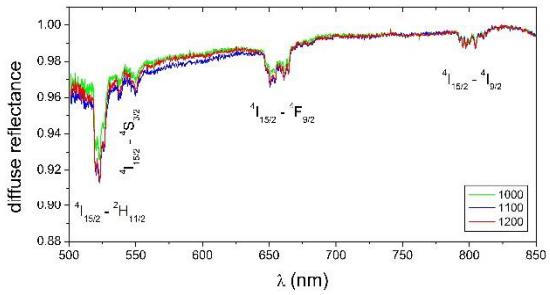

Fig. 1. Diffuse reflectance for samples treated at different temperatures in visible range.

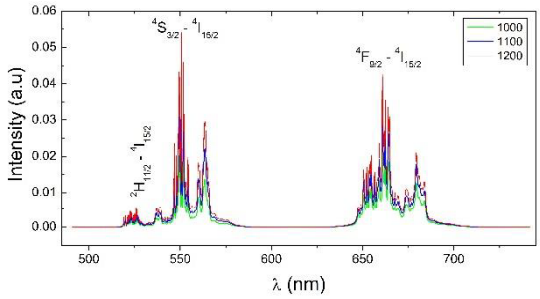

Fig. 2. Upconversion luminescence spectrum for samples treated at different temperatures in the visible range for pumping at 973 nm.

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S1 P5

INTERFACE ELECTRONIC STRUCTURE IN $BaTiO_3/La_{1-x}Sr_xMnO_3$ FERROELECTRIC-FERROMAGNETIC SYSTEM

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$BaTiO_3$ perovskite oxide has been grown on a $La_{1-x}Sr_xMnO_3$ (x=0.3) buffer layer by pulsed laser deposition. Using soft - X-ray angle resolved photoelectron spectroscopy (SX-ARPES) electronic states of the buried interface have been directly visualized and investigated. The bulk character of the band structure in the interface region has been revealed by navigating in three-dimensional **k**-space. The observed Fermi surface is formed by hole cuboids in the corners of the Brillouin zone and electron spheroids in Γ having the interfacial atomic structure rhombohedrally distorted [1]. Our results are possible due to high energy resolution and photon flux available at the ADRESS beamline of Swiss Light Source which allowed surpass the known issue related with the small cross section in the soft X-ray region and thus to obtain the **k**-resolved information about the interface region [2].

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S1 P6

INFLUENCE OF OXIDATION CONDITION ON GaSb SURFACE PASSIVATING LAYER CHARACTERISTICS

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GaSb and related semiconductor devices have potential use in cutting-edge applications for mid-infrared optoelectronics and thermophotovoltaics (Eg ~ 0.73 eV at 273 K). The performance and reliability of GaSb devices depend on surface preparation techniques and it was observed [1] that GaSb surface is much more reactive than that of other III-V compounds. In this view, a major problem to be overcome in GaSb

technology is the poor quality of oxide/semiconductor interfaces [2]. For devices of this type the presence of a stable interface containing a low density of electronic defect states around band gap is essential for device operating characteristics. In GaSb oxidation on the surface there are preferential developed two oxides namely Ga_2O_3 and Sb_2O_3, and the technological effort to find a suitable passivating layer to reduce the interface defect density (D_{it}) in the range $D_{it} \sim 10^{13} cm^2/eV$ is part of state-of-art ability. The present work is dedicated to the influence of oxidation condition (e.g. native oxides, thermal oxides in open furnace, in water vapor flux, on a hot plate, using an incandescence lamp), anodic oxidation, on the aspect and properties of passivating layer namely: aspect (AFM images), optical properties (surface reflectivity) and electrical behavior (I-V characteristics on Schottky contact). In the exposed experimental conditions at GaSb surface is developed a mixture of Ga_2O_3 and Sb_2O_3, when the ratio between Ga oxide and Sb oxide is important for the passivating quality of this film.

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S1 P7

CRYSTAL LITHOGRAPHY; A NEW APPROACH OF SOLID SURFACE PATTERNING

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The ability to produce nanostructured surfaces over macroscopic areas is likely to be of crucial importance to the integration of nanotechnology into commercial devices. The actual techniques, the light and electron lithography, start to reach their theoretical limits. As modern options, methods such as: nanosphere lithography, zone casting, dip-coating, drop-casting, and solution- shearing [1] have been developed to achive large area, well-aligned organic single-crystal arrays.

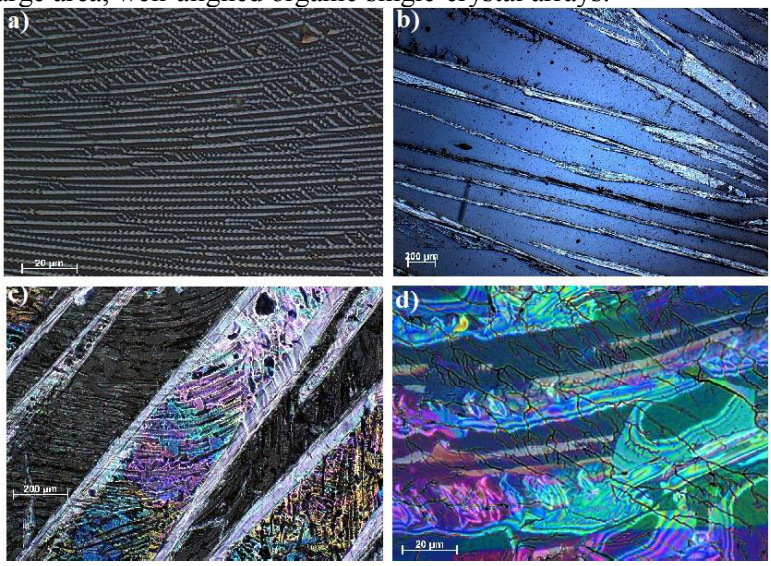

Figure 1. Transmission optical microscopy images: a) KCr single crystal grids, b) Sulphur grids, c-d) KCr and Sulphur grids superposed forming a 2D net

In our approach, ionic salts dissolved in water and Sulphur dissolved in Toluene, are forced to crystallize in proper conditions thus they form large scale single crystal grids onto glass substrates (Fig.1a,b). By controling the direction of crystals growth and by using alternatively polar or nonpolar solvents we grew nets of micrometric, single-crystals cells (Fig. 1c, d). This can be seen in optical microscopy images (Fig.1 d) in which the white light is Bragg diffracted. We mention that our approach can use a larger class of materials than Molecular Crystal Lithography [2] which resumes at organic compounds.

The method is based on the observation that ionic salts crystallize as well known 3D single crystals if concentrated solutions are used and 2D fractal structures (dendritic usually) in the case of low concentration [3-4]. We consider that these crystal grids and nets can be used as sensors (by attaching electrical contacts), nano-photonic components, lithographic masks (deposition of a metal through the mask folowd by its wasing), and many others.

Acknowledgements: This work has been financed by the National Authority for Research and Innovation in the frame of Nucleus programme- contract 4N/2016.

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S1 P8

INVESTIGATION OF ALTERNATIVE BOND COAT MATERIALS BY ELECTRON MICROSCOPY AND FEA

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The main objective of this work is the development of new Ru-based Bond Coats (BC) as part of Thermal Barrier Coating Systems (TBC).

The challenge of this work is to obtain stoichiometric RuAl alloys by avoiding the formation of δ-Ru phase.

There are many papers which investigated the oxidation behaviour of RuAl alloys obtained by induction melting. In this work we tried the processing of this alloy by powder metallurgy and then sintering it by Spark Plasma Sintering.

The alloy was analysed before and after oxidation using advanced microscopy techniques (SEM, TEM). Also, an analysis of the stresses that may appear during thermal exposure was performed using FEA (ANSYS).

The results showed the absence of δ-Ru layer and the maximum stress level is 2.7 GPa while the minimum is 1.5 MPa localised at the thin films edges and in the substrate (not visible due to the large dimensional difference between the layers and substrate thickness). Stress level within the interlayer is lower then that from the Al_2O_3 upper layer.

Acknowledgements: This research is supported by the National Program PN II contract number 182/2012. The authors would like to thank Dr. Ioan Costina from the IHP – Institute for High Performance Microelectronics, Frankfurt am Oder, Germany, for TEM samples preparation and examination.

S1 P9

LASER PROCESSING OF POLYVINYLIDENE FLUORIDE THIN FILMS BY MAPLE

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Advanced polymeric biomaterial can be used on a large areas of applications as optoelectronic, microelectronic membranes, functional smart coatings, sensors, biosensors and tissue engineering. Polyvinylidene fluoride (PVDF) is a highly non-reactive thermoplastic fluoropolymer, piezoelectric, possessing more then one crystalline structures. In this work we report preliminary results on the deposition of PVDF thin films by Matrix Assisted by Pulsed Laser Evaporation (MAPLE). The thin films were deposited on Si, Pt/Si, SiO2 substrates using a target with different concentrations of polymer in the Dimethyl sulfoxide (DMSO) matrix solvent. Different parameters (laser fluence, target characteristics, number of pulses) were varied and studied for finding the optimal deposition conditions.

The coatings were investigated in terms of morphology, chemical structure, and optical with Atomic Force Microscopy (AFM), Fourier transform infrared spectroscopy (FTIR), Ultraviolet–visible spectroscopy (UV-VIS) and Spectroellisometry (SE). The deposition parameters optimization was done by corelating coatings chemical characteristics with the morphological one. We obtained PVDF thin films with structural and optical characteristics ressembling to the bulk material and with roughness up to 200 nm.

Keywords: Polyvinylidene fluoride (PVDF), MAPLE, thin films.

S1 P10

STRUCTURAL, ELECTRONIC TRANSPORT AND MAGNETIC PROPERTIES OF $Co_2FeAl_{0.5}Si_{0.5}$ HEUSLER ALLOY EPITAXIAL THIN FILMS

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One of the key parameters in operating the spintronic devices is the spin polarization of the electronic current. Since they show a bandgap at the Fermi level for the minority spins, the half-metallic ferromagnets (HMFs) are considered ideal candidates as spin polarized electronic current sources. Amongst the different types of HMFs, the Co-based full Heusler alloys are of special importance due their theoretically predicted half-metallicity and relatively high Curie temperature. The structural and chemical order are the most important parameters governing the physical properties of the Heusler compounds. Here, we give a comprehensive overview of the correlations between structural and chemical order, electronic transport (longitudinal and transverse) and magnetic (static and dynamic) properties of $Co_2FeAl_{0.5}Si_{0.5}$ (CFAS) Heusler alloy epitaxial thin films grown on MgO (001) single crystal substrates (Fig. 1).

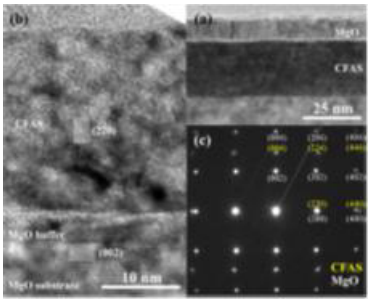

Fig. 1 Low- and (b) high-resolution cross section TEM images and (c) selected area

X-ray diffraction measurements indicated that depending on the annealing temperature the films show B2 or $L2_1$ chemical ordering. Longitudinal magnetoresistivity experiments revealed that for the optimum $L2_1$ ordered films, at temperatures below 125 K, the magnon assisted electronic scattering is quenched indicating the appearance of half-metallicity.

The presence of quantum correction in resistivity, whose strength is dependent on the structural ordering, was evidenced at low temperatures.

Anomalous Hall experiments indicated that the intrinsic band structure contribution has an opposite sign and that is dominant over the extrinsic skew scattering mechanism. The presence of a small uniaxial magnetic anisotropy contribution superimposed on a larger biaxial one was evidenced via ferromagnetic resonance microstrip line measurements. The biaxial term is well correlated with chemical ordering, having a minimum value for the optimum L21 ordered film. The damping parameter was evaluated from ferromagnetic resonance linewidth measurements, and a coefficient as low as 1.9×10^{-3} was found for the L21 phase.

Keywords: Heusler alloys, magnetic anisotropy, Gilbert damping.

This work was supported by UEFSCDI through the SPINTAIL: PN-II-ID-PCE-2012-4-0315, and PN-II-RU-TE-2014-4-1820 SPINCOD research projects.

S1 P11

ELECTRICAL AND OPTICAL PROPERTIES OF SPHALERITE NATURAL MINERAL

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This work presents the determination of electric and optical properties of sphalerite natural mineral found in the mining region of Maramures, Romania, through UV-Vis optical reflectance spectrophotometric measurements.

The spectrophotometric measurements were taken in the UV-Vis-NIR region. The reflection spectrum that was obtained was processed based on the Krames-Kronig formalism [1-4]. This way one computed the spectral dependence of the complex dielectric coefficient with its real part ε_1 (the dielectric constant or dielectric permittivity) and imaginary part ε_2 (the dielectric loss function), refractive index n and extinction coefficient k, effective valence number n_{ef} and optical absorption coefficient α. The above mentioned parameters cannot be measured directly using a single experimental setup, that is why they must be computed numerically. These kind of determinations led us before to the determination of some electrical and optical properties of chalcopyrite [5]. This setup was also used to compute the valence pseudo band gap of some sulfurous minerals involving the energy values of the van Hove singularities [6] in behavior of the electron loss functions $-\mathrm{Im}\,\varepsilon^{-1}$ and $-\mathrm{Im}(1+\varepsilon)^{-1}$ vs. incident photon wavelength [7].

These kind of determinations, computations and comparison with other bibliographic references allowed us to check and optimize the use of optical reflection spectrophotometric method and the theoretical framework in the study of sphalerite natural mineral, taking into account its compositional and structural variety, leading to particular properties which are functions of the nature of the mineral and also of its geological source.

Keywords: UV-Vis-NIR spectroscopy, Kramers-Kronig formalism, optical functions, electrical properties.

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S1 P12

STRUCTURAL PROPERTIES OF Cu(In,Ga)Se_2 THIN FILMS

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This paper offers a study of Cu(In,Ga)Se_2 thin films using multiple structural investigation techniques. The Cu(In,Ga)Se_2 thin films, with different thickness (750 nm, 1000 nm and 1200 nm, respectively), are deposited onto molybdenum back contacts on glass substrate by rf magnetron sputtering technique from a single sintered sputtering target.
Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM) investigations show that surface morphology changes with the deposition technique and it is influenced by the increase in thickness of the Cu(In,Ga)Se_2 layer.
We have presented data on XPS, XRD and SEM characterization revealing the micro-structural changes in these Cu (In, Ga) Se_2 layers, which are to be used in the realization of solar cells. Surface content of the sample Cu(In,Ga)Se_2, given by the XPS intensities, is in good agreement with the subsequent results of the EDAX analysis.
Cu(In,Ga)Se_2 chalcogenide thin films are polycrystalline and have a tetragonal lattice, with plane (112) parallel with the surface of the substrate. Moreover, we found that intensity of the (112) peak is the highest for the 1200 nm thick sample, which suggests the usage of thicker Cu(In,Ga)Se_2 films in order to improve the structural quality of chalcogenide materials.
The increase of thickness of the Cu(In,Ga)Se_2 absorber determined the decrease of the bandgap value.

S1 P13

OPTICAL AND ELECTRICAL PROPERTIES OF INDIUM TIN OXIDES THIN FILMS

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Indium tin oxides (ITO) thin films, with various thicknesses (0.5 μm - 0.7 μm) were deposited on glass substrates by radio frequency magnetron sputtering technique.

The obtained samples were optically (transmission spectra) and electrically (I–V characteristic) characterized.

The optical properties, evaluated by UV-VIS-NIR (190-3000 nm) spectrophotometer, showed that the obtained thin films were highly transparent, with a transmission coefficient between 90 – 96 %, depending on the film thickness.

Optical properties of these oxide films in near infrared (NIR) range were described by the Drude free electron model.

A computational algorithm for oxides films using computational models was developed and optical properties were investigated (the Swanepoel and Wemple DiDomenico model). The size of grains and electrical conductivity increase as the film thickness increases.

S1 P14

SYNTHESIS AND CHARACTERIZATION OF NANOPARTICLES BASED ON IRON AND MANGANESE OXIDES

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Lately, the nano-structure compounds have gained great interest due to their extremely small size and large surface. There is increasing in commercial demand for nanoparticles for their wide applicability in various areas such as energy, electronics, catalysis, chemistry and medicine.

The nanoparticles are traditionally synthesised by physical vapor deposition, chemical vapor deposition, aerosol processing, sol-gel process, reverse micelle method, mechanical alloying/ milling, co-precipitation.

In this study, nanoparticles based on iron and manganese oxides were obtained by biosynthetic and chemically methods and characterised by TEM, BET surface area, FTIR, XPS, XRD, UV-Vis. In the biosynthetic methods were used as reducing agents various plant extracts. The biosynthesis advantage is the low cost and eco-friendly. The chemically synthetized nanoparticles will be compared with those biosynthetized. The nanocatalysts thus obtained will be tested in the process of obtaining biofuels, both in the presence and in the absence of enzymes.

Keywords: nanoparticles, biosynthesis, chemical approach, particle properties

Acknowledgments: This work was supported by the Romanian Ministry of Education and Research within the Nucleu Programme (Project PN16-30-02-05).

S1 P15

CONTRIBUTIONS TO OPTIMIZATION OF THE QUALITY OF ELECTRON DIFFRACTION IMAGE IN CHARACTERISATION OF THIN FILMS USING THE PRECESION SYSTEM

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Nanostructured materials are accurately investigated using TEM (Transmission Electron Microscopy), but compromise must be made when information are acquired using electron diffraction technique. Due to instrument geometries, the errors in electron diffraction data are larger compared to X-Ray diffraction, making the analysis difficult.

The advantage of using electron diffraction is the small area taken into study, up to a few square nanometers, but sample can be complex and can affects the results. For amorphous samples, we cannot separate useful data because of the additional quantity given by scattering on amorphous carbon or formvar fim substrate. Crystalline structure analysis can be done in two steps: first, crystallographic information and cell parameters determination and second, refinement of the unit cell, including atom position.

To improve the quality of electron diffraction analysis we use precesion technique: First of all, the electron beam is deflected and rotated using the condenser lens. Frequency of rotation is a controllable parameter using electronic equipment. After the beam interaction with the matyrial studied, it is recollimated by means of DeScan lens.

We applied Cohen method with a model implemented by Nielson-Riley adapted for electron diffraction by simple trigonometric approximation valid in electron diffraction case ($\sin\Theta = 0$, $\cos\Theta = 1$).
We compared the electron diffraction results in the case of precession method with the conventional electron diffraction method for different thin films.

Keywords: TEM, Electron Diffraction, Precession**,** Thin Films.

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/137750.

S1 P16

MICROSTRUCTURE AND DIECTRIC PROPERTIES OF COMPLEX SUBSTITUTED PZT THIN FILMS

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Ceramic samples of $(Pb_{1-x}\ Sr_x)(Zr_{0.52-y}Sb_y)(T_{0.48-z}Mn_z)\ O_3$ with different lead contents, prepared by solid-state reaction technique, was used to obtain thin films on silicon substrate, by TVA method. X-ray diffraction (XRD) was performed. Scanning Electron Microscopy (SEM) was used to evidence the microstructural properties of the materials. Electrical measurements were performed. The permittivity and the dielectric loss were measured in a frequency range of 10^0-10^6 Hz. Dielectric properties depend both on the lead concentration and the phase content. The dielectric loss for all samples are less than 3% in a frequency range of 10^0-10^4 Hz.

Keywords: thin films PZT, ceramics, dielectric, piezoelectric

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S1 P17

INFLUENCE OF ERBİUM SUBSTİTUTİON ON THE CRYSTAL AND ELECTRONİC PROPERTİES of $Er_xTi_{1-x}BO_3$ OXİDES

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Change in the crystal and electronic structure properties Titanium Borate samples were investigated with the influence of Erbium substitution. The studies were conducted by X-ray Absorption Fine Structure Spectroscopy (XAFS) technique in coordination with the X-ray diffraction (XRD) patterns. Complementary studies to probe the magnetic properties of the samples were performed by the X-ray Magnetic Circular Dichroism (XMCD) technique. Interplay of Er 4*f* electrons with the neighboring atom electrons' kept in the core of the investigations. Besides, *f*-levels of the Erbium atoms were selected as the main playground in the study due to their interesting relations yielding fruitful physical phenomena in the materials that were reported in literature. Besides, 4*f*-3*d* interplay were determined to emerge dominant interactions causing phase transitions both in crystal and magnetic structures of the samples. With the increasing Erbium substitutions, interesting electronic properties were observed in the samples like meaningful changes in the electrical resistivity of crystals.

Keywords: Electronic materials; Oxides ; XAFS (EXAFS and XANES); Electronic structure

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S1 P18

RHEOLOGICAL PROPERTIES OF SOME MATERIALS USED FOR DENTAL IMPRESSION

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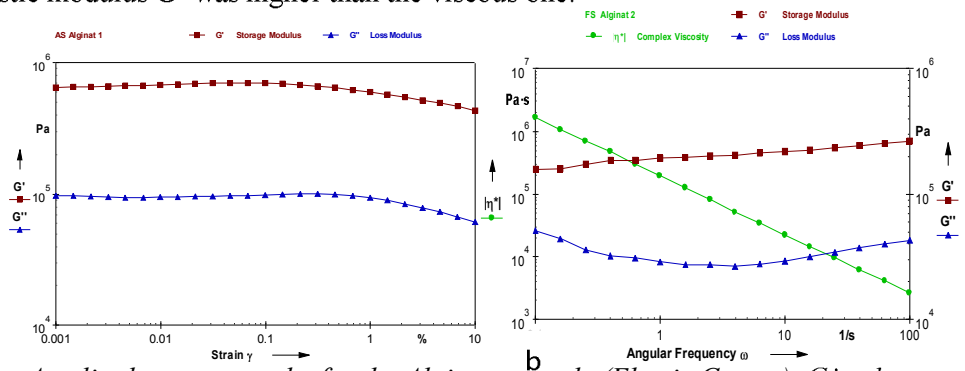
The dimensional stability of dental impression materials is one of the variables that contribute to the accuracy or to the inexactitude of dentures. It is very important that these materials to register all details from the impression field and, at the same time, to transmit these details to the technical laboratory in the very same dimensions. Dental impression materials used in this study are based on alginate (Elastic Cromo) and on condensation silicones (Zetaplus+Oranwash and Alphasil). The rheological properties of these materials were determined by amplitude and frequency sweep tests. Deformation, storage modulus G', loss modulus G" and complex viscosity η^* were studied for each sample. Rheological parameters of the studied materials showed the presence of stable force internal networks which is a proof of their structural and mechanical stability. Moreover, the texture, the stability of the shape, the capacity of distribution on different surfaces and the stability to storage for a long period of time were investigated. All mixtures presented rheological diagrams where the elastic modulus G' was higher than the viscous one.



a *a: Amplitude sweep results for the Alginate* b *le (Elastic Cromo); G' values are represented by full square and the G" values by the full triangle.*

Fig. b: Frequency sweep results for the Alginate sample (Elastic Cromo); G' values are represented by full squares, G" values by the full triangles and complex viscosity η by full rounds.*

It could be assumed that they represent consistent systems, with gel structure, adherent having long-lasting deformations. All samples have large viscous-elastic limits for different types of deformations as the parallelism between the two variation curves of the elasticity modulus components showed. Complex viscosity has very high values, meaning the consistence of all samples is considerable.

The results of the rheological analysis strongly recommend the studied materials to be used as impression materials.

Keywords: Dental impression materials, Rheology, Silicone, Alginate

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S1 P19

ELECTRONIC TRANSPORT PROPERTIES OF NBTI IN COPPER MATRIX SUPERCONDUCTING WIRES

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This work is presenting the study of signal-to-noise assessment, the electronic transport properties of NbTi wires extruded in a Cu matrix with 0.4mm in diameter and volume ratios of NbTi:Cu = 1.35:1. Normal-

state magnetoresistance, I-V characteristics and superconducting state critical currents are thoroughly investigated.

Additionally, we investigated the critical current density as a function of temperature and field using the expressions for the critical temperature, critical magnetic field and Pinning force in NbTi. The measurements undertaken in this research cover a range of the magnetic field between 0T to 7 T at temperatures ranging from 1.9 K to 10 K.

In order to measure the electrical resistance down to cryogenic temperature (2K) it has been used the Physical Property Measurement System (PPMS). The measurements have been done in various magnetic fields, up to 7T. The values of the measured resistance were the bases of the calculation and obtaining data for electrical resistivity, critical current density (J_c) and pinning force (F_p).

Key words: superconducting wires, vortex matter, critical current density, pinning force.

S1 P20

WATER ABSORBTION BEHAVIOUR OF NANO-FERRITES MODIFIED EPOXY RESINS

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The special properties of nano-sized ferrites had generated an increasing interest regarding the modification they can induce when they are dispersed into polymers. Other studies had shown that if the size of ferrites is at micro level they tend to aggregate inside the pre-polymer mixture. In the case of nano-sized ferrites the aggregation is avoided due the balance between dimensions and pre-polymer viscosity. The formed materials are intented for applications in energy applications therefore they have to show valuable properties regarding repeated modifications at environmental parameters that is why part of general study of nano-sized ferrites modified epoxy resins has to include materials behaviour in environmental-like conditions and, in this regard, the water absorption is essential.

Keywords: water absorbtion, nano-ferrites, epoxy resins.
*Acknowledgements*The work of Iulia Graur and Marius Bodor had been supported by the Project 12 P01 024 21 (C11) /31.08.2012 (code SMIS 50414).
The work of Cristian Munteniţă was supported by Project no. POSDRU/159/1.5/S/132397, 2007-2013.

S1 P21

STRUCTURAL AND OPTICAL PROPERTIES OF NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET (Nd:YAG) TRANSPARENT CERAMICS

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Polycrystalline neodymium-doped yttrium aluminum garnet $Y_{3-x}Nd_xAl_5O_{12}$ (Nd:YAG) has been considered to be one of the best solid-state laser materials because exibit good optical, mechanical and thermo-mechanical properties [1, 2].

In this work, 0.5, 1.0 and 1.5-at.% Nd:YAG ceramics were obtained by solid-state reaction method using high purity Al_2O_3 (99.9 %), Y_2O_3 (99.9 %) and Nd_2O_3 (99.9 %) as starting materials; 5-wt.% tetraethyl orthosilicate (TEOS) combined with 1-wt.% MgO were used as sintering aids and 3-wt.% polyetylene glycol (PEG_{400}) as dispersant. The raw materials were mixed in stoichiometric proportions and homogenized in

ethanol medium for 24 h. The slurry was dried at 80°C using spray drying technique. The powder was uniaxially compacted into pellets and cold isostatic pressed (CIP) at a pressure of 245 MPa for 20 minutes. Then, the green body was calcined at 800°C in air for organic solvent removal. All samples were sintered using a vacuum furnace under vacuum ($P \leq 10^{-4}$ Pa) for 12 h at temperatures ranging between 1730 and 1760°C. Annealing cycles were performed in air at1450°C for 10 h in order to promote the oxidation of the phases reduced during sintering under high vacuum.

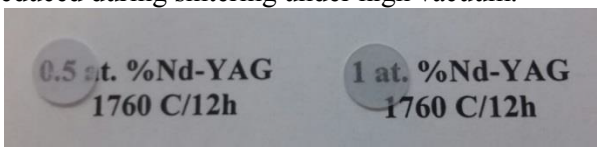

Fig. 1. Optical images of 0.5-at.% Nd:YAG (left) and 1.0-at.% Nd:YAG (right) ceramics sintered at 1760°C for 12 h after annealing treatment.

Photos of 0.5-at.% and 1.0-at.% Nd:YAG ceramics obtained in our work are shown in Fig. 1. The structural, morphological and optical characteristics were studied by X-ray diffraction (XRD), scanning electron microscopy (SEM) and optical spectroscopy techniques.

Acknowledgements This work was financed by Romanian National Authority for Scientific Research and Innovation through the project NUCLEU 1647.

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S1 P22

SPECTROSCOPIC AND STRUCTURAL CHARACTERIZATION OF LAYERED DOUBLE HYDROXIDES THIN FILMS

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Layered double hydroxides (LDHs) are a class of materials with the general formula $M^{(II)}_{1-x}M^{(III)}x(OH)2]-(A^{n-}_{x/n})m\ H_2O$, where M(II) is a divalent cation (Mg, Ni, Zn, Cu or Co) and M(III) is a trivalent cation (Al, Cr, Fe, or Ga). An- is an anion with charge n like CO2-3, Cl-, NO-3 or an organic anion [1]. Due to the large variety of elements, functional materials can be produced leading to a large area of applications like catalysis, drug delivery, sensors, optoelectronics etc.

We report herein on the deposition of thin films of Ni-Al LDH by Pulsed Laser Deposition (PLD) and Matrix Assisted Pulsed Laser Evaporation (MAPLE) on silicon substrates. The experiments took place in vacuum, at room temperature and the films were the result of 10.000-40.000 pulses. The laser deposition techniques offer the advantage of growing well oriented and adherent films, with controlled thickness [2, 3].

The morphological and structural characterizations performed to investigate the deposited films were: X-ray diffraction (XRD), atomic force microscopy (AFM), scanning electron microscopy (SEM) combined with energy dispersive X-ray analysis (EDX) and Fourier Transform Infra-Red Spectroscopy (FTIR).

Keywords: thin films, pulsed laser deposition, matrix assisted pulsed laser evaporation, layered double hydroxides

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S1 P23

DETERMINE THE REFRACTIVE INDEX OF WURTZITE GaN ON SAPPHIRE BY SPECTROSCOPIC ELLIPSOMETRY

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Gallium nitride (GaN) is one of the most importing wide-band-gap semiconductors for short wavelenght light emitting diodes (LEDs), laser diodes (LDs) and UV photodedectors [1]. Refractive index dispersion of GaN is obtained by several authors[2-3-4]. But there is some scattering in data reported by different authors. Further study is necessery for this reason[4]. Undoped GaN epitaxial layer was grown on double side polished sapphire (0001) substrate by using metal organic chemical vapour deposition. The accuracy of refractive index n is determined by accuracy thickness measurement. In this study the thickness of grown GaN film is obtained by scanning electron microscope crosssectional thickness meaurement and refractive index n is found Sellmier dispertion relation.

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Keywords: GaN, MOCVD, SEM, Ellipsometry

S1 P24

STUDY OF BARRIER INHOMOGENEITIES USING CURRENT–VOLTAGE CHARACTERISTIC OF Ni/4H-SiC SCHOTTKY DIODE

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In the present work,simulations of the current–voltage (I–V) characteristics of Ni/4H-SiC Schottky diodes are performed in the temperature range 175–325 K. The Gaussian distribution model have been used to analyze the observed anomalies in the (I-V) characteristics due to the barrier inhomogeneities (SBD).

The analysis based on Thermionic Emission (TE) theory shows that the ideality factor n decreases while the barrier height increases φ_b with increasing temperature. The T_0 effect is validated and provides a clear evidence for the barrier inhomogeneity at interface.
Keywords: Silvaco-TCAD, Inhomogeneity, I-V characteristics, Simulation.

S1 P25

ELLIPSOMETRY AND PHOTOLUMINESCENCE CHARACTERIZATION OF MOCVD GROWN AlxGa1-xAs LAYERS (x = 0.21, 0.33, 0.42)

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AlGaAs compound semiconductors are the fundamental materials for semiconductor lasers, photodetectors, wave-guide optical modulators, solar cells, etc [1-4]. The optical properties of AlGaAs and its alloys are very important for device quality. Spectroscopic ellipsometry and photoluminescence measurements are non-destrcutive, fast and convenient techniques to determine the optical parameters and optical quality, band gap, real and imaginary parts of dielectric parameters etc. of semiconductor thin films. In this study, we have investigated the detailed optical characterization of MOCVD grown epitaxial AlxGa1-xAs (x = 0.21, 0.33, 0.42) layers on GaAs substrates.

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Keywords: AlGaAs, MOCVD, Photoluminescence, Ellipsometry
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S1 P26

FROM TRANSPARENT CONDUCTING OXIDE TO PHOTON DOWN-SHIFTING DOPED ZINC OXIDE THIN FILMS

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In this work we show that a simple approach to tune the physical properties of Nd doped ZnO thin films is given by a precise control of the growth conditions. Nd-doped ZnO films were grown by pulsed electron

beam deposition at 500 °C on Si and c-cut single crystal substrates under oxygen gas. The influence of a slight variation in oxygen pressure (10^{-2} – $2x10^{-2}$ mbar) on the stoichiometry, structure and optoelectronic properties of Nd doped ZnO films grown by PED was studied. Thin films grown at 10^{-2} mbar present a low resistivity ($5x10^{-3}$ Ωcm) and high transparency in visible range without any near-infrared emission due to Nd^{3+} ions. On the contrary, films grown at $2x10^{-2}$ mbar have high resistivity (> 16 Ωcm), high optical transparency and the near infrared emission of the Nd^{3+} ions is observed under indirect excitation at 335 nm (i.e. absorption by the ZnO matrix and transfer to Nd^{3+} ions) [1]. These significant changes in physical properties, leading from transparent conducting oxide to photon down-shifting thin films for solar spectrum conversion, are related to growth mode in pulsed-electron beam deposition.

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Keywords: Nd-doped ZnO; ablation, resistivity, solar spectrum conversion (maximum 4 keywords are required)

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S1 P27

CONTROL OF CRITICAL TEMPERATURE IN SUPERCONDUCTIVITY USING NON-LINEAR CORRELATION MECHANISMS BETWEEN COOPER CARRIERS STIMULATED BY AN-HARMONIC LATTICE VIBRATIONS

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The possibility of selective excitation of nonlinear lattice vibrations in high-temperature superconductors formed from layers or thin films (like in $YBa_2Cu_3O_{6.5}$, $MgBr_2$, $La_{0.7}Sr_{0.3}MnO_3$, graphite layers, etc) opens the new perspectives in the manipulations and control of quantum field in superconducting phase. In many cases the largest critical current is obtain in for thin films or multilayer structures as function of constraints of vibration or electron states. Here we note that the anisotropy of electronic and vibrational structures of the materials plays an important role in superconducting critical current or phase transition temperature. In this context the non-linear mechanisms of cooperative interaction between the layer current carriers through the anisotropy of the vibration states of thermostat are examined. One of such mechanisms corresponds to the cooperative nonlinear interaction between the cooper pairs belonging to different layers in the single and two-phonon (or vibration) exchanges between the electrons. In this case of superconductivity phase transition, the cooperative interaction constant increase as a function of temperature. This effect is accompanied with the increasing of order parameter as function of temperature, after which it begins to decrease till critical point.

The new ideas of non-linear interaction of carriers with lattice vibration in superconductivity phase of multilayer material are proposed taking into consideration the anisotropy of lattice vibrations. In this case the coupling of longitudinal and transversal non-linear oscillation modes in multilayer superconductor materials substantially changes the dispersion law and Debye ay frequency of the spectrum of of the vibrational modes in quasi-harmonic approximation. As a mapping of this nonlinear coupling, it stimulates the temperature increases of the correlation length between the carriers and the coupling integral between the them. The possibilities of the induced generation of coherent vibration modes in the transversal (or longitudinal) geometry of multilayer systems and the control of critical temperature is discussed in the contexts of modern experiments with Raman stimulation of these lattice vibrations in superconducting materials. The Hamiltonian which describes two and single quantum exchanges between the electrons at finite temperature effects was obtained, generalizing the method of elimination of lattice vibration operators for finite temperature. Such a vibration stimulation allows the control of solids in their electronic ground state and the reduced dissipation of direct lattice excitation makes it attractive for applications in functional material control. Many experimental results in this field shown that the electron interaction with non-linear lattice vibration is an important ingredient of the current scenario and can explain superconductivity in novel systems including high temperature

superconducting [1].

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S1 P28

TEMPERATURE DEPENDENT OPTICAL PROPERTIES OF Ga4Se3S LAYERED SINGLE CRYSTALS

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Among the many important semiconducting compounds, the AIIIBVI type has become very attractive due to their structural, optical and electrical properties. GaSe and GaS layered crystals are used in many areas such as solar cells, nonlinear optical applications, optoelectronic devices in red and blue regions, optical switching devices and photo-detectors. The feasibility of mixed crystals in a large range of compositions allows varying in a wide range of some parameters like the band gap energy, conduction type, photosensitivity, carrier mobility, etc. GaSe and GaS compounds form a series of mixed crystals GaxSe1-xS. Ga4Se3S is one of the GaSe1-xSx mixed crystals formed from GaSe and GaS. Taking into consideration the role of constituent compounds, GaSe and GaS, in the technological applications, Ga4Se3S mixed crystal can be thought as a promising candidate to be used in the fabrication of long-pass filter, light emitting devices and optical detecting systems.

Optical properties of Ga4Se3S crystals were investigated using temperature-dependent transmission and room temperature reflection measurements. Analysis of the experimental data showed that by decreasing temperature from 300 to 10 K, the indirect band gap energy increases from 2.239 to 2.371 eV. Analysis on the temperature dependence of the indirect band gap energy resulted with absolute zero value of the band gap of Egi (0) = 2.372eV and rate of change of band gap with temperature of $\gamma = -5.7\times 10^{-4}$ eV/K. The variation of refractive index (n) as a function of wavelength (λ) showed that refractive index of Ga4Se3S decreases slightly as wavelength increases in the $h\nu < Eg$ region. Moreover, the wavelength dependence of the dispersive refractive index in $h\nu < Eg$ range was analyzed to determine the energy of the single effective dispersion oscillator (Eso), dispersion energy (Ed), zero-frequency refractive index (n0) and dielectric constant ($\varepsilon 0$) employing single-effective-oscillator model.

Keywords: semiconductors; chalcogenides; optical properties

S1 P29

VIBRATIONAL SPECTRA OF $Ag_3In_5Se_9$ AND $Ag_3In_5Te_9$ CRYSTALS: AN INVERSION OF LO- AND TO-MODES FREQUENCIES

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$Ag_3In_5Se_9$ and $Ag_3In_5Te_9$ belong to the class of compounds with formula $A_3B_5C_9$, where A = Cu, Ag, Au; B = Ga, In; C = S, Se, Te. The chemical compositions of single crystals, grown by Bridgman method, were determined using the energy dispersive spectroscopy experiments. IR reflection spectra were recorded in the frequency range between 50 and 500 cm^{-1} with a resolution of 1 cm^{-1}. Figure 1 shows the IR spectra of $Ag_3In_5Se_9$ and $Ag_3In_5Te_9$ crystals in the frequency range of 50–500 cm^{-1}. Kramers–Kronig analysis

of the spectra has been performed to get the dispersion parameters. The frequencies of transverse (TO) and longitudinal (LO) optical modes were determined from the maxima of the function of imaginary part of dielectric constant ε_2 and the function of energy losses Im $(1/\varepsilon)$, respectively. Moreover, the dependencies of refractive index *n* and absorption index *k* on the frequency were calculated from reflectivity spectra.

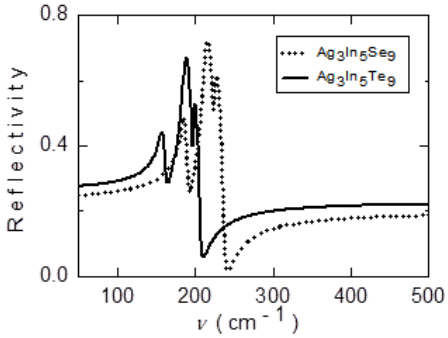

Fig. 1. Reflectivity spectra of $Ag_3In_5Se_9$ and $Ag_3In_5Te_9$ crystals.

We would like to point out that the frequency of highest-intensity modes, the antiphase vibration of cation and anion sublattices, is determined primarily by the III-VI bond. The low-frequency modes may be attributed to IR-active modes,in which only tetrahedral coordinated atoms are displaced along the coordinate axes, whereas octahedral coordinated atoms accomplish deformation vibrations. The inversions of optical mode frequencies take place, i.e. the frequencies of LO modes 221 cm^{-1} ($Ag_3In_5Se_9$) and 195 cm^{-1} ($Ag_3In_5Te_9$)) were found to be less than frequencies of the corresponding TO modes (224 cm^{-1} and 198 cm^{-1}). According to Kirk [1], for multi-oscillator system an LO-mode frequency is always interspersed between any two successive TO-mode frequencies and vice versa.

Keywords: **s**emiconductors; chalcogenides; optical properties; infrared reflection
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S1 P30

(Ba,Sr)TiO_3 THIN FILMS FOR TUNABLE MICROWAVE DEVICES

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Ferroelectric materials with high electric-field tunability of the permittivity and low dielectric loss are very attractive for use in tunable microwave components. Of these, $(Ba_xSr_{1-x})TiO_3$ solid solutions are one of the most used due to its tunability greater than 60% and dielectric loss of few precents. However, in order to operate at low applied voltage, thin films of ferroelectric materials should be used. $Ba_{2/3}Sr_{1/3}TiO_3$ (BST) thin films with different thicknesses were grown by RF sputtering method on iridium-coated silicon substrates. The samples show single-phase perovskite structure and texture evolution from random (in 250 nm thick films) to predominantly (001) texture (in 750 nm thick films). The microstructures as well as the morphological properties were investigated by atomic force microscopy (AFM) and scanning electron microscopy (SEM), showing uniform, dense films with grain size of 50–110 nm. The permittivity, tunability, dielectric loss of the BST thin films were measured on Au/Ti/BST/Ir/Ti/SiO_2/Si structures at different frequencies, DC bias, and temperatures. At room temperature, the relative permittivity and dielectric loss tangent at 100 kHz were 1100 and 0.03, respectively. The permittivity, and hence capacitance, shows a broad and almost flat dependence versus temperature for a range of -50 °C to 70 °C. Morever, the low-frequency (100 kHz) tunability values varies with less than 5 precents over this temperature range. The microwave characterization was performed between 100 MHz to 10 GHz. Tunability was equal to 41 % at 2.45 GHz under 10 V and 20 °C. The results sugest that the BST/Ir structure can be successfully used for tunable microwave devices having improved characteristics over a broad range of temperature.

Keywords: iridium, ferroelectric, tunable
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S1 P31

FERROELECTRIC THIN FILM VARACTORS FOR COMPACT TUNABLE ANTENNAS

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Ferroelectric materials have been intensively investigated for integration in microwave tunable device due to their permittivity variation under an applied electric field. This property makes them very attractive solutions for varactors, tunable filters, reconfigurable antennas, phase shifters, etc. Among these materials, $Ba_xSr_{1-x}TiO_3$ solid solutions have been commonly used in microwave applications [1]. However, significant efforts were made in the recent years for development of new microwave tunable materials [2]. On this line, we report the microwave properties of the $0.92(Bi_{0.5}Na_{0.5})TiO_3$-$0.08BaTiO_3$ (BNT–BT) ferroelectric thin film and its potential for integration compact tunable atennas. The BNT-BT samples were deposited on MgO(100) and Ir-coated MgO(100) substrates by using the sol-gel method from sodium acetate anhydrous, barium acetate, bismuth acetate, and titanium isopropoxide. The film's crystallization were performed in oxygen at 800°C for 15 minutes, details about synthesis and characterization being reported in [3]. BNT-BT films were used for fabrication of ferroelectric varactors based on both planar inter-digitated (IDC) and out-of-plane metal-insulator-metal (MIM) capacitors. The extracted value of the IDC's tunability was around 5% under a 100 kV/cm applied electric field. On the other hand, the MIM capacitor devices demonstrate a 30 % tunability under 260 kV/cm. The microwave properties of the MIM devices integrating the BNT-BT thin films indicate a high potential for their integration in compact tunable antennas.

Keywords: Ferroelectric thin films; tunable capacitors; microwave properties.
Acknowledgements: This work was partially supported by a grant of the Romanian Ministry of Education and Research, CNCS–UEFISCDI, project number 21/Ro-Fr/2015.

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S1 P32

THE EFFECT OF THE DOPANTS ON THE STRUCTURE, ELECTRIC AND MAGNETIC PROPERTIES OF MANGANESE FERRITES

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Three manganese ferrite samples, undoped (sample A) and doped with Ni (sample B) or Zn (sample C) were synthesized by hydrothermal method. The effect of the dopants on structure and particle size of $Ni_xMn_{1-x}Fe_2O_4$ (sample B) or $Zn_xMn_{1-x}Fe_2O_4$ (sample C) were investigated by X-ray diffraction (XRD) and scanning electron microscopy (SEM). XRD patterns indicate that the manganese ferrite powders exhibits a spinel crystal structure. The lattice constant (a) of samples was calculated based on the ionic radii of the constituents. The

particle size determined with the Scherrer formula, decreases by doping with Ni or Zn ions, from *45 nm* (sample A) to *28 nm* (sample B) and *24 nm* (sample C).

The SEM and EDX results of manganese ferrite samples indicates that particles are fairly uniform, and was confirmed elemental composition including the presence of dopant in the matrix. Dielectric properties and effect of temperature on polarization and electrical conduction behaviour was studied for undoped, and *Ni* or *Zn* doped samples, using the impedance complex measurements.

The magnetic properties of the samples were investigated at low frequency (*50Hz*), by means of an inductive method; it was found that samples A and B exhibit ferromagnetic behavior (hysteresis), while sample C exhibits the superparamagnetic behovior, having the saturation magnetization σ_S*=88.4 emu/g*. Using the as-measured hysteresis loops for samples *A* and *B*, the saturation magnetization (σ_S), the coercive field (H_c) and the remanent magnetization (σ_r), were determined and the following values were obtained: $\sigma_S(A)$*=104 emu/g*; $\sigma_S(B)$*=105 emu/g* $H_c(A)$*=49 Oe*; $H_c(B)$*=90 Oe*; $\sigma_r(A)$*=12.5 emu/g*; $\sigma_r(B)$*=24.9 emu/g*.

Keywords: manganese ferrite, doped, hydrothermal method, complex impedance.

AcknowledgmentsThis 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.

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S1 P33

FIRST-PRINCIPLES STUDIES OF THE STRUCTURAL, ELASTIC, ELECTRONIC AND DYNAMICAL PROPERTIES OF $BaVO_3$ AND $SrVO_3$

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Perovskite-type structured ABO_3 oxides have many interesting physical properties, such as a displays, electronic/piezoelectric devices, sensors, high-transition temperature superconductivity, ferroelectricity, transducers and wireless communications; therefore, they are widely used in many technological applications [1-6]. Especially $SrVO_3$ is a potential candidate for photovoltaics, displays and solid-state lighting because of high optical transparency and high electrical conductivity [6]. In this work, we have investigated the atomic, elastic, electronic and phonon properties of $BaVO_3$ and $SrVO_3$ in the framework of the density functional theory. The calculated lattice constants, bulk modulus and elastic constants agree well with previous results[7-10]. Although atomic, elastic and electronic properties of these materials have been studied by different groups but their phonon properties are currently lacking from the literature. It is well known that, vibrational properties are very important for specific heat, thermal expansion, heat conduction and electron-phonon interaction. Thus we have used a linear response approach to density functional theory in order to derive phonon frequencies and eigenvectors. The zone-center phonon frequencies are found to be 189.21 (162.25) cm^{-1}, 259.80 (339.79) cm^{-1}, 373.28 (363.56) cm^{-1} and 497.78 (575.90) cm^{-1} for $BaVO_3$ ($SrVO_3$).

Keywords: Perovskites, Density functional theory, Structural properties, Elastic properties, Lattice dynamics

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S1 P34

STUDY OF CONCRETE AMORPHOUSNESS BY MEANS OF TIME OF FLIGHT NEUTRON DIFFRACTION

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Cementitious materials are widely used as repository barriers and for encapsulation of radioactive wastes (Nicu M et al 2016). The wastes produced as result of nuclear activities are very diverse and it is need to develop special cement matrices to preserve their migration in the environment. The amorphous concrete presents enhanced mechanical strength and composite resistance.

The neutron diffraction is powerful tool that gives the possibility of study the bulk of materials using quite big samples. Diffraction peaks can be observed for crystalline materials. In case of amorphous materials one can see only background. So this technique can indicate if bulk substance is crystalline or amorphous.

The neutron diffraction measurements are carried out at texture diffractometer SKAT in JINR (Ullemeyer K et al 1998, Keppler R et al 2014). The using texture instrument allows having average diffraction intensity on sphere as well as diffraction intensity for a specific direction. To reduce strong incoherent neutron scattering due to water presence the samples were dried preliminary. It were investigated a set of samples with different chemical content. We succeed to select the most amorphous cement matrices.

Keywords: concrete, neutron diffraction, amorphousness, encapsulation of radioactive waste
Acknowledgements The authors thank Dr. Christian Scheffzuk for the helpful discussions and interest in our work. The JINR - IFIN-HH Scientific projects Nos.95/15.02.2016 items 52, 53 and 96/15.02.2016 items 52, 53 are acknowledged.

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S1 P35

NEUTRON METHODS FOR THE INVESTIGATIONS OF MAGNETIC STRUCTURES

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Neutron scattering is a powerful tool for the investigation of polymers, biological objects and magnetism. We review polarized neutron methods for the investigations of magnetic films and microwires:

Larmor precession [1], Zeeman spatial beam-splitting [1,2], neutron spin resonance [1,3], neutron channeling in planar waveguides [4] and neutron sonde microscopy [5,6]. Comparison of different methods for the direct determination of magnetic induction in thick films can be found in our article [1].

The method of Larmor precession is used for the direct determination of the magnitude and the direction of the magnetic induction averaged over the thickness of a thick magnetic film or a foil of the thickness of about 10 μm. The more common method of neutron depolarization allows extract additionally dispersion of the magnetic induction in the magnetic matter.

The Zeeman spatial beam-splitting accompanies the neutron spin-flip process which takes place at the boundary of two magnetically noncollinear media during the reflection and refraction of a polarized neutron beam in grazing incidence geometry. It is an unique effect which allows for the extraction of magnetic induction magnitude near a single boundary inside a matter. Also this method can be used for the investigation of domains [2] and cluster nanostructures in magnetic films [7].

The neutron spin resonance can be used for the direct extraction of magnetic induction value in a single domain in a magnetically nonsaturated film placed in crossed permanent and oscillating magnetic fields.

A planar waveguide is a tri-layer structure with quantum well-like neutron optical potential. In the middle layer (called resonator or channelling layer) the neutron wave is resonantly enhanced and propagates along the interfaces and exits from the channel as a narrow (150 nm width) and slightly divergent (0.1°) microbeam. We used the neutron channeling for the direct determination of the magnetic induction in a weakly magnetic (about 10 mT) film.

Neutron sonde microscopy tool uses the polarized microbeam from a planar waveguide for scanning of local magnetic structures in bulk with a high spatial resolution about 2 μm. One-dimensional microstructures like wires, domain walls and vortices can be investigated.

Keywords: depolarization, Zeeman beam-splitting, neutron spin resonance, planar waveguides
This work was supported by the JINR-Romania Scientific Project No. 95/15.02.2016 item 47.

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S1 P36

CONDUCTIVE POLYMER BLENDS: DIELECTRIC BEHAVIOR-CHEMICAL STRUCTURE RELATIONSHIP IN QUATERNIZED POLYSULFONE/CELLULOSE ACETATE PHTHALATE SYSTEM

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Development of the conductive polymer blends with tailor properties for various applications, from photovoltaic devices to nerve regeneration, promises to become an important goal of the scientific community. In this context, one way to compensate the shortcomings of a conductive polymer is to use it together with another polymer, combining the positive qualities of both materials. Such of blend, which can be used as multifunctional material for different applications, it is prepared by embed of cellulose acetate phthalate (CAP) to the quaternized polysulfone (PSFQ) matrix, yielding a flexible, biocompatible, and biodegradable composite with improved conductivity compared to the PSFQ. Therefore, it is assumed that the quaternization effect and choosing of an appropriate additive (CAP) significantly improve the ionic conductivity and also could optimize dielectric properties required by ionic exchange membrane. In view of the above-mentioned, in this work the dielectric spectra behavior over wide frequency (1 Hz-10^6 Hz) and temperature (-120°C and +120°C) ranges was investigated according to chemical structure and compositional aspects.

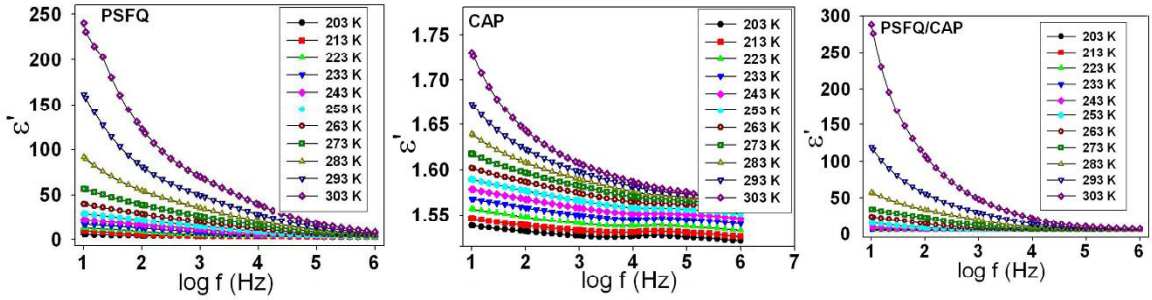

Figure 1. Frequency dependence of dielectric constant at different temperatures for PSFQ, CAP, and PSFQ/CAP blend at 70/30 w/w composition.

The dielectric constants present higher values for PSFQ than for CAP, being dependent on the structural particularities of main chains and the ability of side polar groups to orient themselves in the direction of the applied electrical field, existing a competition between these two contributions. Thereby, the electronic conjugations from the side chains of PSFQ contribute to the enhancement of the dielectric constant values. All films develop two relaxation processes, *i.e.* γ and β relaxation, involving different enthalpy and entropy contributions induced by their chemical structures.

The results obtained showed that the changes in the chemical structure and composition blend correlated to the dielectric behavior effect can provide information on the molecular processes involving different relaxations. Moreover, the outcomes of this work highlight the importance of new polymer blends for better electrical performances.

Keywords: conductive polymer blends, dielectric constant, ionic conductivity, ionic exchange membranes.
Acknowledgment: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS - UEFISCDI, project number PN-II-RU-TE-2012-3-143

S1 P37

DIELECTRIC CONSTANT AND CONDUCTIVITY AS PREDICTORS FOR PHYSICO-CHEMICAL PROPERTIES OF BLENDS BASED ON QUATERNIZED POLYSULFONES

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Polysulfones are known as being part from superior class of amorphous thermoplastics compounds with specific characteristics, such as high strength, excellent thermal stability, resistance to solvents or other chemical agents action, low creep and also good electrical properties and transparency [1]. All these features are found in a wide range of applications such as: membranes, medical devices, plumbing accessories or because of their excellent electrical and optical properties, as a dielectric in capacitors [1] or corneal lenses [2]. In this context, the cationic polysulfones containing quaternary ammonium side groups (PSF-DMBA), synthesized by reaction of the chloromethylated polysulfone with a tertiary amine, N,N-dimethylbutylamine (DMBA)) are considered to be suitable for many of these applications, due to their special properties. Thus, in the present study are calculated theoretically the zero-order connectivity indices ($^{0}\chi$ and $^{0}\chi^{v}$) and first-order connectivity indices ($^{0}\chi$ and $^{1}\chi^{v}$) of PSF-DMBA, poly(vinyl alcohol) – PVA, and of their blends in different ratio [3]. These parameters represent the basis for determination of the refractive index and dielectric constant, being discussed in correlation with dilute solution properties, namely the specific viscosity and electrical conductivity.

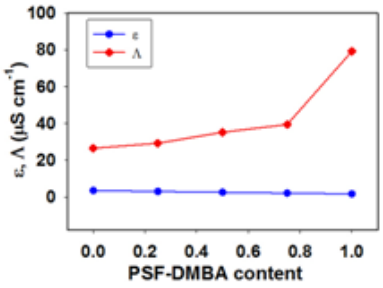

Figure 1. Dielectric constant and conductivity of analyzed blends as a function of PSF-DMBA content

Data obtained emphasize the effects generated by the molecular structure, electrostatic repulsions between charge groups, and/or intermolecular interactions. As the dielectric constant increases, the electrostatic forces become weaker, as result of PVA addition in system. The effect of interaction forces which modify the ε values, can be visualized in conductivity variation, which increase as the number of ions per unit volume increase. Consequently, results will be useful in predicting of the special properties of these polymers in order to obtain high performance materials with applications both in electronic and optical field.

Keywords: quaternized polysulfone, connectivity indices, dielectric constants, conductivity.
Acknowledgment: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-RU-TE-2012-3-143.

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S1 P38

CONTROL OF SURFACE PROPERTIES OF CHARGED POLYSULFONE/CELLULOSE ACETATE PHTHALATE FILMS WITH IMPLICATIONS IN WATER TREATMENT

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Development of materials based on quaternized polysulfones (PSFQ) were carried out as a result of their applications in membrane technology, imposing specific forms and sizes, depending on the application area. A simple and efficient method for designing new advanced materials is represented by the polymers blend concept. In this context, PSFQ membranes with improved properties, and controllable porosity and hydrophilicity degree, were achieved by blending with a hydrophilic polymer, cellulose acetate phthalate (CAP). Particularly, the effects induced by CAP presence in PSFQ matrix on the physical characteristics of blend were investigated at different levels, starting from the surface properties and continuing to the bulk ones. Thus, the embedding of CAP at polysulfonic matrix improves the surface properties (surface tension parameters evaluated by contact angle measurements) and also, modifies the polymer structure at morphological level (surface mechanical properties determined by specific atomic force microscopy experiments, force–distance spectroscopy DFL).

Table 1. Pores average diameter (nm), adhesion forces (nN), and polar components (γ_{SV}^{AB}) of surface tension parameters with electron-acceptor (γ_{SV}^{+}) and electron-donor (γ_{SV}^{-}) contributions (mN/m) for PSFQ/CAP blend at different mixing ratio (wt/wt)

Mixing ratio	Pore average diameter	F_{adez}	γ_{SV}^{AB}	γ_{SV}^{+}	γ_{SV}^{-}
100/0	2160±280	26.35±3.01	3.91	10.45	0.37
75/25	100±17	14.59±2.44	0,13	24.13	0.002
50/50	83±12	12.92±0.79	2.73	18.60	0.100
25/75	63±12	7.47±3.15	4.47	20.17	0.250
0/100	61±22	15.30±1.20	6.42	23.59	0.44

The results highlighted that the adhesion force values are similar to the wetting characteristics of the surface quantified by polar component values of the surface tension. Thus, on the one hand, the high value of adhesion force for PSFQ comparatively with lower adhesion force value recorded for CAP can be explained by its nature less hydrophilic. On the other hand, the increase the CAP content in PSFQ system leads to decreasing of adhesion force values, indicating more hydrophilic surfaces. The resulted data are important in designing composites membranes used in water treatment, where a controllable porosity and a high hydrophilicity degree are essential parameters for their reliability.

Keywords: quaternized polysulfone/cellulose acetate phthalate membranes, surface tension parameters, surface mechanical properties, environmental applications.
Acknowledgment: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS - UEFISCDI, project number PN-II-RU-TE-2012-3-143.

S1 P39

STRUCTURAL AND MAGNETIC PROPERTIES TRANSFORMATIONS BY RAPID THERMAL TREATMENTS IN AlNiCo –TYPE THIN FILMS

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Thin films of nominal composition Fe44.7Al17.2Co22.3Ni12.7Cu3.1 (at%) have been prepared by DC magnetron sputtering from the same composition target alloy, close to Alnico5 permanent magnets. Their structure has been studied by means of scanning electron microscopy and X-ray diffraction and reveals a partly amorphous state in the as prepared samples. The films were rapid annealed at 1000^{0}C, following two different ways of rapid cooling, similar to classic Alnico permanent magnets annealing procedure, then structural and magnetic properties changes were investigated. Rapid quenching of the films showed a preserved structure and even an initial dewetting process is initiated, it exhibits better magnetic properties than the as prepared state, showing a semi-hard magnetic behaviour. However, the nanostructure developed during spinodal decomposition influence the coercivity of Alnico thin films.

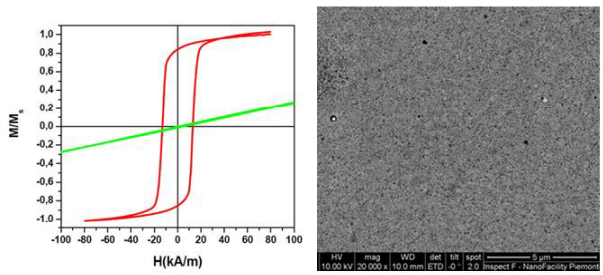

Figure 1 Magnetic measurements (red line - in plane measurement, green line - out of plane measurement) and SEM morphology of a Fe44.7Al17.2Co22.3Ni12.7Cu3.1 (at%) film deposited on a ceramic substrate (thickness =130 nm) quenched at 1000 ^{o}C

Keywords: Alnico, Thin films, Sputtering, Rare-Earth free.
Acknowledgements: This work was supported by the financial support of the Bilateral Research Projects between JINR FLNP and INCDIE ICPE-CA in the framework of the topic 04-4-1121-2015/2017. The authors are grateful also for the technical support useful discussions of our colleagues from INRIM Torino, Electromagnetism Division and Nanofacility Piemonte, a laboratory supported by the Italian "Compagnia San Paolo".

S1 P40

INTERPLAY OF STRUCTURAL, MAGNETIC AND MAGNETO-TRANSPORT PROPERTIES OF FE-AU THIN FILMS

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Since the discovery of giant magnetoresistance (GMR) effect [1], ferromagnetic multilayers and nanogranular thin films have attracted interest for fundamental and technological research, also because their

complex magnetoresistance mechanisms still provide striking queries [2]. In this respect, a complex study of Au/Fe/Au trilayers and Fe-Au codeposited thin films prepared by rf magnetron sputtering technique is proposed. Their structure and composition, predicted by deposition conditions, are sustained by X-ray Diffraction (XRD), X-ray reflectometry (XRR) and energy dispersive spectroscopy (EDS) measurements which gave additional information regarding the geometrical, morphological and in depth elemental profile aspects. The obtained sequences are Si/Au(5nm)/Fe(23nm)/Au(5nm), Si/Au (5 nm)/$Fe_{14}Au_{86}$ (100 nm) and Si/Au (5nm)/Fe_7Au_{93} (100 nm), where the first sample was considered as reference for tuning the deposition time for the other two. The structural analysis of Si/Au/Fe/Au multilayer reveals the formation of α-Fe BCC structure on (110) direction and the preferentially growth of FCC Au structure on (111) and (200) directions, with lattice constants close to the theoretical values. Phase composition, local interactions and magnetic behavior were analyzed by Conversion Electron Mössbauer Spectroscopy (CEMS), Magneto-Optic Kerr Effect (MOKE) and Superconducting Quantum Interference Device (SQUID) magnetometry. The sample with the lowest content of Fe (Si/Au (5 nm)/Fe_7Au_{93}) is paramagnetic whereas magnetic texture was evidenced for the other two samples by MOKE and SQUID results. These results were also confirmed by CEM spectra at room temperature proving the presence of: (i) a narrow magnetic sextet (typical to an unique configuration of Fe in the α-Fe BCC structure) in sample Si/Au/Fe/Au, (ii) a broad magnetic sextet (typical to distributed Fe configurations in the α-Fe BCC structure) in sample Si/Au(5 nm)/$Fe_{14}Au_{86}$ and (iii) a central paramagnetic doublet due to paramagnetic Fe with a higher number of Au neighbors. The clusterization of the Fe atoms in the Au conductive matrix is also supported by the CEMS results. Magneto-transport measurements provided evidence for anisotropic magnetoresistance (AMR) effects which are very sensitive to the direction of the applied field versus both the current direction and the film plane [4]. Also, the temperature dependent resistivity is influenced by both electron-phonon coupling and electron scatterings on local moments [5].

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S1 P41

INFLUENCE OF ELECTRON IRRADIATION ON THE Yb^{3+}/Yb^{2+} CHARGE CONVERSION IN THE CaF_2:YbF_3 CRYSTALS

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Among many kind of materials, the interest in the YbF_3 doped CaF_2 crystals used as laser material is still growing due to their well known good optical materials. By doping a CaF_2 host with YbF_3, both Yb^{2+} and Yb^{3+} ions will coexist in the crystals. The Yb^{3+} ions substitute for Ca^{2+} ions and need charge compensation obtained by an interstitial fluoride ion located in various positions giving rise to a rich multisite structure, which leads to broad IR absorption bands [1,2]. On the other hand, the Yb^{2+} ions substitute for Ca^{2+} ions, therefore do not need charge compensation and posses cubic symmetry [3,4]. The optical absorption spectra of our crystals reveal the existence of both Yb^{2+} (in the near-UV) and Yb^{3+} ions (in near-IR domain). Due to their high UV emission band around 311 nm the CaF_2:Yb^{2+} crystals can be a very good candidatate in psoriasis phototherapy [5,6]. In order to enhance the Yb^{2+} ions concentration in CaF_2 crystals various methods such as γ-irradiation, chemical reduction, heating the crystal in hydrogen gas, x-ray, electronic beam irradiation, etc. were used [7]. A recent studies provide interesting methods for determination of Yb^{2+} ions concentration in CaF_2 crystals [8,9]. Taking into account these recent results concerning the estimation of Yb^{3+}/Yb^2 charge conversion in the CaF_2 crystals the aim of this papaer is to study the influence of electron beam irradiation on the Yb^{3+}/Yb^{2+} charge conversion in the CaF_2 crystals in order to improve the emission intensity of Yb^{2+} ions in UV-VIS spectral region. The $Ca_{1-x}Yb_xF_{2-x}$ ($x=0.0004\div0.00161$) crystals have been grown using the conventional Bridgman technique. Transparent colorless crystals of about 10 mm in diameter over 5-6 cm long were obtained in graphite crucible in vacuum (~10^{-1} Pa) using a shaped graphite furnace; the pulling rate was

4 mm/h. The room temperature absorption spectra have been obtained using a Shimadzu 1650PC spectrophotometer.

Keywords: CaF_2, spectroscopic properties, ytterbium fluoride, electron irradiation.

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S1 P42

SYNTHESIS, STRUCTURAL AND CATALYTIC PROPERTIES OF $LaFe_{1-x}Co_xO_3$ PEROVSKITES

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The perovskites oxides contain more than one metallic element in their lattice. Due to the different amount of metals, the perovskites play an important role as catalysts in various chemical reactions. [1, 2]

The perovskites with chemical composition $LaFe_{1-x}Co_xO_3$ (x =0; 0,05; 0,1; 0,2; 0,3) were prepared by the sol–gel auto-combustion method and sintered at 750 °C for 6 hours. The evolution of the reaction was monitored by infrared absorption spectroscopy (FTIR). The structure of $LaFe_{1-x}Co_xO_3$ perovskites was established by X-ray diffraction (XRD). The BET surface areas were measured at the liquid nitrogen temperature by nitrogen adsorption. Synergic catalytic properties of the oxide compounds were evaluated by reaction of hydrogen peroxide decomposition and rhodamine-B (RhB) degradation.

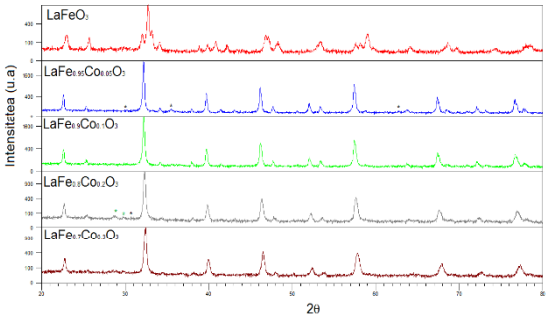

Fig. 1 XRD patterns of $LaFe_{1-x}Co_xO_3$

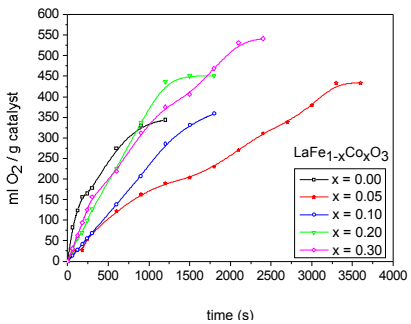

Fig. 2 Variation of O_2 quantity with time in presence of $LaFe_{1-x}Co_xO_3$ as catalyst

The XRD samples show an orthorhombic structure for all the sintered samples (fig. 1). The BET diagrams of $LaFe_{1-x}Co_xO_3$ are specific of III type isotherms, but the all samples have a good affinity for water and oxygen molecules. This property was evidenced by FTIR results and high values of first order rate constants of H_2O_2

decomposition (fig. 2). The perovskites exhibit a good catalytic activity for RhB degradation, in presence of H_2O_2.

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The authors thanks to A. Pui for FT-IR analysis and M. Ignat for BET analysis.

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S1 P43

EFFECTS OF Sr DOPING ON STRUCTURE, MAGNETIC AND ELECTRIC PROPERTIES OF $SmFe_{0.7}Co_{0.3}O_3$

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Perovskites materials have attracted attention due to the rich physical properties resulting from multiorder parameter interactions and promising potential applications on the magnetic, electric and catalytic control devices.

The samples with chemical composition $Sm_{1-x}Sr_xFe_{0.7}Co_{0.3}O_3$ (SSFCO) (x = 0.05, 0.10, 0.2 and 0.3) were synthesized by sol-gel method using as precursors Sm_2O_3, $SrCO_3$, $Fe(NO_3)_3 \cdot 9H_2O$, $Co(NO_3)_2 \cdot 6H_2O$ and citric acid in stoechiometric ratio. The precursors were presintered at 750 °C/6 h in air. The presintered samples were ground and sintered at 1100°C/10 h in air atmosphere. Phase composition, structure and lattice constants were monitorized by X-ray analysis using a diffractometer with a CoKα radiation, equipped with a data acquisition system. The all sintered SSFCO samples show an orthorhombic structure, the unit cell volume increases with increasing of Sr content. The FT-IR spectra revealed a diminution of (Fe,Co)-O bonds polarity, and UV- VIS DR analyze showed an enhancement of Co^3 d-d transitions intensity with x increasing. Evaluation of the morphology and specific surface area included the SSFCO perovskites in nanocrystalline substances with low porosity and small pore size. The magnetic and electric properties were determined. For all samples, the magnetic measurements suggesting an antiferromagnetic behavior with weak ferromagnetic contribution. The lattice effects, local distortions, chemical disorder or/and Jahn-Teller distortions plays an important role in the magnetic and electric behavior of ferrites

Keywords: ferrite, antiferromagnetic material, nanocrystalline substance
Acknowledgements:
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The authors thanks to A. Pui for FT-IR analysis, C. Tascu for SEM analysis and M. Ignat for BET analysis.
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S1 P44

VACUUM ANNEALING EFFECT ON THE STRUCTURAL AND OPTICAL PROPERTIES OF OF ANTIMONY TRIOXIDE THIN FILMS

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Antimony trioxide (Sb_2O_3) thin films were deposited onto glass substrates held at 25 ^{0}C using the thermal vacuum evaporation technique. The films were annealed at 250 ^{0}C in vacuum after evaporation. The morpho-structural properties of the films were studied by X-ray diffraction (XRD), scanning electron microscopy (SEM) and atomic force microscopy (AFM), respectively. The XRD patterns revealed that the films are polycrystalline and have a cubic structure with a strong (222) orientation after the annealing treatment. The structural parameters such as the lattice constant, grain size and surface roughness were calculated. The SEM images revealed the increase of crystallites sizes after annealing. The AFM micrographs showed that the mean surface roughness slightly increases after annealing. The optical properties were investigated for both the as-deposited and annealed film in the wavelength range of 190-1100 nm. It was found that the optical transmission of the annealed thin films increases due to the crystallinity improvement. The optical constants such as the refractive index, the absorption coefficient and the energy band gap were determined from the transmission spectra, by using Swanepoel's method. The energy band gap values are found to increase from 3.58 eV to 3.73 eV following the annealing process.

S1 P45

UNSTABLE VICINAL CRYSTAL GROWTH BY VICINAL CELLULAR AUTOMATA: THE EFFECT OF STEP TRANSPARENCY

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Currently an original model of unstable vicinal crystal growth was introduced [1,2] based on combination of vicinal cellular automata (CA) and diffusional module. It was used to study the evolving surface pattern, step bunches in this case, in the regime of intermediate asymptotics [3] when applying a specially suited modification of our monitoring protocol [4] since in the model are not incorporated step-step repulsions and the formation of macrosteps is observed. The model permits to study different sources of instability – biased diffusion, Ehrlich-Schowebel effect, etc.

Main result of these studies is the clearly shown difference between the diffusion-limited (DL) and kinetics-limited (KL) regimes of growth. The latter is realized with increasing the number of diffusional updates n_{DS} that follows a growth one. In both regimes the time-scaling exponent β of the bunch size is the same and even the scaling pre-factor is the same when the time is properly rescaled. Thus, what distinguishes between the two regimes is the time-scaling exponent of the size of macrosteps - it is $3\beta/4$ in the DL and $3\beta/5$ in the KL regime.

What remained outside the focus of our studies is the problem of step transparency [5, 6]. The step (non-)transparency regulates the way the adatoms are crossing the steps during their diffusional motions. When the adatoms do not "feel" the steps as special points on their diffusional trajectories, these steps are considered fully transparent. On the other side, when after reaching the step adatoms incorporate into the crystal and do not jump on the next terrace, these steps are defined non-transparent [5]. So far, our model [1,2] operates with fully transparent steps.

In this presentation we focus on the problem of step transparency by varying the time the adatoms spend near steps after joining them during their diffusional motion. Our model permits to see clearly that the notion of step transparency has meaning only when $n_{DS} > 1$. This also allows for definition of some part q of n_{DS} as the time the adatoms are binded to the steps before continuing to diffuse. Systematic variation of q between 0 and 1, provided $n_{DS} >> 1$, reveals the differences in the two realizations of the instability and we show quantitatively the consequences of its smooth variation.

VT and AK acknowledge the financial support of grant T02-8/121214 from Bulgarian NSF.

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S1 P46

STRUCTURAL AND MORPHOLOGICAL PROPERTIES OF THERMAL AGING OF SLOT INSULATION BASED ON POLYESTER FOR ROTATING MACHINES

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THERNOMID 10.04 VF flexible slot insulating is a duplex made up of a polyester film (polyethylenterephthalat), on side non woven polyester fibres, thermosetting adhesive and finally impregnated with insulating resin of high thermal resistance (200ºC). One appears in brown color[1]. This composite material insulator are advantages enhance strength, stiffness, aging, resistance, or strength to weight ratio by incorporating strong and stiff fibres in a softer, more ductile matrix [2]. For experiments were realized 5 electric rotating machines type synchrounus equipped with THERNOMID slot insulation. The machines were aging in regime operation of in conditions: 120 ºC for 80, 160, 240, 320 and 400 h. After aging the machines were disassembled and the insulation was extracted for structural characterization.

The thermo-oxidative process of slot insulation was characterized by SEM, spectrometry IR, and was effected a elemental analysis for composition by EDX method

The morphological structure was evidentied from SEM images - Figures 1 and 2, before and after thermal aging where initially the insulation is formed by fibres with diameter 10 μm and after aging was observed a degradation of surface insulation.

The ATR FTIR spectroscopy for peak carbonyl C=O streching a increased intensity from 3.01 to 12.09 for initial and motor 5 tied an oxidation, and also in elemental analysis EDX this phenomena is evidentied by the carbon and oxygen content: initial C=65.27%, O=57.67% and final C 34.22% and O =41.83%; resulting an oxidation process in insulation.

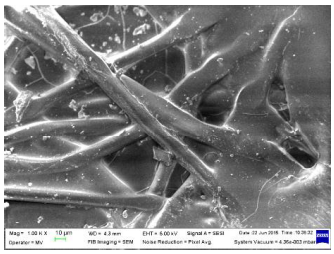

Fig.1 SEM image THERNOMID 10.04 VF before aging

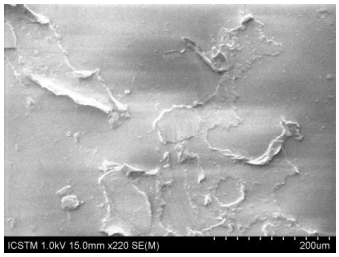

Fig. 2 SEM image for THERNOMID 10.04 VF after aging

Keywords: rotating machines, slot insulation, polyethylenterephthalat, IR spectrometry.
Acknowledgements: The research leading to these results has received funding from PN II 2013 (Partnership Programme) under the project PN-II-PT-PCCA-2013-4-0792 "High performance polymeric insulations for electrical rotation machines. Technology and modeling approaches" (IsMach).
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S1 P47

INVESTIGATION OF MAGNETIC STRUCTURE IN ELECTROTEHNIC SHEETS CUTTED BY DIFFERENT METHODS

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Given limited resources, energy efficiency is one that requires modification of manufacturing technologies and use conditions of equipments and devices. In the present work are presented several investigations of various methods of cutting the sheets of FeSi used in IE3 motors and their effect on global and local enhanced magnetic properties. The magnetic properties of electrical steels are determined by their composition and structure. During processing, depending on the processing technology, electrical steels composition and structure may change, leading thus to change their magnetic properties.

The magnetic properties of non-oriented electrical steel sheets are given by the purity and good control of steel alloying elements but also by the orientation and grain size. When the content of an alloying element, such as Si is increased, it increases electrical resistance, eddy currents in sheet decreases and as a result, the iron loss is reduced, but at the same time decreases the saturation magnetization.

Measurement of the overall magnetic properties was carried out by means of a closed magnetic circuit. Measuring local magnetic properties was carried out by magnetic force microscopy, using a Ntegra Aura AFM-STM platform.

Figures 1 and 2 present images of magnetic domains MFM two different magnetic grade (M400 and M800). Samples of 30 x 30 mm were cut by electroerosion tehnique. We observe a magnetic structure refinement in the margin area.

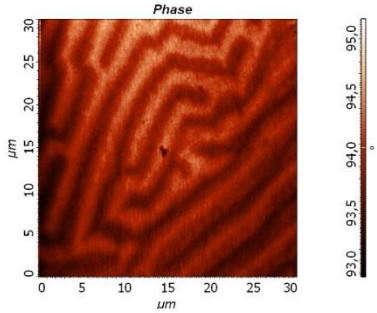

Fig 1. MFM image for M400-65A

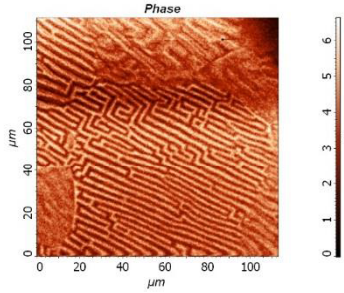

Fig 2. MFM image for M800

Keywords: magnetic domains, energy efficiency, magnetic hysterezis, motors

S1 P48

STUDIES ON Fe_3O_4-SnO_2 COMPOSITE NANOPARTICLES

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In recent years, considerable efforts have been devoted to the design and controlled fabrication of nanostructured composite materials with with tailored structural, optical, electric, magnetic and surface properties. Combining the optical and magnetic properties of tin oxide/iron oxide binary nanostructure would greatly broaden their application in photocatalysis, Li-ion batteries (LIBs), magnetic resonance imaging (MRI), etc [1-3].

The composite nanostructures with different architecture like core-shell do not simply combine properties of the original components but also possess novel and collective performances which are not seen in the original constituents. Physical and chemical properties of nanostructured composite materials can be adjusted by controlling the composition and the relative sizes of various components. The investigations on alternative anode materials have been recently intensified. Nanostructured Fe_3O_4-SnO_2 hybrid materials can be promising anode materials for lithium ion batteries.

The paper aims to report the influence of preparative conditions onto morpho-structural, magnetic, optical and electrical properties of Fe_3O_4-SnO_2 composite nanoparticles. Composite nanoparticles were synthesized by growing SnO_2 nanoparticles on the surface of previously prepared by chemical precipitation of precursors of Fe_3O_4 nanoparticles. The SnO_2 nanoparticles could be obtained by chemical precipitation or sol-gel process.

The composite nanoparticle samples were characterized by using TEM (HRTEM), FT-IR, XRD,UV-Vis, XPS, techniques. Also magnetization and electrochemical behavior were recorded. The results revealed that by adjusting the composition of components, as well as dopant ions one can control the properties of composite nanoparticles.

Keywords: composite nanoparticles, magnetite, magnetic properties, semiconductor

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Acknowledgments

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S1 P49

Gd-DOPED TiO_2 NANOPARTICLES WITH ENHANCED PHOTOCATALYTIC ACTIVITY

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Photocatalytic degradation of organic pollutants using solar radiation is a potential method to control the environmental pollution as solar energy is renewable. For harnessing the solar radiation effectively, suitable semiconductors are to be developed, which is a major task [1-2]. In this work, Gd-doped TiO_2 nanoparticles with diferent atomic percent of Gd (0.1-1%) are synthesized via sol-gel method. The influence of the doping degree on the structure, morphology and optical properties of the nanoparticles have been investigated by X-

ray diffraction (XRD), Electron Paramagnetic Resonance, UV-Vis spectroscopy, transmission electron microscopy (TEM) and photoluminescence (PL). The XRD studies reveal the formation of anatase-type structure. The crystalites size is decreasing with the increase of Gd doping. Using EPR spectroscopy were evidenced the presence of Gd^{3+} ions and the defects created in TiO_2 network by doping. Photocatalytic degradation of Rhodamine B in aqueous solution under visible irradiation in the presence of pure TiO_2 and Gd-doped TiO_2 nanoparticles was investigated. All the samples present photocatalytic activity. The best performance was obtained for 0.3% Gd-doped TiO_2 sample.

Keywords: Gd-doped TiO_2 nanoparticles, structural characterization, optical properties, photocatalytic activity.

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Acknowledgments

Financial support from the National Authority for Scientific Research and Innovation - ANCSI, Core Programme, Project PN16-30/02 02 is gratefully acknowledged.

S1 P50

Cu-DOPED ZnO NANOPOWDERS LOADED WITH Ag NANOPARTICLES: STRUCTURAL, MORPHOLOGIC AND OPTICAL PROPERTIES

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ZnO nanostructures have attracted a significant amount of research interest as a suitable candidate for optoelectronic applications such as lasers, light emitting diodes, and UV photodetectors [1,2]. In the case of photovoltaic devices, ZnO nanostructures can provide better electrical conductivity due to higher electron mobility than the most studied photovoltaic system. Thus, ZnO nanostructures can efficiently enhance charge transportability and efficiency of the photovoltaic solar cells [3]. Recently, metallic nanoparticles have been suggested to be effective solutions for broadband light absorption enhancement for semiconductors with application in solar cells. Metal nanoparticles provide absorption enhancement in solar cells by two mechanisms: (i) light trapping and optical path length enhancement via scattering of incoming light, and (ii) local absorption enhancement by strong local fields caused by plasmon resonance of the particle [4].

The present paper reports detailed structural, morphologic and optical properties of zinc oxide nanoparticles doped with various Cu content (x = 0; 0.005; 0.01 and 0.03) and loaded with Ag nanoparticles. By XRD measurement was observed that all samples have a typical hexagonal wurtzite structure and two additional diffraction peaks corresponding to Ag metallic nanoparticles with cubic structure are present. The morphologies and sizes of samples were characterized using transmission electron microscopy. The presence of surface plasmon resonance (SPR) peak of Ag nanoparticles in UV-VIS spectra confirms the formation of Ag nanoparticles. The EPR spectroscopy shows the presence of Cu^{2+} ions in ZnO samples.

Keywords: solar cells, nanoparticles, EPR spectroscopy

Acknowledgements: Financial support from the National Authority for Scientific Research and Innovation - ANCSI, Core Programme, Project PN16-30/ 02 05 is gratefully acknowledged.

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S1 P51

CONVERSION OF POLYANILINE NANOSTRUCTURES OBTAINED BY DIFFERENT TEMPLATE FREE METHODS TO NITROGEN-CONTAINING CARBON NANOSTRUCTURES

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The nitrogen-containing carbon nanostructures (NCNs) have drawn much attention especially because of their excellent electrocatalytic activities as well as low cost, good durability, and environmental friendliness. The aim of this study is the investigation of different template free synthesis of polyaniline (PANI) nanostructures and their corresponding nitrogen-containing carbon nanostructures. We purpose the synthesis of PANI nanostructures by different template-free methods using: a) in an appropriate mixed solution of ethanol and acetic acid, b) in water, without adding acid, when ammonium peroxydisulfate (APS) is used as an oxidant and c) fibrillar complex of anionic azodye MO (methyl orange) and oxidant $FeCl_3$ will be used as a reactive self-degradable seed template directing the growth of PANI nanostructures. NCNs are obtained after the thermal treatment of PANI nanostructures, under nitrogen atmosphere at 900 ° C. X-ray photoelectron spectroscopy (XPS), Raman Spectroscopy and Scanning Electron Microscopy (SEM) were used to characterize the PANI nanostructures and their corresponding NCNs.

Keywords: polyaniline, template free synthesis, nitrogen-containing carbon nanostructures
Keywords: polyaniline, template free synthesis, nitrogen-containing carbon nanostructures
Acknowledgments
This work is supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-II-RU-TE-2014-4-0221.

S1 P52

STRUCTURAL, MORPHOLOGICAL AND OPTICAL PROPERTIES OF SnO_2-TiO_2 NANOCOMPOSITE MATERIALS

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Lithium ion batteries have drawn world-wide interest for their extensive applications, including mobile electronics, electric vehicles, and renewable energy systems for intermittent energy sources such as wind and solar [1-2]. Nanostructured SnO_2-TiO_2 composite materials can be promising anode materials for lithium ion batteries.

This paper reports structural, morphological and optical properties of nanostructured SnO_2-TiO_2 composite materials. The composite were prepared using various chemical compositions. The nanocomposites were characterized by X-ray diffraction (XRD), high-resolution transmission electron microscopy (HRTEM) and electron paramagnetic resonance (EPR) spectroscopy. Optical properties of the nanocomposites were evidenced using UV-Vis and Photoluminescence (PL) spectroscopy.

Keywords: SnO_2-TiO_2 nanocomposites, structural characterization, optical properties

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S1 P53

STUDY ON CHARACTERISTIC OF BONDING AND STRUCTURAL CHANGES IN MOLYBDENUM-LEAD-LEAD DIOXIDE GLASSES AND VITROCERAMICS

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Glasses and glass ceramics of the $xMoO_3 \cdot (100-x)[4PbO_2 \cdot Pb]$ system where x = 0-50mol% MoO_3 were synthesized by melt quenching method. The obtained samples were characterized by investigations of XRD, FTIR, UV-VIS and EPR spectroscopies and quantum chemical calculations in order to obtain information about the effect on the characteristic of bonding and local structure.

Our IR data indicate that with increasing of higher MoO_3 content the [PbOn] polyhedral units (n=3, 4 and 6) will be connected with the chains of Mo-O-Mo bridges bonds and with isolated $[MoO_4]$ irregular tetrahedral units. The intensity of the resonance lines situated at about g~5.2 and 2 corresponding to the Mo^{+3} and Mo^{+5} ions was gradually modified with the increase of MoO_3 concentration in the host matrix.

The presence of both lead and molybdenum ions in the vitreous matrix generates a competition regarding their coordination with oxygen ions which evidences modifications of the gap energy values.

The quantum chemical calculations suggest that the molybdenum ions produce a complex structure of the host matrix and nonequivalent Pb-O bonds in the all $[PbO_n]$ structural units where n=2, 3, 4 and 6 were identified.

Accordingly, the presence of the microenvironment of multivalent molybdenum ions in host matrix is expected to have a strong effect of depolymerization of the molybdenum-lead-dioxide lead network which will produce the increase of the structural disorder and the formation of Pb_2MoO_5 crystalline phase, in agreement with XRD data.

S1 P54

EFFECT OF NANOWOLLASTONITE ON HYDROPHILICITY OF CELLULOSE SURFACE: MOLECULAR DYNAMICS SIMULATIONS

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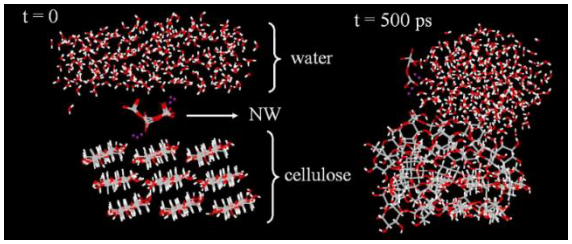
Cellulose is the main constituent of plants and trees; it is also a basic ingredient for many industrial derivatives and products. The presence of hydroxyl groups allows the formation of hydrogen bonds along the cellulose chains and between chains. Also, binding with water can occur when cellulose becomes wet. This leads to disruption of hydrogen bonding of the surface chains of cellulose and formation of new hydrogen bonds with water molecules. For this reason, cellulose is often described as a hydrophilic material. Composite manufacturing factories have always been suffering from some problems such as water adsorption of wood and wood products resulting in breakage of the resin bonds and a severe thickness swelling. To overcome this problem, many experimental attempts have been done. For instance, wollastonite nanofiber ($CaSiO_3$) was used to prevent water absorption. Nanowollastonite (NW) was found to have a considerable improving effect on water adsorption in wood-composites. Water adsorption on cellulose surface in the presence of NW was simulated to clarify the role of NW. The molecular dynamics simulations were performed with Tinker 4.2 package in the NVT ensemble. The simulations revealed strong adsorption of NW on cellulose surface. Hydrogen bonding between NW and cellulose surface played a crucial role in holding NW on cellulose surface. When NW-cellulose got into contact with water molecules in the simulation box, hydrogen bonds between NW and water molecules were formed. Hence, NW can prevent the formation of bonds between cellulose surface and water molecules, and consequently adsorption of water on cellulose surface. By increasing simulation time, the hydrogen bond networks on NW was dominated by hydrogen bonds of water molecules.



Furthermore, the abundant hydroxyl groups in water can significantly increase the number of hydrogen bonds between water molecules and cellulose surface. The formation of cellulose-water and NW-water bonds led to breakage of bonds between NW and cellulose surface. By separation of NW from cellulose, water adsorption on cellulose surface was increased. The results are in good agreement with previous experimental studies.

S1 P55

METALORGANIC AEROSOL DEPOSITION OF $La_{0.67}Sr_{0.33}Mn_{1-y}Ru_yO_3$ THIN FILMS

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Half-metallic $La_{1-x}Sr_xMnO_3$ (LSMO) has been attracted attention as a ferromagnetic electrode for the room temperature operated spintronic devices. Usually, in magnetic tunnel junctions both epitaxially coupled electrodes are made of the same material and strongly desired contrast in the coercivity between the top and bottom electrodes is achieved by an extrinsic method, e.g. by a geometrical shape anisotropy. The intrinsically harder ferromagnet can be made from LSMO by Ru substitution of a few % of Mn [1, 2]. Ru doping increases the coercive force of LSMO by an order of magnitude without significant reducing the conductivity and saturation magnetization. The preparation of Ru-doped LSMO thin layers by common used PLD technique faces the problem of doping level control that is originated from Ru deficiency due to its volatility [1]. In this study we implemented the metalorganic aerosol deposition (MAD) technique for fabrication of $La_{0.67}Sr_{0.33}Mn_{1-y}Ru_yO_3$ (LSMRO) layers on STO(100) substrates. The doping level y was controlled by changing the proportion of Mn/Ru in the organic solution contained mixture of metalorganic precursors.

The crystal structure of the films was examined by x-ray diffraction, and the thickness of the films accurately estimated from x-ray reflection and Laue oscillations was kept of about 23 nm. The surface morphology characterized by atomic force microscopy demonstrates atomically flat step-and-terrace structures with RMS ranged 0.3-0.4 nm. The LSMRO films reveal huge tunable increasing of coercivity field measured at 10K (20 Oe for y=0 and 2300 Oe for y=0.075). Almost the same coercivity contrast of about an order between undoped and slightly doped LSMRO films was remained at room temperature. The magnetization value per formula unit decreases with Ru content more rapidly than it was predicted by antiferromagnetic superexchange interaction between Mn and Ru-site spins. This is probably means that Ru doping disorders the ferromagnetism of LSMO [3]. Our experiments show that not only doping level but strain induced by Ru substitution in LSMO films grown on STO(100) substrates result on magnetic properties of LSMRO films.

In summary, we have demonstrated that MAD technique can be an effective tool for tailoring the cation ratio both for A and B-sites of perovskite structure allowing thus fabrication of high Curie temperature materials (>350K) with a high coercivity contrast that is highly required for spin valve devices. An atomically flat surface allows both LSMRO/LSMO and LSMO/LSMRO epitaxial design for spintronic devices grown on STO(100) substrates.

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S1 P56

MAGNETIC PROPERTIES OF LITHIUM-PHOSPHATE SYSTEMS DOPED WITH IRON IONS

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Glasses from the systems, xFe_20_3 $(100-x)[P_2O_5$ $Li_20]$ with $0 < x < 50$ mol% were prepared and characterized by magnetic susceptibility [1-3]. The iron ions generally modify in a different way the local structure of these glasses, depending on the presence of the Li_2O in the glass matrix [4,5]. The results show the presence of antiferromagnetic or ferromagnetic interactions between the iron ions studied by temperature range. These data revealed that the valence states and the distribution of iron ions in the glass matrix depend on the Fe_20_3 content, and can determine the variation of $\mu_{eff.}$

Keywords: Lithium-phosphate glasses, Iron oxide, Magnetic susceptibility.

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S1 P57

THE STRUCTURAL AND MORPHOLOGICAL PROPERTIES OF ZIRCONIUM OXIDE THIN FILMS PREPARED AT DIFFERENT SUBSTRATE AND ANNEALING TEMPERATURES

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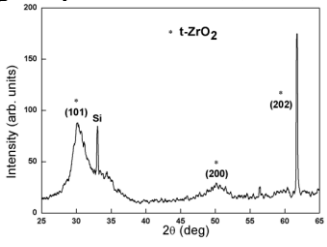
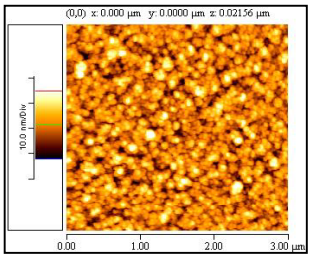
Zirconium oxide (ZrO_2) thin films owing to outstanding physical properties have gained considerable attention in recent years. ZrO_2 thin films were deposited on different substrates by a variety of techniques. In this investigation for preparation of ZrO_2 thin films, the post thermal annealing of zirconium (Zr) thin films deposited on silicon substrates using DC magnetron sputtering method were employed. The Zr thin films were prepared at different substrate temperatures in rang 50-250°C. All the Zr films were subjected to post thermal annealing treatments at 500 °C for 240 minutes. For investigation of annealing temperature effect on the ZrO_2 thin films properties, three Zr samples prepared in the substrate temperature of 200 °C were annealed at different annealing temperature of 500, 600 and 700°C.



(a)



(b)

Figure a: The XRD and b: AFM image of the ZrO_2 thin film on silicon substrate at annealing temperature of 500°C.

The structural and morphological properties of prepared films were studied by XRD and AFM analysis. The XRD results confirmed the formation of ZrO_2 with tetragonal structure in all prepared films and show that the crystallinity of films depends on the substrate and annealing temperatures. The AFM results showed that the surface morphology and roughness of ZrO_2 thin films depend on the substrate temperature. Also, the AFM results confirm the results obtained by XRD. The optimum substrate and annealing temperature for preparation of ZrO_2 films in our experiment are 200 ºC and 500 °C respectively.

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

S1 P58

CRYSTAL GROWTH AND SPECTROSCOPIC INVESTIGATION OF Sm^{3+} DOPED CNGG AND CLNGG SINGLE CRYSTALS

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Novel Sm^{3+} (5 at.%) doped disordered CNGG and CLNGG single crystals (Fig. 1) were grown by the Czochralski method. Structural properties of the as-grown crystals have been studied using X-ray diffraction. Spectroscopic investigations (absorption, excitation and emission spectra, and lifetime measurements) were performed. For both crystals, the emission spectra exhibit three emission bands in visible domain, 550 – 580 nm, 580 – 630 nm, and 630 – 680 nm, corresponding to Sm^{3+} $^4G_{5/2} \rightarrow {}^6H_{5/2,\ 7/2,\ 9/2}$ transitions, respectively (Fig. 2). The most intense Sm^{3+} emission lines in both crystals are situated at 614 nm corresponding to $^4G_{5/2} \rightarrow {}^6H_{7/2}$ transition, and is more intense in the case of CLNGG crystal. Both crystals exhibit very strong absorption lines at 405 nm. Connected with InGaN/GaN laser diodes emission, Sm:CNGG and Sm:CLNGG single crystals could have a great potential as new laser materials with emission in orange domain.

Fig. 1. Sm doped CNGG and CLNGG as-grown single crystals

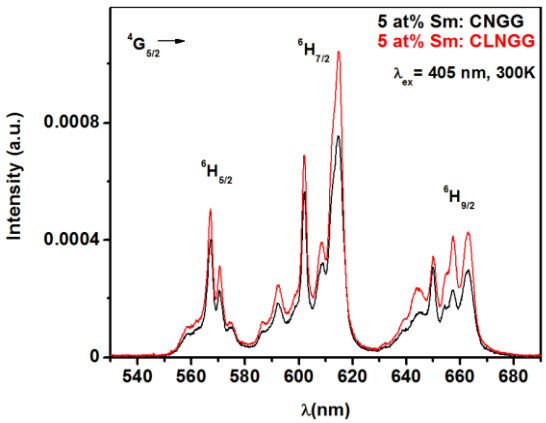

Fig. 2. Emission spectra of Sm^{3+} doped in CNGG and CLNGG crystals

Keywords: disordered materials, crystal growth, Sm^{3+} spectroscopy, orange emission
Acknowledgement This work was financially supported by the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, PNII-RU-TE-2014-4-2443 Contract 208/2015, Project NUCLEU 4N/2016.

S1 P59

THE INFLUENCE OF Eu IONS ON THE PROPERTIES OF Fe_3O_4 - TiO_2 COMPOSITE NANOPARTICLES

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Fe_3O_4-TiO_2:Eu composite nanoparticles were prepared by seed mediated growth of semiconductor (TiO_2:Eu) through an ultrasound sol-gel processing onto preformed magnetite (Fe_3O_4) cores resulted from the co-precipitation method. Different Eu concentration were synthesized from a medium containing metal alkoxide, solvents, dopants and magnetite nanoparticles. Finally, the resulted precursors were annealed in air, at 600ºC to obtain Fe_3O_4-TiO_2:Eu composite nanoparticles. The physicochemical properties of the composites were determined using various complementary characterization methods. Composite nanoparticles were characterized by X-ray diffraction (XRD), porosity and surface area measurements (BET), high resolution transmission electron microscopy (HRTEM), electron paramagnetic resonance (EPR) and magnetic measurements. The doping degree have an important impact on the properties of Fe_3O_4-TiO_2:Eu composite nanoparticles.

Keywords: Eu ions, titanium dioxide, magnetite, composite nanoparticles,
Acknowledgments Financial support from the National Authority for Scientific Research and Innovation - ANCSI, Core Programme, Project PN16-30/02 02 is gratefully acknowledged.

S1 P60

A STUDY ON CORROSION BEHAVIOUR OF POROUS ALUMINIUM OXIDE LAYER OBTAINED BY ANODIC OXIDATION

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It is well known that aluminium and its alloy are used in different industries such as aeronautical or construction. Due to its native oxide film, aluminium and its alloys have a huge advantages in comparison with other metals but is not always completely impervious to corrosion when are exposed to extreme pH levels. Anodic oxidation in acid electrolytes is the most used and cheap method for growining a thick nanoporous aluminium oxide layer on the aluminium surface. The anodic oxide layer act as an insulator against chloride ions from environment and increase the corrosion resistance of the substrate.

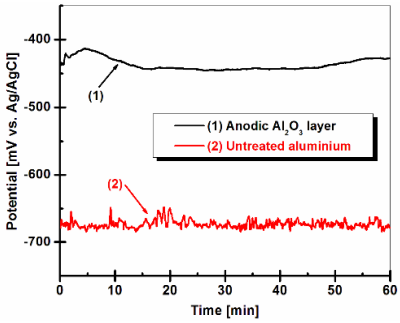

Figure 1. Evolution of OCP recorded after immersion of untretead aluminium alloy and anodic porous oxide layer in natural seawater.

The aims of this research work was to obtain a thick porous aluminium oxide layer with improved corrosion resistance in natural seawater. The corrosion behaviour was investigated in-situ by electrochemical methods such as open circuit potential (OCP), electrochemical impedance spectroscopy (EIS), potentiodynamic polarization and cycling voltammetry and ex-situ by scanning electron micoscpy (SEM).

The results were compared with those obtained for untreated aluminium alloy and show that the anodic oxidation improve the corrosion resistance of aluminium alloy.

Keyword: Aluminium, Anodic Oxidation, Corrosion
Acknowledgements: UEFISCDI - Ministry of Education and Research is acknowledged for the financial support to Competences Centre Interfaces - Tribocorrosion and Electrochemical Systems (CC-ITES) - Dunarea de Jos University of Galati - Research Project: *HyBioElect*, contract 10 /30-08-2013 (2013 - 2016) in the frame of National Research Programme Romania - PN II PCE.

S1 P61

MAGNETIC PROPERTIES OF CARBON NANOTUBES

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In this paper we one deals with the magnetic and transport properties on carbon nanotubes. To this aim one resorts to a tight binding model by accounting for a single π- band [1,2]. Spin degrees of freedom have also been accounted for.

One shows that the application of an external magnetic field produces changes in transport properties of carbon nanotubes. When the applied magnetic field is parallel to the tube axis, one gets faced with the implementation of the well-known Aharonov-Bohm (AB) quantum phase. Needless to say that this phase is relevant for applications in mesoscopic devices. We found that the AB-oscillations in carbon nanotubes with zig-zag boundary conditions are characterized by integer (ϕ_0) and $(\phi_0/2)$ magnetic-flux periods. This result in sawtooth-type oscillations relying on the parity of the electron number [3].

In the presence of a transversal magnetic field we found a halving of the Fermi velocity and an increase of the density of states (DOS) in metallic nanotubes, while the energy gap is suppressed in semiconducting nanotubes [4].

Keywords: Carbon nanotubes, Persistent currents, Aharonov-Bohm effect

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S1 P62

MAGNETIC BEHAVIOUR OF CoPt@Fe_3O_4 CHEMICALLY SYNTHESIZED HARD/SOFT MAGNETIC NANOPARTICLES

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Nanocrystalline ferromagnetic materials exhibit magnetic properties which are interesting for fundamental researches in magnetism as well as for applications [1-2]. Nanocomposite exchange coupled magnets, spring-magnets, consisting of a fine mixture of hard (high coercivity) and soft (high magnetization) magnetic phases have attracted attention for permanent magnet fabrication [3-5].

Ferromagnetic chemically order face-centered tetragonal, $L1_0$ CoPt alloy nanoparticles are promising candidates as the next generation of ultrahigh-density data storage media. Its high uniaxial magnetocrystalline

anisotropy Ku ≈ 4,9 × 106 J m^{-3}[6], in the bulk phase and also its high chemical stability, make $L1_0$ CoPt phase suitable for using as hard magnetic phase in soft-hard exchange coupled systems. In order to obtain the exchange coupling between the hard and soft phases, remain a challenge to generate $L1_0$ CoPt nanoparticles with high coercivity, controllable size and narrow size distribution. We report here the fabrication of CoPt@Fe_3O_4 exchange coupled nanoparticles by employing as precursors for CoPt phase Co acetylacetonate and Pt acetylacetonate and as reaction media is used dioctyl ether. In order to obtain a good crystallinity of phases, the as obtained CoPt nanoparticles are annealed at 700 °C in reduction atmosphere (Ar+10%H_2). The soft magnetic phase will be obtained by precipitation in basic media of iron salts.

The elemental composition of materials were determinate be XPS measurements, the structure and microstructure was checked by XRD and TEM analyses. The remanent magnetisation, the coercive field and the exchange coupling between the hard and the soft phases were deduced from magnetic measurements

Keyword: CoPt@Fe_3O_4 magnetic nanoparticles, exchange coupled systems, polyol synthesis, XPS.

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S1 P63

PEROVSKITE COMBUSTION CATALYST ON MULLITE SUPPORT

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This paper describes a method to develop a combustion catalyst on natural or synthetic porous aluminum silicate (mullite). The method 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 method consists in the co-precipitation, in a colloidal mixture of polyvinyl alcohol deposited on mullitte, of the metal hydroxides that forms perovskite through the reaction between metals salts and ammonium hydroxide following by perovskite synthesis through heat treatment. The gases liberated during the synthesis leave open channels and pores in the oxidic compound, considerably increasing its specific surface area.

The developed catalyst, i.e. the ceramic support impregnated with active substance (La-Pb-Mg-Mn-O perovskite) 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.

Keywords: mullite, perovskite, combustion catalyst.

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S1 P64

INFLUENCE OF COLLOIDAL ENVIRONMENT ON THE GAS SENSING PROPERTIES OF THE IRON MANGANITE PREPARED BY PRECURSOR METHOD OF SELF-COMBUSTION

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In this work the self-combustion method was applied to synthesize simple iron manganite ($FeMnO_3$) nanopowders, using as colloidal medium the polyvinyl alcohol in various ratios between the mass of polyvinyl alcohol and that of metal ions (*A*/*M* ratio). Among the various methods known, the self-combustion method allows a good control over the size of the material particles. In this method, the thermal energy for the reaction of manganite crystallite synthesis is supplied by a fast exothermic combustion reaction and the final product is a finely divided powder. The procedure offers the advantage of producing ultra-fine, homogeneous reproducible multicomponent ceramic powders with precise stoichiometry.

We determined a series of structural and sensitive properties of the nanostructured iron manganites obtained by this method, in particular sensitivity and selectivity to several combustible gases and vapors diluted in air. The samples thus obtained have a favorable microstructure for obtaining the resistive sensors for some gases and vapors diluted in air. The colloidal environment where the precipitation of manganite precursors occurs according to self-combustion method, highly influences both the structural and sensitive properties of the iron manganites.

Acknowledgements: This work was supported by the ANCS (National Authority for Scientific Research), Ministry of Economy, Trade and Business Environment, through the National Program Capacities, Project No. 257/28.09.2010 (Acronym CERNESIM).

Keywords: iron manganite, colloidal medium, gas sensors.

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S1 P65

THE INFLUENCE OF NITROGEN DOPING ON THE PHASE CHANGE BEHAVIOUR $Ge_1Sb_2Te_4$

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Chalcogenide materials are becoming one of the most studied classes of storage media for application in rewritable optical and non-volatile electronic memories. Unlike to $Ge_2Sb_2Te_5$ (GST-225), another type of chalcogenide as $Ge_1Sb_2Te_4$ (GST-124) is used in the present work to be doped with nitrogen. However, most studies on the incorporation of nitrogen into GST film have centered on the macroscopic nature of the structural and electrical properties [1].In the present work, amorphous GST-124 thin films were synthesized using high-power impulsed magnetron sputtering (HiPIMS). The main advantages of HiPIMS technique is a large increase in the ionization degree of the metallic vapor, where it has been shown that the HiPIMS plasma generates large quantities of highly energetic ions [2] with a directed flux of charged species [3]. The N-doped $Ge_1Sb_2Te_4$ thin film has been deposited by HiPIMS technique and thickness of the film is 200nm. Sheet resistance is measured with four point setup probe in order to establish the resistance of the film in the case of doping. The current-

voltage characteristic was measured to study the performance with minimum thermal conductivity. The chemical composition was analyzed by electron excited energy-dispersive x-ray spectroscopy (EDX) attached to the SEM.

Keywords: HiPIMS, chacogenide, thin film.

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Acknowledgments: This work was supported by the project PN-II 174/2012.

S1 P66

SPECTROSCOPIC CHARACTERIZATION OF $LaGaO_3$:Er SYNTHESIZED BY SOLID STATE REACTION

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KEYWORDS: spectroscopy, $LaGaO_3$:Er, luminescence, reflectance

Lanthanum orthogallate $LaGaO_3$ belongs to the wide group of the compounds of general ABO_3 formula (A-rare earth ion, B - Al, Ga, Fe, Cr, V) and crystallise in a distorted perovskite structure. $LaGaO_3$ is an interesting host from the point of view of optical application [1]. This paper reports the synthesis and characterization of $LaGaO_3:Er^{3+}$.

Lanthanum orthogallate $LaGaO_3$ ceramic doped with Er^{3+} and Yb^{3+} was synthesized in our laboratory by solid state reaction, from stoichiometric quantities of high purity oxides (La_2O_3, Ga_2O_3, Er_3O_3). The powders were mixed in agate mortar, pressed with a hydraulic press at 2MPa and then annealed in air at 1350°C for 35h. As a result of the thermal treatment, a solid, ceramic sample was obtained. The sample was cut, polished and washed in an ultrasonic bath to remove the abrasive particles. The sample was characterized by XRD and optical spectroscopy techniques (luminescence, diffuse reflectance and decay measurements).

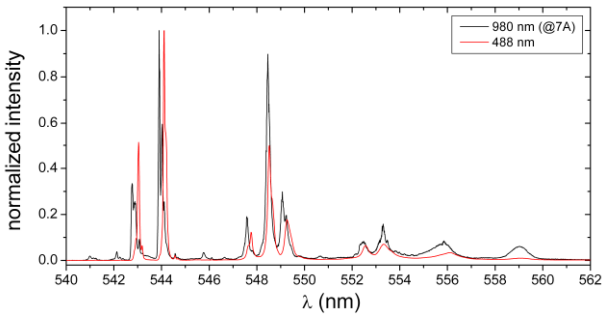

Fig.1. Luminescence spectra of $LaGaO_3:Er^{3+}$

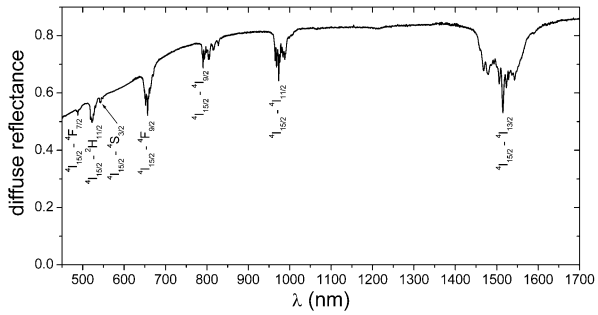

Fig. 2. Reflectance spectra of Er-doped $LaGaO_3$

CONCLUSIONS

Preliminary data concerning synthesis and characterization of $LaGaO_3$ doped with Er and Yb was presented. $LaGaO_3$:Er :Yb ceramic sample with good phase purity was obtained by solid state reaction in air.

Acknowledgments: This work was financed by Romanian National Authority for Scientific Research and Innovation through the program NUCLEU, contract 4N/2016.

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S1 P67

TEMPERATURE INFLUENCE OF THE TOOL STEEL SUBSTRATES ON THE NANOCOMPOSITE COATINGS PROCESSED BY PLD TECHNIQUE

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The cutting tools, made of commercial tool materials (cold/hot work steels, high speed steels-HSS and tungsten carbides), represent a large category of industrial applications in cutting, punching, injection molding, forming and tribological fields. The issues related to their severe functioning conditions demand innovative solutions towards an extended tool life.

One of the most used industrial coating technologies is physical vapour deposition (PVD), providing large batches of uniform coating layers, wide choice of coating materials and environmental safety working conditions. Flexible coatings are widely used in order to achieve fast and economical requirements, high reproducibility and application/user orientation. Conventional coatings made of TiN, Si_3N_4, AlCrN, TiAlN consist in structures type monoblock, multilayer, gradient, nanolayer, nanocomposite and triple coating [1, 2]. Although, these structures cannot entirely absorb the high deformation energy developed during severe machining conditions because, despite of high hardness, they present high toughness [3]. New designing concept of advanced wear coatings involves the decreasing of the toughness by special additions [4]. Our paper subscribes to this concept, presenting the primary research results on the development of new wear resistant nanocomposite coatings. One of the influencing parameters of the coatings deposition is the temperature of the substrate. Two powder metallurgy HSS steels as substrates are preheated at different temperatures before the coating stage. The quality of the interface between the substrate and coating, by means of structure, adhesion and mechanical properties at sub-micronic scale, depends on the preheating state of the substrate.

The investigations developed at interface level, by electron and atomic force microscopy, EDS and nanoindentation, highlight the influence of the substrate temperature on the nanocomposite coatings deposition.

Keywords: Pulsed Laser Deposition, wear coatings, tools

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S1 P68

THE INFLUENCE OF NIOBIUM-ION IMPLANTATIO ON THE TRIBOLOGICAL PROPERTIES OF WC&WS_2 STRUCTURES

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The purpose of this study was to evaluate the impact of niobium-ion implantation in WC&WS_2 structures and their tribological properties.

The WC&WS_2 films were deposited on silicon and stainless-steel substrates by DC and RF magnetron sputtering at 400^0C. Different concentrations for sputtering of WC targets where used while the concentration for WS_2 sputtering was maintained constant for all the deposition processes.

Niobium-ion implantation (Nb^+) with energy of 1.5 MeV and a dose of 6e14 ions/cm^2, at room temperature, was done at the 3 MV Tandetron™ accelerator from IFIN-HH.

RBS investigation gave information regarding stoichiometry and thicknesses of the coatings while tribological properties were studied using a pin-on-ball tribometer before and after niobium-ion implantation.

After Niobium-ion implantation the values measured for the coefficient of friction were slightly lower comparing to those registered before the implantation process.

S1 P69

SPECTROSCOPIC AND STRUCTURAL CHARACTERIZATION OF LAYERED DOUBLE HYDROXIDES THIN FILMS

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Layered double hydroxides (LDHs) are a class of materials with the general formula $M^{(II)}{}_{1-x}M^{(III)}x(OH)2]-(A^{n-}{}_{x/n})m\ H_2O$, where M(II) is a divalent cation (Mg, Ni, Zn, Cu or Co) and M(III) is a trivalent cation (Al, Cr, Fe, or Ga). An- is an anion with charge n like CO2-3, Cl-, NO-3 or an organic anion [1]. Due to the large variety of elements, functional materials can be produced leading to a large area of applications like catalysis, drug delivery, sensors, optoelectronics etc.

We report herein on the deposition of thin films of Ni-Al LDH by Pulsed Laser Deposition (PLD) and Matrix Assisted Pulsed Laser Evaporation (MAPLE) on silicon substrates. The experiments took place in vacuum, at room temperature and the films were the result of 10.000-40.000 pulses. The laser deposition techniques offer the advantage of growing well oriented and adherent films, with controlled thickness [2, 3].

The morphological and structural characterizations performed to investigate the deposited films were: X-ray diffraction (XRD), atomic force microscopy (AFM), scanning electron microscopy (SEM) combined with energy dispersive X-ray analysis (EDX) and Fourier Transform Infra-Red Spectroscopy (FTIR).

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Keywords: thin films, pulsed laser deposition, matrix assisted pulsed laser evaporation, layered double hydroxides

Acknoledgements:

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S1 P70

TUNGSTEN CARBONITRIDE DEPOSITED BY MAGNETRON SPUTTERING

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Tungsten carbonitride (WCN) is a less investigated material for tribological applications than tungsten carbide (WC), but due to its good properties of high hardness, high thermal conductivity and low coefficient of friction could have also large applications in the tribological coatings.

We deposited tungsten carbonitride starting from WC and graphite targets in nitrogen atmosphere. We used different concentrations for reactive gas inlet for studding the evolution of the physical, mechanical and tribological parameters with the amount of measured nitrogen. In order to facilitate the chemical reaction between C and N_2, in the sputtering process the substrate was heated at 300 ^{0}C and biased at -300V DC.

The composition and estimated thickness of the samples were evaluated by Rutherford Backscattering method while the hardness of the coatings was investigated by Hardness Indentation Test. A ball-on-disk tribometer was used for evaluation of the coefficient of friction.

Following the physical, mechanical and tribological investigations we observed an improvement in the coefficient of friction with the increasing of the nitrogen concentration and of the coating thickness. Also, adding graphite and increasing the nitrogen concentration in the tungsten carbonitride higher values of hardness have been obtained.

S1 P71

SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAN PROPERTIES OF FUNCTIONALIZED ZINC OXIDE NANOPOWDERS

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Zinc oxide is an inorganic material, which has a broad range of applications due to its properties (semiconducting, piezoelectric, and pyroelectric properties, and also antibacterial, antifungal, and UV filtering properties, high catalytic and photochemical properties) and, as consequence, versatile applications in transparent electronics, ultraviolet (UV) light emitters, piezoelectric devices, chemical sensors, spin electronics, personal care products, cosmetic material especially for transparent UV protection, coating and paints [1]. Beside a variety of physical and chemical synthesis methods, the nanobiotechnology, an important and emerging technique for ecofriendly synthesis of nanomaterials by using biological sources, was also applied for the synthesis of zinc oxide [2, 3].

We obtained zinc oxide nanopowders functionalized with anthocyanins, through green synthesis methods. The nanopowders were characterized by XDR diffraction, IR and UV-Vis spectroscopy. The electrical properties were estimated by using Tauc equation to calculate the band gap energy. The antimicrobial activity was evaluated against standard strains of *S. aureus* ATCC 25923, *E.coli* ATCC 25922, and the antifungal activity against *C. albicans* ATCC 10231. The optical, electrical and antimicrobial activity of the ZnO nanopowders can be correlated with their morphology, which also involves the synthesis route.

Acknowledgments. This work has been performed in the frame of Project No. 62 from Order No. 96/15.02.2016 of JINR-FLNP, Dubna, Russia.

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S1 P72

TEMPERATURE DEPENDENT REFLECTANCE MEASUREMENTS OF MOCVD GROWN InGaAs

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Direct band gap III-V semiconductors are very common in optoelectronic research field because of their good optical properties. InGaAs is one of them and it is very attractive in those materials because it is possible to grow lattice matched high quality epitaxial InGaAs on InP substrate. Lattice matched InGaAs has a direct band gap at the infrared region so that it is possible to use InGaAs in optical devices as a photodecetor, laser and LEDs. In this study InGaAs is grown by Metal Organic Chemical Vapour Depositon (MOCVD) on (001) oriented InP substrate and epitaxial layers are characterized with reflectance measurement at varied temperatures from low temperature to high temperature. By using varied temperature reflectance measurements, band gaps and refractive indeces of epi-layers are calculated then results are discussed .

Keywords: MOCVD, Spectrophotometer, InGaAs, Temperature

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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

PLASMA THRUSTERS, PRINCIPLES, APPLICATIONS, DIAGNOSTICS

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The scientific data compiled in the lecture originated from the collaboration with the ICARE laboratory, CNRS Orleans, France; the respective literature references are indicated within the presentation.
The presentation is divided into two parts. The first part offers a short review of electric propulsion (EP) technologies for satellites and spacecrafts. Electric thrusters, also termed ion or plasma thrusters, deliver a low thrust level compared to their chemical counterparts, but they offer significant advantages for in-space propulsion as energy is uncoupled to the propellant, therefore allowing for large energy densities. Although the development of EP goes back to the 1960's, the technology potential has just begun to be fully exploited because of the increase in the available power aboard spacecrafts, as demonstrated by the very recent appearance of all-electric communication satellites. The presentation first describes the fundamentals of EP: momentum conservation and the ideal rocket equation, specific impulse and thrust, figures of merit and a comparison with chemical propulsion. Subsequently, the influence of the power source type and characteristics on the mission profile is discussed. Plasma thrusters are classically grouped into three categories according to the thrust generation process: electrothermal, electrostatic and electromagnetic devices. The three groups, along with the associated plasma discharge and energy transfer mechanisms, are presented via a discussion of the examples of long-standing technologies like arcjet thrusters, magnetoplasmadynamic (MPD) thrusters, pulsed plasma thrusters, ion engines as well as Hall thrusters and its variants.
The second part is concentrated on the electric probe diagnostic of two types of Hall-effect thrusters: the small power (200W) PPI thruster and the medium power (1200W) PPS1350®-ML thruster. Applied is the Langmuir probe and emission probe technique in time-averaged and time-resolved modes and the basic plasma parameters (electron density and electron temperature) are evaluated in space and time resolution in the far-field plasma plume of the thrusters. The unique method for synchronization of the originally stochastic breathing oscillations is applied; thus enabling time-resolved Langmuir probe measurements. The time-averaged and time-resolved measurements are compared. Finally, the time-resolved electron energy probability function (EEPF) measurements are presented from which an interpretation of the breathing oscillations as a wave propagating downstream with approximately ion sound velocity is inferred.
Acknowledgment. The author wishes to express his gratitude to Prof. Michel Dudeck and Dr. Stéphane Mazouffre for the opportunity to participate in this prestigious research.

S2 L2

HiPIMS and REACTIVE MAGNETRON SPUTTERING TECHNIQUES USED FOR OBTAINING FUSION RELATED MATERIALS

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In magnetic confinement devices, the interaction between the edge plasma and the surrounding surfaces strongly influences the conditions in the core plasma. Because the plasma-facing components (PFC) are exposed to high heat and particle fluxes from plasma, they must withstand long-term operation and demonstrate a low level of dust production and fuel accumulation [1].

In thermonuclear fusion devices, the fuel retention by diffusion, ion implantation and trapping strongly depends on the material properties. The reactive magnetron sputtering technique was used as model system in order to study the influence of beryllium (Be) and tungsten (W) (materials that will be used as PFC in ITER) films microstructure [2] and gaseous pre-implantation on nuclear fuel retention behaviour.
Very good results were obtained using HiPIMS (high power intensity magnetron sputtering technique for preparation of Be-W mixed layers having nitrogen (N) and/or deuteriu (D) seeded during the deposition process mimicking depositions as plasma facing material. HiPIMS usage for PFC materials behavior studies ensures that the chemical composition and properties of the coatings can be fine tuned by changing the pulse parameters like: applied voltage, pulse length, delay between micro-pulses and sequences, repetition frequency.
Rutherford backscattering spectrometry (RBS) measurements were performed on the Be-W with N and D gas inclusions, Be thin films with D prepared with DCMS (direct current magnetron sputtering) tehnique and Be-W layers obtained by HiPIMS. The morphological and structural analysis of W, Be and W-Be based films deposited by HiPIMS revealed: (i) small cone-shaped blisters with diameters of several micrometers and height of up to 300 nm are formed on W and Be-W films surface while no visible blistering occurred for the Be thin films; (ii) Be thin films are amorphous, while W thin films are highly oriented, with only (110) phase; (iii) Be-W mixed films are polycrystalline, with single or multiple phase for the two materials, depending on the content of Be in the films.
The obtained films were analysed in order to verify the gaseous thermal desorption spectroscopy (TDS) for deuterium content. The results showed N concentration around 16% for W and D concentration around 19% for Be and Be-W mixed layers, acorfing to the layer and the release temperatures were highly dependent on the layers structures.
Keywords: Reactive Magnetron Sputtering, HiPIMS, Fuel Retention
References:
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S2 L3

POWER-SCALING FROM BURRIED DEPRESSED-CLADDING WAVEGUIDES REALIZED IN Nd:YAG AND Nd:YVO_4 BY DIRECT WRITING WITH A FEMTOSECOND-LASER BEAM

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For realization of waveguide lasers a suitable method is based on the ability of a femtosecond (fs)-laser beam to induce changes of the refractive index in amorphous or crystalline media [1, 2]. Very interesting for obtaining an efficient compact laser device is the so-called 'buried depressed-cladding waveguide' [3]. In this scheme many tracks are made around a region of the material that remains unchanged; a decrease of the refractive index is obtained in the vicinity of each written track and therefore light guiding is obtained in the core with the unmodified material.

In this talk we present recent results regarding power scaling of laser emission at 1.06 □m and 1.3 □m from circular, buried depressed-cladding waveguides that were inscribed in Nd:YAG ceramic media and Nd:YVO_4 laser crystals by direct writing with a fs-laser.
Circular waveguides with 100-□m diameter (□) were inscribed in various Nd:YAG ceramics using the 'step-by-step' method [3], as well as a 'helical-moving' technique that was developed in our group. The pump was made with diode lasers in continuous-wave (cw) or quasi-cw mode.

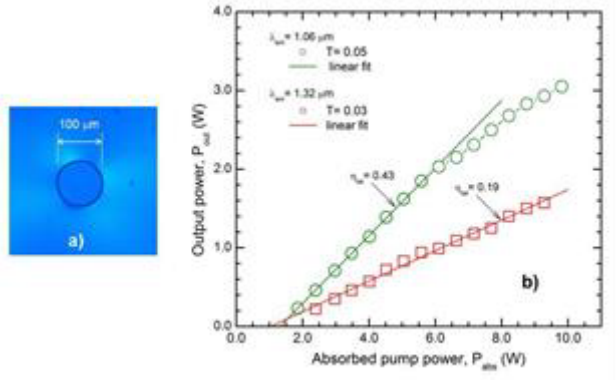

Fig. 1. a) A circular (□= 100 □m) waveguide inscribed in a 1.1-at.% Nd:YAG ceramic. **b)** P_{out} at 1.06 □m and 1.32 □m vs. P_{abs} at 808 nm. T is the out-coupling mirror transmission.

Using the pump at 807 nm, cw power of 3.1 W at 1.06 □m and 1.7 W at 1.32 □m were obtained from an waveguide inscribed by helical moving in 1.1-at.% Nd:YAG (Fig. 1). Power as high as 4.4 W at 1.06 □m and 1.7 W at 1.34 □m were obtained using the pump at 880 nm of an waveguide that was inscribed by classical technique in 0.5-at.% Nd:$YVO_{□}$. Results recorded on Nd:YAG and Nd:YVO_4 laser media with various characteristics will be presented.

These are the highest output powers obtained to date from such waveguides and show the potential of these configurations to obtain compact, efficient, diode-pumped laser sources.

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S2 L4

$SrRuO_3$ FILMS: FROM PULSED LASER DEPOSITION TO NEAR INFRARED PLASMONICS

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Plasmonic nanostructures and metamaterials can have counterintuitive optical properties, with disruptive technological potential. The plasmonic properties of ITO and doped ZnO conductive oxides are already known. New materials can further contribute to the studying and harnessing of phenomena related to the coupling between light and matter at the nanoscale, at various temperatures and under electric and/or magnetic coercive fields. $SrRuO_3$, a ferromagnetic conductive oxide, known for its thermal stability, has been used as an epitaxial electrode for superconductors and ferroelectric capacitors. To this end, a comprehensive study of $SrRuO_3$ thin films growth on different dielectric substrates by pulsed laser deposition 20 to 300 mTorr was carried out. The morphology of films grown on different substrates has been studied, with the suitability for optical applications as the main consideration[1]. Films grown on MgO were selected for further investigation due to their smoothness, and the substarte's low loss tangent and superior thermomechanical properties. A correlation between the lattice constants, resistivity, charge carrier concentration an density and the oxygen partial pressures used was observed. The dielectric constants over the visible and near infrared range of the films have been measured for the first time and linked to the observed charge carrier concentration. $SrRuO_3$ films are shown to support the propagation of surface plasmon polaritions (SPPs) in the near infrared range, with the plasma frequency in 3.16–3.86 eV range and epsilon-near-zero wavelength in 1.11–1.47 mm, which can be

controlled via the deposition conditions[2]. These films can have wide ranging applications, such as tunable Epsilon-Near-Zero (ENZ) absorbers, heat generating nanostructures and magneto-optical or electro-magneto-optical devices.

Keywords: Pulsed Laser Deposition, Strontium Ruthenate, Thin Films, Optics and Photonics
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S2 L5

COMPLEX SPACE CHARGE STRUCTURES EXCITED BY A SPHERICAL GRID CATHODE

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Complex space-charge structures like sheaths, double layers, fireballs, multiple double layers, multiple fireballs, inverted fireballs or plasma bubbles are well-known phenomena in plasma regions where local constraints are applied, often in form of a localized electric field, pulling the system away from thermodynamic equilibrium. The dynamics of such structures give rise to different plasma instabilities, involving complex oscillations of the plasma param-eters or chaotic states.

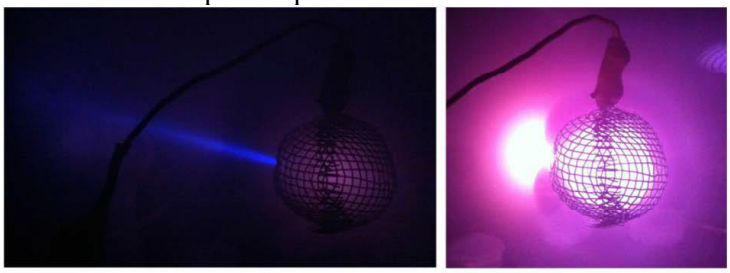

Fig. 1: Spherical grid with complex space charge structure; (a) Vg > –300 V collimated electron beam, (b) Vg = –400 V strongly diverging electron beam and fireball inside and outside the grid.

We report on investigations in a grounded metallic stainless steel chamber (90 cm length, 44 cm diameter) in a thin argon diffusion plasma at a pressure of $p = 2 \cdot 10–2$ mbar. A spherical grid of stainless steel with 6,8 cm diameter and a hole of 5 mm diameter on one side is inserted and biased negatively. For grid voltage $Vg < –$ 300 V a complex space charge struc-ture forms inside and around the grid, resembling two fireballs (Fig. 1a,b), while a significant electron beam shoots out of the hole. For $Vg = –400$ V the beam changes from a collimated shape (Fig. 1a) to a strongly di-vergent shape (Fig. 1b). By changing Vg the structure passes through different dynamic states involving chaos, quasi-periodicity, intermittency and period-doubling bifurcations, ap-pearing like a competition of different routes to chaos. Electrical probe measurements show a positive potential inside the grid with respect to the po-tential applied on it (Vg). This gives rise to a hollow cathode effect, with the inner fireball act-ing as a virtual anode. For more negative potentials, the electrons inside the grid cathode reach sufficient energy to penetrate the inner sheath near the grid, passing through the hole and giving rise to a second fireball-like structure located outside in the vicinity of the hole. This is especially well visible in Fig. 1b.

Space-resolved optical measurements highlight complex processes of excitation and ionization especially in the vicinity of the grid. These can be interpreted as being due to the electron beam performing collisions with different electron populations. The plasma emission spectrum and spectral lines correspond to various exited atoms and ions.

Work supported by the CEEPUS Network AT-0063 and the bilateral Scientific-Technical Collaboration RO 07/2014 of the Austrian Exchange Service (OeAD)

S2 L6

NANOCOMPOSITE TITANIUM BASED THIN FILMS FOR PROTECTIV COATINGS IN INDUSTRIAL APPLICATIONS

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Nanocomposite materials started to be real dimensions for coating the components on production line. The challenge of this work is to find the best combination for coating the mechanical parts of components by suitable complex nanocomposites and by using innovative technology. Specifically, titanium based nanocomposites owing to their remarkable properties of the coating surfaces such as wear resistance, roughness, low friction coefficients have been synthetized and investigated in different combination and forms, such as multi-component composites. Recently, the studies proved that the dependence of the behaviour on the particle sizes can allow one to engineer their properties.

Multi-component thin films as well as single thin films were deposited using Thermionic Vacuum Arc (TVA) technology. The thin films were characterized using scanning electron microscope (SEM, Zeiss EVO 50 SEM) accompanied with energy dispersive spectrometer and transmission electron microscope (TEM, Phillips CM 120 ST, 100 kV) and AFM. The film is composed of nanoparticles very smoothly distributed of 15-30 nanometer size embedded in amorphous matrix film, and by AFM analysis in AAC mode (acoustic AC mode, „tapping“). Roughness analysis using ISO standardization methods of TiCr reveals 1.11 nm Sa roughness.

Acknowledgment This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI – UEFISCDI, project number 160/2012, PN-II-PT-PCCA-2011-3.2-1453

S2 L7

HIGH POWER LASER IRRADIATION OF MIXED BE/C/W FILMS USED IN FUSION TECHNOLOGY

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Fusion reaction, the process where two or more nuclei combine to form an heavier element is among perspective ways of producing energy. The International Experimental Reactor (ITER) for the development and the demonstration power plant (DEMO) are in a great progress in our days [1]. The plasma facing materials to be used in ITER will be tungsten (W) in the divertor area and beryllium (Be) for the inner first wall. Some tungsten coated carbon fiber composite (CFC) are still used in experiments simulating the ITER like wall.

In our study we prepared mixed Be/C/W layers possible to be formed on the inner wall tiles of the fusion reactor using thermionic vacuum arc (TVA) technology [2] and we simulated the plasma effect on films by irradiation with high power laser having wavelengths of 300, 550 and 1350 nm and a comparable energy/power density.

Ablated volume and preferential ablation of lighter elements seemed independent of the photon's energy, but rather on their number. Carbon and Be clustering and crystal formation into the amorphous coating were more effective with more energetic photons. Graphite structures were recorded for fluencies below the ablation threshold. For longer laser wavelengths, carbon atoms tend to organize in ring structures and fullerene formation was also recorded around the ablation zones. Beryllium crystals formed in the ablation zone vicinity tend to be stretched toward the film surface and toward the ablation center suggesting more defects into the formed structures for these zones.

Keywords: fusion, high power laser, TVA

Acknowledgements This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-IDPCE- 2011-3-0522

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S2 L8

NEW DEVELOPMENTS OF PLASMA POTENTIAL PROBES

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The plasma potential Φ*pl* is one of the most elusive plasma parameters as it is not easily measured. On the other hand, the knowledge of Φ*pl* is very important since its negative gradi-ent delivers the electric field, which in turn determines transport phenomena in plasmas. In particular in the edge region of magnetically confined plasmas (tokamaks, stellarators), fluc-tuations of the poloidal and radial electric field are responsible for radial particle and momen-tum losses. Φ*pl* can be determined with a cold plasma probe but not directly since the cold floating potential *Vfl* is inevitably more negative than Φ*pl*.

However, there are plasma probes with the floating potential equal or very close to the plasma potential. We have investigated and further developed two types of such probes. One is an electron emissive probe (EEP) and the other one, named Bunker Probe (BUP), is based on the principle of ion sensitive probes. In case of an EEP the plasma electron current is com-pensated by an electron emission current, for which pur-pose the probe has to be strongly heated. In case of the BUP, which works in strong magnetic fields, the major part of the electron plasma current is screened off the re-tracted probe collector by a screening tube due to the smaller electron gyro radius.

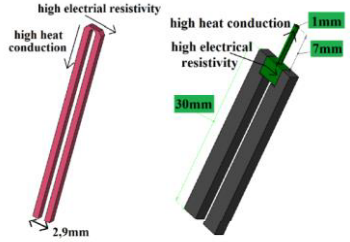

Fig. 1: A highly orientated pyrolytic graphite (HOPG) loop (a) and an indi-rectly heated pin (b).

To make an EEP sufficiently robust and emissive to be useful also in the edge region of tokamaks two types have been designed (see Fig. 1). For the construc-tion the basic properties of Highly Orientated Pyrolytic Graphite (HOPG) have been utilized. HOPG has strong-ly different electric resistivities and heat conductivities in directions perpendicular to each other as seen in Fig. 1. One is a di-rectly heated HOPG loop (Fig. 1a), the other one an indirectly heated HOPG pin (Fig. 1b).

Fig. 2: Photo of the Bunker probe (BUP).

The recently developed BUP is less sensitive to its alignment with the magnetic field ***B*** than the well-known Ball-Pen Probe [1], i.e. its floating potential should be constant and approximately Φ*pl* even for angles < 60° versus ***B*** (see Fig. 2). A BUP is composed of a graphite tube with a slit, a tilted collector inside and a thin ceramic tube for iso-lation. Tests in the Ljubljana Linear Magnetized Plasma Device have shown that the floating potential of a BUP remains close to Φ*pl* even for angles < 30° versus ***B***.

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S2 O1

THE STUDY OF EROSION PHENOMENA ON FUSION RELATED MARKER SAMPLES BY APPLYING μXRF METHOD

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Energetic particle bombardment process takes place in the fusion reactors especially on the surface of plasma facing components [1]. A primary concern is the erosion caused by different processes such as physical and chemical sputtering. Energetic projectile atoms can remove target atoms from the tiles of the first wall of the reactor if they have enough energy in order to exceed their binding energy.
By applying a non invasive method such as the microbeam X-ray fluorescence (μXRF) technique we studied the erosion pattern due to the physical sputtering effect resulted from the energy transfer between primary incident atoms and target atoms. As a particularity, the "micro-" abbreviation term stands for the lateral spatial resolution of ~25μm determined by using a polycapillary X-ray focusing element [2].
By measurements of marker samples before and after tokamak fusion plasma exposure, we can provide substantial information regarding the erosion/deposition pattern depending on factors like the location of the marker samples in the torus interior. As a result the non-invasive μXRF method can provide not only qualitative but also quantitative information (thicknesses and compositions) regarding the measured surface.
The μXRF characteristics line intensities and the thickness of deposited layer are related by measurements of samples deposited using thermoionic vacuum arc (TVA) and calibrated using quartz crystal microbalance (QCM). The calibration curve was further validated by Monte Carlo photon transport simulations.
The results are presented as 2D thickness maps of the investigated surface of plasma exposed marker samples. The measured thickness values range from couple of tens of nanometers up to 6μm for W and 20μm for Ni. These intervals are in good agreement with the thickness values found usually on the marker samples.

Keywords: fusion, plasma facing components, plasma erosion, XRF, TVA

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S2 O2

SUB-NATURAL-WIDTH *N*-RESONANCES OBSERVED IN LARGE FREQUENCY INTERVAL

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Optical systems based on *Rb* atoms, in which narrow band *N*-type resonances appear, have been extensively studied recently. Such *N*-resonances can be considered as a type of three-photon resonance where a two-photon Raman excitation (effective in case of *Rb*) is combined with a resonant optical pumping field [1,2].
Recently, in *Cs* vapor excited by fixed-frequency pump and tunable probe fields, a sub-natural-width (SNW) *N*-resonance has been observed superimposed on the probe beam absorption profile of the $F_g = 4$ hyperfine transitions (D_2 line). Three photon, bi-chromatic excitation of *Cs* vapor, contained in a 10 mm long cell with 20 Torr of neon has been performed and applied for measurement of magnetic fields over a large range [3]. For *Cs*, the pump absorption measurements [1] allow the observation of the SNW *N*-resonance on a flat background, well outside of the D_2 line spectrum [4].

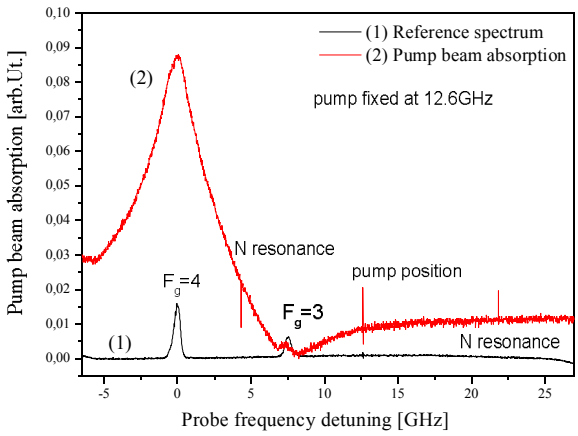

Fig. 1. Pump beam absorption spectrum shows two narrow *N*- resonances, one in the profile of $F_g = 4$ and another at the flat blackground when the pump frequency fixed at 12.6 GHz.

In this communication, we report the SNW *N*-resonances measured within or well outside the pump absorption line (Fig.1). The probe scan is over a spectral interval of more than 40 GHz. Fixing the pump frequency within this interval provides observation of: (i) enhanced-absorption SNW *N*-resonance at various frequencies, (ii) *N*-resonance couple with equal sign and well-known frequency difference, or even couple with reversed signs, i.e. enhanced or reduced absorption (Fig.1).
The richness of narrow features can be advantageous for new frequency references elaboration. Moreover, the pump absorption spectra demonstrate several new peculiarities that can be useful for study the light-atom interactions in cells with large pressure of buffer gas and different alkali atom densities.

Keywords: *N*-type resonance, sub-natural resonance, two-photon Raman process

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S2 O3

THEORETICAL INVESTIGATION OF TWO-COLOUR X-RAY LASING BY MEANS OF INNER-SHELL PHOTO-IONIZATION PUMPING SCHEME

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One of the methods for obtaining coherent X-ray pulses with photon wavelengths of the order of nanometers or less is to apply an incoherent X-ray source, such as radiation from laser-produced plasmas of high Z elements or X-ray Free Electron Lasers, on the lasing medium resulting in photo-ionization of the deep inner-shell electrons. The generated spontaneous emission arising from the selectively populated lasing states will be amplified along the plasma column created by the driving incoherent field in a single-pass configuration. We theoretically investigate the photo-ionization of deep inner-shell electrons in Argon atom using the radiation resulted from laser-produced plasma. Hydrodynamic simulation of short-pulse high-intensity lasers applied on solid targets of high Z transition metals are performed in order to output high conversion X-ray pulses with photon energy higher than 3.2keV, neccesary to photo-ionize electrons belonging to 1s shell in neutral Argon atom. Present atomic data calculations revealed that there are two main raditive decay channels responsible for depopulating the $1s^{-1}$ upper level, namely 1s-3p(3187.2eV or 0.3891nm) and 1s-2p(2953.1eV or 0.4199nm), respectively. Both the continuum and discreete photon energy distributions resulting from the hydrodynamic simulations are merged together and they are applied on the lasing medium. First, the laser gain calculations are performed within a collisional-radiative model, assuming the previously calculated photon energy distribution and a Maxwellian energy distribution for electrons, mainly accounting for photo-ionization, electron-impact ionization, autoionization and radiative decay processes. Secondly, the time-dependent gain calculations are performed adopting the semi-classical description by numerically solving the generalized Maxwell-Bloch equations(PRA 90, 063828, 2014) for the level population densities coupled with the X-ray field resulting from the spontaneous emission. Detailed pulse properties are given as output at the end of the simulation, such as number of photons, energy broadband and pulse duration. These results are usefull for choosing an optimized pumping scheme with high radiation conversion for atomic inner-shell X-ray lasing experiments.

Keywords: X-ray laser, collisional-radiative model, Maxwell-Bloch formalism
Acknowledgements: This work is partially supported by the Institute of Atomic Physics under project No. F03. Financial support under the program NUCLEU LAPLAS IV PN1647 is also acknowledged.

S2 O4

EFFECTS OF ASCORBIC ACID ON THE POLYMERIZATION OF ACRYLAMIDE BY SOLUTION PLASMA PROCESS

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Non-thermal plasma in liquid known as Solution Plasma Process continues to be having an attention simply because of its use to numerous areas of work such as nanoparticle synthesis, sterilization, decomposition of organic substances. The exact mechanism of solution plasma process is still debated. It is verified that active species for the duration of plasma processing which includes radicals, UV radiation and shock waves are generated and leading to various efficient chemical reactions. Solution plasma process presents simple and economical experimental system, operation under atmospheric pressure – room temperature for materials manufacturing. For these reasons solution plasma being a potent implementation to polymerization reactions.

In the present study, solution plasma was used for the solution polymerization of acrylamide to produce polyacrylamide up to high conversion using a capping agent (Ascorbic acid) by sequential sampling technique. The characterization of the plasma medium was determined by optical emission spectroscopy. Polyacrylamide samples were analyzed by gravimetry, UV absorption spectroscopy and capillary viscometry.

Acknowledgement
This work was supported by the research grant of the Scientific and Technological Research Council of Turkey (Türkiye Bilimsel ve Teknolojik Araştırma Kurumu - TÜBİTAK) under the Project number TÜBİTAK-115Z421 and research project coordination unit of Afyon Kocatepe University (Afyon Kocatepe Üniversitesi Bilimsel Araştırma Projeleri – BAP) under the project number ,15.FENED.ALTY.03

S2 O5

DIELECTRIC MATERIALS GROWN AS THIN FILMS BY PULSED LASER DEPOSITION

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In this work we report on the deposition and characterization of antireflective coatings from dielectric oxides for high power laser optics. The combination of dielectric materials with low and high refractive index used as thin films and/or heterostructures with antireflection properties was studied. Starting from targets of Ta_2O_5, Al_2O_3, SiO_2, and HfO_2 in a controllable oxygen atmosphere, thin layers were grown at high temperatures (600°C) by pulsed laser deposition. The deposition parameters i.e. laser wavelength, oxygen pressure, substrate temperature were varied in order to obtain antireflection coatings with low roughness and uniform thickness. In order to obtain heterostructures of HfO_2/SiO_2, Al_2O_3/SiO_2, Ta_2O_5/SiO_2, HfO_2/Al_2O_3, Ta_2O_5/Al_2O_3, all the oxide layers were investigated from morphological, structural and optical point of view.

Keywords: dielectric, thin film, laser ablation
Acknowledgements: This work has been financed by the National Authority for Research and Innovation in the frame of Nucleus programme - contract 4N/2016 and the project PN-PCCA 38/2014.

S2 O6

ANTIMICROBIAL EFFICIENCY OF CU/AG LAYERS obtained by tva DEPOSITED ON FILTERING GRIDS USED FOR SMART VENTILATION SYSTEMS

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To solve this problem of suitable living conditions with low cost and energy consumptions for inhabitants, an autonomous modular smart ventilation systems (SVS) powered by solar energy and located on the building facade was designed. This SVS has the advantage of using green energy and also obtaining natural ventilation. Due to the high risks of air transmitted diseases from outside air which contains a significant higher number of microorganisms, air filtering plays an important role in the development of SVS.

In this study, a SVS interface module, has been developed and investigated for its efficiency in microbiological filtration of processed air. The air filtration section of the module is composed of several fine stainless steel meshes which were coated with a 5μm copper and silver composite layer using the Thermionic Vacuum Arc method due to their antimicrobial properties. The samples morphological and structural properties were investigated. AFM and SEM measurements revealed the textured nature of the sample and also its high roughness. By means of XRD we have identified a inter-metallic $Cu_{0.092}$ $Ag_{0.908}$ phase. The composite atomic ratio of the obtained coatings was analysed by the method called micro-beam X-ray fluorescence (μ-XRF). The samples were exposed the air fluxes contaminated with *Staphylococcus aureus* strain. The performed tests have shown that, the presence of the uncoated grid has a small effect in air microbiological decontamination, while the Cu-Ag coated grids have a high efficiency in removal of microbiological content up to 99.99%

Keywords: Smart ventilation, Cu/Ag layers, Thermionic Vacuum Arc, Air filtration

S2 O7

STRUCTURAL AND MORPHOLOGICAL INFLUENCE ON DEUTERIUM RETENTION FOR Be-W PURE AND MIXED LAYERS EXPOSED TO LOW FREQUENCY D PLASMA

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Beryllium (Be) for the first wall and tungsten (W) for the divertor area will be used in the next generation fusion device - International Thermonuclear Experimental Reactor (ITER). In this configuration they will have to withstand high heat loads as well as high fluences of charged and neutral particles mainly hydrogen isotopes - deuterium (D) and tritium (T). These extreme conditions can alter their thermo-mechanical properties and also it is likely due to sputtering, redeposition processes and material migration to generate Be-W mixed layers which in turn will affect the functioning of ITER. Thermionic Vacuum Arc (TVA) technology was used to develop pure and composite Be-W layers for nuclear fuel retention studies.
To perform this experiment, five types of 500 nm thick layers were coated using TVA technology. Pure Be, Be-W mixed layers with controlled atomic ratio 2:1,1:1,1:2 and pure W thin films were obtained with and without ion acceleration voltage (-700V). Subsequently the samples were exposed to steady state high fluency of D ions generated by low frequency deuterium plasma. obtained between two metallic electrodes one made of a tungsten central wire and the other stainless steel external cylinder. Samples were exposed at two different energies namely low (0-35eV) and high-energy values (200eV). Structural and morphological analysis was performed before and after the samples exposure to deuterium plasma and the results showed an amorphization of the investigated layers after exposure due to the D gas inclusion. Rutherford backscattering spectrometry (RBS) analysis confirmed the Be and W atomic ratio uniformity in the mixed layers. Thermal desorption spectroscopy (TDS) measurements revealed a change in D release behavior and inventory in respect to the Be-W atomic ratio, layer morphology and D incident ion energy.

KEYWORDS: Thermonuclear fusion, Be-W layers, deuterium plasma, deuterium retention

S2 O8

NONLINEAR OPTICAL RECTIFICATION, THE SECOND AND THIRD HARMONIC GENERATION IN ASYMMETRIC DOUBLE QUANTUM WELL UNDER THE INTENSE LASER FIELD

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In this study, the effect of a non-resonant intense laser field on the optical rectification and second and third harmonic generation in asymmetric double quantum well is theoretically investigated. We calculate the

optical rectification and second and third harmonic generation within the compact density-matrix approach. The results show that the intense laser fields lead to significant changes in the coefficients of nonlinear optical rectification, second and third harmonic generation..

Keywords: Nonlinear optics, intense laser field.

S2 P1

IN VITRO BIOCOMPATIBILITY OF SI CONTAINING HIGH ENTROPY ALLOY CARBIDE COATINGS

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Considerind the superior biocompatibility of (TiZrNbTaHf)C coatings [1], in the present work we have studied the effect of the replacement of either Ti or Ta by Si. Si addition to binary or ternary carbide or nitride coatings improves their mechanical, anticorrosive and tribological properties [2]. It was reported that the presence of Si in different biomaterials determines the proliferation and differentiation of human osteoblast-like cell and accelerates the osseointegration of metallic implants [3].The coatings were deposited in an Ar+CH_4 mixed atmosphere by magnetron sputtering method on Si and 316L stainless steel substrates. The coatings, with C/metal ratios close to unity, were characterised in terms of elemental composition (Fig.1), structure (Fig.2), chemical bonds, surface topography, surface electrical charge and biocompatible characteristics. The net surface charge was evaluated at nano and macroscopic scale by measuring the electrical potential and work function, respectively. The biocompatible tests comprised determination of cell viability and cell attachment to the coated surface.

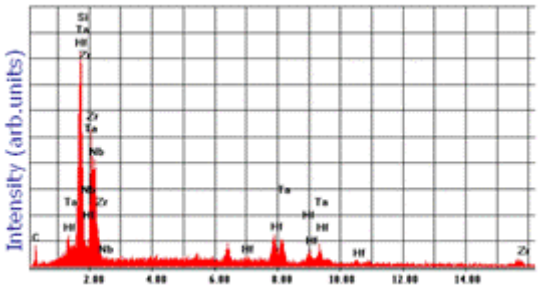

Fig.1 EDS analysis of (SiZrNbTaHf)C coating.

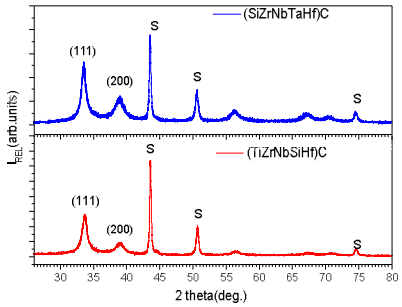

Fig. 2 Diffractograms of the coatings

It was found that Ti or Ta replacement by Si led to improved cell attachment to coating surface, the coatings presenting a more negative surface charge, as compared to the (TiZrNbTaHf)C reference coating. Considering the role of the negatively charged surfaces in cell attachment, the increased cell attachment observed was ascribed to the negative surface charge of the coatings. Consequently, either surface electrical potential or work function could be taken as relative predictors for evaluating a material from a biological point of view.

Keywords: magnetron sputtering, electrical potential,work function, in vitro biocompatibility.

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Acknowledgement: This work was supported by Grant of the Romanian National Authority for Scientific Research, CNCS-UEFISCDI, Project no. PN-II-ID-PCE-2011-3-1016.

S2 P2

CORROSION RESISTANCE AND TRIBOLOGICAL PERFORMANCE UNDER CORROSIVE CONDITIONS OF ARC DEPOSITED ZrCN AND ZrCrSiCN COATINGS

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ZrCN and ZrCrSiCN coatings, where Cr and Si are alloying elements, were deposited on Si, C45 and 316 L steel substrates by cathodic arc method in C_2H_2 and N_2 reactive atmosphere, using Zr and CrSi alloy cathodes. The coatings with a thickness of ~ 3.5 μm were investigated in terms of elemental and phase composition, microstructure, morphology, corrosion and tribological performance in 3.5 % NaCl solution. The atomic concentrations of the elements were: Zr–38.5 at. %, C–56.8 at. %, N–4.7 at. % (ZrCN) and Zr–34.8 at. %, Cr–7.8 at. %, Si–2.1 at. %, C–51.1 at. %, N–4.2 at. % (ZrCrCN). The nanoscale structured deposited coatings exhibited face-centered cubic solid solutions (Fig. 1). The addition of Cr and Si to ZrCN determined a marked reduction in crystallite size (from 9.6 to 3.8 nm), finer (glassy-like) morphology, enhanced corrosion resitance (Fig. 2, Table 1), reduced friction (Fig. 3) and improved wear performance (Fig. 3).

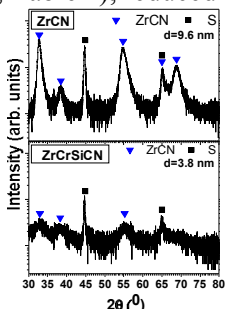

Fig. 1 XRD diffractograms

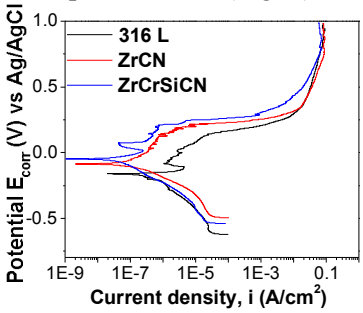

Fig. 2. Potentiodynamic polarization curves

Sample	E_{corr} (mV)	i_{corr} (μA/cm²)	R_p (x10³ Ω)
316 L	-162	1.042	70
ZrCN	-86	0.150	244
ZrCrSiCN	-37	0.023	1232

Table 1. Electrochemical parameters

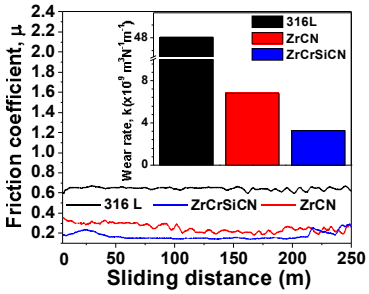

Fig. 3. Friction coefficient and wear rate

Keywords: ZrCN and ZrCrSiCN coatings, arc deposition, corrosion and tribological performance
Acknowledgements: Work supported under the grant of the Romanian National Authority for Scientific Research (CNCS – UEFISCDI), project no. PN-II-PT-PCCA-2011-3.2-1453.

S2 P3

OPTICAL BEHAVIOR OF DOPED BISMUTH FERRITE OBTAINED BY PULSED LASER DEPOSITION

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In last decade, the perovskitic materials with small band-gap have become very attractive for photovoltaic and photocatalytic applications. Multiferoic bismuth ferrite (BiFeO3-BFO) is an inorganic

chemical compound with perovskite structure with band gap value around Eg~2.71 eV. Doping bismut ferite with rare elements like Yttrium in different concentrations (3%Y, 5%Y and 10% Y) the values of bad gap decreases from 2.7eV to 1.9eV.

In this work, we report the properties of thin films of BFO and Y doped BFO deposited by pulsed laser deposition method (PLD) on different substrates such as SrTiO3, Nb doped SrTiO3, GdScO3, ITO/SiO2. A parametric study on the influence of deposition parameters on the properties of the BYFO thin layer was carried out. Crystallinity properties and topography of surface of thin films were studied using X-ray diffraction, atomic force microscopy (AFM). The optical properties were determined by spectroscopic ellipsometry (SE) and the values of band gap (Eg) where determined from Tauc plot. The photovoltaic response for different concentration of yttrium was investigated.

S2 P4

CHARACTERIZATION AND DEGRADATION BEHAVIOR OF HYBRID COATINGS OBTAINED BY MATRIX ASSISTED PULSED LASER EVAPORATION

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In this work we report on obtaining of various hybrid coatings based on syntethic copolymers (PEG-PCL) and natural compounds (Lactofferin-Lf and/ or HA) using a laser based technique: Matrix Assisted Pulsed Laser Evaporation technique (MAPLE). The deposition parameters were optimized for each element of the hybrid coatings by varying laser fluence, number of pulses and target composition. The main functional groups in the MAPLE-deposited films were determined by Fourier transform infrared spectroscopy and our data demonstrated that they are similar to the initial material. The differences in the morphology for each compound deposited by MAPLE or by the hybrid coating were analyzed using Atomic Force Microscopy, revealing smooth surfaces for the copolymer coatings and Lf , while roughness increased with more than one order of magnitude for the hybrid coatings. The degradation behaviour of the hybrid coatings was made in cell culture medium kept at a temperature of about 37 C. The degradation trend during immersion time by the changes in coating thickness and roughness were analyzed by Spectro-ellipsometry (SE) and AFM measurements.

Acknowledgments: The research leading to these results has received funding from the Romanian Ministry of National Education, CNCS – UEFISCDI, under the project PN-II-PT-PCCA 239/2014

S2 P5

THE INFLUENCE OF SYNTHESIS METHODS ON THE STRUCTURE AND MORPHOLOGY OF ZNO NANOPARTICLES

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The aim of this work is to compare different methods of ZnO nanoparticles synthesis regarding their structure and morphology in order to decide which is most suitable for specific applications. We prepared ZnO

nanoparticles through: laser pyrolyses technique (LP), laser ablation of a metallic target in aqueous solution using ultrafast high power lasers (LLA) and solid state combustion (SSC). The as-synthesized powders were investigated with: X-ray diffraction (XRD), Scanning Electron Microscopy (SEM) coupled with Energy Dispersive X-ray Spectroscopy (EDX), Atomic forced Microscopy, Raman spectroscopy and Dynamic Light Scattering (DLS), for search the capability of nanopowders to form stable colloids. The resulted information obtained from samples investigations will be used in the obtaining process of gas sensors using MAPLE method (Matrix assisted pulsed laser evaporation), in which the structure, morphology and stability of dispersions in time are essentials to obtain successfully thin films.

S2 P6

THE COMPLEX DIELECTRIC FUNCTION OF NANOSCALE $CeNi_5$ PULSED LASER DEPOSITED LAYERS

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This work presents the spectral behavior of the real ε_1 (the dielectric constant or dielectric permittivity) and imaginary ε_2 (the dielectric loss function) part of the complex dielectric function in the case of nanoscale thickness $CeNi_5$ layers. These layers were prepared using pulsed laser deposition [1] from grinded bulk powder [2]. Structural determinations and quality check of the deposited films was made using XRD in comparison with the diffraction pattern from the bulk. Absolute reflectance measurements were made for the stabilized He-Ne laser wavelength of 632.8 nm. Differential reflectance spectroscopy was used in the UV-Vis-NIR region to determine the spectral distribution of the reflectance vs. incident photon wavelength in each case. These distributions were processed in the Krames-Kronig formalism [3,4] obtaining the complex dielectric function.

The experimental results for the dielectric permittivity and the dielectric loss function were explained using theoretical considerations in the study of the inflexion points that are displayed in the spectral dependencies. These kind of determinations, computations and theoretical comparisons help to determine the electron energy density functions and the shape of the energy bands of the $CeNi_5$ compounds in the studied energy domain and their variation with the layer thickness and deposition substrate.

Keywords: UV-Vis-NIR reflectance spectroscopy, Kramers-Kronig formalism, electron energy bands.

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S2 P7

MATRIX ASSISTED PULSED LASER EVAPORATION OF TiO_2 AND ZnO 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) and zinc oxide (ZnO) 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 and ZnO/FTO electrodes depend on this parameter. The TiO_2 and ZnO 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: TiO2 and ZnO thin films, MAPLE, DSSCs.

S2 P8

SYNTHESIS AND CHARACTERIZATION OF ORGANOSILICON THIN FILMS BY PECVD

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Organosilicon thin films were deposed on Si substrates using low pressure radio-frequency capacitively coupled discharge (13.56 MHz). We used hexamethyldisiloxane (HMDSO) and oxygen gas mixtures. A dc self-bias was induced by the rf discharge and accelerated the ions towards the substrates during the whole deposition process. It was variated only the gas pressure. The deposition films were optically characterized UV-VIS and FTIR. The results showed that the optical properties are different.
Keywords: HMDSO, UV-VIS, FTIR.

S2 P9

THE EFFECT OF ELECTRIC FIELD ON THE NONLINEAR OPTICAL PROPERTİES IN ASYMMETRIC PARABOLİC QUANTUM WELL UNDER INTENSE LASER FİELD

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In this present study, we have theoretically investigated the effect of electric field on the nonlinear optical properties in asymmetric parabolic quantum well under the intense laser field. The energy levels and corresponding wave functions are calculated using the effective mass approximation and optical properties are obtained using the compact density-matrix approach. The numerical results show that the intense laser and electric fields lead to significant changes in the optical characteristics of these structures.
Keywords: Nonlinear optics, intense laser field, electric field.

S2 P10

LANGMUIR PROBE DIAGNOSTIC INSIDE GAS AGGREGATION NANOCLUSTER SOURCE

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The gas aggregation cluster sources (GAS), which use the planar magnetron as the plasma source, work with pressures higher than what are typical for magnetrons. At the conditions favourable for the formation

of nanoparticles the detailed diagnostics of plasma parameters is necessary for better understanding of their nucleation and growth.
For that purpose the special gas aggregation source with axially movable magnetron was constructed. It allows study the plasma parameters inside the aggregation chamber using Langmuir probe, optical emission spectroscopy and mass spectrometry. Outside the aggregation chamber the quartz crystal microbalance is used. The radially movable Langmuir probes together with the movable magnetron scan the plasma parameters in two dimensions – radial and axial. System is supposed to have the cylindrical symmetry.
As the target material the titanium was used. The working gas was argon. As the oxygen admixture triggers the nanoparticles production the study was performed with the flow of oxygen as parameter.
Keywords: nanoparticles, TiOx, Haberland cluster source, Langmuir probe, plasma parameters

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S2 P11

TWO-DIMENSIONAL CAVITY MAGNETOEXCITON-POLARITONS DISPERSION LAWS

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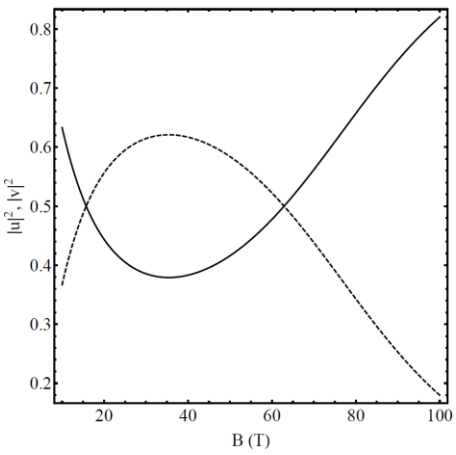
The energy spectrum of the 2D cavity magnetoexciton-polaritons has been investigated previously, using exact solutions for the Landau quantization of conduction electrons and heavy holes provided by the Rashba method [1]. Two lowest Landau quantization levels for electrons and three lowest Landau levels for heavy-holes, lead to the construction of the six lowest magnetoexciton sates. They consist of two dipole-active, two quadrupole-active, and the two forbidden quantum transitions from the ground state of the crystal to the magnetoexciton states. The interaction of the four optical-active magnetoexciton states with the cavity mode photons with a given circular polarization and with well-defined incidence direction leads to the creation of five magnetoexciton-polariton branches. The fifth order dispersion equation is examined by using numerical calculations and the second order dispersion equation is solved analytically, taking into account only one dipole-active magnetoexciton state. The effective polariton mass on the lower polariton branch, the Rabi frequency and the corresponding Hopfield coefficients are determined in dependence on the magnetic field strength, the Rashba spin-orbit coupling parameters and the electron and hole g-factors.



The dependences on the magnetic field strength B of the Hopfield coefficients square moduli $|u|^2$ and $|v|^2$ in the case of magnetoexciton state F_1 interacting with the cavity photons in the presence of the Rashba spin-orbit coupling.
Keywords: magnetoexciton, polariton, Rashba spin-orbit coupling, Hopfield coefficients.
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S2 P12

ANALYSIS ON INTERFACE OF MICRO GRAPHITE FILMS PLACED BY ELECTRICAL DISCHARGES IN PULSE CONDUCTED WITH GRAPHITE CATHODE AS TOOL ELECTRODE

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This paper presents the results of thermogravimetric analyzes, conducted on graphite films lodged by electrical discharges in pulse over metallic surfaces. It was demonstrated experimentally that the graphite films lodged by electrical discharges in pulse with graphite cathode, are changeing the surface properties of metal surfaces on which they are filed.
The thermogravimetric analyzes of the graphite films lodged by electrical discharges in pulse with graphite cathode are trying to identify the products that are obtained at the interface graphite film and metallic surface. Surface treatments performed by electrical discharges pulse with graphite cathode aim to change the the chemical composition for the metal surface on a small depth (order of microns). Thus, as the result of the surface treatments performed by electrical discharges in pulse, are obtained oxides, nitrides and salts of the metal subjected to electrical discharges in pulse.
The changings of the chemical properties of the metal surface it occurs on a depth of a few microns and it is still enough to determine the perceptible changes of its physical properties.
The electrical discharges in pulse treatment, conducted with graphite cathode, generates it seems, besides the graphite film, a host of spatial formations of carbon also, such as fullerenes, carbon nanotubes and other diamond type spatial formation of carbon which are responsible of the substantial hardness increase of the metallic surface.
Key words: Thermogravimetric analysis, electrical discharge in pulse, graphite film

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S2 P13

OPTICAL PROPERTIES OF ASYMMETRIC PARABOLIC QUANTUM WELL UNDER THE INTENSE LASER FIELD

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In this study, the effects of the intense laser field on the total absorption coefficient (the linear and third-order nonlinear) for the optical transitions between two first lower-lying electronic levels in the asymmetric parabolic $GaAs/Ga_{1-x}Al_xAs$ quantum well are investigated. The optical transitions (linear, nonlinear and total absorption coefficients) for the transitions between any two electronic energy levels were calculated by using density matrix formalism and the perturbation expansion method. Furthermore, changes in the resonant peak position and amplitude of the absorption coefficient by changing well dimensions and symmetry center of the structure as well as the intensity of the non-resonant intense laser field will be investigated.
Keywords: Parabolic Quantum well, Intense laser Field, Optical Transitions

S2 P14

HARD COATINGS WITH HIGH WETTING ANGLE

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Synthesis of metals embedded in hydrogen-free amorphous carbon (a-C) matrix, deposited by a high vacuum and free buffer gas technique, were investigated. The films with compact structure and extremely smooth surface were prepared using the Thermionic Vacuum Arc (TVA) method in one electron gun configuration, on glass and silicon substrates. The surface morphology and wettability of the obtained multifunctional thin films were investigated using: Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM) and Free Surface Energy (FSE) by See System. The morphology and the C Metal thin films influences the wettability as well as the subsequent properties. For the thin films deposited we obtained, by measuring the contact angle, a hydrophilic character of the surfaces. Also the FSE results prove how different material in combination with carbon can make changes to the surface properties

Acknowledgment This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI – UEFISCDI, project number 78/2013, PN-II-ID-PCE-2012-4-0059.

S2 P15

SYNTESIS AND CHARACTERIZATION OF THE Ti-Cr NANOCOMPOSITES DEPOSITED BY THERMIONIC VACUUM ARC METHOD

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The aim of this paper is investigate the growth and structure properties of Ti-Cr thin films deposited by Thermionic Vacuum Arc (TVA) technology in one electron gun configuration on silicon, glass and OLC 45 special substrate. The properties of the deposited Ti-Cr thin films were investigated in terms of morphology, tribology, topography and wettability. The thin films were characterized using Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM) with energy-dispersive X-ray detection and the morphology were determined from BF-TEM image performed by Philips CM 120 ST TEM system. Also, the free surface energy has been evaluated by means of Surface Energy Evaluation System (See System) using contact angle method.

Acknowledgment This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI – UEFISCDI, project number 78/2013, PN-II-ID-PCE-2012-4-0059.

S2 P16

EFFECT OF AN INTENSE LASER FIELD ON THE NONLINEAR OPTICAL RECTIFICATION AND SECOND HARMONIC GENERATION IN ASYMMETRIC DOUBLE QUANTUM WELL UNDER THE HYDROSTATIC PRESSURE AND TEMPERATURE

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In this work, the effect of an intense laser field, hydrostatic pressure and temperature on the second-harmonic generation (SHG) coefficients in asymmetric double quantum wells are studied theoretically. The eigenfunctions and the energy eigenvalues are obtained by solving Schrödinger equation within the framework of effective mass approximation. In addition, the analytic expression of SHG coefficients is acquired by using compact-density-matrix approach and iterative method. The numerical results show that both the amount of

peaks of SHG coefficients and the magnitude of peaks are significantly affected by intense laser field and hydrostatic pressure.
Keywords: Nonlinear optics, intense laser field, Hydrostatic pressure

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S2 P17

NONLINEAR TRANSITIONS IN SINGLE, DOUBLE AND TRIPLE δ-DOPED GaAs STRUCTURES

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In this study, the intersubband optical absorption coefficient and the refractive index change in single, double and triple delta-doped GaAs structure will investigate for the uniform doping distribution model. The electronic properties of the structure such as potential profile, subband energies and wave functions will be calculated by solving the Schrödinger and the Poisson equations self-consistently. Dependence on different doping wells of the intersubbands nonlinear transitions is more important for potential variations in photodetectors and optical modulators. These structures will play a key role in researches of quantum electronics and photonic devices in future.
Keywords: Nonlinear Optic, Self Consistently, Delta-doped

S2 P18

DOWN AND UP-CONVERSION PROCESSES IN Ho^{3+} and Ho^{3+}, Yb^{3+} CO - DOPED CeO_2 NANOPARTICLES

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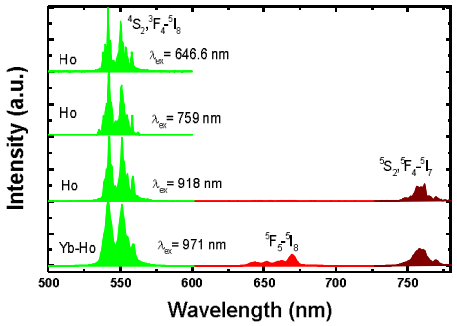

Figure 1. UPC emission spectra of Ho^{3+} and Ho^{3+}, Yb^{3+} doped CeO_2.

Lanthanide doped up – converting (nano) materials have been intensively investigated due to their exciting applications in solar cell, optical thermometry, displays, bio - imaging and theranostics [1, 2]. Here, we present an extensive characterization at 80K of the photoluminescence properties of Ho^{3+} and Ho^{3+}, Yb^{3+} co – doped CeO_2. The investigated emissions spanned a broad spectral range from blue (~ 400 nm) to near infrared (~ 1700 nm). Following excitation at ~ 646, 759, 918 and 971 nm, a green color up – conversion (UPC) emission was observed for Ho^{3+} and Ho^{3+}, Yb^{3+} co-doped CeO_2, respectively (Figure 1). The mechanisms involved in UPC emission are discussed in terms of ground state followed by excited state absorption or/and ground state followed by energy transfer.

Keywords: up-conversion, CeO_2, luminescence, lanthanide ions
References:
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Acknowledgements: IP, DA and CT acknowledge financial support from UEFISCDI, PN-II-ID-PCE-309/2011.

S2 P19

SIMPLE ALGORITHMS TO GENERATE DYNAMIC LIGHT SCATTERING TIME SERIA

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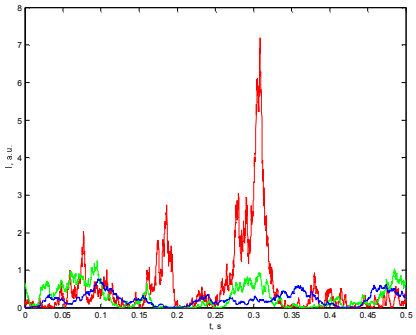
Dynamic Light Scattering (DLS) is a technique currently used in characterizing the particles in suspensions. A coherent light beam is incident on a fluid containing suspended particles. Each particle scatters light by an elastic interaction. The scattered wavelets are coherent, therefore they interfere in the far field. The aspect of the far interference field is of maxima and minima randomly distributed.



As the scattering centers undergo a complex motion, with the main component being the thermal (Brownian) motion, the scattered light presents time fluctuations. By recording the fluctuations at a certain angle a DLS time series is obtained.
It is of interest in developing and improving the DLS procedure to have an algorithm and codes to generate realistic time series. Two such algorithms were used. First the CHODIN algorithm was revisited and improved. It moves all particles in suspension simulating the thermal motion and at each step calculated the value in the time series, for the experimental setup it is simulating.
The second algorithm uses a sum of harmonic functions with random phases and amplitudes computed in such a manner to provide the power spectrum expected by the real system. The correctness of the simulated time series was verified by using a least square fitting procedure, previously described.
The figure presents two time series generated at a scattering angle of 63.43° for particles having diameters of 50, 150, and 550 nm. The algorithms are presented in detail in the extended paper.
Keywords: Dynamic Light Scattering (DLS), time series, computer simulation
References: COHERENT LIGHT SCATTERING ON NANOFLUIDS - COMPUTER SIMULATION RESULTS, Dan Chicea, Applied Optics, Vol. 47, No. 10 April 1, pp. 1434-1442, 2008.

S2 P20

PULSED LASER DEPOSITION OF SIMPLE AND REINFORCED BIOLOGICAL HYDROXYAPATITES FOR MEDICAL APPLICATIONS

Liviu DUTA[1*], Jeanina LUNGU[2], George STAN[3], Andrei POPESCU[1], Gianina POPESCU-PELIN[1], Carmen RISTOSCU[1], Faik OKTAR[4,5,6], Ion MIHAILESCU[1]

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We report on the feasibility of using hydroxyapatite (HA) from renewable biological sources (bovine or ovine bones) for the synthesis of reliable implant-type coatings by pulsed laser deposition (PLD) technique. Simple and reinforced biological HA thin films were synthesized using a KrF* excimer laser source (λ = 248 nm, $\tau_{FWHM} \leq 25$ ns, υ = 10 Hz).
The biological HA powders were calcinated according to a protocol which induces crystallization and guarantees also the full security against disease transmission and contamination. The morpho-structural properties of the films were evidenced by SEM-EDS, XRD, and FTIR spectroscopy, whilst their adherence to

the Ti substrate was evaluated by pull-out tests. The role of reinforcement upon the structure and bonding strength of the PLD coatings was also investigated.

The surface of biological HA films consisted of closely-packed spheroidal particulates with a mean diameter of ~2 μm. The origin of these particulates represents a common characteristic of the PLD process. The EDS analysis revealed a slight carbonation of the biological HA films, along with the presence of Na, Mg, Cl, and Si traces, besides the prevalent Ca and P elements. This composition is similar to that of the genuine human healthy bone. XRD and FTIR investigations evidenced the monophasic HA structure of the PLD films, with their crystallinity degree being influenced by biological origin and reinforcement type. We note that the adherence values of biological HA films were superior to the ones imposed by the international standards for application with high mechanical loads.

Due to their improved performances and low cost fabrication from renewable resources, these novel coating materials could represent a prospective competitor to synthetic HA for medical applications.

Keywords: biological hydroxyapatite, bone oligoelements, high adherence, Pulsed Laser Deposition
Acknowledgements: LD, ACP, GPP and INM acknowledge with thanks the support of the Romanian National Authority for Scientific Research and Innovation, CNCS-UEFISCDI, under the project number PN-II-RU-TE-2014-4-1570 (TE 108/2015).

S2 P21

IMPACT OF PLASMA JET SURFACE TREATMENT ON THE PROPERTIES OF POLYMERIC SURFACE FOR INDUSTRIAL APPLICATIONS

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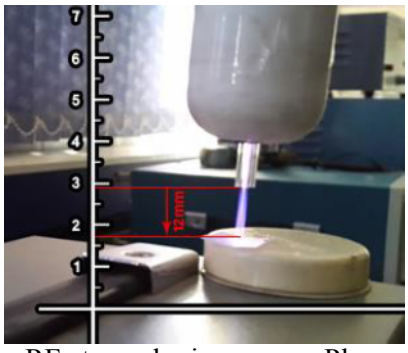

RF atmospheric pressure Plasma jet used for polymeric surface treatment.

In this paper, the effect of cold atmospheric plasma jet treatment on the PET polymeric surface properties such as morphology and surface structure, bonding and hydrophoby has been studied. The plasma jet ran by a radio frequency power supply at 36 kHz. Helium was used in atmospheric pressure as a precursor gas. Treatment time was in the range of 20-120 seconds. This surface treatment can attribute to different industrial applications. Impact of different treatment times on the structure and surface composition of the polymeric surfaces were investigated by atomic force microscope (AFM), FTIR and water contact angle measurements, respectively. Results and conclusions are presented in the full paper.

Keywords: RF atmospheric pressure plasma jet, He gas, PET surface treatment, Characterization.
Acknowledgment: The second author, S. M. Borghei acknowledges full support from the Karaj Branch of Islamic Azad University, Karaj, Iran.

S2 P22

A NONCONVENTIONAL PROCEDURE FOR DLS TIME SERIES PROCESSING

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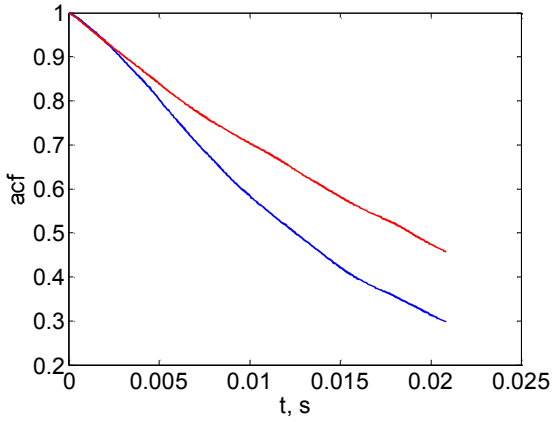
Dynamic Light Scattering (DLS) is a technique currently used in characterizing the particles in suspensions. If a coherent light beam is incident on a fluid containing suspended particles, each particle absorbs

and emits light, the scattered waves being coherent. They interfere forming a far interference field with a succession of maxima and minima randomly distributed. Due to the thermal (Brownian) motion, the scattered light presents time fluctuations, which, if recorded, form a DLS time series.

Several algorithms were used to generate time series. A neural network for fitting was designed, with one hidden layer of neurons. The autocorrelation functions of a big set of generated time series were used to train the neural network. The neural network was used later on to assess the diameter using the autocorrelation function of simulated time series, which were generated using the CHODIN code previously developed and tested. The accuracy of the procedure depends of many parameters, as the data acquisition rate and the scattering angle used in simulations. The figure presents the autocorrelation function of three time series, generated at a scattering angle of 63.43° for particles having diameters of 50, 150, and 550 nm. Details are presented in the extended paper.



Keywords: Dynamic Light Scattering (DLS), Time series, Neural Networks

References

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S2 P23

THE PHYSICAL PROPERTIES OF CHROMIUM OXIDE THIN FILMS PREPARED BY PLASMA OXYDATION OF CHORMIUM THIN FILMS

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Chromium oxide thin films due to attractive chemical, optical and electrical properties have been widely used in many fields, such as electronics, and optics. It was shown that chromium oxide thin films could be grown by variety techniques, such as e-beam evaporation, pulsed laser deposition, direct current (DC) sputtering, and radio frequency (RF) magnetron sputtering [1,2]. In this work, chromium oxide thin films were grown by plasma oxidation of chromium thin films deposited on silicon substrate by DC magnetron sputtering.

The plasma oxidation was done at different plasma powers. X-ray diffraction (XRD) analysis was performed to investigate the structural properties of the films. The XRD results show that the polycrystalline Cr_2O_3 and CrO_3 phases were formed in all prepared films and the preferred orientation was belonging to CrO_3. It was found that by increasing of oxygen plasma power the crystallinity was improved. The surface morphology and electrical properties of films were studied by atomic force microscopy (AFM) and four point probe (FPP) analysis respectively. The results exhibited the decrease in surface roughness and the increase of sheet resistivity by increasing of oxygen plasma powers.

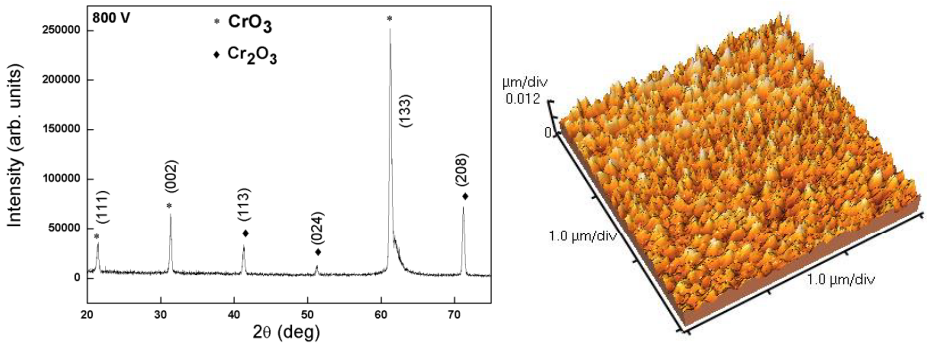

Figure. The XRD and AFM images of chromium oxide thin film grown on silicon substrate

ACKNOWLEDGEMENT

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

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S2 P24

EXPERIMENTAL STUDY OF AN ATMOSPHERIC PRESSURE PLASMA IGNITED PERIODICALLY BY HIGH VOLTAGE PULSES

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INFLPR Bucharest-Magurele

Study of an atmospheric pressure plasma generated by using a particular electrical circuit is presented. The experimental setup is shown in Fig. 1. Electrical circuit consists of two electrical voltage sources parallel connected by means of the summing circuit, Add. One of them, HVPG, is a low power very high voltage pulse generator which ignites periodically the electrical discharge between the plasma generator electrodes. The high voltage pulse generator is driven by the digital frequency synthesizer, S, allowing the control of the frequency and duty cycle of the output pulses. The second one, HVDC, is a conventional dc high voltage source sustaining the electrical discharge. Present work follows preliminary results reported in [1]. The flyback converter, whose operating point is difficult to be controlled, is replaced by a stand-alone high voltage pulse generator. The resulting voltage is applied to the plasma generator, PG. As working gas was used Ar. The whole setup and the experimental data are controlled and collected, respectively, by means of a computer. A general purpose ADC represents the interface between computer and experimental setup. The main goal of the presented work was to determine the operating conditions, i.e. amplitude, frequency and duty cycle of the high voltage pulses, for plasma jet generator, in order to optimize power consumption and plasma jet stability.

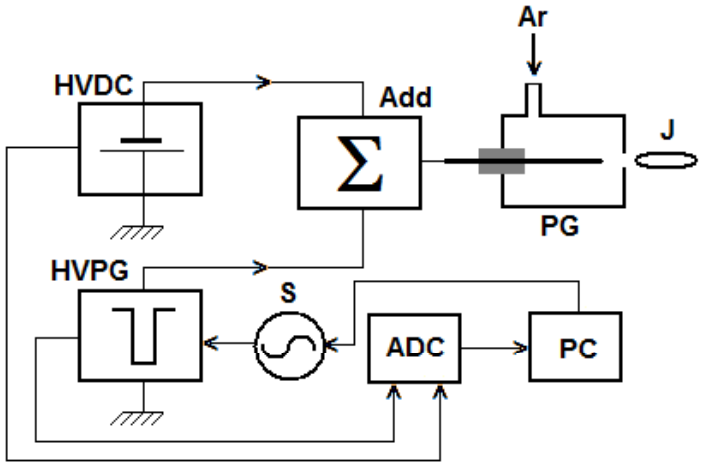

Fig. 1 Experimental setup. PG-plasma generator, J-plasma jet, Ar-working gas, HVDC-high voltage dc power supply, HVPG-high voltage pulse generator, Add-summing circuit, S-frequency synthesizer, ADC-analog to digital converter, PC-personal computer.

Keywords: plasma jet, high voltage

Aknowledgement: This work is supported by ANCSI project PN 16 47-LAPLAS IV

References:[1] O.S. Stoican, The European Physical Journal Applied Physics, 55 , 30801 (2011)

S2 P25

INCLUSION OF PALLADIUM NANOPARTICLES IN PLATINUM-NICKEL THIN FILMS

Lucian PETRĂŞESCU[1,*], Victor CIUPINĂ[2,3], Ştefan Gabriel TUTUN[1], Rodica VLĂDOIU[2], Aurelia MANDES[2], Virginia DINCA[2], Gabriel PRODAN[2], Corneliu POROŞNICU[4], Eugeniu VASILE[5], Iulian PRIOTEASA[1], Radu MANU[1]

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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 TEM analysis revealed an uniform character and a polycristalline structure of the thin film and 5-10nm sized grains are observed. The diffraction rings evidentiate the presence of nickel oxide and Pt/Pd. The electrical analysis illustrates the conductor behavior of the thin film.
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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S2 P26

STRUCTURAL AND PHOTOLUMINESCENCE OF $CuIn_xGa_{1-x}Te_2$ THIN FILMS (x=0, 0.5)

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The Cu-III-VI_2 family of semiconductor compounds (III= Ga, VI= Te) have been attracted an increasing amount of interest due to their potentials in optoelectronic and solar cell applications. $CuIn_{1-x}Ga_xTe_2$ polycrystalline thin films have been deposited onto Corning glass substrates by flash evaporation, and investigated by X-ray diffraction (XRD) for the phase structure, optical transmission to determine the band gaps.Photoluminescence spectra were recorded at 7 K and 700 mW to characterize the defects and the structural quality. The main peak as a function of composition has been studied.X-ray patterns revealed that $CuIn_{1-x}Ga_xTe_2$ films are polycrystalline in nature after annealing at temperature of 500°C with a tetragonal structure predominantly oriented along a direction perpendicular to the (112) plane. The optical properties in the near infrared and visible range [500-3000] nm were determined from spectral transmission data. Films have high absorption coefficients (4.10^4 cm^{-1}) and optical band gap ranging from1.06 eV for $CuGaTe_2$ to 1.21 eV for $Cu_{0.5}Ga_{0.5}Te_2$

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S2 P27

STUDY OF Zn/$CuIn_3Se_5$ THIN FILMS FABRICATED BY FLASH EVAPORATION

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Zn/$CuIn_3Se_5$ polycrystalline thin films have been deposited by flash evaporation on a Corning 7059 glass substrates. The films have been investigated by X-ray diffraction (XRD) for the phase structure, scanning electron microscopy, atomic force microscopy (AFM) for the morphology and optical transmission to determine the band gap. X-ray patterns revealed that Zn/$CuIn_3Se_5$ films are polycrystalline in nature with a tetragonal structure and lattice parameters a = 5.646 Å and c = 11.292 Å after annealing at temperature of 400°C. The optical properties in the near-infrared and visible range [500-2500] nm were determined from spectral transmission data. The absorption coefficient α is about 10^4 cm^{-1} and the band gap has been found around 1.292 eV.

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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

FERMI GAS MODEL APPROACHES TO STUDY OF HEAVY NUCLEI STRUCTURE

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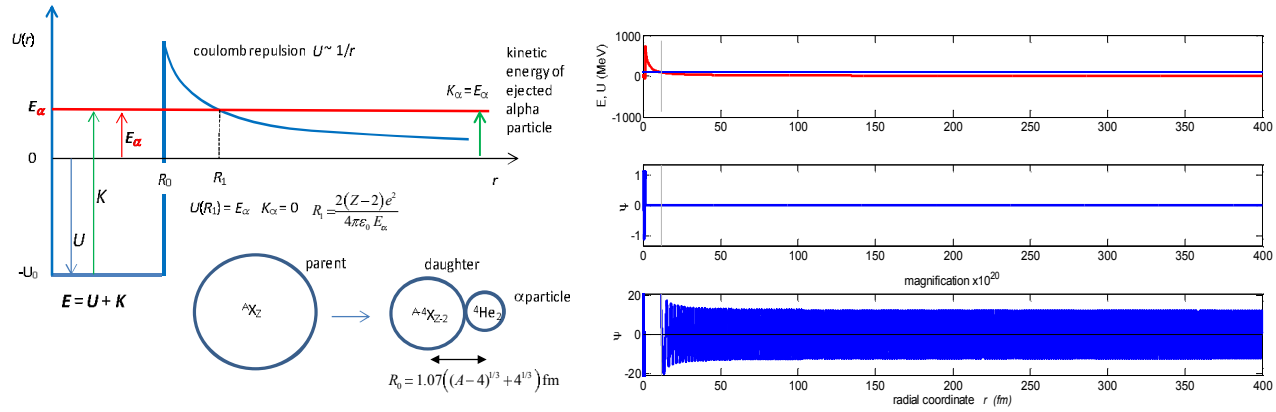
One of the methods to study of nuclear structure in heavy and super heavy regions is alpha – decay half-live. The first semi empirical relation for that reason was offered by Gieger – Nuttall as the same name law at 1911.The present study is initially restricted to even-even nuclei in the heavy mass region with N>126. And the alpha decay half life has been estimated by theoretical calculation based on the Fermi gas nuclear model. By consideration of nuclear potential as depth of nuclear well and coulomb potential as a barrier in the basis of Fermi gas mode features, the Schrodinger equation has been solved to achievement of wave function of particle in the nucleus and out of it. Since the probabilistic results which can be obtained from wave function relation, half live of alpha decay calculated theoretically. The calculation extended to deformed nuclei by changing the nuclear radius relation to $R(\theta) = R_0(1+\beta_2 Y_{20}+\beta_4 Y_{40})$ and all of the equations derived in deformed condition. The alpha decays half – lives obtained are found to be in good agreement with the experimental data.

Keyword : Alpha decay, Half-life, Fermi gas model, Schrodinger equation.



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S3 L2

MEDICAL RADIOISOTOPES
NUCLEAR PHYSICS APPLICATIONS IN MEDICINE

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The radioisotope production has nowadays a crucial role in medical diagnosis or therapy. The radionuclides were mainly produced using accelerated beams or nuclear reactors. This was done in the past only in nuclear physics facilities, but in the late years dedicated facilities were constructed. The radioisotopes are used either to precisely localize the illness or treat the illness by selectively targeting the site.

In the nuclear medicine, a branch of medicine and medical imaging, radioisotopes are used for diagnostic and therapeutic purposes. In nuclear medicine procedures, radionuclides are combined with other chemical compounds or pharmaceuticals to form radiopharmaceuticals. These radiopharmaceuticals, once administered to the patient, can preferentially localize to specific organs or cellular receptors. This property of radiopharmaceuticals allows nuclear medicine the ability to image the extent of a disease-process in the body,

based on the cellular function and physiology, rather than relying on physical changes in the tissue anatomy. Treatment of disease, based on metabolism or uptake or binding of a ligand, may also be accomplished, in this case the radiopharmaceuticals rely on the tissue-destructive power of short-range ionizing radiation.

The applications of radioisotopes in nuclear medicine require high specific activity which can be usually obtained using nuclear reactions induced by high intensity accelerated beams or neutrons coming from nuclear reactors. In this case the radioactive element is transmuted from the target isotope and can be easily separated by chemical procedures (carrier free). This method involves also high reaction cross-sections spanning from few barns to thousands of barns.

Although various imaging modalities have been used in molecular imaging, to date the majority of clinical applications are in the field of nuclear medicine. Many diagnostics applications are based on positron-emitters for 3D imaging with PET (positron emission tomography) or gamma ray emitters for 2D imaging with gamma cameras or 3D imaging with SPECT (single-photon emission computer tomography). A high sensitivity of detection systems is the main advantage of nuclear medicine methods using tracers at very low concentrations. With extremely low amounts of radiotracers and single dose administration, any biochemical effect on the organism is expected. This is desirable in a diagnostic procedure, such that normal body functions are preserved while information is collected. However, the intrinsic advantages of nuclear medicine diagnostics requires that the radiotracers have relatively high specific activity such that the injected radiotracer is not accompanied by too many stable isotopes of the same (or a chemically similar).

Keywords: radioisotopes, nuclear medicine, molecular imaging, radiotherapy
Acknowledgements PN 16420204

S3 L3

NUCLEAR STRUCTURE STUDIES USING THE ROSPHERE ARRAY

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The mixed HPGe and $LaBr_3(Ce)$ gamma detection array is a very versatile tool, allowing the measurement of the half-lives of excited nuclear states over a broad range of orders of magnitude. The array has been used in many successful experiments during the last years and one of the results was the building of a consistent international user community at the Tandem Laboratory of IFIN-HH. This lecture will provide a brief review of the most relevant experiments performed with ROSPHERE in the last years, like the study of particle-octupole states in the odd-mass Copper isotopes, the study of isospin symmetry breaking reflected in asymetric E1 transitions in mirror pairs or the spectroscopy and lifetime measurements in neutron-rich nuclei populated in transfer reactions with Li, ^{13}C and ^{18}O. One part of the lecture will be dedicated to the future development plans, which include the coupling of ROSPHERE with a large array of neutron detectors, and the experimental thematic that might be addresed following these developments.

S3 O1

XRF AND MICRO-PIXE STUDIES ON BRONZE GREEK HISTRIAN MONETARY SIGNS

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We performed compositional analyses on 180 Scythian-type arrowheads and pre-monetary signs using XRF method and on 60 small fragments (approx. 100 microns diameter), sampling being performed on previously corrosion-cleaned areas on the items surface, using micro-PIXE. The items are found in Dobroudja:

Istros-Histria region (Histria, Tariverde, Sinoe-Zmeica, Golovita and Cogealac settlements from Istros *chora* - external area mainly destinated to contacts with local population) and Floriile (autochthonous – Getae? - fortified settlement on Danube near border with Bulgaria). The most relevant for numismatists result is that for each finding place the same type of alloy was used both for fighting arrowheads and for pre-monetary signs. Our analyses suggest three types of alloys: Cu-Sn-Pb ("normal" bronze), Cu-Sn-Mn-Pb and Cu-Sn-Sb-Pb. The big problem to be solved is how antimony and manganese can be components of a copper alloy. Antimony is a component of poly-metallic geological deposits, its presence being an indicator for the use of secondary enriched sulfide ores (grey ores or fahlerz) in bronze metallurgy, ores including copper, arsenic, antimony, but also, in small quantities, silver, nickel and bismuth. The analysis performed on bronze items belonging to British Museum collections suggested antimonal bronze is found mainly in Kuban area (North-East to Black Sea), a region with a strong Scythian presence. Unless a relatively pure Cu-Sb mineral was widely available, the two most likely explanations for the compositions seen are the co-smelting of copper minerals with a relatively pure antimony mineral (e.g. stibnite, Sb_2S_3), or the addition of metallic antimony to copper. So, the most credible hypothesis concerning the use of antimonal bronze for some "arrowheads" pre-monetary signs found both in Olbia and in Histria is its Scythian provenance. The problem of ancient bronze containing manganese is more complicated. An explanation could be the use of manganese oxides as flux necessary to smelt oxidized ores. It is the case of Timna in the Sinai ores occurring in a highly siliceous gangue which must be fluxed with an iron mineral such as hematite or limonite (both often mixed with manganese oxides). Our hypothesis is a similar type of copper ores smelting in Ukraine – in the region of Nikolaev, very rich in manganese minerals – an area also known with a significant Scythian presence, but to definitely accept this hypothesis more studies will be necessary. Both antimony and manganese presence in Scythian bronze is facilitated by the use of primitive metallurgical procedures. We must outline that copper minerals from North Bulgaria and Serbia don't contain manganese or antimony.

Keywords: Histria, bronze, monetary signs, X-Ray Fluorescence

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S3 O2

FEW-BODY PHYSICS WITH ULTRACOLD POTASSIUM RUBIDIUM MIXTURES

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Within the past decade, research on ultracold atoms has moved from the investigation of their fundamental properties to the application of ultracold samples in quantum simulation and precision metrology. The ability to tailor external potentials freely and to manipulate the interaction strength within the samples has led to numerous advances in the field. In particular, mixed quantum gases have attracted considerable interest, since they offer a wealth of research opportunities. These include the creation of deeply bound dipolar molecules [1], the investigation of few-particle physics [2, 3], the observation of quantum phases in optical lattices [4] and precision measurements [5]. Such mixed quantum gasses can generally be realized by using a single atomic species in multiple quantum states, by using multiple isotopes of the same species, or by using different atomic species. Thus it is possible to realize Bose-Fermi, Bose-Bose or Fermi-Fermi mixtures. Since cooling techniques to achieve ultracold temperatures have become available for an increasing number of atomic species, this leads to a considerable number of possible mixtures. Here, we present the production of dual-species Bose-Einstein condensates of ^{39}K and ^{87}Rb. Preparation of both species in the $|F = 1, mF = -1\rangle$ state enabled us to exploit a total of three Feshbach resonances which allows for simultaneous Feshbach tuning of the ^{39}K intraspecies and the ^{39}K-^{87}Rb interspecies scattering length. Thus dual-species Bose-Einstein condensates were produced by sympathetic cooling of ^{39}K with ^{87}Rb. A dark spontaneous force optical trap was used for ^{87}Rb, to reduce the losses in ^{39}K due to light-assisted collisions in the optical trapping phase, which can be of benefit for other dual-species experiments. The tunability of the scattering length was used to perform precision spectroscopy of the interspecies Feshbach resonance located at 117.56(2) G and to determine the width of the resonance to 1.21(5) G by rethermalization

measurements. The transition region from miscible to immiscible dual-species condensates was investigated and the interspecies background scattering length was determined to 28.5 a0 using an empirical model. This paves the way for dual-species experiments with ^{39}K and ^{87}Rb BECs ranging from molecular physics to precision metrology.

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S3 O3

TIME SCALE EFFECTS AT THE TRANSITION FROM MULTI-FRAGMENTATION TO NECK-FRAGMENTATION

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We have studied the dynamical properties of the heavy-ion reactions 124Sn+64Ni and 124Xe+64Zn at beam energies of 35AMeV and 45 AMeV respectively, by performing numerical simulations within a microscopic transport model based on Landau-Vlasov transport equations. The dynamical properties of various kinematic variables is analyzed for two different parameterizations with density of the symmetry energy. For direct collisions the breaking of the target projectile is observed and the corresponding dynamical properties of the intermediate mass fragments which decouple from the target fragment have been analyzed. The study revealed that the formation of intermediate mass fragments originated from target fragment occur at late times with the corresponding isospin content closer to the isospin of the target fragment. Furthermore, the corresponding time scales associated with the two fragmentation phenomena which drives the nuclear fragmentation - dynamical emission and induced fission – are studied and the kinematic properties of the nuclear system are discussed.

S3 O4

CBM - TOF Wall, SIX SCENARIOS FOR THE INNER ZONE ARCHITECTURE

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The performance of the Multi-Gap Multi-Strip Resistive Plate Counter (MGMSRPC) prototypes developed by our group fulfil the requirements, in terms of high counting rate and track multiplicity, of the most challenging zone of the CBM-TOF (Compressed Baryonic Matter (CBM) - Time of Flight (TOF)) wall - the small polar angle region .

Based on a series of MGMSRPC prototypes designed and built in our department and tested using cosmic rays, direct beams and reaction products, a few alternative architecture for the inner zone of the CBM-TOF are considered.

The proposed design is configured in a modular structure, the basic units of this structure being called modules, each module containing a number of RPCs. An uniform coverage of the active area, with a minimization of the overlap between both counters in a given module and modules respectively is considered. In the same time this architecture has to fit with the outer region of the CBM-TOF.

Six scenarios for the inner zone architecture of CBM-TOF subdetector at FAIR/SIS100, from a cylindrical like symmetry to a planar asymmetrical one, are proposed. The different versions take into account the MGMSRPCs disposal inside the modules and of the modules in the available space inside the CBM-TOF wall architecture. The advantages and disadvantages of each configuration will be discussed. The final decision will be based on the performance of different RPC architectures, the characteristics of different versions of the proposed inner wall architecture and the available financing budget.
Keywords: FAIR, CBM-TOF Wall, Multi-Gap Multi-Strip Resistive Plate Counter (MGMSRPC)

S3 O5
ELECTROMAGNETIC DIPOLE FEATURES OF THE EVEN-EVEN ^{232}Th NUCLEUS

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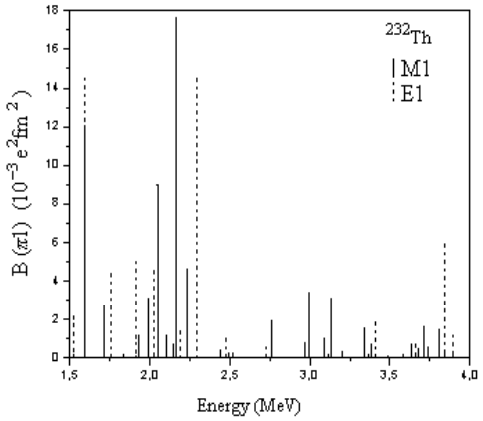

Fig 1. Comparison of the B(E1) and B(M1) values calculated within translational and rotational invariant RPA for the ^{232}Th nucleus in the energy range of the scissors mode excitations. The solid lines represent the levels with $K^{\pi}=1^{+}$ while the dashed lines represent the levels with $K^{\pi}=1^{-}$. Only states with $B(\pi 1)\geq 0.1\cdot 10^{-3} e^2fm^2$ are displayed. We present the electric dipole (π=E) and magnetic (π=M) modes with K=1

In this study, the E1 strength distributions of the even-even ^{232}Th nucleus have been studied via translational and Galilean invariant quasiparticle random-phase approximation up to neutron binding energy (PDR) and Giant Dipole Energy Regions (GDR) . Calculations are carried out for both $\Delta K=1$ and $\Delta K=0$ branches. It is also studied the effect of separation of the spurious translational states to the properties of the electric dipole 1^- states. We found that the main part (more than 60%) of the spurious state is spread over many levels and the larger admixtures being situated in interval between 6 MeV and 8 MeV below neutron threshold energy (PDR) and GDR energy regions. Besides, the comparative contribution of 1^- and 1^+- states to the total dipole transitions are investigated in the spectroscopic energy region of ^{232}Th nucleus (see Fig.1).

S3 O6
^{171}Er HALF-LIFE AND SOME ^{171}Tm TRANSITION ENERGIES MEASUREMENTS

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Erbium nuclei are bomarded with bremstrahlung photons by using clinical electron linear accelerator to perform photonuclear reactions. In this experiment, possible of neutron capture process has been observed because of emitted neutrons appearing experimental area. In this experiment, neutron capture of ^{170}Er nuclei

and after the ^{171}Er decays into the ^{171}Tm have been observed. ^{171}Er half-life and some transition energies of ^{171}Tm have been determined. The results are found in agreement with available experimental data.
Key words: Erbium, thulium, half-life, photonuclear reaction.
Acknowledgments: This research has been supported by Sinop University Scientific Research Projects Coordination Unit. Project Number: FEF-1901-14-04, 2014. The authors specials thank to Akdeniz University Nuclear Research and Application Center.

S3 O7

NEURAL NETWORK SEMI-EMPIRICAL MASS FORMULA COEFFICIENT DETERMINATION BY USING MEDIUM MASS NUCLEI

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In the liquid drop model of the atomic nuclei, the binding energies of the nuclei can be obtained by using a semi-empirical mass formula which was formulated by Weizsacker in 1935. Although the coefficients in the formula are determined by using experimental data, the formula is based on the theoretical calculations. The coefficients are updated and improved since 1935 by several methods. Determining the best coefficients for the entire region of the nuclidic chart is not possible. Besides, better results in certain areas and conditions are available. In this work, the coefficients in the semi-empirical mass formula are aimed to determine closing to the experimental values by using artificial neural network. As a mathematical method neural network mimics human brain functionality. It is very useful when standard techniques fail. According to the results, determined coefficients give binding energies of the medium mass nuclei with high accuracy.
Key words: neural network, semi-empirical formula, medium mass nuclei
Acknowledgments: This work has been supported by the Cumhuriyet University Scientific Research Council under Project No. SHMYO-008.

S3 O8

STUDY OF JET FRAGMENTATION FUNCTIONS IN RELATIVISTIC NUCLEAR COLLISIONS

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One of the main objectives of the research of the relativistic nuclear collisions is the study of the nuclear matter in extreme conditions of temperature and baryonic/energy density. Under these conditions, a phase transition can occur to the quark-gluon plasma in the hot and dense fireball created in the collision. Jet quenching is one of the most promising signals of QGP formation in these collisions. In such collisions, high p_T partons pass through the colored medium and lose energy via induced gluon radiation and elastic scattering and therefore can probe the quark gluon plasma phase of the fireball evolution. The partonic energy loss in medium can be observed as a modification of the jet fragmentation function produced in heavy ion collisions. The fragmention functions for identified particles for pp collisions at LHC energies obtained using different simulation codes will be presented. The properties of the p_T and multiplicity distributions of jets will also be shown and discussed.
Keywords: relativistic heavy ion collisions, quark-gluon plasma, jet quenching

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S3 O9

NON-EQUILIBRIUM EFFECTS IN HIGH-ENERGY NUCLEAR COLLISIONS

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Invariant transverse momentum spectra obtained in relativistic nuclear collisions are analysed with Tsallis distribution. We will present the dependence of the Tsallis distribution parameters, (the system temperature and the degree of non-equilibrium), on the energy available in the collision, rapidity and collision centrality in order to get information about the properties of the system formed in the collision. The oscillations that appear in the ratio "data/Tsallis fit" as a function of transverse momentum and their depencence on the type of system (A+A vs. p+ p) collision centrality, rapidity and available energy will be also shown and discussed.
Keywords: relativistic heavy ion collisions, quark-gluon plasma, kinetic freeze-out

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S3 O10

SUMMED M1 STRENGTH OF THE SCISSORS MODE FOR NUCLEI IN THE N=82-126 MAJOR SHELL

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The low-lying orbital magnetic dipole strength in even-even nuclei of the mass region 130<A<200 is discussed using a rotational invariant Quasiparticle Random Phase Approximation (QRPA). Systematical analysis of the summed B (M1) strengths as well as the mean excitation energies of the scissors mode as a function of deformation parameters is done. The total M1 strength in the excitation energy range of 2.5-4 MeV in the investigated even-even nuclei of the mass region 130<A<200 increases proportionally to the square of the deformation parameter. These findings represent a reliable confirmation of the results recently reported for the nuclei. In contrast to summed B(M1), a weak dependence ϖ on the mass of the nucleus as $17 \cdot A^{-1/3}$ is visible. It is shown that the centers of gravity of the observed M1 strength distributions are close to 3 MeV.
Keywords: scissors mode, summed B (M1) strengths, Quasiparticle Random Phase Approximation (QRPA, deformation

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S3 O11

A MONTE CARLO STUDY OF THE EFFECTIVE SHERMAN FUNCTION FOR MOTT POLARIMETRY

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The method of Mott polarimetry is used to determine the spin-polarization of electron beams of energies up to several MeV. It is used both in basic research and numerous applications (e.g., spin-polarized scanning electron microscopy).

The method is based on measuring the azimuthal asymmetry (related to the Sherman function) in scattering of a polarized electron beam on thin targets made of heavy elements. As the measurement is performed on targets of finite thicknesses, the effective Sherman function has to be used, in which multiple interactions of the electron are accounted for. These effects cannot be calculated analytically and simulation tools must be used for modeling the passage of polarized electrons through matter. Furthermore, experimental data covering a wide range of scattering angles exist for a few energies only.

The PEBSI Monte Carlo simulation was recently upgraded towards usefulness to study the effective Sherman function. The description of Mott scattering was improved and polarization transfer in Møller scattering was included in the code.

The reliability of the simulation was proved by comparison with available experimental data for a 100 keV polarized electron beam incident on 10 — 500 nm Au targets in the scattering angle range from 20 to 160 degrees. A good agreement of the simulations with the data was found.

The angular dependence of the Sherman function was analyzed from the perspective of experiment optimization. Simulation allows to exclude regions less suitable for measurement (e.g., where the Sherman function undergoes rapid changes with scattering angle). The dependence of the Sherman function on target thickness (for a given scattering angle) was also analyzed and compared to commonly used parameterizations.

Properties of the effective Sherman function were investigated with particular emphasis on effects caused by Møller scattering on electrons in the target. The angular and energy distributions of scattered electrons were studied, both for all particles and based on interaction types which took place in the target. Electrons originating from Møller scattering were found to have important impact on the effective Sherman function if low energy particles are taken into account, thus leading to significant decrease of the analyzing power of the polarimeter. Furthermore, simple dependence on target thickness is not observed anymore in this case. This effect can be avoided by imposing proper detector cuts on electron energy.

Keywords: polarized electron, Mott polarimetry, Sherman function, Monte Carlo simulation

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S3 O12

NEUTRON ACTIVATION ANALYSIS AND X-RAY BASED TECHNIQUES USED IN MATERIAL SCIENCE AND ENVIRONMENTAL STUDIES

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Experience in applying non-destructive nuclear and atomic analytical techniques in materials science and environmental studies is reviewed. The employed techniques are: neutron activation analysis (NAA), Energy-Dispersive X-ray Fluorescence (ED-XRF), and Scanning Electron Microscopy with Energy-Dispersive X-ray Analysis (SEM-EDX).

NAA was applied at Frank Laboratory of Neutron Physics (FLNP) of Joint Institute of Nuclear Research (JINR) at Dubna, Russia, to investigate the elemental content of some metallurgical and environmental materials and the results are compared with those obtained by ED-XRF and SEM-EDX at "Dunarea de Jos" University of Galati (UDJG), their advantages and drawbacks being discussed in relation with each analyzed matrix (metallurgical slag, steel, soil).

The results of INAA and SEM-EDX techniques obtained in the frame of JINR-Romania bilateral projects between FNLP and UDJG, for the investigation of micro-composition of high purity materials such as boron nitrides and synthetic diamonds obtained at National Academy of Sciences of Belarus, in combination with their micro-structure characterization using imaging techniques SEM and X-ray Diffraction (XRD) are described. Application of SEM-EDX for the investigation of micro-composition of crystalline samples allowed the determination of impurity content in diamond samples (Al, O, Si, Ca), besides the influence of the catalyst composition of Mn-Ni-Fe and synthesis conditions on the crystallization processes and characteristics of the diamonds, including the degree of conversion of graphite to diamond, and the impact of impurity composition

on the physical and technical characteristics of diamonds. Electron microscopy highlighted the structural differences between the powder diamond samples with various grain sizes (160/125 mm, 500/400 mm, 400/315 microns and 250/200 microns), synthesized in different pressure and temperature conditions. According to neutron activation analysis, the Fe-Ni-C growth system allows to synthesize diamond powders containing less technological impurities, probably due to less crystal growth rate than the system Mn-Ni-C.

On-going work is carried out in the frame of Romanian-Russian collaboration between UDJG and JINR, by using NAA and complementary nuclear and atomic techniques for the investigation of trace constituents of complex matrices, including Atomic Absorption Spectroscopy (AAS).

Keywords: NAA; ED-XRF; SEM-EDX; complex materials.

S3 O13

TECHNOLOGY DEVELOPING FOR DECOMMISSIONING OF THE HORIZONTAL CHANNELS OF VVR-S RESEARCH REACTOR, MAGURELE - BUCHAREST ROMANIA

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The VVR-S nuclear research reactor owned by Horia Hubulei - National Institute of Physics and Nuclear Engineering (IFIN-HH), has functioned between 1957 and 1997 at a nominal thermal power of 2 MW, using low-enriched nuclear fuel (10%) type EK-10 and highly enriched fuel (36%) type S-36. The reactor designed for research and radioisotope production was permanently shut-down in 2002 after 40 years of operation.

The reactor vessel, the main component, is completely made of aluminum, cylinder-shaped with bulging bottom, with an internal diameter of 2245 mm and a height of 5700 mm in which the followings are mounted: the separator into which the nuclear fuel assemblies are introduced, tubes for control and protective rods, ionization chambers, experimental and transfer channels.

In the median plane of the core, 9 horizontal experimental channels are mounted (three with ø 60 mm and six with ø 100 mm). In the same plane, there is an opening with ø 1116 mm for inserting the mobile thermal column. To carry out the experimental works, the thermal column has an axial experimental channel with ø 120 mm, and to perform different measurements there are four vertical channels out of which two are placed in the shielding water and two in the concrete shielding. The irradiated samples are transported from the reactor to the hot cells by three channels placed in the middle vessel, two channels with ø 45 mm and the third one with ø 70 mm. The three channels join all together into one common pipe that makes the connection with the hot cells. A channel with ø 260 mm is used for the transport of the assemblies to the SNF storage facility.

Implementation of the decommissioning strategy for the VVR-S nuclear research reactor, IFIN-HH, requires knowledge of the activation and contamination levels of were occurring during operation and are maintained after stopping the installation. Neutron activated materials is by far the major contributor to the total inventory of radioactive reactor. Identifying areas activated / contaminated is an extremely useful tool for mapping the decommissioning process concrete area "clean".

For the activation profile of the concrete biological protection that surrounding the channels were executed core drilling with core drilling machines in order to:

a. to establish the type of equipment that best suited the operation of core drilling and diamond core consumption for existing concrete type in biological protection of Reactor Block;

b. taking of samples for determining the degree of activation / contamination of heavy concrete around a horizontal channel;

c. estimating the amount of water and waste water (slam) resulting from the biological protection core drilling process.

When we execute a biological reactor block coring (diameter 57 mm and depth of about 240 cm) it was using approximate 200 liters of water as a cooling agent and it given about 12 kg concrete slam.

To determine the active area of the concrete in the protection side of the block reactor were performed using machine core, in three vertical planes selected a total of 12 core drilling with the diameter of 57 mm, directed across the axis of the reactor vessel as follow):

- In the vertical plane situated between horizontal channels no. 5 and no. 6 respectively at the same distance: core no.9 - 3 m; core no.10 - 2 m; core no.11 - 1.5 m; core no.12 - 1.0 m.
- In the vertical plane situated between horizontal channels no. 8 and no. 9 respectively at the same distance: core no 7 - 0.7 m; core no. 5 - 1.14 m; core no. 6 -1.4 m; core no. 8 - 2.0 m;
- In the vertical plane situated between horizontal channels no. 9 and thermal column respectively at the same distance: core no. 13 - 3 m; core no. 14 - 2 m; core no. 15 - 1.5 m; core no. 16 - 1.0 m

Each core drilling was identified with permanent marker with a code that corresponds to the mark (number) of each core drilling executed in the reactor block. The cores ware placed in an extraction order of Ø 100mm PVC pipe cut diametrically.

Coring operations have led to identification of the one separation plan between two specific qualities of concrete:

- Light concrete (upper protection);
- Heavy concrete with scrap metal in composition 3.2 tones / m (lower protection).

Ongoing coring operations were conducted with cooling water. Coolant recirculation is achieved using a peristaltic pump Cole Parmer after the slams were settling.

Gamma spectrometric measurements were made for the other three cores extracted from the reactor biological protection in the area adjacent horizontal channel no. 9. 6 samples were taken from the core no.5, and 5 samples from each of the cores no.6 or no.7.

Given the results of gamma spectrometry and half-life, and ^{60}Co, ^{152}Eu remained the main radionuclides present in the concrete reactor building.

It was measured samples of water resulting from core drilling and identified radionuclides were: ^{137}Cs, ^{60}Co and ^{152}Eu with activity values below minimum detection activity. It was also sampled slam result in coring process; gamma spectrometric measured activity concentration was below the minimum detectable activity for ^{137}Cs, ^{60}Co, ^{152}Eu and ^{154}Eu.

Keywords: decommissioning, gamma spectrometry, activity concentration

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S3 P1

ASSESSMENT OF EFFECTIVE DOSE FROM NATURAL RADIONUCLIDES INTAKE THROUGH BREAD

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Romania is ranked the first in European Union regarding the consumption of bread, in the way that bread represents a basic food-stuff for the Romanian people. For this reason a study was carried out to investigate the level of natural radioactivity and to determine radiation doses received by human beings from the intake of bread consumption. In this paper the concentrations of ^{210}Po, ^{210}Pb, ^{238}U, ^{232}Th, ^{40}K, natural radionuclides in nine bread samples collected during 2013-2015 from Galati, Braila and Vrancea counties from Eastern Romania were determined. The concentrations of ^{210}Po and ^{210}Pb were determined after self deposition on nickel disc by gross alpha measurements. For ^{238}U and ^{232}Th the concentrations were determined by spectrophotometric measurements of arsenazo III-U^{4+} complex and arsenazo III-Th^{4+} complex, respectively. The concentrations of ^{40}K were measured by gamma-spectrometry using a NaI(Tl) detector.

The concentration in bread for ^{210}Po, ^{210}Pb, ^{238}U, ^{232}Th and ^{40}K ranged from 0.014 Bq kg^{-1} to 0.031 Bq kg^{-1}, 0.006 Bq kg^{-1} to 0.080 Bq kg^{-1}, 0.009 Bq kg^{-1} to 0.040 Bq kg^{-1}, 0.001 Bq kg^{-1} to 0.021 Bq kg^{-1}, and 10.4 Bq kg^{-1} to 31.4 Bq kg^{-1}, respectively. Based on the obtained results there were calculated the effective doses from consumption of one kg of bread. The lowest effective dose obtained (0.23 nSv kg^{-1}) was the one due to the ingestion of ^{232}Th, while the highest effective dose (194 nSv kg^{-1}) was due to the ingestion of ^{40}K.
Keywords: ^{210}Po, ^{210}Pb, ^{238}U, ^{232}Th, ^{40}K natural radionuclides; bread; Romania.

S3 P2

PIXE-PIGE TECHNIQUES USED IN ENVIRONMENTAL STUDIES

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Applications of non-destructive nuclear analytical techniques Particle-Induced X-ray Emission (PIXE) and Particle-Induced Gamma-ray Emission (PIGE) in environmental studies are described.

PIXE and PIGE ion beam techniques were applied at the 3 MV Tandetron of Horia Hulubei National Institute for Physics and Nuclear Engineering (IFIN-HH) using a 3 MeV proton beam in order to investigate the elemental content of selected environmental samples (soils, sediments, clams, aquatic plants) collected from the target border areas in Lower Danube Euroregion (Danube River, Prut River, Danube Delta) in the frame of the Romania-Ukraine-Republic of Moldova cross-border project MIS ETC 1676 (INPOLDE).

The analyses have been carried out using comparator standards of similar matrix, prepared as thick targets (IAEA and NIST standards, as well as chemical compounds of elements to be determined). The detectors used in experiments are: a) for PIXE (X-ray detection) - IGLET-X-06135-S High Purity Germanium (6 mm diameter, 6 mm depth), with a Be window of 0.0127 mm, placed inside the reaction chamber; b) for PIGE (γ-ray detection) - GEM10P4-70 High Purity Germanium (1.75 keV FWHM at 1.33 MeV of ^{60}Co), placed at 15 cm outside the reaction chamber. The elements of interest were: Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, As, Br, Rb, Sr and Pb for PIXE and F, Na, Mg, Al, Si, P, S, Cl, Cr, Mn, Fe, Cr, Co, and Cu for PIGE.

The results will be compared with those obtained by complementary atomic techniques Energy-Dispersive X-ray Fluorescence (ED-XRF), atomic absorption spectrometry (AAS) and inductively-coupled plasma optical emission spectrometry (ICP-OES) – employed at the collaborating institutions of INPOLDE network: Dunarea de Jos University of Galati, Romania, Institute of Zoology and Institute of Geology and Seismology of Academy of Sciences of Moldova, Chisinau, and Ukrainian Scientific Centre of Ecology of the Sea, Odessa, Ukraine.

The PIXE and PIGE results will complete the existing database of heavy metals and toxic elements, will permit to identify the specially affected areas and sources of pollution in RO-UA-MD border regions, as well as to establish the background concentrations for trace elements which are not of anthropogenic origin.

Keywords: PIXE; PIGE; environmental materials.

S3 P3

ENVIRONMENTAL RADIOACTIVITY ON CHITUC SANDBANK

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Regarding of the hydrographical basin, the Black Sea shows a great asymmetry because its major affluents, the Danube and Dnepr, which contribute more than half of the entire hydrological and sedimentary material flow.

Chituc is a sand bank which separates the waters of Lake Sinoe and the Black Sea. It was established at protected area of national interest [1] . Sand samples were sampled on the surface of the sand bank in order to assess the radioactivity of between Corbu village (south) and channel Periboina (north).

Samples were measured by high-resolution gamma spectrometry in the underground laboratory from Mine Unirea, Slanic-Prahova [2].

Shielded background in the underground laboratory is reduced about 4000 times compared to the unshielded background measured overground (< 2nSv/h) [3, 4].

Results show that the activity concentrations of the principal radionuclides contained in the samples are: ^{228}Ac (7.5 ÷18.7 Bq/kg), ^{226}Ra (6.2÷21.3 Bq/kg), ^{137}Cs (0.3 ÷1.53 Bq/kg) and ^{40}K (169÷362 Bq/kg).

Key words: activity concentration, high-resolution gamma spectrometry, underground laboratory

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S3 P4

NATURAL RADIONUCLIDES IN DIET AND THEIR EFFECTIVE DOSE

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Assessment of specific activity in radionuclides from diet is a way to evaluate the effective dose due to food-stuff intake. The aim of this study was to determine the specific activity of the natural radionuclides ^{40}K, ^{226}Ra, ^{210}Po, ^{210}Pb, ^{238}U and ^{232}Th in diet. Nine food samples were collected from kindergartens during 2013-2015 and analyzed.

The specific activity of ^{40}K was determined by gamma-spectrometry using a NaI(Tl) detector. The specific activity of ^{210}Po and ^{210}Pb was determined by gross alpha measurements after self deposition onto nickel disc. The specific activity of ^{226}Ra was determined by gross alpha measurements after co-precipitation. The specific activities of ^{238}U and ^{232}Th were determined by spectrophotometric measurements using Arsenazo III.

The concentration in diet for ^{40}K, ^{226}Ra, ^{210}Po, ^{210}Pb, ^{238}U, and ^{232}Th ranged from 21.2 Bq kg^{-1} to 57.9 Bq kg^{-1}, 0.014 Bq kg^{-1} to 0.048 Bq kg^{-1}, 0.019 Bq kg^{-1} to 0.091 Bq kg^{-1}, 0.007 Bq kg^{-1} to 0.065 Bq kg^{-1}, 0.025 Bq kg^{-1} to 0.198 Bq kg^{-1} and 0.004 Bq kg^{-1} to 0.051 Bq kg^{-1}, respectively. The assessment of effective dose due to intake of natural radionuclides from diet led to average value of 1.186 μSv kg^{-1} for one person. This evaluation was made for 2-7 years old children.
Keywords: : ^{40}K, ^{226}Ra, ^{210}Po, ^{210}Pb, ^{238}U, ^{232}Th natural radionuclides; diet; effective doses.

S3 P5

SPECTROMETRIC TECHNIQUES USED IN THE PRE-SCREENING STAGE OF RADIOCARBON DATING PROCESS

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The present work highlights several case studies in which molecular structure characterization methods offered additional information in establishing the age of museum materials under suspicion of being contaminated with preserving agents, but also for a series of archaeological materials for which the contamination is mostly due to environmental factors from the post-depositional stage.

Macromolecular structure characterization was performed by Fourrier Transformed Infrared and Raman spectroscopy using a Bruker Vertex 70 FT-IR spectrometer equipped with a RAM II Raman module (N2 cooled detector). FT-IR was performed in transmission mode with KBr pellets and FT-Raman with a Nd:YAG laser excitation source of 1064 nm.

Present study focuses on using spectrometric techniques to study wood, coal, graphite in order to prepare them for the pretreatment step or for checking background level contamination, which is very important in age calculation. All of these samples were dated in RoAMS Carbon-14 dating Laboratory from IFIN-HH using a latest generation 1 MV Tandetron accelerator produced by High Voltage Engineering Europe Company.

Searching for trace contaminants or museum preservatives, old wood materials were compared with modern samples. For fossil samples, we looked for oxidation products as well any form of carbon dioxide or other volatile products which can be present in aerosols in order to determine the nature of inerent contamination of the coal surface. We also studied amber to be an original AMS background alternative to traditional coals, graphite or petrified woods. Its ability to fix airborne contaminants is greatly reduced.

AMS radiocarbon dating method is based on measuring the three Carbon isotopes, namely ^{12}C, ^{13}C, ^{14}C, from the given samples in order to determine the $^{13}C/^{12}C$, $^{14}C/^{12}C$ isotopic ratios. The sensitivity of method rises to the level of 10^{-15} ($^{14}C/^{12}C$), which makes it the most sensitive mass spectrometry technique. Basically, the radiocarbon from the sample is determined by counting every ^{14}C nucleus. Moreover, AMS age determination technique covers a wide variety of samples, from modern ones, with a 10^{-12} ($^{14}C/^{12}C$) concentration, to samples that are at most 60.000 years old, with 10^{-15} ($^{14}C/^{12}C$) concentrations. The femtogram level represents a strong reason to do such kind of investigation work.

Keywords: radiocarbon dating, FT-IR and FT-Raman spectroscopy, wood

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S3 P6

ON THE RADIOACTIVITY OF LONG-LIVED ^{26}Al INDUCED IN THE CENTRAL ALUMINIUM VESSEL OF VVR-S REACTOR

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During a reactor operation, a lot of radionuclides are produced in its structural materials, as result of neutron activation of constituent elements. Fast, epithermal and thermal neutrons generate short, medium and long-lived radionuclides by interaction with internal components. The irradiation of natural aluminum ^{27}Al with fast neutrons leads to ^{26}Al formation, a long-lived radionuclide with half-life of 7.17×10^5 y, by the (n,2n) reaction. This paper presents investigation of ^{26}Al radioactivity in the central aluminium vessel of 2 MW VVR-S research nuclear reactor of IFIN HH at Magurele, in present in decommissioning process. The aluminium vessel walls have endured in 40 years of operation (113,467 h of irradiation) a neutron flux 2×10^{13} $cm^{-2}s^{-1}$. ^{26}Al activity was assessed based on the fast neutrons flux distribution in the reactor core [1] and geometry data of the aluminium vessel.

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S3 P7

SAFETY CULTURE AND RISK MANAGEMENT IN NUCLEAR ACCIDENT PREVENTION

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The project leader takes clear responsibility in improving the safety culture of the organization and understand that nuclear safety is the product of the entire management system. Best Driving Act for NPP requires full integration of risk management in the general business management. This attitude requires managers who have "special skills for nuclear businesses": discernment, knowledge and skills to manage interactions between technological, economical and human factors in a constantly changing environment.
Although unwanted, major industrial accidents, especially those resulting in loss of lives, should become turning points in the evolution of risk management, so that mistakes of the past will not be repeated; regulators

and supervisors of nuclear activities must have a more active presence in NPP-s life, encouraging safety culture events.
The nuclear plants vulnerabilities exist and may allow the occurrence of accidents caused both by natural factors (disasters can be caused by large earthquakes, floods, etc.) as well as by antropic factors (flammable materials, incomplete operating procedures, inadequate management, etc.), expressing the NPP-s inability to deal with simultaneous and combined perturbations. Although the estimated probability for the occurrence of such accidents is very low, under 10^{-6} ev/year, the nuclear disasters from US, Ukraine and Japan shows that efforts are yet to be done for a holistic analysis of nuclear risk, including intercorrelations determined by low-probability events. This way the risk management will be completed with preventive and protective measures required to ensure the operational safety to such high level that well informed public opinion become favorable to the sustainable nuclear energy.
The aim of this paper is to highlight some important aspects in NPP-s risk management, as they outcome from the analysis of the accident that occurred in March 11-16, 2011 in Japan, aspects that could help to prevent the appearance and/or escalation of the accident and in the future can contribute to the the successful improvement of risk-informed management policies.
Keywords: safety culture, vulnerability, risk-informed management, nuclear accident, hazard, initiating event.

S3 P8

THE RESUTS OF THE RADIOACTIVE WASTE SUPER-COMPACTION COMPAIGN

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The super-compaction is a process used for 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.

The main aim of the treatment of radioactive waste by super-compaction is 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.

This paper describes the results of the second radioactive waste compaction campaign performed from February to March 2016 at NIPNE DMDR Măgurele, in order to enhance the efficiency and safety of storage of radioactive waste. The radioactive waste is generated from decommissioning of WWR research reactor which belongs to NIPNE. Some of them are secondary radioactive waste generated by own treatment activities and some are coming from different licensed institutions in the country. The radioactive waste mainly consists of contaminated scrap metal, contaminated debris, protective clothes, glass, and other contaminated materials.

The paper describes the variation of the compaction factors, mass and dose rate measurements for different types of radioactive waste. The content of each radioactive waste package is taken from existing records required by the licence. The content of each final disposal package is calculated in order to meet the requirements for mass, dose rate at surface and total activity per package.

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S3 P9

PHYSICO-CHEMICAL CHARACTERIZATION OF NEUTRON AND GAMMA IRRADIATION EFFECTS ON XYLENE-MESITHYLENE MIXTURES AND RELATED COMPOUNDS

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The behavior of mesithylene-xylene mixtures in radiation fields was studied as possible candidates for cold moderators in IBR-2 reactor at Dubna. The irradiations were carried out at 30 K using reactor radiation. All studied samples became yellow after reactor radiation exposure and formation of relative high amounts (in the range of percents) of high molecular weight products (measured as evaporation residue) was observed. The optical absorption in ultraviolet of irradiated samples presented a very intense maximum at approx. 310 nm while the initial, unirradiated compound shows a maximum at 269 nm. The infrared spectra (ATR-FTIR) presented less differences between irradiated and unirradiated sample, suggesting that the structure of high molecular weight compound is rather similar to that of the initial one. Besides increased absorption due to the presence of some oxidation compounds (bands at 3400 cm^{-1}, 1750 cm^{-1}, 1100-1250 cm^{-1}, the changes observed in relative intensity of other bands in the range of 600 - 900 cm^{-1} proves also the existence of radiation-induced degradation of these molecules. The chemical composition of the irradiated fluid after polymer extraction was analyzed by gas chromatography and compared to that of initial one. The results showed the presence of lower and higher molecular weight soluble products resulting from C-H and C-C scissions and subsequent free radicals recombination. Irradiation with gamma irradiation proven less degradation effects in concordance with our earlier observations on polystyrene system.
Keywords: degradation, gamma, neutron, radiation

S3 P10

XRD STUDY OF CEMENT MATRICES CONTAINING RADIOACTIVE CONCENTRATE FROM THE LIQUID RADIOACTIVE WASTE TREATMENT

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Radioactive wastes are generated in a variety of physical and chemical forms, including gases, liquids and solids. The immobilization of radioactive waste in Portland cement matrix is the most used method, applied in the world by the countries developing nuclear energy programs. To respect waste acceptance criteria for disposal, the matrix must be stable in time from chemical, physical, mechanical and geometric point of view. The study of the concentrate resulted in the liquid radioactive waste processing and their behaviour during the cementation is extremely difficult because of their complexity (phase composition and structure). The aim of this work is the XRD application for the phase identification of matrix that simulates the conditioned concentrate. The chemical nature and proportion of the concentrate affect both the hydrolysis of the initial cement components and the reactions of metastable hydration constituents as well as the chemical resistance of the hardened cement system.
Keywords: Cement, radioactive waste, conditioning matrix, XRD.

S3 P11

COMPARISON STUDY OF INORGANIC CEMENTS TO THE CONDITIONING OF THE SECONDARY RADIOACTIVE WASTE

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Portland cement is currently the most widely used as a matrix for shielding and immobilization of low level radioactive waste. Performance in the long term of cement based matrix depends on the cement formulation as well as the interactions between cement and radioactive waste components. Also a comparison of Portland cement with other composite cements was made. This paper presents the results regarding the influence of cement and the concentrate content on properties of waste form cement, such as: fluidity, setting time, and compressive strength (in fresh and hardened state). A simulated concentrate and different types of cement were used in this study. The engineering properties of the resulting paste or mortar are correlated with XRD characterization data in order to obtain an optimized formula of cement based matrix.
Keywords: Cement, radioactive waste, XRD, mechanical tests.

S3 P12

STUDY OF THE MAGNETIC DIPOLE EXCITATIONS IN ^{167}Er NUCLEUS

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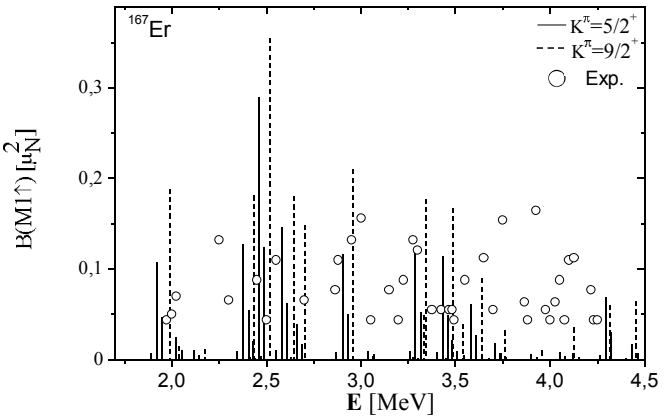

Figure. The comparison of the $M1$ strength distribution in ^{167}Er with the experimental data (Schlegel et al., 1996). Full lines and dashed lines represent the transitions to $K = K_0 - 1$ and to $K = K_0 + 1$ excitation states, respectively

A restoration method of a broken symmetry which allows self-consistent determination of the separable effective restoration forces now adapted to odd mass nuclei in order to restore violated rotational invariance (RI-) of the Quasiparticle-Phonon Nuclear Model (QPNM) hamiltonian. We calculated the Magnetic dipole (M1) strength distribution in ^{167}Er within this method using the phonon basis for ^{166}Er. We found a strong fragmentation of the M1 strength in ^{167}Er which was in qualitative agreement with the experimental data. The calculated fragmentation of the $M1$ strength in ^{167}Er is much stronger in comparison with that in ^{166}Er. It is shown that the ^{167}Er nucleus has a strong B(M1) strength structure, which corresponds to the scissors mode (in energy region between 2-4 MeV) as given by following figure.

Keywords: M1 strength, Scissors mode, QPNM, Er

Acknowledgements: This work was supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK), Grant No: 115F564 and Sakarya University Research Funds, Project No: 2012-02-02-007.

S3 P13

ION BEAM MODIFICATION OF POLYMER NANOCOMPOSITES USING AG^+ ION IMPLANTATION

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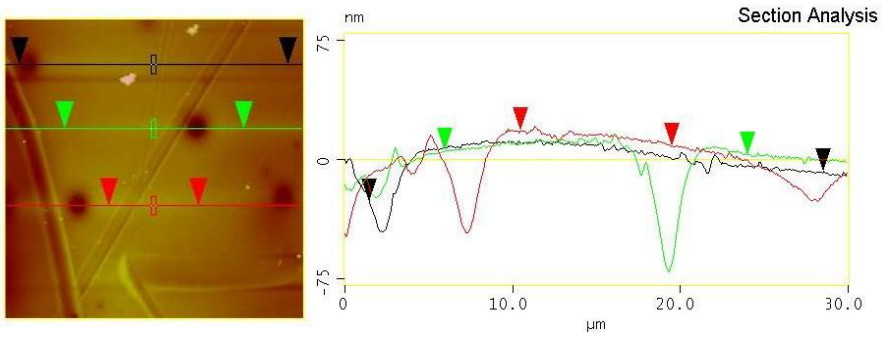
Silver-ion implantation (Ag^+) with an energy of 1.7 MeV and a dose of 2e15 ions/cm^2, at room temperature, was done at the 3 MV Tandetron^{TM} accelerator from"Horia Hulubei" National Institute for Physics and Nuclear Engineering – IFIN-HH, Magurele, Romania, on epoxy resin polymer nanocomposites. Morphology and stoichiometry of the structures was measured using AFM and RBS. AFM results indicated the presence of particles having from tens to a few hundred of nm diameter on the surfaces of the samples while the RBS gave information regarding the composition and the Ag implanted dose.



AFM height image and section analysis profile after (Ag^+) implantation; maximum implantation depth is about 75 nm; scan size 30x30 µm^2

S3 P14

THE EFFECTIVE RADIUM CONTENT AND RADON EXHALATION RATES OF THE SOIL SAMPLES FROM NİLÜFER, YILDIRIM AND GÜRSU DISTRICTS OF BURSA, TURKEY

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In this study, the so-called "Sealed Can Technique" have been used by LR-115-type II nuclear track detectors to determine effective radium content and radon exhalation rates in 60 soil samples collected from Nilüfer, Yıldırım and Gürsu districts of Bursa,Turkey. The obtained effective radium contents are found to

vary from 2.32 to 120.30 $Bqkg^{-1}$ with a mean value of 16.85 $Bqkg^{-1}$. The radon exhalation rates measured in terms of mass and area of soil samples are found to vary from 17.54-909.30 $mBqkg^{-1}h^{-1}$ with a mean value of 127.40 $mBqkg^{-1}h^{-1}$ and 0.44-22.73 $Bqm^{-2}h^{-1}$ with a mean value of 3.20 $Bqm^{-2}h^{-1}$. All the measurements show that the values of radon exhalation rate and radium content are under the safe limit recommended by Organization for Cooperation and Development. The measured activity concentrations in this study are compared with the other global measurements for different parts of the world and Turkey.

Acknowledgements: This work was supported by the Sakarya University Research Funds (SAU BAP), Project No: 2015-50-01-014.

S3 P15

PYGMY DIPOLE RESONANCE IN ^{124}SN

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In this study, quasiparticle random-phase approximation with the translational invariant Hamiltonian using spherical basis for protons and deformed axially symmetric basis for neutrons has been conducted to describe electric dipole excitations in semi-magic ^{124}Sn nucleus. The results of the summed B(E1) value of the 1^- excitations are good agreement with the experimental results. The calculations showed resonance like structure between 7-8.5 MeV energy intervals, which can be identified as pygmy dipole resonance. The results indicated that there are a few positive parity 1^+ levels that their contribution are too low in ^{124}Sn in PDR region.

Keywords: *Electric Dipole (E1), ^{124}Sn, QRPA, PDR*

S3 P16

NEUTRON FIELD INSIDE THE TR19 PET CYCLOTRON VAULT ROOM IN IFIN-HH

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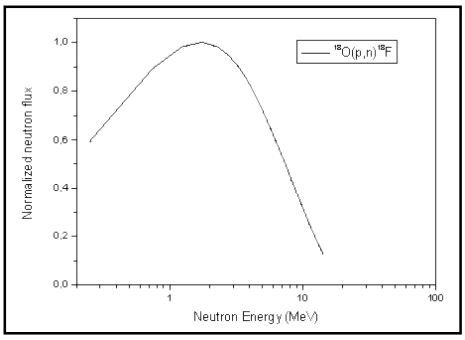
The TR19 cyclotron was commissioned in 2012 as a part of the first major project in Romania dedicated to the study of radiopharmaceuticals, both for medical imaging and targeted The accelerator (Fig. 1) was designed, custom-built and tested for IFIN-HH by Advanced Cyclotron System Inc. (ACSI), in Richmond, 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 TR-19's moveable local shielding provides easy access to any component of the cyclotron in a few minutes. The main purpose of the shielding is to reduce the neutron flux during the operation of the machine. Any shielding that will reduce the neutron flux to an acceptable level will also reduce the gamma flux. Final testing should be done using a reaction which produces a lot of neutrons. For the present study, among the possible reactions for producing radioisotopes, the neutron production during the ^{18}O(p, n)^{18}F reaction, with a

current of 50 μA, is the largest one. The characterization of the undesirable neutron field is important to define health physics programs as well as the quality of neutron shield represented by the vault room walls.

This paper presents a numerical analysis of neutron energy spectra by Monte Carlo calculations using a detailed model of cyclotron and vault room (Fig. 2).

Fig. 1. A view of TR-19 local shielding and the layout of the cyclotron vault room



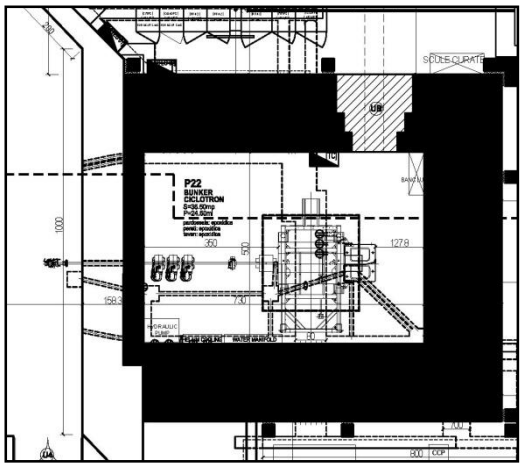


Fig. 2 Neutron spectra performed with Fluka code

Neutron energy spectra were experimental measured in different locations inside the vault room of a PET with a neutron He-3 detector.

Measured and calculated spectra, show the same behavior; neutron spectra obtained in sites close to target position shows a peak in the high energy region that is shifted to lower energies as the site is located beyond the target site, also the importance of epithermal and thermal neutrons is growing as the site is located beyond the target site where the room return effect becomes more important.

Keywords: Neutron, Fluka code, TR19 cyclotron

References:

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S3 P17

ON THE PREDICTIVE POWER OF ANN METHOD FOR RMF MODEL PARAMETERS

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Relativistic Mean Field (RMF) model is a powerful tool for predictions of various ground-state properties of nuclei such as binding energy, radii and deformation of nuclei. It is a phenomenological model and mainly its success aroused from fitting of some parameters of it from experimental data. Calculations of nuclear properties of nuclei within the framework of RMF model is achieved iteratively because of nature of this model. On the other hand, artificial neural network (ANN) method is successful in understanding the non-linear relation data. Considering this point, we have obtained RMF predictions for binding energy of some spherical nuclei by changing of RMF model parameters step by step. Thus, we have obtained data of binding energies for different parameters values. Later we have employed ANN method for this data by using experimental binding energies for obtaining of best parameters for considered nuclei. Thus we have discussed predictive power of ANN method for RMF model parameters.

Key words: Relativistic mean field model, artificial neural network method, lagrangian parameters.
Acknowledgments: This work has been supported by the Scientific Research Council of Turkey (TÜBİTAK) under Project No. 115F291.

S3 P18

THE EFFECT OF TRANSLATIONAL AND GALILEAN INVARIANCE IN GIANT DIPOLE EXCITATIONS IN ^{238}U NUCLEUS

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In this study, **t**he giant dipole resonance of the even-even ^{238}U nucleus has been studied via translational and Galilean invariant quasiparticle random phase approximation (RPA) up to Giant Dipole Energy Regions (GDR). It has been shown that the effect of taking into account the translational and Galilean invariance of the Hamiltonians in the QRPA with separation of zero energy spurious solutions are noticeable in the GDR. In order to determine the energy region where the admixtures of spurious state are of importance, we calculated the overlapping integrals between one-phonon states (with broken translational invariance) and the spurious state.

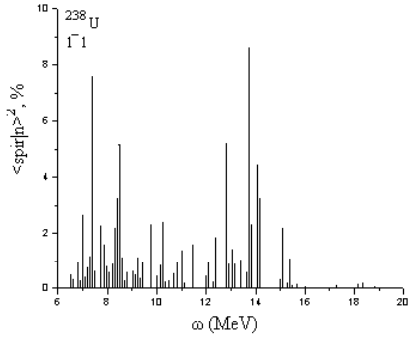

Fig.1. Distribution of the admixture of the spurious state in 1^-1 excitations calculated within rotational non-invariant model in the ^{238}U nucleus.

A typical distribution of the mean squares of the overlapping integrals with respect to the energy spectrum is shown in Fig. 1 for ^{238}U. It has been show that the main part (more than 60%) of the spurious state is spread over many levels and the larger admixtures being situated in interval between 6 MeV and 8 MeV below neutron threshold energy (PDR) and GDR energy regions. The method allows to treat more rigorously without free parameters, the properties of the electric dipole vibration mode and is used to develop the translational and Galilean invariant microscopic model of the states with spin and parity $I^{\pi} = 1^{-}$. The Goldstone mode separates out and has zero energy.

S3 P19

MICROSTRUCTURAL INVESTIGATION OF BIOGENIC FERRIHYDRITE PARTICLES USING SYNCHROTRON X-RAY RADIATION, SANS AND AFM TECHNIQUES

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The development of techniques for the synthesis of nanoparticles of well-defined size, shape and composition is a challenge and an important area of research. A promising new dimension in this field is the

use of microorganisms for the production of inorganic nanoscale particles. The clean, nontoxic and environmentally friendly ability of eukaryotic and prokaryotic microorganisms to form nanoparticles either intra- or extra-cellularly is particularly important in the development of nanobiotechnology.

In the present work structural properties of biogenic ferrihydrite particles [1, 2] produced by bacteria *Klebsiella oxytoca* are investigated by means of synchrotron X-ray radiation, SANS and TEM techniques.

Bacterium *Klebsiella oxytoca* creates different types of ferrihydrite nanoparticles as a result of variation of the growth conditions (duration, exposition to light, medium content, etc.) [3]. Earlier, it was shown that ferrihydrite nanoparticles produced by bacteria Klebsiella Oxytoca in the course of biomineralization of iron salt solutions from natural medium exhibit unique magnetic properties: they are characterized by both the antiferromagnetic order inherent in a bulk ferrihydrite and the spontaneous magnetic moment due to the decompensation of spins in sublattices of a nanoparticles. The properties of several types of these particles were identified by means of Mossbauer spectroscopy [4], static magnetic measurements analysis [5], scanning electron microscopy and small angle X-ray scattering methods [6].

Keywords: biogenic ferrihydrite particles, synchrotron X-ray radiation, SANS, AFM

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S3 P20

STRUCTURAL INVESTIGATION OF A SILICONE RUBBER/SOFT MAGNETIC CARBONYL IRON MAGNETORHEOLOGICAL ELASTOMER

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Magnetorheological (MRE) materials belong to a class of functional materials with smart behaviour, due to the fact that their physico-mechanical properties can be controlled by external magnetic fields. Magnetorheological elastomers generally consist of a natural or synthetic rubber matrix interspersed with micron-sized ferromagnetic particles. New magnetorheological elastomers containing Fe microparticles were prepared using: silicone rubber (RTV3325, Rhône-Poulenc), catalyst (60R, Rhône-Poulenc), silicone oil (Merck), and stearic acid (S4641773, Merck), soft magnetic carbonyl iron (CI) from Sigma firm with average diameter 5.0μm was used as a dispersible microparticle. Two sets of samples were prepared: (i) S1 containing 75 % silicone rubber, 20 % MR suspension, and 5 % catalyst), S2 (55 % silicone rubber, 40 % MR suspension and 5 % catalyst) and S3(35 % silicone rubber, 60 % MR suspension and 5 % catalyst); (ii) same as at item (i), but keept between the poles of a Weiss electromagnet for 24 h until Sm1, Sm2, Sm3 were obtained.

In the present work there are reported results on SANS investigation on the two series of samples for better understanding of the complex behaviour of these composite materials.

Keywords: magnetorheological elastomers, anisotropic elastomers, small angle neutron scattering

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S3 P21

APPLICATION OF X-RAY FLUORESCENCE ELEMENTAL ANALYSIS FOR MURAL PAINTING RESTORATION OF "OTETELESANU" CHURCH IN MAGURELE (PAINTED BY GH. TATTARESCU)

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Elemental composition for pigments from the mural oil painting of Church "St. Constantine and Helena", Magurele, Ilfov County, obtained using a portable X-Ray Fluorescence (XRF) spectrometer is discussed. The author of mural and icons-iconostasis painting is Gheorghe Tattarescu (1853). In the last six years a long difficult process for repairing of the Church was performed. Concerning the painting, for a correct restoration it was necessary to identify the mineral pigments used by the old master and from the eventual re-paintings. As a general rule, our investigation showed the use by Gheorghe Tattarescu of the same pigments, both for icons and for mural paintings. The chemical element predominant in all spectra in the red areas is mercury, which leads to the conclusion that the pigment is cinnabar (HgS - mercuric sulfide). In pink areas we also detected Hg together with Pb, which means cinnabar was mixed with lead white -$(PbCO_3)_2 \cdot Pb(OH)_2$. Yellow pigment was probably made from a mixture of chrome-yellow ($PbCrO_4$) and ochre (Fe based yellow ochre - $Fe_2O_3 \bullet H_2O$, - hydrated iron oxide). In the blue area where a iron-based pigment – probably Prussian blue - $Fe_7(CN)_{18} \cdot xH_2O$ was identified, we observed the presence of zinc which means a repainting with zinc white (ZnO) on the original lead white layer. Most probable, this re-painting was performed in the first quarter of 20th Century. These results have been used by the painting team led by master Silviu Petrescu to restore the Church mural painting with the same or similar pigments trying to preserve the original characteristics of Gheorghe Tattarescu work.

Keywords: X-Ray Fluorescence, pigments, mural painting, Tattarescu

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

NEUTRON TIME-OF-FLIGHT QUANTITATIVE TEXTURE ANALYSIS OF THE *MYTILUS GALLOPROVINCIALIS'* SHELLS

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[2] *Borissiak Paleontological Institute, Russian Academy of Sciences, Moscow, Russia*

Crystallographic texture traditionally was studied for the polycrystalline metallic alloys, rocks or industrial materials. Recently more and more interests are focused on the biological objects. It turns out that polycrystalline 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, could be essential in understanding of the polycrystalline biological 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.
In the present work we focused on the study of the shells of *Mytilus galloprovincialis* Lamarck, 1819 from Crimea peninsula, a shore of the Kazantip Bay, an area near the village Pesochnoe. The spectra of the shells were measured at SKAT (Ullemeyer K et al 1998, Keppler R et al 2014) spectrometer at pulsed reactor IBR-2 (Dubna, Russia). It is shown the texture changes after 40 years of the shells ashore exposition. The anisotropy has decreased. A calcite/aragonite ratio is changed. A number of aragonite is increased.
Keywords: crystallographic texture, neutron diffraction, *Mytilus galloprovincialis'* shells
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Keppler R et al 2014 Potential of full pattern fit methods for the texture analysis of geological materials: implications from texture measurements at the recently upgraded neutron time-of-flight diffractometer SKAT *Journal of Applied Crystallography* **47** 1520

S4 L2

FORECASTING ISSUES IN COHERENT TIME SERIES

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The paper assess the connectivity among time series collected in the same calendar times cycles in the upper band that contribute at most to the point-to-point variations. Such connectivity gives suitable information in the case of one step forecasting. The method relies on the theory of the complex cross coherence function (CCCF) of couples of series that may evidence connected processes embedded herein [1-2]. Particularly the phase synchronization is suitable for estimating distinct time shifts in separate frequency bands leading to subsequently disentangling the long-term business cycles from the short-term speculative transactions [3]. The time shifts are considered indicators for connectivity if there is a certain level of phase synchronization as indicated by the mutual phase coherence function (PCF). The connectivity based on time shifts is superior to other connectivity relationships since it combines two independent features, namely the coherence which measures the statistical presence of a common component in both series at a certain frequency, and the scaling of the relative phase across the band such that knowing the sense and the magnitude of the movements in the advanced series might indicate the trends in the delayed one. Apart from the particular assessment of the connectivity, the technique allows to detect time shifts smaller than the sampling period instead of integer multiples of the sampling step as usual. The method is highly sensitive to co-movements that affect equally

both series in the couple like the financial flows going with the trades. By imposing more restrictive conditions on the statistical significances of the time delays estimations, it is possible to extend the time shifts evaluations from a single pair to multiple pairs such that to achieve a chronological mapping of the band limited processes embedded in the series (see figure) [4].

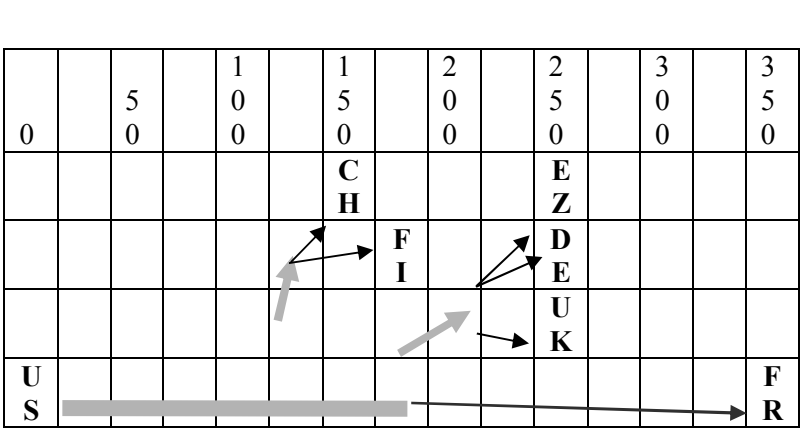

Fig.1 Chronological map of the relative time shifts among series: the case of GDPs. The codes correspond to the standard ISO-3166-1.

The revealing of such maps is of ultimate importance to disclosing spillover effects or contagion speeds that help forecasting techniques. Finally, the results are useful for developing forecasting algorithms based on Bayesian programming, or to further breakdowning the sampling period in smaller intervals such that to lay the input variables in correct time positions in the case of mixed frequency models or in the case of multivariate correlations of ARMA type.

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S4 L3

TIO_2 PHOTOCATALYTIC DEGRADATION OF COMMON ANTIBIOTICS – A DFT STUDY

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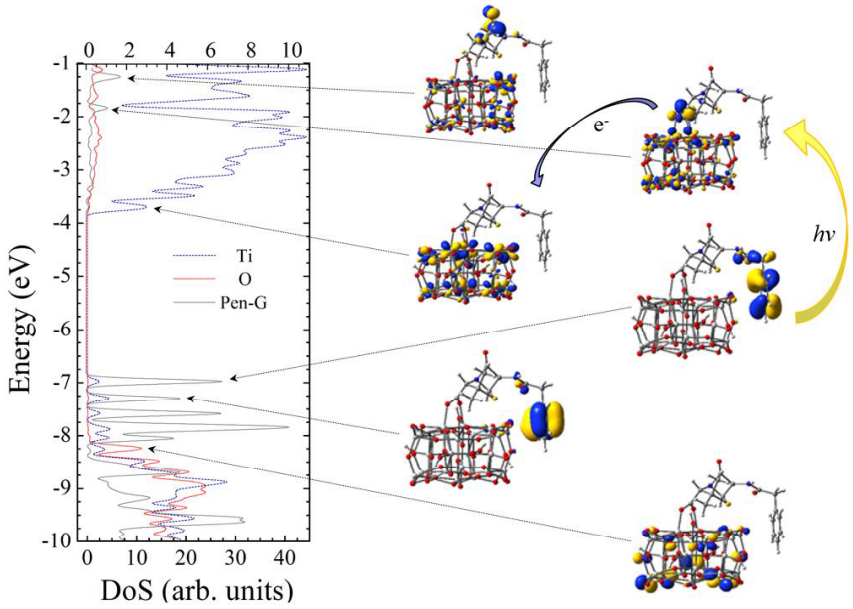
We report results of density functional theory calculations of penicillin G, penicillin V, ampicillin and amoxicillin in solution as well as adsorbed on a TiO_2 nanoclusters, in order to study the photocatalytic degradation under visible light irradiation. We analyze the absorption spectrum of the free and adsorbed penicillin, the binding configurations, the energy spectrum, and the density of states and discuss the likelihood of the charge-transfer from the pollutant to the titania substrate. We compare and contrast the photodegradation processes for the four types of antibiotics, discussing the possible mechanisms relevant for the residual water cleaning.



Density of states and electron density of key molecular orbitals of Penicillin G on TiO_2 nanoclusters.

The orbitals with mixed character, having contributions from both the antibiotic and the catalyst lead to the occurrence of weak but allowed transitions in the visible range. We suggest that such optical transitions induce the electron transfer from the pollutant to the catalyst. The extra electron may be further transferred from the semiconductor to the water molecules in solution, causing the appearance of superoxide, O_2^-, which attacks the antibiotic degrading it.

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* The financial support of UEFISCDI/CNCS through the grant PN2-ID-PCE-14/2013 is gratefully acknowledged.

S4 L4

A BIOPHYSICAL APPROACH OF PROTEIN STABILITY AND PROTEIN - LIGAND INTERACTION

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Proteins are key macromolecules in living systems, being involved in many processes, from signaling, catalysis, regulation, transport and movement. The structural stability of proteins is very sensitive to the variation in temperature, pH, ionic strength, solubility, detergents, radiations or other chemical agents. The relationship between the structure of a protein and its function is an important topic in structural biology. Protein-ligand interactions, like molecular recognition or transmission of signals, are crucial for understanding the fundamental processes occurring within living organisms. Protein functions are based on highly specific sites for the different ligands, with affinities that satisfy the needs of biological function. An important role in the regulation of biological function has the cooperativity in ligand binding, directly linked to the protein conformational change. Quantifying interaction is done using mathematical expressions based on the stoichiometry of the binding equilibrium. The equilibrium constants of protein-ligand interactions provide a thermodynamic measure of the strength of the interaction.

Spectroscopic approaches are used to monitor the stability of proteins and the protein-ligand interaction. Fourier Transform Infrared spectroscopy (FTIR), Circular Dichröism (CD), or spectrofluorimetry are

conventional techniques used to get information on the stability, secondary structure of proteins, cooperative structure transition, and protein folding or unfolding, as well as on the mechanism of protein-ligand interactions. Using calorimetric methods, the thermodynamic changes of the enthalpy (ΔH), entropy (ΔS), free energy (ΔG), and heat capacity (ΔCp) can be measured. These parameters must be understood in molecular terms and they must be correlated with the forces involved in the interaction. Two calorimetric techniques are usually used to investigate protein-ligand interactions: isothermal titration calorimetry (ITC) and differential scanning calorimetry (DSC). ITC is used to characterize the strength of the interaction and the thermodynamic fingerprint of protein-specific ligand binding. ITC allows also to monitor the protonation/deprotonation effect and to determine the number (n) of released/absorbed protons of the binding process. DSC is used for the study of protein misfolding, aggregation, stability, and ligand interaction.

An important question is: could the structure and stability of a protein be correlated to the thermodynamic properties obtained by calorimetric methods? Although nowadays, many proteins are very well characterized, both experimentally and computationally,however, the correlations between their structure and thermodynamic properties have not yet reached a reliably predictive level.

Keywords: protein stability, protein-ligand interactions, spectroscopic and calorimetric methods.

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S4 O1

GRAPHENE BASED MATERIALS AS NEW SUPPORTS FOR DEHYDROGENASE BIOSENSING PLATFORM

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NAD-dependent dehydrogenases are one the largest class of enzymes used for electroanalytical biosensing. Functioning of these biosensors is based on the monitoring of the NADH formation in the substrate conversion reaction catalyzed by these enzymes. In this work we report the use of different composite electrode materials based on poly(allyamine hydrochloride) (PAH), graphene oxide (GO)/electrochemically reduced graphene oxide (ERGO) and gold nanoparticles (AuNPs) for NADH detection. Screen-printed electrodes (SPE) modified with GO-PAH, ERGO-PAH, AuNPs-PAH, AuNPs-GO, AuNPs-ERGO, AuNPs-GO-PAH and AuNPs-ERGO-PAH were tested for NADH detection. The ERGO was obtained by direct electrochemical reduction of GO onto the electrode surface. The electrode materials were characterized by Raman spectroscopy, Scanning Electron Microscopy and UV–Vis spectrometry. The AuNPs-ERGO-PAH/SPE sensor exhibits very good analytical performances with high sensitivity of 131.0 ± 1.2 μA/ mM·cm^2 and a detection limit of 3.5 μM NADH. Selective detection of NADH in the presence of ascorbic acid, dopamine, glucose and uric acid was achieved by using differential pulse voltammetry. This approach provides a simple and effective way for fast, sensitive and reproducible detection of NADH. The AuNPs-ERGO-PAH/SPE sensing platform was exploited for development of a dehydrogenase-based biosensor by entrapment of the enzyme into the composite material.

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S4 O2

LASER BASED METHODS FOR NANO- AND MICRO-ENGINEERED BIOMATERIALS FOR REGENERATIVE MEDICAL APPLICATIONS

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In the last decades, there is an increased interest in developing strategies for improving biomaterials aiming an enhanced biological response. By using laser processing technique, polymeric surfaces used as substrate were structured as nano- and micro- surfaces that mimic natural occurring biological architecture. Laser-based method for surface modification is a promising alternative as it can be automated and is reproducible, does not generate contamination and, moreover, it can confer a variety of nano- and microstructures with increased roughness and stable characteristics for long-term bio-interaction assays. This work will provide information about how biointerfaces can influence cell fate, with a focus on their effect on stem cells and on bio-interfaces engineering using laser-based methods. In this way, various topographical depths scaling from 100 nm to 12 μm will be investigated for the topography induced cell viability, morphology and spreading changes. The number of viable cells determined by colorimetric non-radioactive cell proliferation assay performed for 18 hours revealed no cytotoxic effect onto cells.
Immunofluorescent microscopy studies of actin and vinculin proteins implicated in cellular adhesion show that cells respond to nano and microscale grooved substrate.
In conclusion , the laser engineered biomaterials with a geometrical model comparable to natural occurring biological architecture might modulate the *in vitro* response of cells.
Acknowledgments: *This work has been financed by the National Authority for Research and Innovation in the frame of Nucleus programme- contract 4N/2016 and the PN-II-PT-PCCA-2013-4-199, PN-II-RU-TE-2014-4-2434 and PN09-39*

S4 P1

THE PHYSICAL DIMENSIONS OF THE SIGN COMMUNICATION

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The clay is one of the most effective natural healing substances. The company sign or logo is an important tool for communication, impact, identification and connectivity. We have studied the influence of the different kinds of signs on the aqueous solution through examining the absorption coefficient, vibration frequency of the Lorentz oscillators, pH and the frequency of fading dipole oscillator. We have made an experiment for the explanation of the essence and the mechanisms of influence, conclusion for the meaning and the application of the sign. There are new opportunities for use of the sign in marketing management for increase of sales. The study presents the utility and mechanism of the impact of clay.

S4 P2

MINIMALLY INVASIVE SURGERY USING SEEG-GUIDED RADIO-FREQUENCY-THERMO-COAGULATION IN REFRACTORY EPILEPSY

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Introduction Radio-Frequency-Thermo-Coagulation (RFTC), a minimally invasive surgical approach, is performed at the end of video-SEEG (StereoEEG) monitoring, for patients with intractable epilepsy. Its characteristic is the fact that contacts placed in cortex area which show low voltage, fast activity or spike and wave activity ,indicate seizure onset zone (SOZ) .Electrical stimulation of the contacts can facilitate a clinical response (induce a seizure).
Method and Patients Two patients which suffered from pharmacoresistant epilepsy underwent this procedure. They presented evoked seizures by stimulating on certain electrodes. In both cases the RFCT was applied on the same electrodes that induced the seizure by stimulation.
Results After the intervention, seizure control was obtained without any neurological deficits
Discussion The best results are seen in symptomatic epilepsies due to malformations of cortical development.
Conclusion Patients with seizures which are not controlled by drugs, can benefit of RFTC only if all selection conditions are accomplished. It is important to bear in mind that lesion can be irreversible.
Keywords: Radio-Frequency-Thermo-Coagulation (RFTC), refractory epilepsy, evoked seizures, malformations of cortical development.
Acknowledgment: *Ana Gheorghiu (Ciurea) was supported by the strategic grant POSDRU/159/1.5/S/133652, "Integrated system to improve the quality of doctoral and postdoctoral research in Romania and promotion of the role of science in society" cofinanced by the European Social Found within the Sectorial Operational Program Human Resources Development 2007–2011.*

S4 P3

SEEG IN STARTLE EPILEPSY: CASE REPORT

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Startle Epilepsy, is a rare form of epilepsy in which the trigger is often a sudden and unexpected stimulus, usually sound, although visual and somatosensory stimuli, less often, could also trigger seizures. The involvement of anatomical regions (like the rolandic sensory-motor area or supplementary motor area- SMA) is usually correlated with this type of epilepsy.

Case report

We present the case of a 33 years old male, with intractable epilepsy, categorized as a startle syndrome. Seizure semiology indicated the mesial frontal region with no clear lateralization. In our case the patient did not have a visible lesion on MRI. Presurgical evaluation using depth electrodes was performed. We found an epileptogenic network including prefrontal , left medial orbitofrontal, premotor (medial and lateral),cingulate cortex (anterior and middle) and supplementary motor area (SMA) and pre-SMA. A good outcome was acquired after tailored frontal mesial resection, using accurate SEEG investigation. Histopathological analysis revealed type I focal cortical dysplasia. One year after surgery the patient was seizure-free.

Discussions and Conclusions
This is a case of startle epilepsy with a large epileptogenic network which had a good outcome after surgery. Seizure freedom and positive histopathological result confirms the fact
that we explored and removed the right structures.
Keywords: intractable epilepsy, startle syndrome, SEEG investigation , epileptogenic network.
Acknowledgment: *Ana Gheorghiu (Ciurea) was supported by the strategic grant POSDRU/159/1.5/S/133652, "Integrated system to improve the quality of doctoral and postdoctoral research in Romania and promotion of the role of science in society" cofinanced by the European Social Found within the Sectorial Operational Program Human Resources Development 2007–2011.*

S4 P4

BIOLOGICAL EQUIVALENT DOSE - THE IMPACT IN NONCONVENTIONAL HYPOFRACTION

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The biologically effective dose is a relatively modern method of accounting for the effects of fractionation on the observed effects, taking into account the different behaviour of early and late reacting tissues. The biological effect **E** of a dose of *D* Gy is:
$E=\alpha D+\beta D_2$

Hypofractionation has been proposed for a variety of cancer types, such as breast and early-stage lung cancer. Hypofractionation studies have so far been limited by their relatively short follow-up and a modest increase in dose per fraction. There is the added difficulty of establishing comparisons among different radiation techniques, hypofractionation schemes, and toxicity scales. Hypofraction radiotherapy is represented by doses of 2 Gy and above. Hypofractionation… the first thing that comes to mind when considering large dose per fraction radiation treatment is the concern for "late effects". Cell surviving fractions are determined with in vitro or in vivo techniques. Several mathematical methods of varying degrees of complexity have been developed to define the shape of cell survival curves, all based on the concept of the random nature of energy deposition by radiation. One of the simplest and most used radiobiological model is the so-called "linear quadratic" or "alpha/beta" model developed and modified by Thames, Withers, Dale, Fowler and many others. The radiobiology of normal tissues is very complex. Different organs respond differently. There is a response of a cell organization, not just a single cell. Repair of damage is important large α/β ratio, typical of tumour control, means low sensitivity to changes in fractionation. A small α/β ratio, typical of late sequelae, means large sensitivity to changes in fractionation. If α/β ratio of tumour is the same or less than that of the critical normal tissue, then a larger dose per fraction (hypofractionation) is preferred. i.e., prostate cancer, breast cancer. Over the last years, waiting lists for radiotherapy have become common in publicity health systems in many parts of the world. Hypofraction reduces the number of radiotherapy sessions. How long, then, is it reasonable for patients to wait for RT? Given that there is no theoretical reason to believe that there is a threshold below which delay is safe, we believe that it is prudent to apply the principle that delays in RT should be As Short As Reasonably Achievable, (ALARA), modeled on the ALARA principle which guides risk management in the field of radiation protection.

S4 P5

THE EVALUATION OF FOREST AREAS HEALTH LEVEL. A COMPARATIVE STUDY USING IMAGE PROCESSING AND A STATISTICAL ANALYSIS OF THE RESULTS

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The evaluation of health woodland is currently a major requirement. In the present research of our team, we managed to integrate a complete system to assess the level of afforestation and the health of forested areas. By using ortho-photomaps built specifically for this purpose, and using fractal image analysis programs, we succeeded in building a process of assessing the level of afforestation to measure the health of forest areas. It is presented as a study case the forest area of Matele- Mogos from Galati County.
Acknowledgements: this work is suported by the research grant 658/24.06.2015 - "Identifying and implementing modern methods for monitoring of forest ecosystems to assess the level of health".
Keywords: UAV, image analysis, statistical analysis

S4 P6

COMPARATIVE STUDY ON DYNAMIC PROPERTIES OF A SYSTEM OF FIXED WING TYPE

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In this paper we present a comparative study between theoretical assessments on dynamic parameters of a flying wing on one hand and experimental measurements performed in the wind tunnel on other hand. The good concordance between modeling and experimental data is a major achievement that will be used to proceed to stage of optimization of the built prototype..
Acknowledgements: this work is suported by the research grant . 606/21.01.2013 - "Identifying and implementing modern methods for monitoring of forest ecosystems to assess the level of health".
Keywords: UAV, flying wing, numerical approach, experimental

S4 P7

ORBITAL RESONANT SYSTEMS. STUDY ON THE PROBLEM OF 3 BODIES.

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The present work presents the obtained results from the numerical approach to the problem of 3 bodies in the particular cases of resonance. Numerical simulations were performed on the latest generation of HPC system. The conclusions obtained and how that imposed resonance manifests are promising and offer a new direction for research.
Acknowledgements: this work is suported by the research grant . 606/21.01.2013 - "Identifying and implementing modern methods for monitoring of forest ecosystems to assess the level of health".
Keywords: numerical approach, resonant systmes

S4 P8

MEASUREMENTS TO EVALUATE THE UTILIZATION OF INDUSTRIAL RESIDUES AS PART OF MIXTURE TO PRODUCE BRICKS 2° PHYSICAL PROPERTIES OF THE GREEN AND FIRED BRICKS OBTAINED BY CLAY AND CUBILOT SLAG MIXTURES

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Actually the environmental problems of the industries are, not to have a process that does not produce dangerous residue, but the elimination and preferably the reuse of the dangerous residue produced. In a previous paper we demonstrated the possibility to have bricks for paving utilizing a mixture cubilot slag added to clay. Moreover, was evaluate the optimization of the base mixture to prepare the slag-clay bricks. In this paper we applied the measurement techniques, following the UNI-EN-ISO rules, normally used to characterize the bricks, to define the properties of this inusual material for paving.
The cubilot slag was produced in Crotone and the clay is taked from a new mine in Rosarno, both towns are in Calabria region (Italy). The addition of the Slag to the Clay need to be less than 5% because more slag produces a deformation of the bricks due to the increasing of the inert material. In fact, the addition of slag does not modify the crystallographic composition observed by XRD diffractograms, after the firing at 1000°C, and 1100°C, because, the cubilot slag does not modify the crystallographic composition after the same firing. Just Calcium Sulfate (gypsum), Magnesium ferrites and Zinc aluminate are observed in the analysis. In the table are reported the composition of the slag and of the clay detected by Energy Dispersive Spectrometry, Electron Backscatter Diffraction (EDAX).

Table: EDAX chemical analysis of cubilot slag and of clay, % in weight.

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	MnO	ZnO	CuO	PbO	SOx	BaO	Others	Ignition loss	SiO_2/ Al_2O_3
Slag	6.72	1.05	40.24	1.39	1.39	0.18	15.48	1.12	20.21	1.33	6.14	4.09	0.66	-----	-----	5.17
Clay	55.57	18.20	6.62	4.22	2.15	2.94	1.55	0.96	-----	----	----	----	----	1.09	6.99	5.12

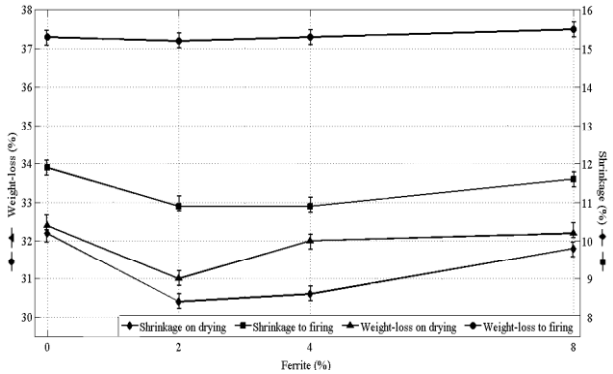

Figure 1: Shrinkage and weight loss of the slag-bricks after drying and firing.

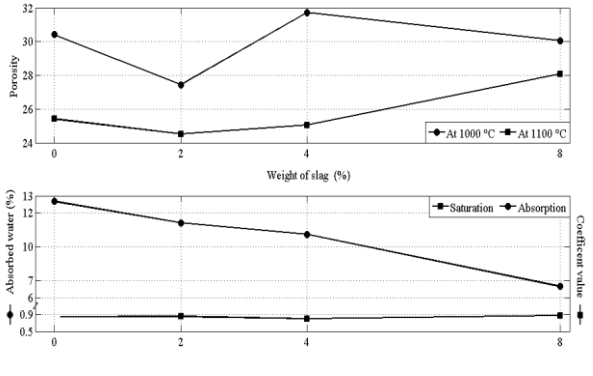

Figure 2: Porosity (a) and water absorbing parameters (b) of the slag-bricks fired at different temperature.

Figures 1 reports the variation of the shrinkage and of the weight loss, computed after the drying and the firing at 1000°C and at 1100°C. With the addition to clay of a small amount of the slag, a lightly shrinkage and weight loss reduction is observed. Figure 2a and 2b show the trend of the porosity and adsorption of water respectively. In both cases the amount of 4% of slag to the clay appear to be the best value. More slag added to the clay produce a less compaction of the bricks probably because the plasticity of the clay cannot play the right role. It is the confirmation that the amount of the slag play just a role of inert.

S4 P9

APPLICATION OF LIGHT STABLE ISOTOPE RATIOS AND ELEMENTAL PROFILE IN THE ORGANIC VEGETABLES CHARACTERIZATION

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The market of organic food and beverages has been rapidly growing over the past decade. At the same time, the Increasing demand for organically grown food, characterized also from economical point of view by premium prices, have created a financial enticement to mislabel and try to pass off cheaper conventional products as organic. The globalization of food markets, together with fast and cheap means of transportation, associated with import or export of food commodities, have resulted in the need for improved traceability systems. According EU law, traceability is defined as the "ability to track any food, feed, food-producing animal or substance that will be used for consumption, through all stages of production, processing and distribution". Thus, for successful utilization of traceability system, the certification of geographical origin and growing conditions (organic vs. conventional and field vs. greenhouse) is a must. For this reason the whole food sector demands the development of analytical strategies capable to tracing back food commodities to their production area (F. Longobardi;2011).

This work presents the isotopic and elemental profile of some Transylvanian vegetables and also the best markers association that could distinguish organic grown vegetables from those obtained through conventional agriculture. Also, the differences that appear between field and greenhouse growing vegetables are emphasise in this work.

Keywords: Vegetables, stable isotopes, elemental profile

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S4 P10

STRUCTURAL AND SPECTROPHOTOMETRIC CHARACTERIZATION OF BIOGENIC FERRIHYDRITE NANOPARTICLES

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Some spectroscopic properties of biogenic ferrihydrite nanoparticles produced by bacteria *Klebsiella oxytoca* were investigated by UV-Vis spectroscopy, FT-IR spectroscopy and fluorescence spectroscopy.

Dispersions in water and HEPES buffer of biogenic nanoparticles at different dilution were analysed by UV-Vis spectroscopy. Absorption spectra of diluted samples of the ferrihydrite nanoparticles show a large absorption in the 250 - 400 nm spectral range.
The chemical composition of biogenic ferrihydrite nanoparticles was evaluated using FT-IR spectroscopy. The FT-IR spectra revealed the typical absorption peaks characteristic to the exopolysaccharides. The exopolysaccharides can be present either on the surface and/or inside the pores of the ferrihydrite nanoparticles. Analysis on the basis of FT-IR spectroscopy shows also the characteristic peaks of amide groups present in proteins. The emission fluorescence spectroscopy does not confirm the presence of protein containing fluorescent amino acids in the sample. It is possible that some proteins to be present in the samples, but surely they do not contain fluorescent amino acids or they are in a very small quantity.
The interaction of biogenic ferrihydrite nanoparticles with human and bovine serum albumins was investigated by the mean of UV-Vis and fluorescence spectroscopies. UV-Vis spectra show a little spectral shift and a change in the optical density of the tryptophan residues from proteins, in the presence of ferrihydrite nanoparticles. This is an indication that ferrihydrite nanoparticles bind the protein site with little or moderate strength. Emission spectra show that protein-ferrihydrite nanoarticles interaction is moderate, both for human and bovine serum albumin. Thermal denaturation of albumins and of their complexes with ferrihydrite nanoparticles reveals an one step process. There is a very little stabilization of the protein structure against the denaturation in the presence of ferrihydrite nanoparticles.
Keywords: Bacterial nanoparticles, albumins-ferrihydrite nanoparticles interaction, spectroscopic methods.
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Acknowledgment: The work was accomplished with the financial support of the IUNC "Structural and spectrophotometric characterization of biogenic systems", Grants 4-1069-2009/2014 and 04-4-1121-2015/2017.

S4 P11

STUDY ON THE AIRBORNE PARTICULATE MATTER DISTRIBUTION IN TIMISOARA CITY URBAN AREA

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Air pollution describes the presence of a complex and diverse mixture of chemicals, particulate matter, or of biological material in the ambient air. Numerous studies revealed its various adverse effects, including those on human health, vegetation, agricultural crops, animals, aquatic and terrestrial ecosystems, and on the climate of earth as a whole. Among these, the most important effects of air pollution are the harm it causes to human health and its demonstrated effect on aging. Whereas statistics show that people live today longer, there is increasing observational evidence showing the opposite for those exposed to high levels of fine particulate air pollution from anthropogenic emissions, which always include nanoparticles. All these represent potent motivation to urgently search for strategies to reduce nanoparticle concentrations in the air. In Romania, although in the last two decades important steps forward were done in controlling air quality, with positive impact on the pollutants concentration in air, still remains a number of important cities, Bucureşti, Iaşi, Timişoara, Braşov and Baia Mare, where the daily limit values for airborne particulate matter are exceeded. Our work aims to contribute to the general effort of air pollution control and prevention developed in Timisoara city. Urban air quality monitorization by direct measurements was performed and the distribution of diffent classes of particulate matter is represented on suggestive maps. The resulting data represents valid indicators of major specific pollution sources and are usefull tools to support the development of more refined source-based models, analyses directed at identifying source signatures, or source apportionment methods.
Keywords: pollution, airborne particulate matter, control, monitorization

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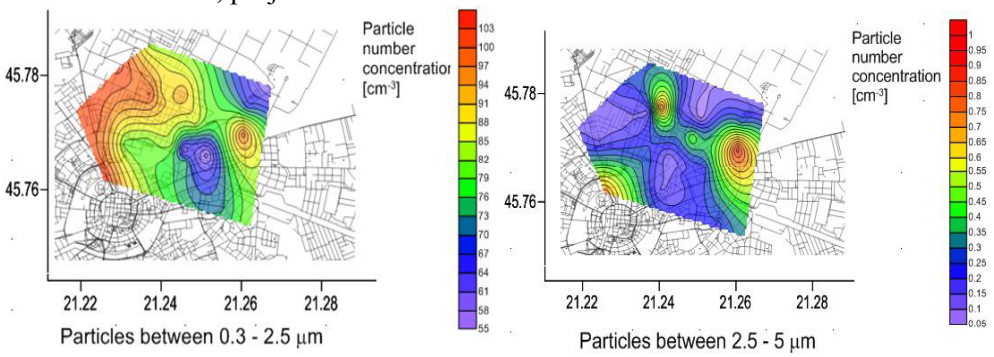

S4 P12

BURST OF SEISMICITY IN THE MARASESTI - FOSCANI REGION IN 2014-2015

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The goal of the paper is to investigate the crustal earthquake sequence generated in the East Vrancea crustal zone at the end of 2014 (22 November 2014). The main shock, occurred on 22 November 2014, 19:14 (45.86^0N, 27.16^0E, h = 39 km, M_L = 5.7), is the greatest instrumentally recorded earthquake produced in this region. The aftershocks are unusually small for the sequences characterizing the Vrancea foredeep area (around 200 events with magnitude below 2). The largest aftershocks were recorded on 7 December 2015 (M_L = 4.4) and 19 January 2015 (M_L = 3.8). We apply cross-correlation analysis together with empirical Green's function (EGF) deconvolution and spectral ratios techniques to optimise the source parameters determination. At the same time we applied inversion techniques to retrieve the moment tensor solution for the largest shocks. For EGF and spectral ratios applications, we associated to the main event many co-located aftershocks ($2.0 \leq M_L \leq 4.4$), selected according to the requirements for empirical Green's functions. The source parameters are estimated as mean values for all the available earthquake pairs. Source scaling properties and focal mechanism are investigated and discussed in terms of the regional seismotectonics and comparatively with the source scaling relationships for the Vrancea intermediate-depth earthquakes.
Key words: source parameters, earthquake sequence

S4 P13

ULTRAHIGH FREQUENCY-LOW POWER ELECTROMAGNETIC FIELD IMPACT ON PHYSIOLOGICAL PARAMETERS OF TWO TYPES OF CEREALS

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Exposure to electromagnetic fields emitted by mobile communications technologies has been increasing significantly in the last decades. Potential environment consequences, including in plants physiology could therefore appear. *Zea mays* and *Hordeum vulgare* species have been recognised as excellent

indicators of the mutagenic effects in higher plants. The aim of this study was to investigate the impact of mobile communication low power radiofrequency radiations on physiological and growth parameters of these two types of plantlets developed from exposed seeds. Identical biological samples of 30 *Zea mays* seeds and 60 *Hordeum vulgare* seeds respectively, with a uniform genophond per plant type, were exposed in controlled conditions to continuous waves to 1800MHz at 6.44W/m^2 incident power density and to 850MHz at 1.16W/m^2 power density respectively. Exposure of seeds was realized inside a transverse electromagnetic (TEM) cell, for different exposure durations between 0 and 6 hours, and then let to germinate. After the 12 days of plantlets growth the electromagnetic field impact was quantified. The specific absorption rate (SAR) of energy deposition per sample was in average 0.08W/kg in *Zea mays* and 0.38W/kg in *Hordeum vulgare*. Experimental and numerical dosimetry was applied for all experimental cases. Field propagation simulation has been performed using a commercial code (CST Microwave Studio). The germination rate, roots and stems length, the photosynthetic pigments contents (chlorophyll a, chlorophyll b and total carotenoid pigments) and the average nucleic acids (DNA and RNA) levels were estimated and compared with control sample results. Also, the water content for all samples was obtained with an infrared termobalance. The assimilatory pigments and average nucleic acids (DNA and RNA) levels were assayed by spectrophotometric methods, after the 12 days of plant growth. Using the Statistica v.7.0 computer soft, significant differences between exposed samples and control could be revealed.

Keywords: athermal, ultrahigh frequency electromagnetic field, assimilatory pigments, cereal seeds.

S4 P14

VOLUMETRIC MODIFICATION AS A STABILITY INDICATOR FOR HYDROCOLLOIDS

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The essential conditions that an impression material should fulfil are plasticity, fidelity, flexibility, good mechanical strength, dimensional stability, suitable setting time and compatibility with materials from which the models are manufactured. Among impression materials the highest ratio is represented by the elastic ones. An impression material should be evaluated in terms of dimensional stability, flexibility, thixotropism, hydrophilic character and working time.

In this paper we study the behavior of impression materials considering the following parameters: the reproductive capacity of morphological details - dimensional stability - the ability to reproduct with accuracy the ratio between morphological elements.

In the study we used alginate, condensation and addition silicones and the measurements were recorded with DIGIMATIC digital micrometer, caliper with sharp measuring surfaces for exterior measurements and with rounded measuring surfaces for indoor measurements.

The measurements performed in this study are limited to a linear dimension following the changes on a single direction, although the contraction is a volumetric change. Therefore we recorded impressions based on the above-mentioned materials, we poured models after the impression at 6, 24 and 48 hours. We performed the measurements between the points marked on the simulated model, from first premolar to the second molar corresponding to A-B points and edentulous ridge width, corresponding to C-D points. After a period of time from preparation, impression materials are losing their plastic condition, entering into a stable form therefore maintaining the shape of the structure to which they have been in contact.

The mechanisms by which this phenomenon occurs are diverse (polymerization, gelification, solidification), depending on the chemical type of the material. In the study of impression materials, this evaluation in relation to the volumetric variation indicates that the condensation materials are superior in terms of contraction time, this being much lower than for alginate, thus providing certitude, in achieving the final product.

The contraction of these materials is due to the evaporation of volatile byproducts and reorganization of bonds that are subsequent to polymerization.

The study results indicate that condensation silicones present the highest volumetric changes, their contraction being the result of the evaporation of volatile by products.
Keywords: volumetric change, contraction, silicones, impression materials

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S4 P15

MAGNETITE/TARTARIC ACID NANOSYSTEMS FOR EXPERIMENTAL STUDY OF BIOEFFECTS ON *ZEA MAYS* GROWTH

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Environmental impact of nanotechnology products generates an increased concern regarding possible side effects that engineered nano-sized particles could have on the soil, water, air, microorganisms, plants and animals. Experimental study was carried out with magnetic nanosystems supplied to *Zea mays* cereal species. Diluted suspensions of colloidal magnetite nanoparticles (MNPs) stabilized in water were supplied in the culture medium: volume fraction ranging between 50 and 300µl/l, equivalent with nanoparticle concentrations between 3.7µg/ml and 22.5µg/ml. The impact of MNPs administration was recorded at the level of: seedling growth, green tissue contents of assimilatory pigments, photosynthesis apparent efficacy. The highest growth stimulation in 12 days old seedlings was found for the MNP concentration of about 11µg/ml consisting in over 50% increasing in average plant length and for higher concentrations brown spots were evidenced suggesting toxic effect on the maize plantlets. Chlorophyll *a* level was found enhanced with up to 20% for MNP concentrations beyond 11µg/ml but for higher concentration inhibitory effect of MNPs on the assimilatory pigment biosynthesis was observed as denoted by chlorophyll *a* level diminution with 15-20% compared to the control samples. Similar biochemical response was obtained for chlorophyll *b* while for carotenoid pigments less evident changes were recorded. Photosynthesis efficacy appeared to be also stimulated by MNPs as resulted from slight but statistically significant increase of the chlorophyll *a*/chlorophyll *b* ratio. MNPs uptake and lysosomal digestion was presumed to occur in the plant cells with further iron ions release that had catalytic action with influence on cytoplasm redox processes affecting chlorophyll synthesis as well. Possible biotechnological tool based on low costs and available materials could be designed to conduct the growth of cereal plantlets for enhancing some biological parameters with MNPs.
Keywords: nanosized magnetite; assimilatory pigments; photosynthesis efficacy; maize biotechnology

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S4 P16

RE-EVALUATION OF DEPTH, MAGNITUDE AND DIRECTIVITY EFFECTS OF THE 26TH NOVEMBER 1829 VRANCEA EARTHQUAKE USING REVISED MACROSEISMIC INFORMATION

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The Vrancea seismic region, located at the bending area of the South-Eastern Carpathians in Romania, is the most active cluster of seismicity in Europe, producing earthquakes at intermediate depths (60-200 km). Destructive earthquakes of magnitude above 7 occur a few times per century in this region. The purpose of this paper is to analyze an historical event that occurred on November 26, 1829 (magnitude Mw=7.2 in the Romanian catalogue). New macroseismic information is collected from original and compiled historical sources, such as annals of that time, notes on the religious books, etc. which allowed a better constrain of the

macroseismic distribution associated with this event. The macroseismic information is re-evaluated using Medvedev-Sponheuer-Karnik (MSK-64) scale and an updated version of the macroseismic map for the study earthquake is compiled, including several tens of macroseismic data points in Romania and neighboring countries. The comparative analysis with the effects recorded for the recent major Vrancea earthquakes (1940, 1977, 1986) is used to estimate the hypocenter depth, magnitude and specific source directivity effects.

S4 P17

STRUCTURAL CHANGES OF LIPID MEMBRANES IN AQUEOUS SOLUTION UNDER HYDROSTATIC PRESSURE MEASURED BY SANS

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High penetration of neutrons give us the possibility of studying lipid membranes in aqueous solution. For surfactants, biological and model lipid membranes studying it is enough to have a pressure of several kbar. It is known that aqueous solution of DMPC has its' main phase transition near 24°C [1]. Increasing of pressure cause increasing the temperature point of the main phase transition. In this work the results of investigation of heavy water DMPC membrane solution, which consists of multilayers and inlayers vesicles, under hydrostatic pressure are presented. The measurements were performed on small-angle neutron scattering spectrometer YuMO [2] at IBR-2 reactor FLNP, JINR, Dubna, Russia. It was found that the trend of the main phase transition temperature point versus pressure is linear with 0,013°C/bar coefficient. The comparison with literature was made. The supplementary measurements (densimetry changes with temperature) were performed and results are shown here. The discrepancies between different sources are also discussed.

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Keywords: lipid membranes, DMPS, SANS, densimetry

S4 P18

PHYSICO-CHEMICAL PROPERTIES OF SOME NON-DRUG SUBSTANCES CAN BE USED TO PREDICT THEIR SAFETY PROFILES FOR THE HUMAN BODY

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Absorption, Distribution, Metabolism, Excretion and Toxicity (ADME-Tox) profiles are used generally to predict the oral bioavailability and safety levels of molecules with biological importance [1], but they are also useful for testing other chemicals [2].

The aim of this study is to produce the ADME-Tox profiles for several food colorants, parabens and some phthalates using the FUFDrugs3 computational tool [1] and to emphasize those physico-chemical properties that are commonly used to produce the safety profiles. Food colorants are widely used for creating a specific

appearance of our food or drinks. Parabens are ingredients commonly found in cosmetic products (lipsticks, mascaras, shampoos) and they can enter the human body through the skin. Phthalates are used in the manufacture of plastics, solvents and personal care products and they can leach into food and drinks being absorbed into the human body or enter there through the skin. Almost all colorants, conservants and phthalates considered in this study reveal good oral bioavailability but the safety profiles indicate that some food colorants, all the parabens and all phthalates may have adverse effects on humans.

Fig.1. The safety profile of sunset yellow colorant (a) and bis(4-methyl-2-pentyl) phthalate (b)

Figures 1 present the safety profiles of sunset yellow colorant (a) and bis(4-methyl-2-pentyl)phthalate (b). The properties of the sunset yellow are located in the dark grey square illustrating that it is safe for the human health. The properties of bis(4-methyl-2-pentyl) phthalate are located at the limit between light grey and dim grey squares, revealing its low safety level for humans.

Keywords: food colorants, parabens, phthalates, ADME-Tox profile.

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S4 P19

MONITORING OF RADON AND AIR IONIZATION IN A SEISMIC AREA

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A seismic area is characterized by a high tectonic stress. This generates earthquake precursor phenomena like gas emission, aerosols and air ionization. This paper describes the correlation of radon, positive and negative ions and CO_2 with seismicity in a multidisciplinary network that monitor Vrancea area (bending zone of eastern Carpathians Mountains characterized by intermediate earthquakes). The network automatically send information to National Institute for Earth Physics, Romania's decision center about telluric field, magnetic field, electric-electrostatic field, radio ULF waves, solar radiation, clouds, infrasound, light and acoustic phenomena, meteorological parameters, air-earth temperatures, crustal deformation, satellite data. Methods used correlate radon concentration with meteorological information. Tectonic stress accelerates the creation of microfractures, dilated pores and moving gas to the surface. Low atmospheric pressure and high temperature promotes release of radon through the ground to open the pores. The results of detection, effects evaluation, and data analysis alert the beneficiaries specialized in emergency situations (Inspectorate for Emergency Situations, organizations involved in managing special events). Figure 1 is an example of multidisciplinary analysis.

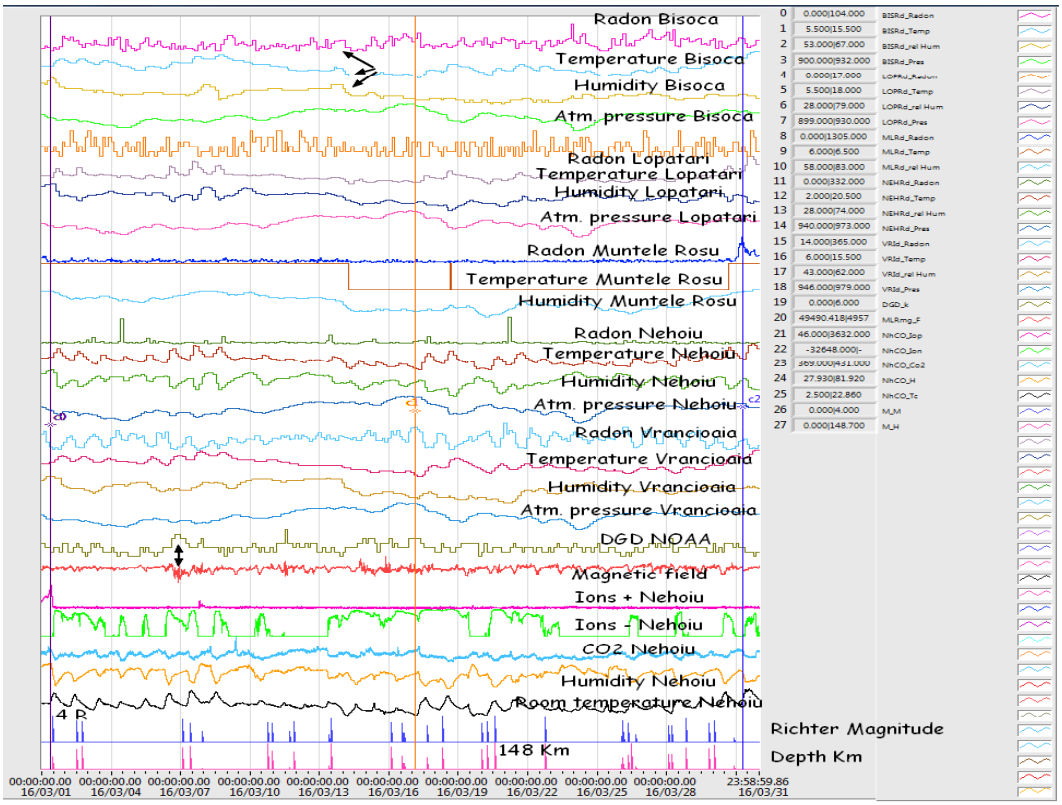

Figure 1. Multidisciplinary information (radon concentration, CO_2, meteorological, ionization, seismicity).

Six stations are involved in real-time simultaneous monitoring of radon, temperature, humidity, atmospheric pressure (sample interval 1 or 3 hours).
In conclusion it is essential to correlate the radon, ions and CO2 concentration with other factors. System structure, software and methods implemented are part of AeroSolSys research program.
Acknowledgements This work was supported by a grant of the Romanian National Authority for Scientific Research, Program for research- Space Technology and Advanced Research - STAR, project number 84/2013.
Key words: radon, air ionization, CO_2**,** early warning, multidisciplinary network, alert network, and earthquake forecast

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S4 P20

MAGNETIC ENVIRONMENTAL POLLUTION: EXPERIMENTAL SIMULATION OF ENGINEERED MAGNETIC NANOPARTICLES IMPACT ON *ZEA MAYS* VEGETAL EMBRYOS

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The engineered nanoparticles release into the environment raises important ecological worldwide problems. To evaluate the effects of the magnetic nanoparticles on *Zea mays* vegetal embryos, we have accomplished experimental studies focused on the cell proliferation in the meristematic tissue during the seeds germination under the influence of magnetic nanoparticles coated with different layers. Seeds with uniform genophond have been germinated in presence of different magnetic nanoparticles type and different nanoparticles concentrations in the culture medium of seeds. Quantitative cytogenetic parameters have been used to evaluate cellular chromosomal damage on *Zea mays* seeds induced by nanoparticles presence. Mitotic

division process appears to be stimulated than controls and chromosomal aberration frequency was increased for enhanced nanoparticles concentrations added in the germination seeds medium. The experimental results have been comparatively analysed by means a statistically soft in order to obtain mathematical models to describe the magnetic nanoparticles influence on mitotic division process and chromosomal aberrations appearance. Statistical analysis have been performed using the Kruskal-Wallis one-way analysis of variance [1] with Systat v.13 [2], in order to highlight the differences between the effects induced by different types of magnetic nanoparticles. In order to provide the mathematical models to the dependence functions between nanoparticles concentration and the quantitative cytogenetic parameters values, we tested several polynomial functions using the Non-linear Estimation package from Statistica v.7.0 [3] and we considered the ones with the most suitable statistical parameters. The specific influence of each nanoparticles type, coated with different layers, was confirmed by the statistical analysis. The size of the coated magnetic nanoparticles seems not to be an important factor in chromosomal aberration appearance on meristematic tissues of *Zea mays* roots; it's likely that the chemical particularities of the coating substances could be responsible for the chromosomal aberrations appearance.

Key words: magnetic nanoparticles, chromosomal aberrations, statistical analysis, mathematical modelling.

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S4 P21

THE INVESTIGATION OF THE STRUCTURE OF BICELLES BY THE METHOD OF SMALL-ANGLE SCATTERING

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The results of the small-angle X-ray (SAXS) and neutron (SANS) scattering experiments on bicellar systems are presented. The main goal of the experiments is to investigate the changes of the bicellar structural parameters during the crystallization of membrane proteins. The measurements were carried out on the samples with the molar ratio of DMPC/CHAPSO = 2.7, with different concentrations of the lipids, buffer composition at different temperatures.

The measurements were carried out on the Rigaku spectrometer (MIPT, Dolgoprudny) and YuMO spectrometer (JINR, Dubna). The scattering intensities depending on the scattering vector were obtained during the experiments. The experimental scattering curves were approximated by the bicelles and cylinder models using the SASView program package without taking into account the interaction between the bicelles in solution.

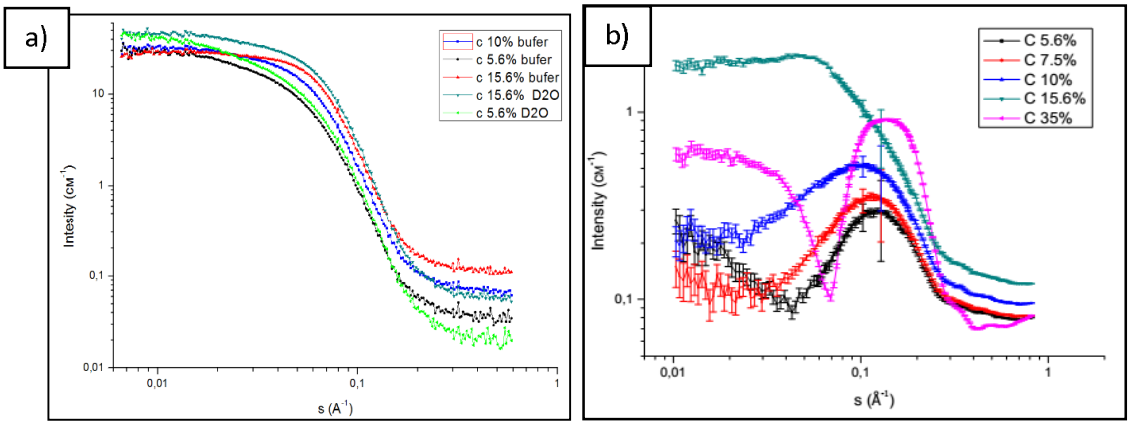

Fig.1 The graphs of the scattering intensity (I) from the scattering vector (s) for (a) SANS and (b) SAXS depending on the different concentrations of lipids (C) at a temperature 20^0C.

Curves SAXS and SANS drastically differ for the same samples that are associated with the heterogeneity of the system.

The experiments showed the changes of the structural parameters of the bicelles with the changes of the lipid concentration, buffer composition and time of the stabilization of the solution.

The work was supported by the Ministry of Education and Science. The authors are grateful the program "5 Top 100"

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S4 P22

ANTICANCER ACTIVITY OF ANTIMICROBIAL PEPTIDES

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Antimicrobial peptides (AMPs) are a class of molecules synthesized by a wide range of organisms, as an ancient innate defense mechanism against pathogens like bacteria, fungi, viruses. Their characteristics, like hydrophobicity and positive charge, make them good candidates to fight, not only against bacteria, but also cancer cells. Thus, AMPs have been investigated in the last years as alternatives to the conventional cancer drugs.

The aim of this study was to investigat the anticancer activity of 2 AMPs (Gramidcidin A and S) agains cancer cells. Their toxicity against both normal and cancer cells was determined using tetrazolium dye assays (MTS and LDH). AMPs hemolytic activity was also determined against red blood cells (hemolytic index). The viability of the cells was evaluated and used to calculate the therapeutic index for the AMPs. Also, cellular apoptosis and necrosis were analyzed. Peptides showed different activity against the cancer cell lines used, supporting the working hypothesis of the specific action of some AMPs on cancer cells.

Keywords: anticancer peptides, apoptosis, gramicidin, necrosis

Acknowledgements: This work was supported by the following grants of the Romanian National Authority for Scientific Research, CNDI-UEFISCDI, project numbers: PNII-123/2012, PNII-98/2012, PN-II-ID-PCCE-2011-2-0027 and PN 09370301.

S4 P23

PHOTOPHYSICAL AND PHOTOCHEMICAL PROPERTIES OF ZINC PHTHALOCYANINES - SILVER NANOPARTICLES CONJUGATES

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The conjugation of nanoparticles to phthalocyanines (Pcs) has drawn a great deal of attention because these nanoparticles, especially Ag and Au, show some photoactivity under UV-irradiation, and upon combination with photoactive molecules such as Pcs, the photochemical activity of Pcs is enhanced and the stability of nanoparticles is increased [1]. This work reports the synthesis, characterization and the photosensitizing properties of tetracarboxamido-zinc phthalocyanine $ZnPc(CONH_2)_4$ and octacarboxamido–zinc phthalocyanine $ZnPc(CONH_2)_8$. These derivatives were investigated by conjugating them with silver nanoparticles (AgNP), Fig.1. The formation of the amide bond was confirmed by IR and UV-Vis spectroscopies. Fluorescence lifetimes and quantum yields decreased for the conjugates compared to the phthalocyanines alone, due to the quenching caused by the AgNPs. The antimicrobial activity of the zinc phthalocyanines and their conjugates against *Saccaromices cerevisiae* was investigated. The Pcs complexes and their AgNP conjugates showed an increase in antibacterial activity, due to the synergistic effect afforded by AgNP and Pcs. Improved antibacterial properties were obtained upon irradiation. This work demonstrates improved photophysicochemical properties of phthalocyanines and a synergistic effect against *S.cerevisiae* afforded upon conjugation.

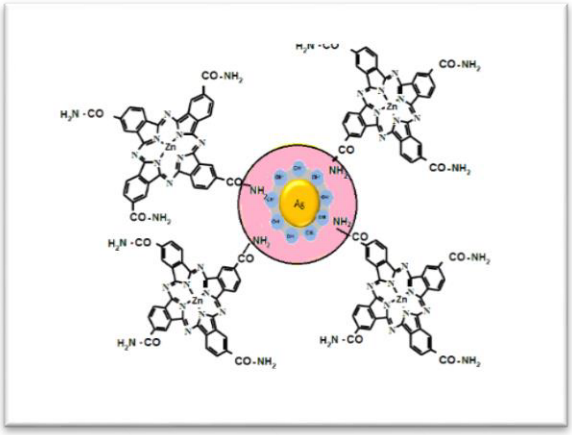

Figure 1. The structure of AgNP - Pc conjugate

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Acknowledgements: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI-UEFISCDI, project number PNII 185/2014.

Keywords: phthalocyanines, nanoparticles, silver, photophysics, photochemistry

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

CHARACTERIZATION OF NANOCOLLOIDS WITH QUARTZ CRYSTAL MICROBALANCE

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The purpose of this study was to characterize the metal nanoparticles in pure water and their adsorption with Quartz Crystal Microbalance (QCM). Considering the fact that nanocolloids are difficult to investigate under normal conditions, we choosed to use a QCM in order to remove the liquid and retain only the nanoparticles from the sensor surface for the further investigations. 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.
In our paper we analyzed the behavior of nanocolloids containing precious metals or non-noble in deionized water, sized between 60 nm and 80 nm. Studied metals were obtained by laser ablation. In our study we used 0.5 mL from different colloidal samples: Ti, Fe, Pd, Ag and Au with a concentration between 15 and 25 mg/l. Adsorbed nanoparticles on TiPt sensors have been analyzed by Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray Spectrometer (UltraDry EDS). Determination of material deposition by surface morphology analysis and atomic force microscopy combined with spectroscopy shown some interesting bounds between nanoparticles.
***Keywords*:** Quartz Crystal Microbalance, Newtonian liquids, nanocolloids

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S5 L2

THE COUPLING OF DIPOLE MODES TO QUANDRUPOLE OSCILLATIONS IN A SEMI-CLASSICAL APPROACH

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Within a microscopic investigation based on Landau-Vlasov equation we study the macroscopic structure of Pygmy Dipole Resonance in neutron rich nuclei and explore the effects of the coupling to the quadrupole modes.

S5 L3

ELECTROMAGNETIC STIRRING IN DIRECTIONAL SOLIDIFICATION OF MULTICRYSTALLINE SILICON

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Currently, directionally solidified multi-crystalline silicon is predominant in the market of photovoltaic silicon (2015: 60%) and is expected to stay so during the following decade. This is mainly due to lower

manufacturing costs and simpler process compared to Czochralski growth. With the increasing demand for high efficient solar cells, one of the challenges in photovoltaic industry is the improvement in the quality of the silicon ingot during the solidification process. The properties of multicrystalline silicon, like minority carrier lifetime or diffusion length, which are key properties for the solar cell efficiency, are correlated to the content and the occurrence of C, N, O, metals and dopants as well as structural defects (dislocations, grain boundaries) and their interaction. The quality of the silicon ingot is strongly dependent on the growth parameters which control the melt flow and interface shape. Controlling the melt flow structure, in order to obtain a complete homogenization of impurities and an optimal axial segregation profile, is one of the important issues in direct solidification(DS) of multi-cristalline silicon. Due to the fact that in DS method the solidification starts from the bottom and consequently the temperature is hotter at the top than at the bottom of the crucible, the buoyant convection in the melt occurs just because of the lateral temperature gradients and cannot generates a good mixing in the whole melt volume. This requires the employment of a forced convection. In the present contribution we investigate an approach based on a mix between vertical magnetic field and electrical current generating an electromagnetic field stirring (EMF)[1]. Time dependent three-dimensional numerical simulations were carried out in order to understand the effects of forced convection induced by electromagnetic stirring of the melt on the melt flow and impurities distribution in multicrystalline silicon (mc-Si) melt. Numerical simulations were performed on a pilot scale furnace with crucible dimensions of 38x38x40cm^3. The computational domain used for the local 3D-simulations consists of melt and crystal. Once the electromagnetic stirring is switched on, in a relative short period of time impurities are almost homogenized near the S-L interface. The obtained results show that enhanced convection produced by the electromagnetic stirring leads to a uniform distribution of impurities in the melt.

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S5 L4

CHARACTERIZATION OF NITROGEN DOPED SILICON CARBIDE MULTI-LAYER NANOSTRUCTURES OBTAINED BY TVA METHOD

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Ionized nitrogen doped SiC multi-layer thin films used to increase the oxidation resistance of carbon have been obtained by Thermionic Vacuum Arc (TVA) method. The 100 nm thickness carbon thin films were deposed on silicon or glass substrates and then seven N doped SiC successively layers on carbon were deposed. To change the energy of Nitrogen, carbon and silicon ions, p to -1000V negative bias voltages were applied on the substrate. To characterize the microstructure and tribological properties of as prepared N-SiC multi-layer films, Transmission Electron Microscopy (TEM, SEM), Energy Dispersive X-Ray Spectroscopy (EDS), X-Ray Photoelectron Spectroscopy (XPS), Electron Scattering Chemical Analysis (ESCA) and tribological techniques were achieved.Samples containing multi-layer N doped SiC coating on carbon were investigated up to 1000^{o}C. Thermal treatments reveals that oxidation resistance of carbon increase with increase of the number of N-SiC layers. Oxidation protection is based on the reaction between SiC and elemental oxygen, resulting SiO_2 and CO_2, and also on the reaction involving N, O and Si-C, resulting silicon oxynitride (SiN_xO_y) with a continuously vary composition.

The tribological properties of structures were studied using a tribometer with ball-on-disk configuration from CSM device with sapphire ball. The measurements show that the friction coefficient on the N-SiC is smaller than friction coefficient on uncoated carbon layer.

Electrical conductivity at different temperatures was measured in constant current mode. The results confirm the fact that conductivity is greater when nitrogen content is greater. To justify the temperature dependence of conductivity we assume a thermally activated electrical transport mechanism.
Keywords: N-SiC multi-layer nanostructures, TVA method, TEM, STEM, EDS, XPS, ESCA, tribological properties, electrical conductivity,

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S5 O1

INVESTIGATION AND MODELING OF FIXED BED SORPTION OF CESIUM BY PNF-SG

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Cesium sorption on nickel ferrocyanide, precipitated on silica gel (PNF-SG) from low and intermediate level liquid radioactive waste was investigated in a fixed-bed column. The breakthrough characteristics of the ion-exchange system were studied at different Cs concentrations (50–150 mg/L), bed heights (20–60 mm) and feed flow rates (1–6 mL/min).
For the same flow rate and bed height, when the influent concentration of Cs was increased, sharper breakthrough curves were obtained and a steep breakthrough curve was observed at 150 mg/L. With the increase in bed height, was noticed the improvement in both the breakthrough and the overall capacity. Earlier breakthrough and exhaustion were observed with increase in flow rate.
Mathematical models of Thomas and Yoon–Nelson were applied to the experimental data to investigate the column performance. The results fitted well the Thomas and Yoon–Nelson models with correlation coefficient values of $R^2 \leq 0.91$.
Keywords: cesium, nickel ferrocyanide; breakthrough; modeling
Acknowledgments. Authors acknowledge support from the projects PN II-PT-PCCA-2011-3.2-0334 – SARAWAD-BB

S5 O2

ELECTROMAGNETIC PROPERTIES OF 2D MATERIALS.

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This talk will deal with the experimental results regarding electromagnetic properties of 2D materials such as graphene and MoS2 in electromagnetic spectrum encompassing microwaves, millimetre waves, terahertz and visible spectrum.
We will show first that graphene and MoS_2 monolayers are tunable microwave materials with important applications in antennas and switches. It is further experimentally shown that graphene transistors working in the ballistic regime are producing THz signals via negative differential resistance. Further, we will show that graphene and MoS_2 devices are producing in visible spectrum high photo responsivities which in the case of nanostructured FET graphene are exceeding 10^3 A/W while in the case of MoS_2 Schottky structures we are able for an optimal sensing of ambient light.

Keywords : 2D materials, graphene, MoS_2 ,ballistic transport, microwaves, THz, optical photodetectors.
Acknowledgements We acknowledge the financial support of Nucleus Project TEHNOSPEC PN 1632 2015-2017 and of the Romanian National Authority for Scientific Research, CNCS-UEFISCDI, project number PN-II-ID-PCE-2011-3-0071.

S5 O3

INVESTIGATION OF PRE-EARTHQUAKE IONOSPHERIC ANOMALIES USING VLF/LF INFREP EUROPEAN AND GNSS GLOBAL NETWORKS

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In the last two decades a significant effort has been invested in order to understand and interpret the link between seismic activity and ionospheric perturbations. Since not any individual seismo-ionospheric precursor can be used as an accurate stand alone for earthquake prediction it is required 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 prior to large (M>6) earthquakes in South European area following a multi-instrument and multi-technique approach, using subionospheric propagation characteristics of LF signals provided by VLF/LF INFREP European network and Total Electron Content (TEC) observations from GNSS global network.
To identify possible ionospheric anomalies before the earthquakes we applied the terminator time and nighttime fluctuation methods on the amplitude of subionospheric LF radio signals and spectral analysis on diurnal TEC variations several days prior the seismic event. It was found that sunrise terminator times are delayed approximately 20-40 min few days before and during the earthquake day. Intensified wave-like TEC oscillations with periods around 20 min were also revealed up to 5 days prior to the earthquake shocks in all cases that could be interpreted as possible ionospheric precursors of the impending earthquakes.
Acknowledgements This work was partially carried out within Nucleu Program, supported by ANCSI, projects no. PN 16 35 03 01/2016, the Partnership in Priority Areas Program– PNII, under MEN-UEFISCDI DARING Project no. 69/2014, Capacity Program, Module III – Projects supporting Romania's participation in international research projects, Bilateral cooperation programs Romania – Cyprus, 2014-2015, project number 759/2014, and and the project "Investigation of earthquake signatures on the ionosphere over Europe" - ΔΙΑΚΡΑΤΙΚΕΣ/ΚΥ-ΡΟΥ/0713/37which is co-financed by the Republic of Cyprus and the European Regional Development Fund (through the ΔΕΣΜΗ2009-2010 of the Cyprus Research Promotion Foundation).

S5 O4

SILVER NANOPARTICLES AND THE OXIDADTIVE STRESS INDUCED IN ENVIRONMENTAL MICROORGANISMS

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Silver nanoparticles are known for various applications in technical and life sciences due to their unique optical, electrical, and thermal properties. Such engineered nanosystems are used, for example in conductive inks, pastes and fillers, molecular diagnostics and photonic devices, antimicrobial textiles, wound dressings, and biomedical devices based on low level of silver ions to provide protection against bacteria. Finally the silver nanoparticles are released in the environment so that the issue of pollution risks should be considered at the present time. We studied the some bioeffects of silver nanoparticles yielded by classical

method and characterized by optical (dark fied microsocpy, transmission electron microscopy) and spectroscopic methods (UV-Vis spectra) on cellulolytic fungi *Phanerochaete chrysosporium* with important role of cellulose waste degrading in the environment.

We analyzed the results of growth test (Fig. 1), oxidative enzyme activity measurements and lipid peroxidation indicator in microbiological samples supplied with silver nanoparticles in various concentrations. The activities of antioxidant enzymes namely catalase and superoxidedismutase were assayed by biochemical methods as well as the content of malondyaldehyde – the end product of membrane lipid degrading because of reactive oxygen species. Also the Krebbs cycle cellulases were assayed in silver supplied samples and control ones. The results interpretation was based on the silver action in microorganism cells and their adaptation ability in conditions of moderate stress, which could lead also to some biotechnological applications.

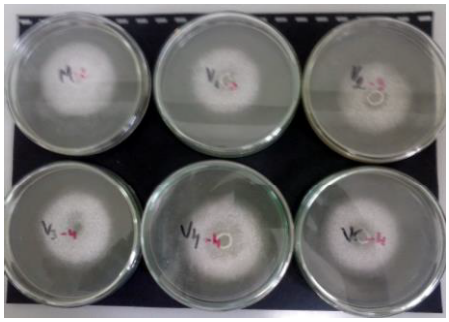

Fig. 1. Fungi growth in the presence of different silver nanoparticles concentrations - reduced disk areas were noticed compared to the control (M)

Key words: nanoparticulate silver, cellulolytic fungi, oxidative stress

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S5 O5

HIGHLIGHTING NANOPARTICLE AGGREGATION WITH THE TIME CONTRAST ALGORITHM

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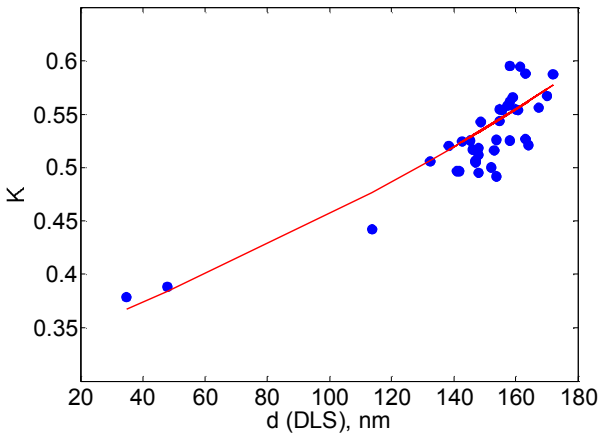
Fe_3O_4 nanoparticles have been extensively considered for biomedical applications, especially for drug delivery, as they can be metabolised by living organisms and for tumour treatment by hyperthermia. Fe_3O_4 nanoparticles functionalised with different surfactants can be produced with a low cost precipitation procedure. A batch of Fe_3O_4 nanoparticles was produced following a procedure previously described, with known physical and rheological parameters. Fe_3O_4 nanoparticles in aqueous suspension remain a nanofluid if different salts with controlled concentration are added, but aggregate fast when deionised water is the carrier fluid. Typically the aggregation process dynamics can be monitored using different optical procedures, as Dynamic Light Scattering (DLS) and Static Light Scattering (SLS). The time contrast algorithm uses a time series recorded during a coherent light scattering experiment performed on a Fe_3O_4 concentrated nanofluid during it's rapid aggregation. The time series was analysed both using the modified version of the DLS and the time contrast proposed procedure. The time contrast procedure computes a parameter named time contrast on equally spaced time slices of the time series. The time contrast parameter



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variation is compared with the variation of the average aggregates diameter during nanoparticles aggregation and the results are presented and discussed in the extended paper.
Keywords: Dynamic Light Scattering (DLS), Time series, Time contrast
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S5 O6

LASER WRITING OF MICRO-DEVICES FOR FLEXBILE ELECTRONICS

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One dimensional materials such as carbon nanotubes (CNT) emerged as attractive materials with outstanding potential in applications such as low cost high efficiency sensors and biosensors or photodetectors. However, the complex structure of these materials and the difficulty of manipulation hinder their integration into devices. In this work a procedure for rapid prototyping of CNT is described.
This procedure enables the use of laser-induced forward transfer (LIFT) as a powerful technique for direct writing of CNT patterns as a proof of concept for the fabrication of different flexible micro-devices (sensors and thin film transistors). In LIFT, a laser beam is focused through a transparent support plate onto a thin film of the material to be transferred. Every single pulse promotes the transfer of the thin film material onto a substrate that is usually placed parallel and facing the thin film at very short distances. The underlying transfer mechanism, in the case of inorganic materials such as metals or oxides, consists in the vaporization of a fraction of the transferred material followed by a recondensation of the laser-generated vapour onto the receiving substrate. However, in the case of more complex materials, the energetic laser pulses may damage these materials and result in the loss of functionality. Therefore, a photodegradable triazene polymer (TP) may be used as a dynamic release layer which also protects the material to be transferred from direct laser irradiation. Here, we show the advantages of LIFT, i.e. rapid, solvent-free procedure for the fabrication of different electronic components based on carbon nanotube networks on noncoventional flexible surfaces that overcomes challenges associated with solvent-assisted chemical functionalization and integration of these materials into devices.
Keywords: laser, flexible, carbon nanotubes, micro-devices
Acknowledgements
This work was supported by the National Authority for Research and Innovation in the frame of Nucleus programme- contract 4N/2016, a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-II-RU-TE-2014-4-2311, and a grant from the Commission for Technology and Innovation CTI (project no. 16713.1 PFNM-NM).

S5 O7

EFFEC OF AlGaN BARRIER THICKNESS ON THE CUT OFF FREQUENCYOF AlGaN/GaN HIGH ELECTRON MOBILITY 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 AlGaN barrier thickness on the drain source current in different gate length , gate source and drain source biases.

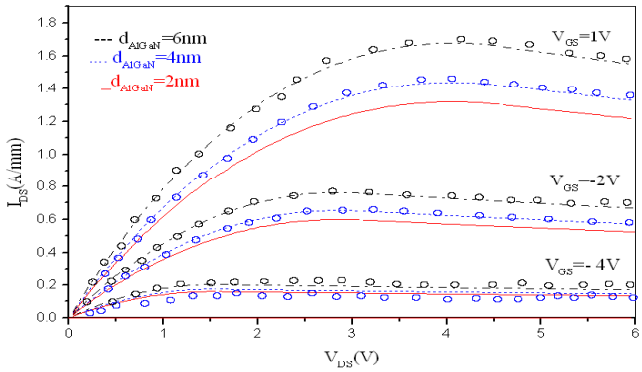

Fig.1. Drain source current versus drain source voltage for the $Al_{0.4}Ga_{0.6}N/GaN$ .The dots represent experimental data .

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[1,2]. In addition current and three dimensional mobility in the barrier of AlGaN, traps density in AlGaN are also take in to account. Fig. 1 shows the characteristics drain source current versus drain source voltage for the $Al_{0.4}Ga_{0.6}N$/GaN HEMTs in different AlGaN barrier thickness. In this Fig all electron trap states, depletion layer effect and temperature effects are included. There are good agreement between the model and experimental data for HEMTs device.

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S5 O8

EFFECT OF HIGH TEMPERATURE ON THE NOISE OF InGaN/GaN/InGaN HIGH ELECTRON MOBILITY TRANSISTORS (HEMT)

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An analytical-numerical model for the electronic current of two dimensional quantum well InGaN/GaN/InGaN in high electron mobility transistors has been developed in this paper that is capable of accurately predicting the effect of temperature on the electronic current of two dimensional quantum well[1] and transconductance[2,3] . Salient futures of the model are incorporated of fully and partially occupied sub-bunds in the interface quantum well .In addition temperature dependent of band gap , quantum well electron density , threshold voltage, mobility of electron , dielectric constant , polarization induce charge density in the device are also take in to account . The calculated model results are in very good agreement with existing experimental data for high electron mobility transistors device.

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S5 O9

INTERFACE CHARGE TRANSFER in FePt@TiO_2 CORE-SHELL NANOPARTICLES

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During the past decade, considerable efforts have been made to the fabrication of nanostructured composite materials with tailored structural, optical, electric, magnetic and surface properties. Binary alloys

such as FePt with a *L*10 phase exhibiting high magnetocrystalline anisotropy are potential candidates for high-density recording media Combining the optical and magnetic properties of FePt and semiconductors like TiO_2 in a convenient architecture like core-shell would greatly broaden their application in environmental science and catalysis, etc. [1-3]. In order to achieve these requirements, several studies on the influence of experimental synthesis parameters on specific properties were reported. High-temperature post-annealing is typically required to transform FePt particles into the *L*10 ordered phase.

The paper presents our results on synthesis and characterization of FePt@TiO_2 nanoparticles. By varying amount of TiO2 different core-shell structures formed by exchange coupled hard/soft magnetic cores and/or shells were obtained.

Core-shell nanoparticles were synthesized by growing TiO_2 nanoparticles on the surface of previously prepared FePt by reducing platinum acetylacetonate in 1,2 haexandiol . The TiO_2 shell were obtained by sol-gel process.

The properties of these composites nanoparticles are investigated by TEM, HRTEM, X-ray diffraction (XRD), X-ray Photoelectron spectroscopy (XPS) and superconducting quantum interference device (SQUID) magnetization measurements. The results revealed that by adjusting the composition of components an interface charge transfer could be observed.

Keywords: core-shell nanoparticles, FePt alloy, magnetic properties, semiconductor

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Acknowledgments

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S5 O10

BAND BENDING AT PT/PZT INTERFACES

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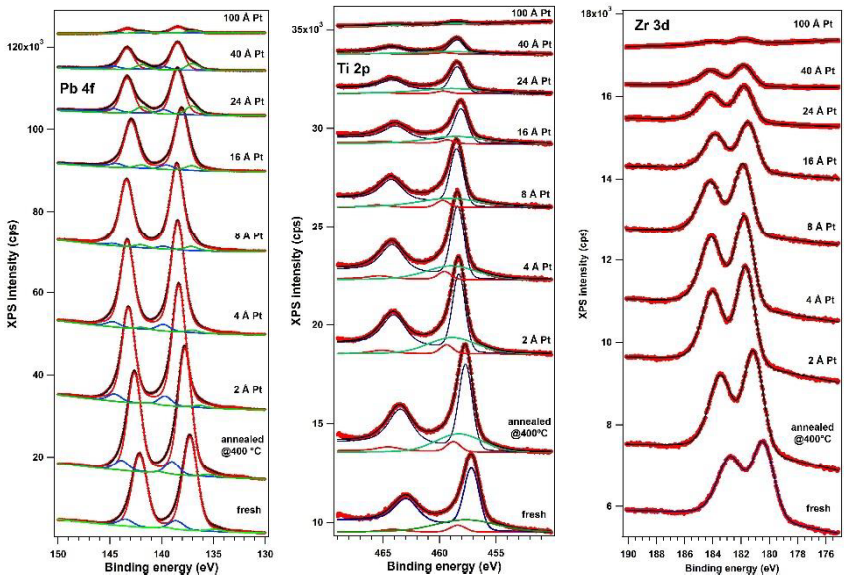
Pb(Zr,Ti)O_3 (PZT) is one of the most investigated ferroelectrics this days, due to his large polarization (1C/m^2) [1] and his applications in ferroelectric capacitors and random acces memories. The growth of platinum layers on Pb(Zr,Ti)O_3 deposited on $SrTiO_3$ is investigated by X-ray photoelectron spectroscopy (XPS) in the Pt thickness range 2-100 Å. XPS is an appropiate tool for investigating band bendings [2,3] in contacts formed by the ferroelectrics with metals [4,5] .The stoichiometry of the layer reproduces satisfactory that of the PZT target.The analisys of the core level shifts as function on the metal deposition provides information about the band bending occuring at the interface between PZT and platinum and also about the state of polarization exhibited. One can observe that when platinum is deposited on top of the PZT layer, the core levels of the substrate are strongly attenuated, which implies that the platinum layer is continuous.

Keywords: band bending, ferroelectrics, lead zirco-titanate, X-ray photoelectron spectroscopy



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S5 O11

SOME ANALYTICAL RESULTS REGARDING INTERFACE AND CONFINED OPTICAL PHONONS IN NANOCRYSTALS

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In nanocrystals not only the electrons and holes but also the phonons are confined. Confined and surface optical phonons determine the electron-phonon coupling and consequently the lifetime of charge carriers in nanostructures and they may be also an alternate route to plasmonic materials in far infrared and even further in THz due to low energy loss [1].

At the nanoscale the phonons are described quite successfully by continuum models. The boundary conditions expressing the behavior of optical modes are the continuity of the electric potential and the normal component electric induction. For studying interface and confined optical phonons in nanocrystals we will present a procedure based on a boundary integral equation method. A similar method has been previously used to describe localized plasmon resonances in metallic nanoparticles [2,3].

The method inherits some analytical features that will be applied to interface and confined phonons in crystal nanostructures. Nanocrystals of various shapes, dimers, and cavities are analyzed. Many other particular results presented in literature are also discussed and generalized.

Keywords: nanocrystals; interface confined and phonons; polaritons; plasmons.

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S5 O12

MULTIFUNCTIONAL $(BA_{1-X}CA_X)(ZR_YTI_{1-Y})O_3$ COATINGS OBTAINED BY LASER DEPOSITION METHODS

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A huge values of piezoelectric coefficients have been for long time a characteristic of PZT and a chalenge for lead free materials. The lead free materials were intensified studied in last decades but the materials properties are slighly lower from electrical point of view than lead ceramics. The non-lead ceramic based on $BaTiO_3$ system with a huge value of dielectric constant and piezoelectric coefficient d33 ~ 650 pC/N was developed by varying the Ba/Ca and Zr/Ti ratios. The phase diagram of $(Ba_{1-x}Ca_x)(Zr_yTi_{1-y})O_3$ (BCZT) system exhibit a morphotropic phase boundary (MPB) point around x/y = 0.15/0.10, where the rhombohedral and tetragonal phases coexist. For BCT-BZT system the ferroelectric, dielectric and piezoelectric properties are maximized at MPB point. Another route to enhance the dielectric and piezoelectric properties of BCZT solid solution can be obtained by tailoring the space of constraints (i.e epitaxial strain).

In this work, we present the BCZT thin films with tailored properties for different functionalities needed in photonics, electronics and biotechnology. Using Pulsed Laser Deposition (PLD) technique, the role of epitaxial strain and fine stoichiometric changes induced into the BCZT thin films during growth on the enhancement of electrical and electro-optical properties is revealed. Laser based approaches to obtain BCZT as biomaterials which supports cellular adhesion, proliferation and differentiation, can have important impact to their exploitation in a variety of biomedical applications. The applicability of layers of BCZT thin films deposited by Matrix-Assisted Pulsed Laser Evaporation (MAPLE) in biotechnology has been demonstrated.

S5 O13

V/III RATIO EFFECT ON DOPING OF HIGH QUALITY InAlAs FOR QUANTUM CASCADE LASER STRUCTURES

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Quantum Cascade Lasers (QCLs) have become a powerful candidate for mid-infrared spectrum applications such as spectroscopic detection of trace amount of chemicals, environment monitoring, active counter measure, medical diagnosis etc [1]. The mid-infrared spectral range between (3-11 μm), has a dense array of absorption lines of numerous molecules, due to the presence of fundamental vibrational modes [2]. InGaAs and InAlAs are the most preferable materials to grow QCL structures with. In this study we have

grown high quality InxAl1-xAs (0,50<x<0,60) epitaxial layers on InP substrates by Metal Organic Chemical Vapor Deposition (MOCVD). During growth we have observed surface status, growth rate and temperature by 880 nm wavelength of in-situ optical reflectance. Fig.1 shows in-situ temperature and reflectance measurement of InxAl1-xAs layer. Also we have studied on crystalline structure characterization of grown samples by High resolution X-Ray Diffraction (HRXRD) which shown in Fig.2. Slightly doped InAlAs epitaxial layers are required to built full QCL structure. For this purpose; we have ongoing detailed study of doping of InAlAs doping and the effect of V/III ratio. Room temperature Electrical characterizations of n-doped InAlAs layers were carried out by HEMS (Hall Effect Measurement System) and ECV (Electrochemical capacitance voltage) measurement.

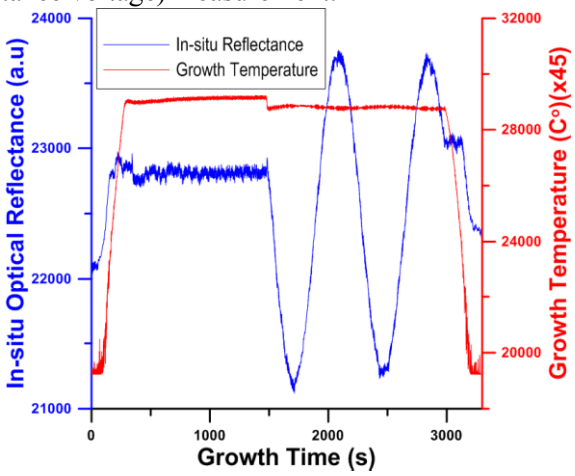

Fig.1 In situ optical Reflectance and Growth Temperature of InAlAs on InP

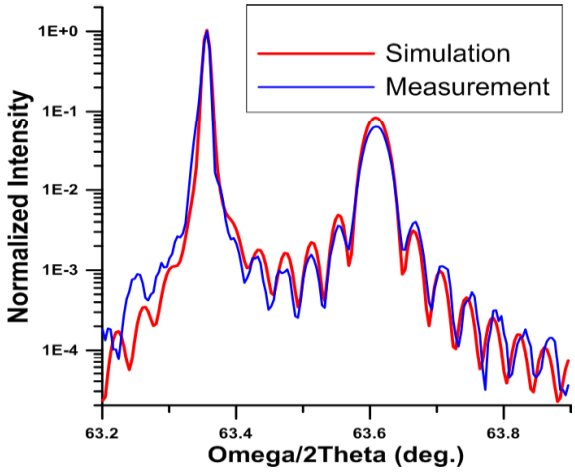

Fig.2 HRXRD measurement (blue) and simulation (red) of InAlAs on InP.

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Keywords: InAlAs, QCLs, MOCVD, Doping
Acknowledgements: This work was partially supported by the SANTEZ Program of project number 0573.STZ.2013-2

S5 O14

MULTIPLE SEISMO-ANOMALIES ASSOCIATED WITH SOME EARTHQUAKES RECORDED IN VRANCEA ZONE

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Short-term earthquake prediction (timescale of hours, days and weeks) is of essential importance to mitigate strong seismic events disasters. In the scientific world, during last decade was registered an increased interest and a lot of progress in non-seismic measurements of multi-parameter geophysical /geochemical seismic precursors derived from geospatial and in-situ monitoring data for short-term earthquake in comparison with classical seismic measurements (i.e. mechanical observation of crustal movements). Medium-to short-term earthquake forecasting 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 active geotectonic zone 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. 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 of 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. For some moderate and strong Vrancea earthhquakes, multiple geophysical parameters including air and land surface temperature, net latent heat flux, air radon, crustal deformation, electromagnetic waves and total electron contents (TEC) in the ionosphere, are examined together to investigate pre-earthquake anomalous activity. Cross-parameter comparison eliminates anomalies that are detected in one parameter only and examine earthquake-related phenomena in various fields, simultaneously. 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. 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.

Keywords : Seismic anomalies, geophysical parameters, Vrancea active zone, Romania.

S5 O15

THERMAL INVESTIGATION OF THE LOW-FLUORINE PRECURSOR CHEMISTRY FOR THE SOLUTION DEPOSITION OF $YBa_2Cu_3O_{7-x}$ EPITAXIAL THIN FILMS

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The paper investigates the influence of the thermal decomposition conditions of metal-propionates and trifluoroacetate used as precursor solution for preparation of high-temperature $YBa_2Cu_3O_7$ (YBCO) superconducting films. The precursor solution was prepared starting from yttrium acetate, barium trifluoroacetate, copper acetate and propionic acid.

The thermal decomposition and phase evolution of the precursor powder has been investigated by thermal analysis using thermogravimetric (TG) and differential thermal analysis (DTA), thermogravimetric analysis coupled with quadrupole mass spectrometry (QMS) and X-ray diffraction (XRD). The kinetics of the thermal decomposition for precursor powder were studied under different atmospheres such as air, oxygen, humid oxygen and dry nitrogen from ambient temperature to 1000 °C. During the decomposition of the precursor powder several intermediates phases were detected (Cu, Cu_2O, CuO and $B_{1-x}Y_xF_{2+x}$) and, as a result, a mechanism of formation of the mixed oxide by this method was proposed [2]. Thermogravimetric analysis of the precursor powder show 4 wt.% additional weight loss, under dry conditions. These results have a great importance for obtaining dense with high critical current density in YBCO superconducting films.

Acknowledgements The research leading to these results has received funding from the European Union Seventh Framework Programme [FP7/2007- 2013] EUROTAPES under grant agreement n° NMP-LA-2012-280432. Also, this work has been carried out within the framework of the EUROfusion Consortium and has been received funding from the European Union's Horizon 2020 research innovation programme under grant agreement number 633053 and also from the Romanian National Education Minister under contract 1EU/2014. The reviews and opinion expressed herein do not necessarily reflect those of the European Commission.

S5 O16

SPIN ORBIT TORQUES AND MAGNETIZATION SWITCHIG IN W/Co_2FeAl/MgO STRUCTURES

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Current-induced spin-orbit torques (SOTs) in ultrathin ferromagnetic layers interfaced with a heavy metal and an oxide have recently attracted considerably research interest for the development of low power consumption spintronic devices. Up to date SOTs have been used to realize in-plane current-induced magnetization switching [I.M. Miron, et al., Nature 476 (7359), 189 (2011)], fast domain-wall motion [P. P. J. Haazen, et al., Nat Mater 12 (4), 299 (2013)] and high frequency magnetization oscillation [L. Liu, et al., Phys. Rev. Lett. 109 (18), 186602 (2012)]. Generally, in this type of systems, the SOTs have been attributed to the angular momentum transfer from the spin-current, generated within the heavy metal via the spin Hall effect (SHE), to the magnetization of the ferromagnetic layer. Therefore, the SOTs efficiency is directly connected to the ratio of the spin-current generated per unit of in-plane charge current flowing through the heavy metal layer and it is parametrized by the spin Hall angle (θ_{SH}). The SOTs are equivalent with two types of effective fields, such as the Slonczewski-like (H^{SL}) and the field-like (H^{FL}) effective field, the former being responsible for magnetization switching. Here, we investigate the SOTs effective fields in UHV magnetron sputtered β-W/Co_2FeAl/MgO ultrathin structures. As a ferromagnetic layer we have chosen Co_2FeAl full-Heusler alloy, which is an attractive material for spintronic applications, since it was shown to provide large spin polarization and to possess a low Gilbert damping [M. S. Gabor et al., SPIN 4, 1440022, (2014)]. We demonstrate the attainment of perpendicular magnetic anisotropy (PMA) without the need of magnetic annealing, a key aspect for the scalability of spintronice devices. We characterize the SOT effective fields using harmonic Hall voltage measurement technique [J. Kim, et al., Nat Mater 12 (3), 240 (2013)] on UV lithographed micro-structured devices. Furthermore, we point out the essential role of the planar Hall effect corrections for a precise determination of the SOT induced fields when using the harmonic Hall voltage method. We estimate for β-W an effective spin Hall angle as large as 0.3±0.03 and a spin diffusion length of 2.2±0.3 nm. Moreover, we demonstrate SOT-induced magnetization switching for unprecedentedly low charge current densities of the order of 10^6 A/cm^2 which makes the β-W/Co_2FeAl/MgO system an interesting candidate for future spin-orbit torque spintronic devices.

Keywords: Spin orbit torque, Perpendicular magnetic anisotropy, Heusler alloys.
This work was supported by UEFSCDI through the PN-II-RU-TE-2014-4-1820 SPINCOD research project.

S5 17

THE PREPARATION OF ELECTRODES FOR PHOTOVOLTAIC APPLICATION

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Solar cell is the one of the promising semiconductors that transforms solar light to electrical energy. The most well-known p-n type photovoltaic solar cell made up of silicon, which is costly part of solar panels for obtaining defect free semiconductors for the application. Therefore, researchers are focused on cost effective photovoltaic materials. Dye sensitized solar cell (DSSC) is the one of cost effective materials for solar application. DSSC includes nanocrystalline semiconductors oxide film as photoanode, dye sensitizer, electrolyte, counter charge metal electrode or photocathode and transparent conductive substrate. The

advantages of DSSC over p-n junction are free from defects problem, easy production and low cost, very wide working temperature, independent efficiency from incident light angle, wide materials selection, light cell and flexible or stable substrate.

Metal oxide (TiO_2, ZnO, SnO etc.) are used to produce photoelectrodes that is important part of DSSC. Moreover, TiO_2, ZnO and Nb_2O_5 are significant in terms of photovoltaic properties. Furthermore, titanium oxide with high surface area is used commercially as photoelectrode materials as well as photocatalyst.

This study covers the preparation of nanocomposites with high surface area and various morphology as photoanode (TiO_2 and N_2O_5) and photocathode,then formation of film by spin coating. Dye sensitized solar cell will assembled by using these electrodes, then photovoltaic properties (short circuit current, Isc, open circuit voltage, Voc, filling factor, FF and efficiency) will be measured, then the dependence of microstructure and applied process with respect to these properties will be investigated.

Keywords: Nano-size TiO_2 thin film, photovoltaic, supercritical fluids

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S5 O18

MORPHOLOGY MANAGEMENT OF STRUCTURES BASED ON Ge NANOCRYSTALS IN OXIDE AND EFFECT ON MEMORY DEVICE PERFORMANCE

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The structures containing nanocrystals (NCs) embedded in dielectrics are intensively investigated for different applications of non-volatile memories, switches, optical and radiation sensors, solar cells and others. In particular, Ge NCs embedded in different oxides (firstly used SiO_2, HfO_2, Al_2O_3, ZrO_2) are of high interest for non-volatile memory devices as Ge NCs work as proper nodes for charge storage [1]. Additionaly, Ge is a suitable material for obtaining nodes of Ge NCs because it has a strong quantum confinement and low thermal budget for NCs formation. The morphology of structures with Ge NCs in oxide matrix is a key point that determines the performance of memory devices.

In this work, we show how we manage the morphology of trilayer structures, meaning this obtaining Ge NCs with high density and proper position in respect to the Si substrate/wafer. For this, we prepare trilayer structures of *gate oxide / intermediate layer of Ge NCs in gate oxide / tunnel oxide/ p-Si wafer* in which the gate/control and tunneling oxides are of SiO_2 and HfO_2, tunneling SiO_2 being grown by rapid thermal oxidation. The rest of layers in the structure were deposited by magnetron sputtering (MS) and e-beam evaporation (EBE), respectively. The nanostructured Ge/Ge NCs we obtained either by heating the substrate during MS deposition or by rapid thermal annealing (RTA) of the as-deposited structure, under controlled conditions. The structure and morphology were investigated ((HRTEM and HAADF-STEM, Raman spectroscopy, XPS), and the memory characteristics (capacitance-voltage $C - V$ and retention curves) were measured and the corresponding parameters (memory window, retention time) were determined.

By finding the suitable conditions for preparation (deposition and RTA), we obtain trilayer structures with intermediate layer of Ge NCs (5 – 7 nm size) with high density but well separated to each other and positioned at tunelable distance in respect to Si substrate. This morphology determines optimal memory characteristics ($C - V$ hysteresis loops) and parameters (memory window of 1 – 4 V, excellent retention time). We demonstrate that the memory properties of these trilayers are only due to Ge NCs and the traps contibution to the memory characteristics is negligible [2].

Keywords: Ge nanocrystals in oxides, non-volatile memories

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S5 P1

PROSPECTS FOR PERMEABLE THERMOELEMENTS APPLICATION

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The results are presented of the study promising of permeable thermoelectric elements and they applications. The method is based on solving differential equation systems to determine temperature distributions and using mathematical optimal control theory to determine optimal parameters and functions. Realization of this method in computer programs allows revealing maximum coefficient of performance. Theoretical research was carried out for different variations of permeable structures for thermoelements operating in electric energy generating modes, thermoelectric cooling and heating.

The analysis of computing results for permeable cooling thermopiles for thermoelectric Bi-Te-Se-Sb-based materials has pointed to the possibility of the coefficient of performance improvement by 30-60% as compared to conventional thermocouple Peltier elements. In the mode of electric energy generation the use of permeable thermoelements enables the obtaining of energy efficiency 1.3 to 1.6 times as big as that of conventional thermoelements. Experimental data confirm the essentials of the theory and reveal the possibility of thermoelectricity wider practical application.

S5 P2

MICROFLUIDICS OF CLAY AQUEOUS SOLUTION

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In this work, we are presented the application of clay aqueous solution for the health care. Therefore, we are investigated the microfluidics parameters of this solution at room temperature. The hydrodynamic method is applied for determining the coefficient of friction, the Gibbs energy, the enthalpy, the velocity of fluid, the form factor and the mean free path of molecules.

S5 P3

PRIMARY SEMICONDUCTOR THERMOELECTRIC CONVERTERS FOR GRADIENT HEAT FLOW METERS

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The results of research on primary heat flow converters based on multi-element thermopiles made of Bi-Te-Se-Sb extruded materials. The calculated results indicate the possibilities of volt-watt sensitivity increase by 1 to 1.5 orders of magnitude. Experimental sample of a gradient heat flow meter with semiconductor primary heat flow converters was fabricated and studied. Preliminary test data show that the measurement error 5%.

S5 P4

THE STUDY OF WATER QUALITY. DETERMINATION OF NITRITE IN DRINKING WATER AND SPECTROPHOTOMETRIC METHOD VALIDATION

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In organisms, water fulfills multiple functions, from dissolution and absorption of nutrients, to transport and disposal of toxic and/or resulted products from metabolism. Water affects human health both by its quantity (direct influence) and, especially, the quality of its (indirect influence).

It is obvious that polluted water should be a concern subject to every citizen. Understanding the sources, the interactions and the effects of pollutants in water is essential for controlling and monitoring contaminants in a safe environment and in a manner acceptable economically. To this end, there were developed analytical methods designed to certify the presence of pollutants in the environment and to assess the level of contamination of certain areas.

The involvement of rich in nitrogen soils and training of the fertilizers based on nitrogen, as well as intense contamination of water with organic substances which arise from the processes of self-cleaning, generate nitrate turns into nitrite in the body under certain conditions.

This paper presents a spectrophotometric method for determination of nitrite in drinking water and the research results were in concordance with the requirements of Law 458/2002 looking the drinking water quality (amended by Law 311/2004) and according to SR ISO 26777/2002. Method validation was performed, the evaluation of accuracy and precision was performed on 3 levels of concentration; standard solutions were prepared with concentrations of 0.1 mg/L; 0.25 mg/L; 0.5 mg/L, starting from second standard solution SCHARLAU 999±5mg/L. The detection limit is 0.0006 mg/L, the limit of quantification is 0.002 mg/L.
Keywords: quality water, nitrite, validation.

S5 P5

SPATIAL PATTERNS OF THE STRONG GROUND MOTION PARAMETERS, DISPLAYED BY THE INTERMEDIATE-DEPTH EARTHQUAKES OF VRANCEA REGION

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The characteristics of the seismic ground shaking at a particular site are determined by the characteristics of the seismic source (earthquake size, focal depth, focal mechanism, peculiarities of the rupture process), the seismic wave propagation from the source to the site (hypocentral/epicentral distance, physical properties of the medium along the ray path), and the local site effects (local geology).

The most dangerous seismogenic zone in Romania is located at the bending of the Eastern Carpathians, in the subcrustal lithosphere (depth range 60 - 200 km) – the Vrancea region.

Due to the poor seismic instrumentation before 1980, and to the relatively low occurrence rate of strong Vrancea earthquakes, we have not, in this moment, digital strong motion records of major Vrancea seismic events. For the strong earthquakes which occurred at the end of the XXth century, only a rather modest number of analogue records (which have been subsequently processed in digital form) is available. The strongest digitally recorded Vrancea earthquake is the event of October 27, 2004 ($M_w = 6.0$).

The patterns of the ground motion generated by the strong intermediate depth Vrancea earthquakes exhibit a couple of common features – revealed by both instrumental and detailed macroseismic data – which indicate that the level of ground shaking is strongly controlled by the local and regional geological conditions: (i) large values of ground motion parameters observed over wide areas orientated predominantly NE-SW; (ii) strong, abnormal attenuation of the seismic waves propagating towards the Intra-Carpathian zone.
As a consequence of the significant effort carried out during the past years – mainly since 2008 – the present-day Romanian seismic network comprises 118 permanent digital stations equipped with 3-component accelerometers, which cover the entire country.
The large amount of recently collected high quality data allows us to examine the spatial distributions of the ground motion parameters (peak ground acceleration, peak ground velocity) generated by several tens of moderate-size Vrancea undercrustal earthquakes (magnitude $M_w \geq 4.0$) which occurred during the past decade, the strongest one having moment magnitude 5.4.
The observed spatial patterns display the common features emphasized by the strong events – a rapid decrease of the ground motion amplitudes towards the Intra-Carpathian zone, and a prominent asymmetry of the strong motion parameter distributions – indicating that the local and regional geological conditions control the ground shaking to a larger degree than the focal distance. On the other hand, the individual patterns exhibit a notable variability, consequence of the diversity of the focal mechanisms and hypocenter locations within the seismogenic zone. The contributions of these two factors to the spatial pattern variability cannot be quantified separately, they are combined in a particular way for each event; the analysis shows that even rather small variability in source mechanism and source location may result in noticeable differences of the observed ground motion distributions.

S5 P6

ADVANCED PILOT TECHNOLOGY FOR ALTERNATIVE ENERGY

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Alternative energy refers to energy resources which no implies fossil fuels or nuclear energy. Alternative energy sources are renewable and are thought to be “free“ energy resources. They all have lower carbon emission compared to conventional energy and are very friendly with environment. These sources includes Solar energy , Wind energy and bioenergy obtained from biomass. Combining this resources we obtained an enhanced of the energy efficiency and also a better clean alternative energies . These tools and more can help make the transition form non-renewable energy to clean and environmental friendly energy.

We intend to build an demonstrative mixed alternative energy framework in the Cluj-Napoca area in order to show that combining this renewable sources will be obtain a better energy efficiency. By showing the results to the potential investors we consider that their trust in sustainable energy obtained by alternative sources will be increased and they will invest in this idea in the future. We will build an mix energy platform which will be able to calculate the energy efficiency and this will give us the possibilities to give different solutions adapted with the climate condition and the necessities of different investors. During the project we will improve the energy efficiency of this park by experience exchange between partners and the result will be compared in order to show which is the best solution for best energy efficiency and storage adapted with the area and the results we expect to obtain.

Keywords: Alternative Energy, Solar Cells, Clean energy , Mixed Energy

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S5 P7

COMPARATIVE STUDY REGARDING THE TSUNAMI RISK PERCEPTION AND PREPAREDNESS WITHIN THE BLACK AND MEDITERRANEAN SEAS COMMUNITIES

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The main purpose of this paper is to present in a comparative way the perception of the people from two different sites from Romania and France, regarding the tsunami risk in the Black and Mediterranean Seas communities.

In the frame of the EC Programme FP7 ASTARTE project (Assessment, Strategy And Risk reduction for Tsunamis in Europe), two surveys over residents' and tourists' perception and preparedness of tsunami hazard were carried out for Eforie Nord and Nice Test Sites. The questions from the tsunami questionnaire translated in Romanian and French languages are referring to: interviewee's relation to Eforie Nord and Nice sites, information about interviewed people, tsunami hazard knowledge/risk perception, evacuation issue, awareness of the existing warning system, information, and communication.

The results obtained after the surveys confirm that coastal communities from Romania and France are not resilient to tsunami hazard, our respondents have mentioned from natural and anthropic types of hazards, the tsunami as third rank in Eforie Nord and Nice test sites, coming after earthquakes/pollution and storms. Whatever the respondent's status (i.e. local population, or tourists), earthquakes and sea withdrawal are cited as tsunami warning signs by 62% and 60% of the respondents from Eforie Nord and by 41.5% and 30.4% of the respondents from Nice, respectively.

Regarding the perception of a future tsunami event in Eforie Nord, 36,3% of the respondents think that the place could be affected by a tsunami and the tsunami wave could reach more than 2-5 meters (heights cited by approx. 14% of respondents) or even more than 5-10 meters (values cited by 15% of interviewed people). Regarding the perception of a future tsunami event in Nice, 78% of the respondents think that the place could be affected by a tsunami. With such a negative perception of tsunamis, it is not surprising that more than 40% of the respondents expect waves of more than 10 m high.

As in the European scale, also at local level this survey underlines the need to better inform communities about: (1) the reality of the tsunami risk; (2) the maximal wave height that has been modeled for possible strong earthquake generated in the area; and (3) where to evacuate in case of a future tsunami warning.
Acknowledgements: This work is partially funded by project ASTARTE - Assessment, Strategy And Risk Reduction for Tsunamis in Europe - FP7-ENV2013 6.4-3, Grant 603839 and Project 268/2014, PNII, Capacity Module III.
Key words: earthquake, tsunami hazard, tsunami warning system, resilience

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S5 P8

MOMENT MAGNITUDE ESTIMATION FOR THE SEISMIC SWARM RECORDED IN GALATI AREA IN 2013, USING STRONG MOTION DATA

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The recent upgrade of the seismic network in Romania with high dynamic range accelerometers (114 real time seismic stations equipped with episensors) allows recording of moderate to large magnitude

earthquakes at very close epicentral distances (less than 10-20 Km). A network for monitoring the strong motion that can occur in a given area records data that provide an excellent opportunity to study how source, path and site influence the ground motion, specifically that in the near-source area. A fast seismic data analysis is essential to provide rapid and useful information to Authorities that have to take decisions immediately after a strong earthquake occurrence. Modern accelerometers are the only instruments that can provide near-source high-quality data during a strong earthquake.

The seismic swarm analyzed in this study, started on September 23, 2013, close to Galati city, in Izvoarele region (Romania), and lasted until November 12, 2013. 406 earthquakes were located, during several phases of seismic activity. The strongest events—a magnitude 3.9 earthquake, occurred on September 29, and two M_L 3.8 shocks, occurred on October 3 and 4, respectively, were accompanied by specific seismicity bursts. The significant seismic events were strongly felt by the population, they created panic and produced damages, having a macroseismic intensity of V–VI.

The purpose of this work consists mainly in the estimation of moment magnitude Mw using the strong motion network of NIEP. The main goal is the independent estimation of seismic moment and corner frequency for all events recorded by the strong motion network.

Key words: moment magnitude, seismic moment, strong motion, seismic swarm

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S5 P9

IMPROVING MONOCHROMATICITY OF GREEN UPCONVERSION LUMINESCENCE BY CODOPING Eu^{3+} IONS IN $CaSc_2O_4:Ho^{3+}:Yb^{3+}$

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Upconversion luminescence of $CaSc_2O_4:Ho^{3+}$, Yb^{3+} ceramics codoped with different concentrations of Eu^{3+} ions were investigated to improve the monochromaticity of the upconversion luminescence emission. Rare-earth-doped upconversion ceramics can convert near-infrared excitation light into visible emissions. The calcium scandate ceramic samples doped with Ho^{3+}, Yb^{3+} and Eu^{3+} were synthesized by the solid state reaction method (at 1500°C for 4 h) from stoichiometric quantities of high purity oxides (Sc_2O_3, Ho_2O_3, Yb_2O_3, Eu_2O_3) and $CaCO_3$.

The calcium scandate ($CaSc_2O_4$) is a new host for efficient upconversion [1] due to low energy phonons (540 cm^{-1}), short distances between positions that can be occupied by the dopants (yielding an efficient energy-transfer) and high solubility of Yb^{3+} ions. The room-temperature luminescence spectra were excited at 980 nm and recorded in the wavelength domain 350–850 nm. $Yb^{3+} \rightarrow Ho^{3+}$ energy transfer processes of the emitting levels of Ho^{3+} are discussed and ($^5I_7$) $Ho^{3+} \rightarrow$ ($^7F_6$) Eu^{3+} the energy transfer was evidenced.

The decays of ($^5S_2$, $^5F_4$) and $^5I_6$ levels were excited with the second harmonic (532 nm) of the Nd:YAG laser and their effective lifetimes were calculated. The upconversion luminescence is analyzed using luminescence spectra, power dependence of the emission intensity, and lifetime measurements.

Three energy transfer processes between Ho^{3+} and Yb^{3+} were considered: ET1 ($^5S_2$, $^5F_4$; $^2F_{7/2}$) $\rightarrow$ ($^5I_6$; $^2F_{5/2}$), ET2 ($^5I_6$; $^2F_{7/2}$) $\rightarrow$ ($^5I_8$; $^2F_{5/2}$), and ET3 ($^5I_8$; $^2F_{5/2}$) $\rightarrow$ ($^5I_6$; $^2F_{7/2}$). The ET1 and ET2 processes accelerate the decays of ($^5S_2$, $^5F_4$) and $^5I_6$ [2].

Concentration-optimized $CaSc_2O_4:Er^{3+}:Yb^{3+}$ and Eu^{3+} phosphor presents efficient $Yb^{3+} \rightarrow Er^{3+}$ energy transfer and strong green (($^2H_{11/2}$, $^4S_{3/2}$)(Er^{3+}) $\rightarrow$ $^4I_{15/2}$(Er^{3+})) very weak red (($^4F_{9/2}$)(Er^{3+}) $\rightarrow$ $^4I_{15/2}$(Er^{3+})) luminescence.

Keywords: upconversion luminescence, monochromaticity, $CaSc_2O_4$
Acknowledgement
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S5 P10

TEMPERATURE- URBAN LAND COVER INTERACTIONS DERIVED FROM TIME-SERIES SATELLITE DATA

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In frame of predicted global warming, urban thermal environment is an important issue in scientific research. This paper investigated the influences of urban growth on thermal environment in relationship with other biogeophysical variables in Bucharest metropolitan area of Romania. Remote sensing data from Landsat ETM+ and time series MODIS Terra/Aqua sensors have been used to assess urban land cover– temperature interactions over period between 2000 and 2015 years. Vegetation abundances and percent impervious surfaces were derived by means of linear spectral mixture model, and a method for effectively enhancing impervious surface has been developed to accurately examine the urban growth. The land surface temperature (Ts), a key parameter for urban thermal characteristics analysis, was also analyzed in relation with the Normalized Difference Vegetation Index (NDVI) at city level. Based on these parameters, the urban growth, Urban Heat Island (UHI) effect and the relationships of Ts to other biogeophysical parameters have been analyzed. Results indicated that the metropolitan area ratio of impervious surface in Bucharest increased significantly during investigated period, the intensity of urban heat island and heat wave events being most significant. The correlation analyses revealed that, at the pixel-scale, Ts possessed a strong positive correlation with percent impervious surfaces and negative correlation with vegetation abundances at the regional scale, respectively. This analysis provided an integrated research scheme and the findings can be very useful for urban ecosystem modeling. Was also analyzed UHI phenomenon during extreme heat waves events. Satellite data analysis stressed a clear land surface temperature contrast between the central, median and peripheral zones of Bucharest city. Monthly average values of the temperature differences between urban and rural areas range between 1^{o}C and 8^{o}C. The analysis show that different urban/periurban zones and landscapes bring diurnally and seasonally different contributions to the local and regional thermal environment. Urban land cover was the most important contributor to increases in regional Ts. Vegetation had a clear cooling effect as the normalized vegetation difference index (NDVI) increased during summer periods.
Keywords: urban Heat Island, time-series MODIS Terra/Aqua satellite data, biogeophysical parameters, Bucharest.

S5 P11

USE OF GEOSPATIAL DATA FOR FOREST VEGETATION CONDITION ASSESSMENT UNDER CLIMATE AND ANTHROPOGEIC STRESSORS

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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. The climate system responds in complex ways to changes in forcing that may be natural or human-induced and climate-induced changes at the land surface may in turn feedback on the climate itself through changes in soil moisture, vegetation, radiative characteristics, and surface-atmosphere exchanges of water vapor.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 multispectral and multitemporal satellite imagery (Landsat TM, LANDSAT ETM, MODIS Terra/Aqua and IKONOS satellite data) for a mountain forest ecosystem in Prahova Valley; Romanian Carpathians test area Romania, over a period 2000-2015. The climate of the Carpathians is moderately cool and humid, with both temperature and precipitation strongly correlated with elevation.Extreme climatic events and anthropogenic effects have a strong impact on forest ecosystem. 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. Forest cover has also a great impact on local mountain climate. In this paper we studied the sensitivity of projected climate-change signal, associated with the annual and monthly climatology of various surface forest fields and pollution (dray and wet deposition, $CO_{2,}$ SO_2, CO-organic carbon, BC-black carbon, and dust). Based on meteorological data and regional climatic models simulations have been analized changes in temperature and precipitation regime in association with aerosols circulation and dynamics.

Keywords: time-series MODIS Terra/Aqua satellite data, biogeophysical parameters, montain forests.

S5 P12

MICROSTRUCTURAL INVESTIGATION OF BIOGENIC FERRIHYDRITE PARTICLES USING SYNCHROTRON X-RAY RADIATION, SANS AND AFM TECHNIQUES

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The development of techniques for the synthesis of nanoparticles of well-defined size, shape and composition is a challenge and an important area of research. A promising new dimension in this field is the use of microorganisms for the production of inorganic nanoscale particles. The clean, nontoxic and environmentally friendly ability of eukaryotic and prokaryotic microorganisms to form nanoparticles either intra- or extra-cellularly is particularly important in the development of nanobiotechnology.

In the present work structural properties of biogenic ferrihydrite particles [1, 2] produced by bacteria *Klebsiella oxytoca* are investigated by means of synchrotron X-ray radiation, SANS and TEM techniques.

Bacterium *Klebsiella oxytoca* creates different types of ferrihydrite nanoparticles as a result of variation of the growth conditions (duration, exposition to light, medium content, etc.) [3]. Earlier, it was shown that ferrihydrite nanoparticles produced by bacteria Klebsiella Oxytoca in the course of biomineralization of iron salt solutions from natural medium exhibit unique magnetic properties: they are characterized by both the antiferromagnetic order inherent in a bulk ferrihydrite and the spontaneous magnetic moment due to the decompensation of spins in sublattices of a nanoparticles. The properties of several types of these particles

were identified by means of Mossbauer spectroscopy [4], static magnetic measurements analysis [5], scanning electron microscopy and small angle X-ray scattering methods [6].
Keywords: biogenic ferrihydrite particles, synchrotron X-ray radiation, SANS, AFM
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S5 P13

HEAVY METAL ANALYSIS IN DIFFERENT ENVIRONMENTAL SAMPLES FROM LOWER DANUBE EUROREGION

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The heavy metal concentration in different environmental samples (natural waters, soil, sediments) is important for the assessment of the environmental quality and pollution sources. The soil contamination creates a risk of deep and shallow groundwater pollution. Low Danube transboundary region has a strong impact from different pollution sources which are situated in these countries: industrial activity, polluted sites, agriculture, landffils etc. The aim of this study is an assessment of heavy metal concentration in different environmental objects in samples from natural and polluted sites. The concentration of heavy metals was analysed in water and sediments from deltaic area and in soil samples from selected polluted sites from Romania and Republic of Moldova. The analysis of water, 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 higher concentration of several heavy metals (Pb, Cu, Zn, Cd,As) in sediments from Danube Delta and Prut River was determined 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.

S5 P14

POROUS COPPER SHEETS DEVELOPMENT FOR PEMFUEL CELLS

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In the last two decades porous copper sheets have gain the attention of many researchers due to their high thermal management, good electric conductivity and high fluid permeability, properties that are making them a useful alternative tool in different applications like catalysis, separation systems, electronic materials and Proton Exchange Fuel Cells (PEMFCs). The present paper highlights the development of such porous copper sheets used to replace the actual carbon- based gas diffusion layer (GDL) media in the PEMFCs. The porous copper sheets were obtained using a sintering fabrication technique. Different amounts of copper filings and naphthalene were mixed, pressed and thermally treated at 850°C and 900°C respectively. To avoid oxidizing, the mixture was sintered in Ar-H_2 gas mixture. Using this technique we achieve a better porosity control and pore distribution, instead of using the Toray based GDL, which is an encouraging improvement for the GDL development in the PEMFC technology.
Key words: PEMFC, GDL, porosity

S5 P15

SEISMICITY MONITORING AT THE IZVORUL MUNTELUI DAM (EASTERN CARPATHIANS, ROMANIA) USING MULTIPLE APPROACHES

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Artificial water reservoirs may often generate seismic events as a result of stress variation due to the weight of water, weakness of fractures or faults and increase of pore pressure in crustal rocks. Izvorul Muntelui is one of the largest dams, built between 1950 and 1960, located in the northeastern part of Romania, within the Eastern Carpathians. According to Romplus catalog (Oncescu et al. 1999), for a maximum distance range of 0.3^0 relative to the dam, only a small number of seismic events were recorded between 984 and 2011. Since 2012, as a result of Romanian Seismic Network developing, the seismicity monitoring is performed using 2 nearby stations: Bucovina (BURAR) - a small seismic array situated about 100 km northwest relative to the dam and a 3-C broadband seismic station, Bicaz (BIZ) placed next to the dam. The analysis was firstly accomplished on the catalog data and further extended to the waveforms recorded by both seismic stations between 2012 and 2015 time interval. Multiple techniques like cross-correlation, polarization, frequency-wave-number analysis as well as relative magnitude computation were performed to improve the detection capabilities and source parameters estimation. The obtained results revealed that only a reduced number of seismic events may be directly associated to water level variations.
Key words: water reservoirs, stress variation, seismic array, detection capabilities, source parameter estimations

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S5 P16

SYNTHESIS AND CHARACTERISATION OF SOME CuCoFe THIN FILMS WITH SPECIAL MAGNETORESISTANCE PROPERTIES

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CuCoFe thin films were deposited by Thermoionic Vacuum Arc (TVA) method on Si substrate. The deposition was a multylaier one, each layer having a thickness of 10 nm. The first layer was of Cu, then one layer of Co, and last one of Fe; this order repeated itself until it reached the tikness of 160 nm (16 layers). A part of the samples were thermally treated for an hour at the temperature of 400°C. In the case thermally treated structures the grains size is about 15-20 nm. The magnetoresistance of the films was measured at different temperatures. The magnetic field was mentained at 0.3T value. The magnetoresistance decrease up to -20,5% at 50°C. Structure of the films was characterised by STEM tehniques.

Keywords: TVA, Grains size, Magnetoresistance, STEM

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S5 P17

THERMOELECTRIC SENSORS AND DEVICES BASED ON THEM

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It was established that information on temperature and heat flux distribution on the surface of human body can be an efficient means for creation of novel diagnostic approaches to various diseases. Of particular interest is the possibility of using such measurements for detection of postsurgical inflammatory processes.

The paper presents the results of research on the requirements to temperature and heat flux sensors with such measurements. It was established that the use of conventional heat metering sensors can lead to essential errors due to the impact of phase transition processes on the skin surface, change in ambient temperature and sensor attitude in space. To minimize these effects, special heat flux meters have been developed allowing to separate the drift of heat from skin surface due to convective heat exchange and phase transition. The paper describes the results of research on computer design and optimization of such sensors.

Based on this research, heat flux sensors have been developed that simultaneously determine the temperature on skin surface through use of the temperature dependence of the internal resistance of sensors. These sensors were used to create automated measuring devices with computer control, read-out and processing of information. The devices are promising for detection of postsurgical inflammatory processes.

S5 P18

NATIONAL LABORATORY FOR ADVANCED SCIENTIFIC VISUALIZATION AT UNAM - MEXICO

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In 2015, the National Autonomous University of Mexico (UNAM) joined the family of Universities and Research Centers where advanced visualization and computing plays a key role to promote and advance missions in research, education, community outreach, as well as business-oriented consulting. This initiative provides access to a great variety of advanced hardware and software resources and offers a range of consulting services that spans a variety of areas related to scientific visualization, among which are: neuroanatomy, embryonic development, genome related studies, geosciences, geography, physics and mathematics related disciplines. The National Laboratory for Advanced Scientific Visualization delivers services through three main infrastructure environments: the 3D fully immersive display system Cave, the high resolution parallel visualization system Powerwall, the high resolution spherical displays Earth Simulator. The entire visualization infrastructure is interconnected to a high-performance-computing-cluster (HPCC) called ADA in honor to Ada Lovelace, considered to be the first computer programmer. The Cave is an extra large 3.6m wide room with projected images on the front, left and right, as well as floor walls. Specialized crystal eyes LCD-shutter glasses provide a strong stereo depth perception, and a variety of tracking devices allow software to track the position of a user's hand, head and wand. The Powerwall is designed to bring large amounts of complex data together through parallel computing for team interaction and collaboration. This system is composed by 24 (6x4) high-resolution ultra-thin (2 mm) bezel monitors connected to a high-performance GPU cluster. The Earth Simulator is a large (60") high-resolution spherical display used for global-scale data visualization like geophysical, meteorological, climate and ecology data. The HPCC-ADA, is a 1000+ computing core system, which offers parallel computing resources to applications that requires large quantity of memory as well as large and fast parallel storage systems. The entire system temperature is controlled by an energy and space efficient cooling solution, based on large rear door liquid cooled heat exchangers.

This state-of-the-art infrastructure will boost research activities in the region, offer a powerful scientific tool for teaching at undergraduate and graduate levels, and enhance association and cooperation with business-oriented organizations. Although this is a newly implemented infrastructure, it is already employed in several large national and international collaborative research projects as: high-resolution three-dimensional coupled petrological-thermomechanical numerical simulations of subduction processes that are at the frontier of plate tectonics (UNAM Mexico – ETHZ Swiss), large scale numeric simulation of subduction beneath Japan (UNAM Mexico - U. Kobe Japan), advanced studies related with human genome and neurobiology (UNAM) and X-ray high-resolution microscopy studies of rocks for geothermal energy (UNAM) related studies.

S5 P19

ADVANCED FLUID MECHANICS NUMERIC SIMULATIONS OF IRREGULAR OCEANIC PLATES SUBDUCTION BENEATH CONTINENTS

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For some volcanic arcs, the geochemistry of volcanic rocks erupting above subducted oceanic fracture zones is consistent with higher than normal fluid inputs to arc magma sources. Here we use enrichment of

boron (B/Zr) in volcanic arc lavas as a proxy to evaluate relative alongstrike inputs of slab-derived fluids in the Aleutian, Andean, Cascades and Trans-Mexican arcs. Significant B/Zr spikes coincide with subduction of prominent fracture zones in the relatively cool Aleutian and Andean subduction zones where fracture zone subduction locally enhances fluid introduction beneath volcanic arcs. Geodynamic models of subduction have not previously considered how fracture zones may influence the melt and fluid distribution above slabs. Using the supercomputing and visualization infrastructure at UNAM, we performed high-resolution three-dimensional coupled petrological-thermomechanical numerical simulations of subduction, and demonstrate for the first time that enhanced production of slab-derived fluids and mantle wedge melts concentrate in areas where fracture zones are subducted, resulting in significant along-arc variability in magma source compositions and processes.

S5 P20

DESIGNING EFFICIENT PHOTOCATALYSTS BY CONTROLLING THEIR MORPHOLOGY

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The manipulation of the nanostructures' morphology represents one of the most important challenge in the nanotechnology development. The shape control of the nanostructures involved in the photocatalytic processes, is one of the hot topics in current material science, and can lead to a great enhancement of the photodegradation rate of a given organic pollutant.

Recently, our research activity was focused on controlling the morphology of photocatalysts based on TiO_2, WO_3 and Au nanoparticles. Thus, our first interest was directed towards understanding the role played by the Au nanoparticle's shape on the photocatalytical properties, when they were in contact with commercially available Evonik Aeroxide P25. By the variation of specific synthesis parameters, three differently shaped Au nanoparticles, i.e. nano-spheres, nano-wires and nano-triangles, were synthesized and deposited on the surface of the chosen commercial titania, and the photodegradation rate and hydrogen production of the composites were evaluated. It was concluded that the shape of the deposited nanoparticles can highly influence the efficiency of the composites, making thus possible a shape defined application tuning. Our interest was further focused on preparing in a controllable way, by various preparation methods, i.e. sol-gel, supercritical drying, hydrothermal, materials based on TiO_2 and/or WO_3 with different morphologies. Moreover, our purpose was 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 performed analyses being finally completed.

The information achieved from the investigations of nanostructures with various morphologies [1-3], i.e. nano-plates, nano-spheres, nano-eggs, nano-labyrinthes, by means of UV-Vis, Raman, XRD, TEM, and SEM techniques reveals 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: photocatalysis, morphology, structure.
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S5 P21

PHOTOCATALYTIC ACTIVITY OF THE COMPOSITES BASED ON TiO_2-WO_3-NOBLE METALS

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Ternary composites based on TiO_2, WO_3 and noble metal nanoparticles are interesting materials with photocatalytic performances that depends on the constituents morphological and structural particularities. Thus, titania/tungsten (VI) oxide/noble metal (Au and Pt) nanocomposites were prepared by different approaches. The first one deals with the synthesis of the nanocomposites by using a selective photodeposition method that leads to the deposition of Au or Pt nanoparticles either on TiO_2 or WO_3 surfaces. The selective deposition of the noble metals nanocrystallites was verified by SEM-EDX measurements, and their size was determined using DRS and TEM. The control of the Au and Pt particles' localization induced great changes to the overall properties, i.e. light absorption, photocatalytic activity and hydrogen production. This demonstrates that the ternary composites should be designed very carefully, calculating every contact possibilities of the components [1].

The second approach evidenced the role played by the "build-up" methodology of ternary photocatalyst for improving their performances for chemical decontamination of water, including the intermediates formation. Thus, composites based on TiO_2-WO_3 (4 and 24 wt%)-Au (1 wt%) were obtained by sol-gel method followed by supercritical drying. Photoreduction of Au was then performed with UV/visible light. Their photocatalytic activity and intermediate formation profiles were evaluated using phenol as a model pollutant. The intermediates' evolution profile and structural peculiarities were successfully correlated and it was shown that each minor structural (bulk or surface) change has a significant impact on the photocatalytic activity and intermediate formation dynamics. The interest was also focused on the understanding of the structural and morphological particularities of the titania based photocatalysts The information derived from the Raman analysis alongside the others obtained from investigations performed by means of UV-Vis, XRD, X- XPS, SEM and TEM techniques revealed a relatively complete image of the role played by the structural and morphological particularities that gave rise to a differentiate degradation rate of phenol and its intermediates formation [2].

Keywords: photocatalysis, TiO_2, WO_3, noble metal.
Acknowledgments: This work was supported by the grant of the Romanian National Authority for Scientific Research PN-II-ID-PCE-2011-3-0442.

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S5 P22

CHARACTERIZATION OF AGRICULTURAL SOILS IMPROVED WITH ZEOLITES

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Zeolites are natural crystalline aluminosilicates which, among the most common minerals present in sedimentary rocks, have multiple agricultural applications. Ion-exchange properties as well as large porosity are their useful features recommending them as additives for soil; in this respect, they have the capacity to act as buffer for the process of nutrients translocation from soil to plants. The high absorption, cation exchange, catalysis and dehydration capacities of clinopltilolite made it the most utilized zeolite in agriculture. Present study aims to demonstrate the influence of natural zeolite addition (approx. 60% clinoptilolite) added on of agricultural soils upon its ion-exchange capacity. Experiments performed show comparative data between treated and untreated soils, at various time intervals during one year. Conclusions drafted evidentiate the role of natural zeolite in the soil matrix used as substrate for plant growth.

S5 P23

EFFECT OF FERTILIZERS AND PESTICIDES ON HEAVY METAL CONTENT OF ORCHARD SOILS AND FRUIT TREES

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The knowledge of the heavy metal content in soils and the origin of these levels are priority objectives in the European Union (EU). At the beginning of 2002, the European Commission published a report ‘‘Towards a Thematic Strategy for Soil Protection’’ [1], that established the basis and guidelines for at least maintaining or even improving the quality of soil.

The objective of this study was to assess the heavy metals content in orchard soils and fruit trees (apple and plump) from different types of samples (soil, trees bark, leaves and fruits body) in order to characterize the influence of various fertilizers and pesticides used in agriculture. The samples were collected quarterly from different areas of Dambovita and Arges County famous for fruits and fruit trees production.

Solid samples were analyzed by wavelength dispersion X-ray fluorescence (WDXRF) an instrumental nuclear activation methods (INAA). The same types of samples, after microwave digestion in acid solution, were analyzed by atomic absorption spectroscopy (AAS). We determined the content of Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn. Moreover, soil properties were determined in order to characterize agricultural soils and to analyze relationships between heavy metal contents and soil properties.

Multivariate data analysis was performed to identify a common source for heavy metals.

Correlations between the concentrations of heavy metals in the analyzed samples and pesticides and fertilizers used in these areas were found.

Keywords: heavy metal content, fertilizers, pesticides, apple tree, plump tree, analysis

References: [1] - EC, 2002- Communication of 16 April 2002 from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions: Towards a Thematic Strategy for Soil Protection. European Commission (EC), Brussels.

S5 P24

NEUTRON DIFFRACTION STUDY OF RETAINED AUSTENITE IN HIGH-STRENGTH STEELS

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Large thickness of semi-products in thermomechanical treatment of high strength steels results in essential non-uniformity of temperature, strain and hence final properties. Very local scales (microns) of conventional optical microscopy, SEM, TEM and XRD necessitate enormous sampling amount to determine the above mentioned non-uniformity in representative terms.

High penetration ability of neutrons enables distinct diffraction from steel samples of high thickness (up to tens of millimeters). This is particularly promising for investigation of dispersed secondary phases with extremely low volume fractions (e.g. retained austenite or carbides). We use neutron time-of-flight diffraction for determining the retained austenite content of high-strength steels.

The neutron diffraction measurements are carried out at texture diffractometer SKAT in JINR (Ullemeyer K et al 1998, Keppler R et al 2014). The existing methods for determination of the retained austenite are very sensitive to the presence of crystallographic texture. The using texture instrument allows reduce influence of the preferred orientations.

Keywords: high strength steels, neutron diffraction, retained austenite
Acknowledgements The JINR – "Prometey" agreement No. 400-784/477- 2016 are acknowledged.

Ullemeyer K et al 1998 The SKAT texture diffractometer at the pulsed reactor IBR-2 at Dubna: experimental layout and first measurements *Nuclear Instruments and Methods in Physics Research A* **412-1** 80

Keppler R et al 2014 Potential of full pattern fit methods for the texture analysis of geological materials: implications from texture measurements at the recently upgraded neutron time-of-flight diffractometer SKAT *Journal of Applied Crystallography* **47** 1520

S5 P25

OPTIMIZATION OF METALLIC SEGMENTED NANOWIRES FABRICATION PROCESS USING AL_2O_3 TEMPLATE

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Metallic segmented nanowires are suitable candidates for capacitive sensing devices due to relatively easy controllable growth process. On the other hand, alumina (Al_2O_3) template offers important advantages like low cost and ordinary fabrication techniques. Growing vertically aligned nanowires implies finding the optimal working parameters, related to targeted applications. In this study, we investigated the fabrication process of nickel (Ni) segmented nanowires using supported alumina template. Optimal working parameters of electrochemical deposition related with nanowires diameters and length were determined and discussed.

Keywords: nanowires, alumina template, nanostructures

Acknowledgements: This work was supported by Romanian Executive Unit for Financing Higher Education, Research and Innovation (UEFISCDI) by grant no. 60/2011.

S5 P26

STUDY OF PHYSICAL PROPERTIES OF NI:CU SEGMENTED NANOWIRES FOR SENSING DEVICES

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We report the growth of nickel:copper (Ni:Cu) segmented nanowires in supported alumina (Al_2O_3) template by electrochemical deposition using $NiSO_4$, (150g/L)+H_3BO_3 (50g/L), and $CuSO_4$, (85 g/L)+H_3BO_3 (30 g/L), solutions. The diameters of fabricated nanowires were determined to be about 100 nm, while their length was 500 nm. On the other hand, Al_2O_3 template was directly obtained by aluminum (Al) anodizing process. Morphological properties of fabricated nanowires were determined by scanning electron microscopy (SEM), while structural features were analyzed by X-ray diffraction. Electrical behavior of our fabricated nanowires was investigated by current-voltage (I-V) characteristics in 100K – 300K temperature range. Obtained results were discussed in relation to a good magnetic response.
Keywords: nanowires, alumina template, nanostructures
Acknowledgements: This work was supported by Romanian Executive Unit for Financing Higher Education, Research and Innovation (UEFISCDI) by grant no. 60/2011.

S5 P27

THE PROPAGATION OF MULTIPLE OPTICAL VORTICES THROUGH ATMOSPHERIC TURBULENCES

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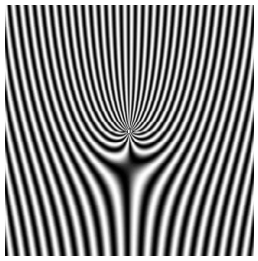
To increase the capacity of the optical communications channels several methods are currently in use like wavelength mutiplexing, polarization multiplexing, or quadrature amplitude modulation [1]. Optical vortices (OVs) are spatial multiplexing tools providing additional degrees of freedom that increase the transmission capacity up to several Tbit/s when all types of modulation are used at the same time [1]. Unfortunately, the free space communications are affected by the atmospheric turbulences within the refractive indices fluctuate over space and time [2]. So far the influences of different types of turbulences on a single OV beam were investigated [3-4]. The computer generated holograms (CGHs) obtained by the interference between a tilted plane wave and a helical phase distribution with topological charge *m* (Fig.1a) are addressed on a spatial light modulator (SLM). A collimated laser beam is diffracted by the SLM resulting in an OV characterized by annular intensity distribution around a central hole.

a)


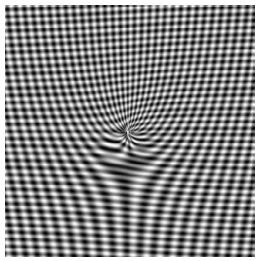
b)


Fig.1. CGH for m=20 (a), CGH for m_1=20, m_2=8 (b).

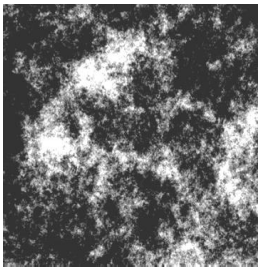


Fig.2. The phase screen of a non-Kolmogorov turbulence.

Here we propose a technique to study the simultaneous influence of a particular type of turbulence upon combinations of OVs, i.e. a multiple diffracted beam consisting in different orders of OVs passing through the same turbulence. Multiple OVs of topological charges $\pm m_1$, $\pm m_2$, $\pm(m_1+m_2)$, $\pm(m_1 \square m_2)$ are obtained in the far field of the diffracted beam on the CGH of two orthogonal plane waves which interfere with distinct helical phase distributions of topological charges m_1 and m_2 (Fig.1b). The phase screens of a non-Kolmogorov type of turbulence were generated and inserted in the optical path (Fig.2).

The effect of the strength of the turbulence upon the propagation of OVs with different values of topological charges is discussed in the terms of the efficiency of the reading process. The experimental results show that the turbulence modifies the phase and the intensity profiles of OVs and reveal the existence of a threshold that breaks the symmetry of the OVs.

Acknowledgement: The research was financed by the Romanian Government contract ANCSI-UEFISCDI PN-II-PT-PCCA no.203/2012.

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S5 P28

ATOMIC AND NUCLEAR ANALYTICAL METHODS APPLIED ON THE SEWAGE SLUDGES FROM DAMBOVITA COUNTY

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Nuclear Analytical Methods can be used for research activities on environmental studies like water quality assessment, soil, pesticide residues, global climatic change, pollution and remediation. Heavy metal pollution is a problem associated with areas of intensive industrial activity. The concentration of this heavy metals in sewage sludges from Dambovita County Romania it was determined with complementary nuclear and atomic analytical methods: Neutron Activation Analysis (NAA), Atomic Absorption Spectrometry (AAS)

and Energy Dispersive X-Ray Fluorescence Spectrometry (EDXRF). These high sensitivity analysis methods were used to determine the concentrations of Cd, Cr, Cu, Fe, Mn, Pb and Zn. Sewage sludge has valuable agronomic properties in agriculture. In using sewage sludge must be taken of the nutrient needs of the plants without, however, impairing neither the quality of the soil nor that of surface and ground water. Some heavy metals present in sewage sludge may be toxic to plants and humans, therefore required careful monitoring of these sludge from sewage.
Keywords: heavy metals, sewage sludge, EDXRF, AAS, NAA, Pearson correlation

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S5 P29

STUDY OF TOTAL DEGRADATION OF THE *TRANS- RESVERATROL* BY THE TEMPERATURE

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In this paper was studied by UV-Vis spectrophotometry and FT-IR spectroscopy, the effect of temperature on the trans-resveratrol till to total degradation.

Using statistical methods, it was observed that trans-resveratrol is unstable to higher temperatures than 100°C, even in the absence of light. However, at temperatures up to 70°C, resveratrol was found to be enough stable for time periods as short as 30 minutes. Pearson correlations of absorbance values at 304 nm (characteristic for trans-resveratrol) and 286 nm (characteristic for cis-resveratrol) shown that no conversion of trans-resveratrol to cis resveratrol is produced at elevated experimental temperatures.
Keywords: trans-/cis- resveratrol, UV-Vis spectrophotometry, FTIR, thermal stability, Pearson correlation

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S5 P30

APPLICATIONS OF LOW-VOLTAGE SCANNING ELECTRON MICROSCOPY FOR CHARACTERIZATION AND PATTERNIG OF GRAPNENE DEVICES

Adrian DINESCU, Mircea DRAGOMAN, Florin COMANESCU and Andrei AVRAM

IMT Bucharest, Romania

The presentation will be focused on achievements in low-voltage scanning electron microscopy (LV-SEM), both for imaging and structuring at the nanoscale. Fabrication of graphene devices requires advanced techniques to achieve relevant images, understand their functionality and improve fabrication technologies. Progresses in graphene technology over the last years confirmed the SEM an indispensable equipment for characterization and patterning of graphene. The development of very efficient in-lens detectors for SEM and the capability to use low energy electron probes are the gateway to the revelation of new features and new properties of nanomaterials that have been hidden by the use of high accelerating voltages and large interaction of volume, in the high resolution SEM (1,2). Electron beam has been used for lithography for decades and pattern generators can be fitted to all modern SEMs, converting them in very powerful nanolithographic tools, without degrading or limiting their imaging capabilities. The SEM became a very versatile tool for micro and

nanofabrication, the same equipment used for fabrication being used to view the resulting nanostructures. To illustrate the patterning capabilities of electron microscopy, a large part of the talk will be dedicated to the fabrication of a top gated ballistic field effect transistor on graphene (3) featuring negative differential resistance with large peak valley ratio.

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S5 P31

ELECTRONIC PROPERTIES OF O-DOPED POROUS GRAPHENE AND BIPHENYLENE CARBON: A DENSITY FUNCTIONAL THEORY

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Recent advances in the field of nanotechnology have led to synthesis and characterization of two-dimensional nanostructures such as graphene. Graphene is introduced as a promising material for nanoscale electronics due to its unique structure and electronic properties. It should be mentioned that the absence of a band gap limits the application of graphene in nanoelectronic devices. For this reason, searching another two-dimensional nanostructures with non-zero band gap becomes a focus of many research activities.

In recent years, two-dimensional carbon based nanostructures such as porous graphene (PG) and biphenylene carbon (BPC) have attracted considerable attentions. The atomic structures of PG and BPC are shown in Fig. 1. It was found that the electronic properties of PG and BPC are not similar to graphene. The PG is an insulator, while PBC shows semiconducting property.

Since it is almost impossible to work with impurity-free materials, it is essential to understand how impurities change the electronic properties of graphene based materials. Hence, we have studied the effect of oxygen impurity on the electronic properties of PG and BPC using density functional theory. The electronic band structures and density of states are calculated by using OpenMX3.7.

Our results indicate that oxygen doping has a considerable effect on the electronic properties of PG and BPC. The O-doped PG and BPC are n-type semiconductors. The energy band gap of PG and PBC are decreased due to the presence of oxygen impurity. The band gaps of O-doped porous graphene depend on the atomic position of the oxygen atom.

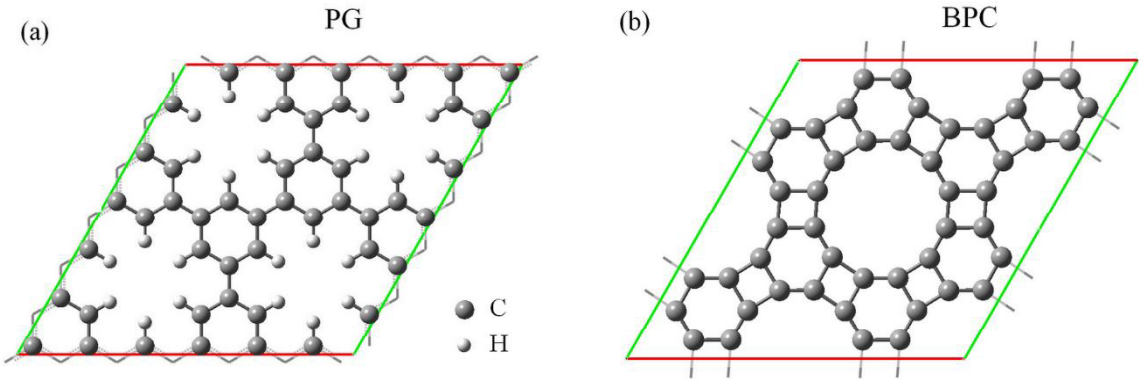

Fig. 1 Atomic structures of PG and BPC.

S5 P32

SURFACE WATER ASSESSMENT IN GALATZ CITY DURING 2014-2016

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In this study, surface water quality in Galati, Romania was evaluated. In order to assess annual variations of water quality, ten stations were used for sample collection. For monitoring the water quality some physical and chemical parameters were determined. The analyzed chemical parameters were: ammonium, dissolved nitrate, nitrite, salinity, magnesium and calcium, iron, chlorides , residual chlorine, sulfates and pH. As physical parameters we studied only conductivity and turbidity. These data were collected during March 2014– March 2016. The physico-chemical parameters were determinated each month during this period. Electrical conductance is always the most important parameter in contributing to water quality variations for all four seasons.

S5 P33

LOCAL CENTRE FOR RADIOLOGICAL SURVEILLANCE OF THE ENVIRONMENT (LCRSE) – COMPONENTS AND FUTURE UPGRADES FOR WEB AND OFFLINE USE

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NIPNE's facilities, held by Department of Life and Environmental Physics, named Local Centre for Radiological Surveillance of the Environment – LCRSE, can provide the following environmental and radiological monitoring activities:

- 24/7 hours monitoring of equivalent dose rate in air due to X and gamma radiation (perimetral radiological surveillance system consisting of six outdoor fixed detection stations with solar panels and an indoor dispatch unit);
- 24/7 hours monitoring of radionuclides emitting gamma, alpha and beta radiation in aerosols (detecting the presence and measuring the concentration of radionuclides in aerosols, separately for only gamma emission and combined for alpha and beta emissions);
- 24/7 hours complex meteo-radiological monitoring of radioactive aerosols and gases. It includes a 60 m tall meteo-radiological tower, which sends data online to the website http://meteo.nipne.ro/logger/last24h.html.

Using the knowledge and expertise gained in the project ***EMERSYS – "Toward an integrated, joint cross-border detection system and harmonized rapid responses procedures to chemical, biological, radiological and nuclear emergencies"***, where was developed a platform for data and information exchange (DIEX), see Figure 1, a local database was created, in order to held all data from LCRSE, in cronological order.

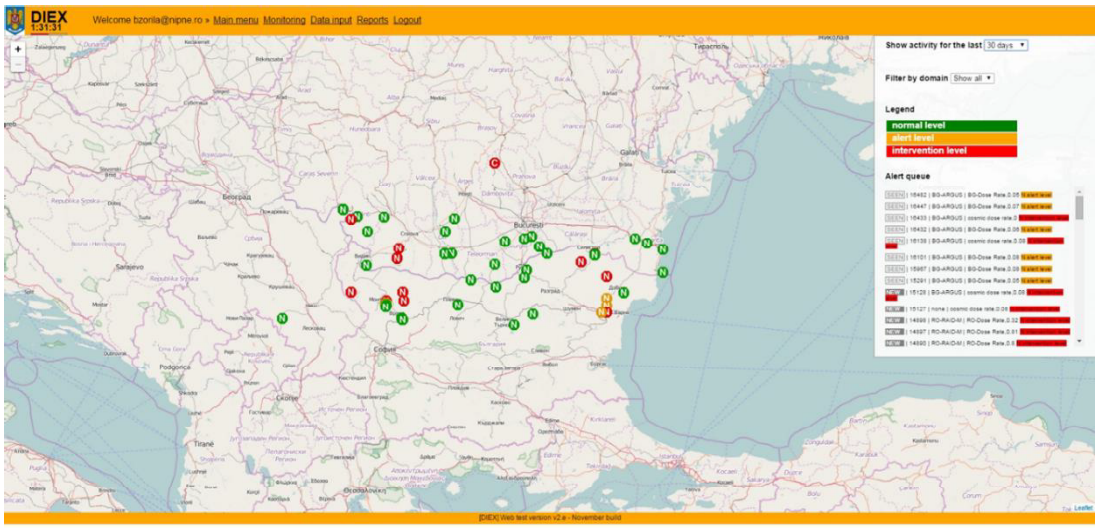

Figure 1. CBRN data from DIEX platform during an exercise for testing the communication between the in-field equipments and test server.

For populating the local database, was designed equipment-specific softwares (for radiological stations at meteo tower and perimetral radiological surveillancesystem, for the moment), to fit our needs for reading and transferring the data records. Also, for testing, two web pages was created, one for data geolocation and another for graphing data from a specific equipment (Figure 2).

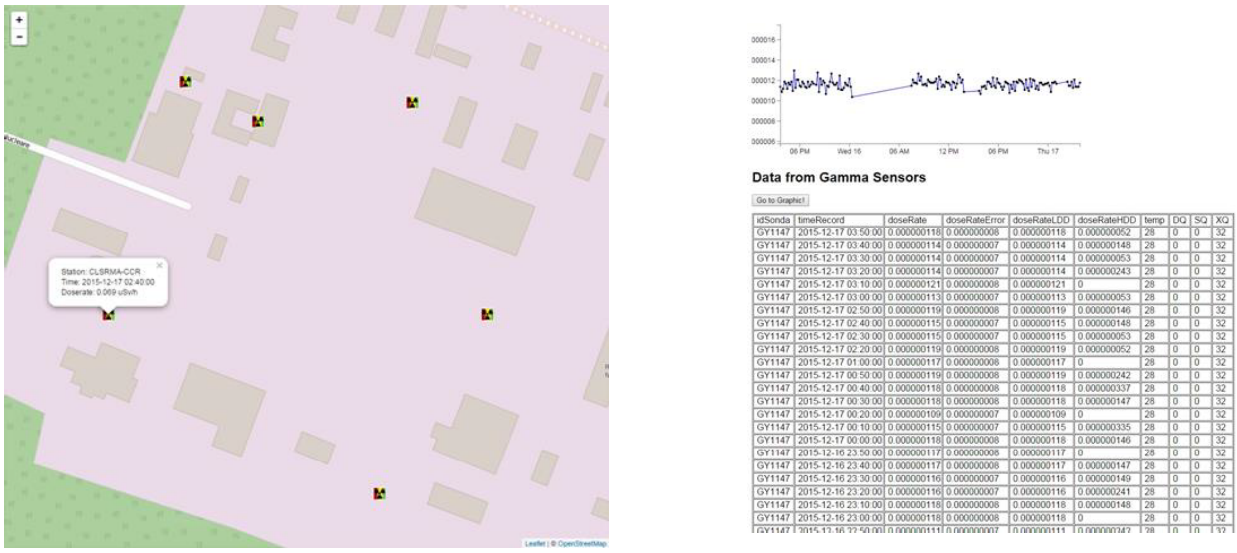

Figure 2. Geolocation view of gamma sensors(left) and 24 hours records of radiological data from GammaTracer XL2 equipment (right).

In the future, and based of the IoT (Internet of Things) principles, it will be developed softwares for all equipments (radon monitors, aerosol monitors, meteorological sensors and ceilometer). These softwares, together with the web applications can be used as a Early Warning System (EWS) and routinely monitoring of meteo-radiological parameters at NIPNE's site. Also, in the future, the records from the database can be automatically provided to RODOS System.

For the offline use of LCRSE data, we will develop a software program for data sorting, reporting and graphing.

Keywords: radiological surveillance, database, sensor geolocation, time-series graphic.
Acknowledgments. Bogdan ZORILA is preparing a PhD at Faculty of Physics, University of Bucharest. This work was supported by the Romanian Ministry of Education and Research through Grants: PN 09370301 and PN 16420203.

S5 P34

INVESTIGATION OF INFRASONIC SIGNALS RECORDED ON THE ROMANIAN BLACK SEA COAST

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At the beginning of year 2013, a permanent infrasound monitoring system composed by a MB-AZEL2007 microbarometer, the digitizer and the transmition equipment, was installed by NIEP, at Mangalia, Romania, on the Black Sea coast line (at 50m from the water front) to test the infrasonic method in correlation with local, regional and global sources producing acoustic waves with frequencies lower than 20Hz.

Three years of recordings shows at lower frequencies (<2Hz) a predictable behavior of infrasonic activity on the seashore, suggesting the presence of highly coherent infrasound waves in atmosphere. At higher frequencies (2Hz-8Hz) there appeared a type of waves that was never recorded before by our infrasonic sensors in other locations far away from the sea shore. The interesting aspect on the spectrogram resides in well defined, visible superior harmonics of the dominant signal, which develops between 2-8Hz. These harmonics are clear and create the specific "spider-legs" aspect present in spectrograms (Figure1).

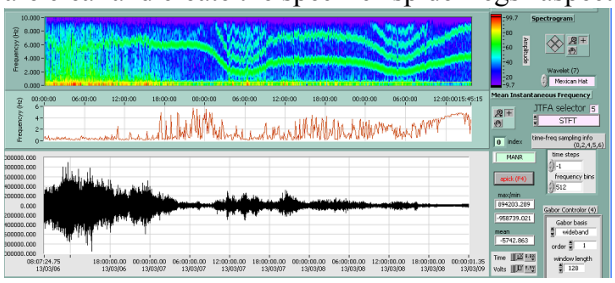

Figure 1. Infrasonic signals and spectrograms for three days in early 2013 spring days.

The precise source of these high amplitude signals at higher frequencies is under investigation and a couple of suppositions have been made. One of them refers to the composition of atmosphere that might be possible to act as a band-pass filter which selects certain preferred frequencies from the background infrasonic noise induced by water's surface. The propagation parameters of this "filter" may be altered by aerosols concentration, humidity, temperature and, perhaps, by other factors. The corroboration of the infrasound recordings and spectrograms with local meteorological data show a good correlation between the spectrogram and the daily variation of the humidity parameter.

Acknowledgements This work was partially carried out within Nucleu Program, supported by ANCSI, projects no. PN 16 35 03 01/2016, the Partnership in Priority Areas Program– PNII, DARING Project no. 69/2014 and the Programe for research- Space Technology and Avanced Research - STAR, project number 84/20130.
Key words: Infrasound monitoring

S5 P35

GREENHOUSE GASES: TRENDS WORLDWIDE AND CORRELATIONS WITH ANTHROPOGENIC ACTIVITIES

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The increasing population and of its needs, the continuous development of the industry, transport and other human activities, including those regarding domestic consumption, alongside natural phenomena and

processes represent emitters of greenhouse gases (GHG). The increase of their concentration in the atmosphere alters its physical-chemical balance, contributing, on long term, to the climate change, as the world is really concerned nowadays about the global warming. That is why we present here the analysis of the long scale evolution of GHG worldwide, from carbon oxides, to methane, to nitrogen oxides and anthropogenic fluorinated and hydrogenated carbonated compounds. The data are taken from three databases: 1) Giovanni (Geospatial Interactive Online Visualization and Analysis Infrastructure) from USA, 2) EDGAR (Emission Database for Global Atmospheric Research) of the European Union and 3) JMA (Japan Meteorological Agency) from Japan's most advanced research center. These databases are created and developed within the efforts of the world's scientists to keep a close eye on the evolution of the environment and to be able to know when and how to adapt the international and national policies in order to maintain our lives in as good conditions as possible, such that the sustainable development would be accomplished.
Keywords: greenhouse gases, databases, anthropogenic activities, trends

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S5 P36

SOME ASPECTS REGARDING PRECIPITATES IN THE TINI AND TINICU SHAPE MEMORY ALLOYS OBTAINED BY POWDER METALLURGY

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*

This paper presents a study about the investigation of the formation of Ti-Ni and Ti-Ni-Cu alloys by solid state diffusion from elemental Ti, Ni and Cu powders and spark plasma sintering combined with mechanical alloying technique. The TiNi and TiNiCu samples were characterized by means of x-ray and neutron diffraction, scanning electron microscopy, energy dispersive spectroscopy and nanoindentation measurements. It was found that elemental powders sintered by spark plasma equipment with 48.5%at.Ti balance Ni and 50%at.Ti-40%at.Ni balance Cu did not result in single phase. Instead, multi-phases including $TiNi_3$, Ti_2Ni and TiNi were found to co-exist in the microstructure even after heat treatment at low temperatures.
Keywords: mechanical alloyed, spark plasma sintering, shape memory, TiNi, precipitates

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S5 P37

EXTREME SOLAR WIND EVENTS AND CLOUD COVER: POSSIBLE CORRELATIONS

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Quantifying the natural contributions to climate change is of major significance for a correct assessment of anthropogenic effects on climate at global or regional scale. One major uncertainty refers to clouds, which are deeply involved in water and energy exchange with important effects on the radiation budget. Lately it has been showed that cloud properties and inherently cloud cover may be influenced by atmospheric electricity. This, in turn, is influenced by the solar wind and near-Earth properties, namely the interplanetary electric and magnetic fields (IEF and IMF, respectively), but also by the galactic cosmic rays, whose influence on the terrestrial atmosphere is modulated by the solar wind itself. Changes in the plasma wind speed (PWS) and of the IEF and IMF intensities may influence cloud cover at regional or global scale on different time scales. Our study aims at identifying whether significant changes in cloud cover following extreme changes of extra-terrestrial parameters, are observed, and possible dependence on cloud type, as differentiated by cloud height and composition. Cloud data are taken from the ISCCP project (International Satellite Cloud Climatology Project), for the period between 1983-2009, while solar wind characterization is obtained from

the OMNIweb-site of NASA, which is an hourly-averaged data set of the near-Earth solar wind magnetic field and plasma parameters, as obtained from several spacecrafts which have geocentric orbits. Preliminary studies prove that cloud cover seem to respond to extremes of PWS, IEF and IMF, at specific terrestrial latitudes, but only for particular regional and seasonal conditions.
Keywords: cloud cover, solar wind, IMF, extreme events, correlations
Acknowledgements: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS—UEFISCDI, project number PN-II-ID-PCE-2011-3-0709 (SOLACE). The ISCCP project is acknowledged for the cloud data. The Omniweb website of NASA is acknowledged for the solar wind data.

S5 P38

QUANTUM MECHANICS OF HETEROSTRUCTURES WITH BEN-DANIEL – DUKE BOUNDARY CONDITIONS

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Quantum mechanics of systems with space-varying mass is an emerging, promising domain of semiconductor physics. In this contribution, the analytical approximations of the solutions of quantum well problems, studied in detail for systems with constant effective electron mass, are extended for heterojunction where BenDaniel-Duke boundary conditions must be applied. In this way, new physical behaviour is revealed. The optoelectronic applications are shortly discussed.
Keywords: quantum wells, semiconductor heterojunctions, BenDaniel – Duke boundary conditions

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S5 P39

PERFORMANCE OF POLYANILINE/CNTs AND POLYPYRROLE/CNTs NANOCOMPOSITES AS ANODE FOR MICROBIAL FUEL CELL

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The polyaniline/CNTs and polypyrrole/CNTs nanocomposites were evaluated as an anode material for microbial fuel cells (MFCs). X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM) were used to characterize polyaniline/CNTs and polypyrrole/CNTs nanocomposites.
The maximum power densities were obtained for MFCs with polyaniline/CNTs (202.26 mW/m^2) modified carbon cloth as electrode vs polypyrrole/CNTs (167.8 mW/m^2) and CNTs (145.18 mW/m^2) modified carbon cloth. The results regarding the conducting polymer/CNTs nanocomposite modified anode show that the conducting polymer modified anode can be an alternative for improving the MFC performance.
Keywords: polyaniline/CNTs, polypyrrole/CNTs, nanocomposite, microbial fuel cell
Acknowledgments
This work is supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-II-RU-TE-2014-4-0221.

S5 P40

THE MODELING OF THE MACROSEISMIC FIELD ASSOCIATED WITH ROMANIAN NORMAL AND INTERMEDIATE DEPTH EARTHQUAKES

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The present work is a study of macroseismic intensity distribution, using the isoseismal maps for 12 normal depth earthquakes and for 18 intermediate depth earthquakes that occurred in Romania, between 1790 and 1966, during the historical period of seismology. The maximum epicentral intensity is in the range IV ½ - X, in the MSK intensity scale.

The intensity distribution for all events was first modeled using different atenuation laws as function of epicentral intensity, distance and azimuth and then compared with the existing izoseismal maps.

The set of macroseismic attenuation laws used for modeling were established for the main seismic provinces from the Romanian territory by Pantea et al, 1994, Pantea and Moldovan, 2000 and Pantea et al., 2001 for crustal foci from Romanian territory and Enescu and Enescu, 2007, Moldovan, 2007, and Sokolov et al, 2008 for Vrancea subcrustal earthquakes.

The bulk of the modeling is to determine the best attenuation law that will be used to estimate the expected macroseismic intensity at different important sites from Romania, and to further use them in the assessment of the seismic hazard and risk of the country and to design the real time shake maps.

Acknoledgements This paper was partially carried out within Nucleu Program, supported by ANCSI, projects no. PN 16 35 01 06, PN 16 35 03 01 and PN 16 35 03 05 and the Partnership in Priority Areas Program – PNII, under MEN-UEFISCDI, DARING Project no. 69/2014.

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Enescu, D and B.D. Enescu A Procedure For Assessing Seismic Hazard Generated By Vrancea Earthquakes And Its Application. III. A Method For Developing Isoseismal And Isoacceleration Maps. Applications Romanian Reports In Physics, Vol. 59, No. 1, P. 121–145, 2007

Moldovan I.A., 2007, Metode si modele statistice in seismologie, pag 236, Editura Morosan, Bucuresti 2007.

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S5 P41

TESTING THE MACROSEISMIC INTENSITY ATTENUATION LAWS ON THE ROMANIAN CRUSTAL SEISMIC EVENTS

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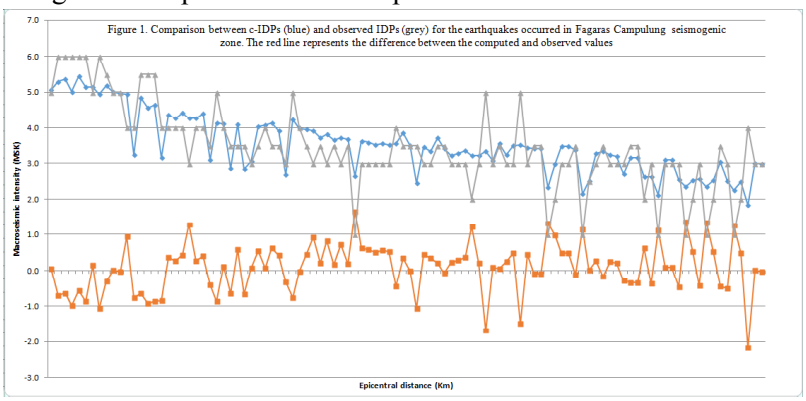
In the present work we test existing macroseismic intensity attenuation laws, using the intensity data points (IDPs) for 18 normal depth earthquakes that occurred in Romania in Banat, Crisana Maramures, Fagaras-Campulung, Predobrogean Depression, Intramoesian Fault and Vrancea crustal seismogenic zones and in Bulgaria - Shabla Seismogenic zone, between 1908 and 2014. The epicentral intensity is in the range IV ½ -VIII, in the MSK intensity scale. For this study there have been used more than 1250 IDPs.

The set of macroseismic attenuation laws used for testing were established for the main seismic provinces from the Romanian territory by Pantea et al, 1994, Pantea and Moldovan, 2000, Pantea et al., 2001 and 2002 and Zsiros, 1996 for crustal foci from Romanian. Using 16 attenuation relationships there have been computed theoretical intensity data points (c-IDPs) in the locations where observed intensities were available. In Figure 1 is represented the comparison between IDPs and c-IDPS using Pantea, 1994 modified relationship.



The final purpose of the testing is to determine the best attenuation law that will be used to estimate the expected macroseismic inten-sity at different sites, and to further use them in the assessment of the seismic hazard and risk of the country and to design the real time shake maps.

Acknoledgements
This paper was partially carried out within Nucleu Program, supported by ANCSI, projects no. PN 16 35 01 06, PN 16 35 03 01 and the Partnership in Priority Areas Program – PNII, under MEN-UEFISCDI, DARING Project no. 69/2014.

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S5 P42

TESTING THE MACROSEISMIC INTENSITY ATTENUATION LAWS ON THE VRANCEA (ROMANIA) SUBCRUSTAL SEISMIC EVENTS

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In the present work we test existing macroseismic intensity attenuation laws, using the intensity data points (IDPs) for 11 intermediate depth earthquakes that occurred in Vrancea, Romania seismogenic zone, between 1738 and 2004. The epicentral intensity is in the range VII-X, in the MSK intensity scale. For this study there have been used more than 4371 IDPs.

The set of macroseismic attenuation laws used for testing, were established for Vrancea, subcrustal earthquakes by Enescu and Enescu, 2007, Moldovan, 2007, Sokolov et al, 2008 and Sorensen et al, 2008 and 2010.

Using 5 attenuation relationships there have been computed theoretical intensity data points (c-IDPs) in the locations where observed intensities were available.

The final purpose of the testing is to determine the best attenuation law that will be used to estimate the expected macroseismic inten-sity at different sites, and to further use them in the assessment of the seismic hazard and risk of the country and to design the real time shake maps.

Acknoledgements This paper was partially carried out within Nucleu Program, supported by ANCSI, projects no. PN 16 35 01 06, PN 16 35 01 09, PN 16 35 03 01 and the Partnership in Priority Areas Program – PNII, under MEN-UEFISCDI, DARING Project no. 69/2014.

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Enescu, D and B.D. Enescu A Procedure For Assessing Seismic Hazard Generated By Vrancea Earthquakes And Its Application. III. A Method For Developing Isoseismal And Isoacceleration Maps. Applications Romanian Reports In Physics, Vol. 59, No. 1, P. 121–145, 2007
Moldovan I.A., 2007, Metode si modele statistice in seismologie, pag 236, Editura Morosan, Bucuresti 2007.
Sokolov V, K.-P. Bonjer, F. Wenzel F., B. Grecu B., and M. Radulian, 2007. Ground-motion prediction equations for the intermediate depth Vrancea (Romania) earthquakes, Bull Earthquake Eng (2008) 6:367–388 DOI 10.1007/s10518-008-9065-6
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S5 P43

GEOMETRY OPTIMISATION OF A THERMO-PHOTOVOLTAIC SYSTEM USING THE FINITE ELEMENT METHOD

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Thermophotovoltaic (TPV) systems convert heat into electricity by thermally radiating heat onto a photovoltaic (PV) diode array. They have potential applications as TPV combined heat and power (CHP) generation units, with radiator based on SiC or Yb_2O_3 and considering as a heat source a combustion flame. Small area PV cells can be used in order to reduce the system costs, and the use of some specials mirrors for radiation focusing onto photocells became necessary. Unfortunately, if the intensity of the radiation focused by mirrors becomes too high, the PV cells can overheat and degrade. In this paper, it was developed a basic TPV model using commercial Finite Element Method (FEM) package Comsol Multiphysics (version 5.0). The lengths of the mirrors and of the photocells were optimized in terms of surface radiosity and surface irradiation by selecting a geometrical model having the optimal operating temperature low enough to ensure a reduced temperature gradient in the vicinity of the mirrors.

S5 P44

SEISMICITY OF MARAMURES COUNTY

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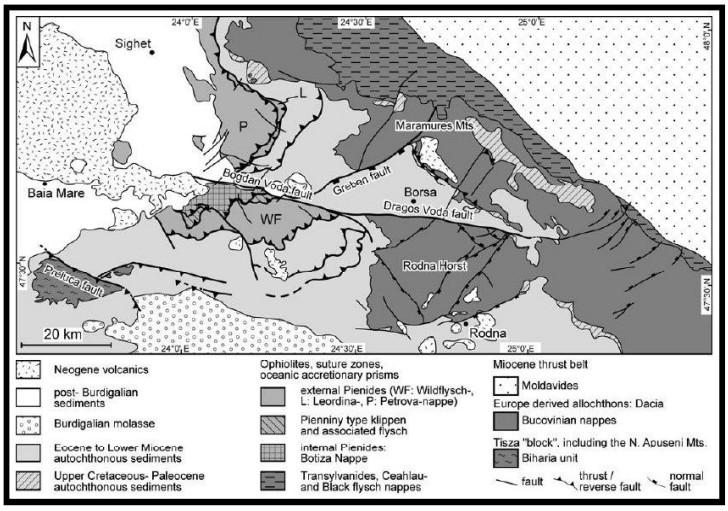
Maramures area, is located outside the Carpathians, near the transition to the Western Carpathians and includes terminology of tectonics the Carpatho-Pannonian area, the north-eastern block Tisza (Bihor Unit) and almost all of the northern part of the Dacia block (Bucovinic nappe). The most obvious structure of the area is represented by Bogdan - Dragos Voda system faults, senestrum strike-slip faults oriented to the east. In his western part Bogdan Voda Fault cuts sedimentary cover of the both Tisza-Dacia and Pienidele blocks and is covered by volcanic sediment. To the east Dragos Voda fault, forms the northern limit of the crystalline body with horst form (Rodna horst).

Halmeu fault present a weak overthrust movements as result of the compression of Baia Mare eruptive block on the Satu Mare depression, in the west. Mara fault crossing Gutai block and Sighet depression. Benesat-Ciucea fault allow adifferential movement of the eastern flank of Zalau-Cehu Silvaniei grabens in relation to western flank that has a subsidence movement



Earthquakes of Maramures are known by shocks from the period 1876-1926 of V maximum intensity. Maramures area is affected by a crustal seismicity grouped around a few localities. In Baia Mare area (the Dragos Voda fault) occurred few quakes one at 06.30.1978 (MW = 4), and three earthquakes in 1979, maximum magnitude 3.2 (Mw).

On the Mara and Halmeu faults, are highlights few seismic foci with a active precense in frequency. In 1893 and 1894 have Tectonic map of the Maramures County (Schmid et al., 2008) produced an earthquake of magnitude

3.8 (Mw), r espectively 4.7 (Mw); in 1888 an earthquake of magnitude 3.8 (Mw) held in Coştiui; nearby Sarasau in 1911, four earthquakes with magnitude 4(Mw). Over a period of 66 years (1876-1940) was not felt intensities higher than I = 5 +, so seismic activity was relatively weak.

Acknowledgements for :
This paper was partially carried out within Nucleu Program, supported by ANCSI, projects no. PN 16 35 01 06, PN 16 35 01 12, PN 16 35 03 01, PN 16 35 03 04, and PN 16 35 03 05

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S5 P45

A TEMPERATURE AND RELATIVE HUMIDITY TRANSDUCER ARCHITECTURE FOR USING IN ENVIRONMENTS WITH IONIZING RADIATION

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[2]*Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH)*

The ambient temperature and relative humidity monitoring in environments with ionizing radiation is performed without semiconductor sensors. Due to its low energy band gap (1.1eV), a silicon-based material may fail prematurely when exposed to radiation. In this paper, some techniques are proposed for measuring the above parameters by using sensors which are insensitive to high radiation doses.

The architecture is presented in Fig.1. Inside the experimental room (where a ionizing radiation source is mounted), a thermocouple is used to evaluate the ambient temperature, and a humidity sensitive resistor is used for relative humidity measurement. A thermocouple temperature compensation IC and a second humistor are used to monitor the same parameters in the control room (where is no radiation source). The humidity sensors are supplied with AC signal form a Wien bridge oscillator through coaxial cables. An 8-bit microcontroller samples the acquired signals from sensors, and convert the data to be sent for storage through a serial port. For better resolution and precision measurements, an EEPROM memory is used to store the thermocouple voltage-temperature chart and the the humistor resistance-humidity modified table. The memory communicates with the microcontroller on the I^2C bus.

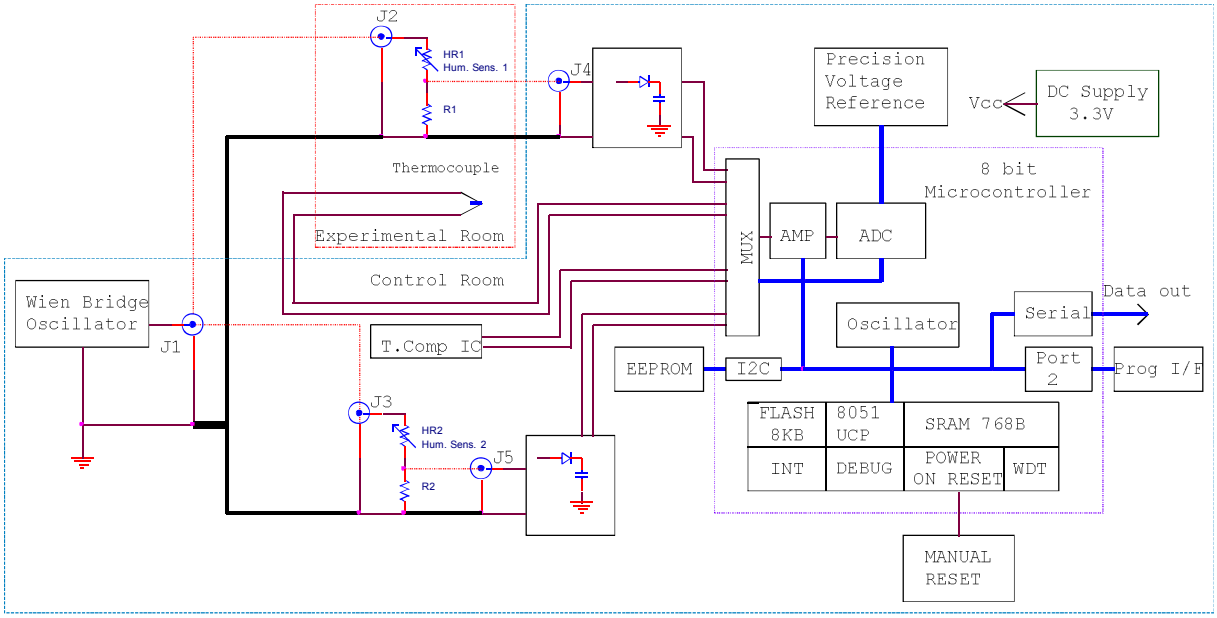

Fig.1 The proposed architecture

Acknowledgment: "The work has been funded by the Sectorial Operational Program Human Resources Development 2007-2013 of the Ministry of European Funds through the Financial Agreement POSDRU/159/1.5/S/ 134398."
Keywords: temperature, relative humidity, transducer, ionizing radiation.

S5 P46

LABORATORY INSTALLATION FOR CATALYTIC COMBUSTION OVER OXIDIC CATALYSTS

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The installation serves the study of the catalytic properties of oxidic compounds, ferrites or perovskites with sub-micron structure, at the combustion of gases and vapors diluted in air. This installation allows the control of the catalytic combustion parameters: gas flow, fuel gas concentration in air and the reaction temperature. Using gas analyzers, determine the degree of conversion and the composition of combustion resulting gases. The studied gas in this installation has a reduced concentration, well below the flammability limit. **Acknowledgements**: This work was performed by financial support of the Project PN-II-ID-PCE-2011-3-0453, CNST-UEFISCDI.
Keywords: installation, catalytic properties, oxidic catalysts.
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S5 P47

NUMERICAL PERFORMANCE FOR THE InGaN/InN/InGaN/InN DOUBLE CHANNEL HIGH ELECTRON MOBILITY TRANSISTOR.

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An analytical - numerical model for the noise 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[2,3] , 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 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.

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S5 P48

EFFECT OF GaN CAP LAYER ON THE CUT OFF FREQUENCY OF GaN/AlGaN/GaN HIGH ELECTRON MOBILITY TRANSISTORS

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An analytical- numerical model for the total drain source current and mobility of GaNAlGaN/GaN based high electron mobility transistors has been developed that is capable to predict accurately the effects of GaN Cap layer thickness on the drain source current in different gate length , gate source and drain source biases. 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 current and three dimensional mobility in the barrier of AlGaN, traps density in AlGaN are also take 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[1,2]. The calculated model results are in very good agreement with existing experimental data for HEMTs device

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S5 P49

CHARACTERIZATION OF PLASMONIC METASURFACES FOR OPTICAL COMPONENTS ABLE TO MANIPULATE THE LIGHT BEYOND THE FUNDAMENTAL DIFFRACTION LIMIT

Costel COTIRLAN-SIMIONIUC, Constantin LOGOFATU, Catalin Constantin NEGRILA, Adrian Stefan MANEA

National Institute for Materials Physics, Bucharest-Magurele, Romania

Plasmonics provides an unique way to manipulate the light at truly nanoscales beyond the diffraction limit. Unlike conventional bulk optics, the plasmonic nanostructures encoded on an ultrathin and planar surface, so-called metasurface, provide a revolutionary way of directing the light in the free space [i]. The planar geometry of metasurfaces [ii] can achieve full phase modulation, the polarization of light and it is suitable for the subsequent device integration. The metasurface based quarter-wave plate was characterized by confining the long axis of the nanorods within the plane of incidence, i.e. the x-z plane. A conventional IR quarter-wave plate was used to generate circularly polarized incident radiation (Fig.1). The polarization state of the reflected IR radiation was characterized by rotating a linear polarizer as broadband analyzer in steps of 10° in the plane perpendicular to the wave vector of the reflected radiation and detecting the transmitted image from DT 1500 measuring set with a thermal camera (Optris PI450). The circularly polarized incident image was provided by inserting a conventional broadband quarter-wave plate immediately after the linear polarizing component and in front of the sample. This investigation reveals that strong coupling between nanorods plays a critical role in controlling the scattering phase difference for achieving the anisotropic optical dispersion required for low-loss performance on broadband.

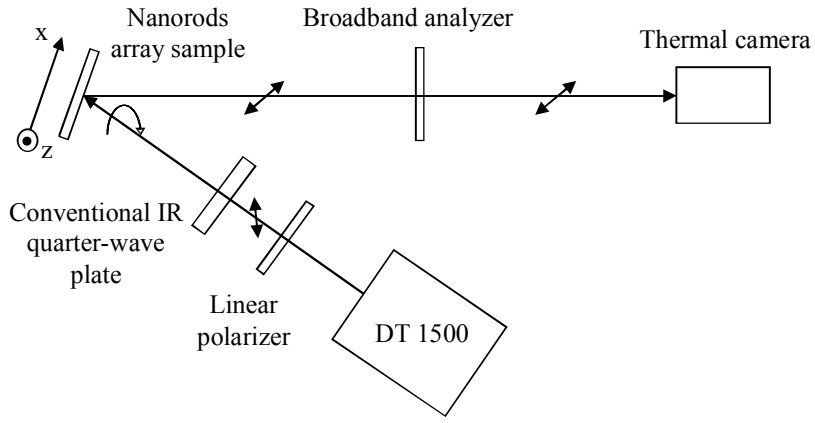

Fig. 1 Optical setup for metasurfaces characterization.

Keywords: Plasmonic metasurfaces, polarization, sub-wavelength resolution

Acknowledgements: PCCA 2013, contract 277/2014, Core Program 2016-2017, project 3

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ABSTRACTS

S6 – Topics in Physics Education Research

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

S6 O1

DO OUR STUDENTS NEED TO KNOW MORE ON NANTOECHNOLOGIES

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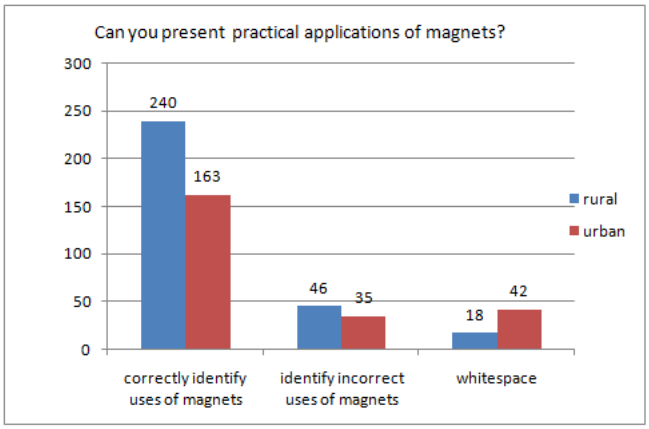
The pupils use in day by day life computers, communication and electronic devices that include nanotechnologies or nanostructured materials. Teaching physics must be often adapted to nowadays scientific discoveries pushing the limit of knowledge. The various examples of practical applications can be used by teachers to introduce new contents and new practical activities to drive the interest of students in physics topics. By bringing students closer to nanoscience and nanotechnologies they can become conscious of their role in developing society knowledge and in challenging the technological progress. The aim of the study was to evaluate the interest of the middle school students and teachers in instructional activities based on last decades scientific and technological discoveries.

This paper presents the results of the survey of pupils' knowledge / opinions on nanotechnologies. The targeted public pertained to sixth to eighth grades scholars distributed in urban and rural areas of Vaslui country. The study was conducted in order to identify the level of awareness of pupils on nanotechnology (focusing particularly on notions about magnetism and ferrofluids) and their possible interest regarding this field of science. To achieve the first part of the goal the existing curricula and textbooks of different educational system in Europe and North America were studied. Was concluded that are countries in which technologies and in particular ferrofluids are studied in practical activities.

The hypothesis of the educational research was: "Children would be interested in recent technological discoveries". A questionnaire was designed and tested in one class and after refined. In second stage the questionnaire was distributed in 9 schools (five in urban and four in rural area) and returned by 544 of respondents. The items were simple and refereed to concept as small magnets, interaction in between and application, solid and liquid state, viscosity, magnetic liquid, ferrofluids and application. As example in Fig. 1 are shown students responses on magnets applications and can be see that 74% indicate correct use.



The paper analyzes students responses from different point of view and conclude on necessity to introduce in textbooks and within curricular recommendations new technologies and materials as example ferrofluids.

Keywords: teaching, magnetism, nanotechnology, ferrofluids

Acknowledgements are brought to teachers who helped in distributing questionnaires in schools involved in this survey.

S6 O2

TEACHING PHYSICS IN A MIXED REALITY BASED ENVIRONMENT. A PRE-SERVICE TEACHER PERSPECTIVE

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The integration of collaborative web 2.0 applications, of open educational resources based on modern learning technologies (mobile learning, MOOC, virtual and remote laboratories) and Internet (cloud computing), of various visualization techniques (3D printers, mixed reality, visual data analysis) and digital strategies (flipped classroom, games and gamification, and location intelligence) in open, flexible modern learning environments which facilitate access to resources, represents a challenge for all science teachers in Romania in general, and for novice teachers in particular.

Although large efforts have been made worldwide to invest in educational technologies, their impact on the learning process of students is quite modest. As a direct consequence, a wide body of pedagogical theories has been developed lately to understand how the students' interaction with technology influences their learning process, their learning outcomes and respectively, the way in which new technologies can be useful instruments with a decisive impact in teaching and assessment strategies [1,2]. In this context, science teachers are provided not only with advanced educational technologies but also with pedagogical models that help them understand the process through which technology can support learning, teaching and assessment, leading to a significant improvement of the teaching process.

In this paper, we describe and analyze various curricular and extracurricular activities, specifically designed for and undertaken by preservice science teachers. These activities employ new educational technologies, use a blended learning environment, and are based on modern teaching theories. We study the way in which students relate to these modern technologies in general, and to the use of mobile augmented reality for teaching science in particular, but also how students are able to efficiently interweave scientific content knowledge with pedagogy and technology.

Keywords: science education, modern pedagogic theories, learning activities, mobile augmented reality.

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S6 L1

THE IMPACT OF THE INVESTIGATION STUDY AS METHOD IN THE TEACHING APPROACH

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In this paper we approached multiple applications of the method of investigation in the teaching learning process. The method has been tested successfully on groups of students in their final years of the Faculty of Sciences, University of Craiova. The article presents the results of this experimental methodical and scientific approach.

Key words: Teaching learning process, Method of investigation

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