

**9th International Conference on
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ABSTRACT BOOK

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TOPIC 1

Biomaterials and Healthcare Applications

<p>I-1</p>	<p>Advanced structural studies of bio(co)polyesters at the molecular level by mass spectrometry <u>Grazyna Adamus</u>¹, Marek Kowalczyk¹ ¹<i>Polish Academy of Sciences, Centre of Polymer and Carbon Materials, 41-819 Zabrze, Poland</i></p> <p>Polyhydroxyalkanoates (PHA) represent an interesting group of thermoplastic biodegradable polyesters which have functional properties that are quite suitable for commercial applications. Because of their inherent properties biodegradability and biocompatibility they are considered as materials for biomedical application. However, the specific applications in medicine requires from polymeric materials a wide range of exclusive properties. Therefore a lot of research is conducted on the development of new polymeric biomaterials with assumed properties based on matrices or structural segments derived from PHA biopolyester and their synthetic analogues. Continuous search of novel biodegradable polymeric materials require precise methods of their characterization. In recent years mass spectrometry has become a routine analytical tool for characterization of polymers, complementing NMR and other traditional techniques by providing detailed structural information about the individual macromolecules in a (co)polymer samples and polymerization mechanism involved.[1-2] Recent results concerned with application of mass spectrometry technique, for structural characterization of selected PHA biopolyesters as well as their synthetic analogues will be presented. [3-5]</p> <p>Acknowledgement; This research has been supported by European Regional Development Fund, project MARGEN; contract N^o: POIG.01.03.01-00-018/08 and project ANIMPOL; contract N^o: FP7-KBBE-2009-3-245084.</p> <p>1. G Montaudo, R.P. Lattimer. Eds. Mass Spectrometry of Polymers, CRC Press: Boca Raton, FL, 2002. 2. G. Adamus, M. Kowalczyk, in „Mass Spectrometry in Polymer Chemistry”, C. Barner-Kowollik et al. Eds. Wiley-VCH, Weinheim, 2011, p. 405. 3. E. Zagar, A. Krzan, G. Adamus, M. Kowalczyk Biomacromolecules, 2006, 7, 2220; IF 5,327. 4. G. Adamus, M. Kowalczyk, Biomacromolecules, 2008, 9, 696-703. 5. G. Adamus, Macromolecules, 2009, 42, 4547-4557.</p>
<p>I-2</p>	<p>Trace-level quantitation by isotopic dilution GC/MS methods <u>Monica Culea</u>¹ ¹<i>Biomedical, Theoretical and Molecular Spectroscopy Physics Department, Faculty of Physics, “Babeş-Bolyai” University, 1 M. Kogălniceanu St., Cluj-Napoca, Romania</i></p> <p>Mass spectrometry, including combined gas chromatography - mass spectrometry, GC-MS, is the most widely applied technology in metabolomics, as it provides a rapid, sensitive and selective qualitative and quantitative analyses with the ability to identify metabolites. The aim of this work is to present some of our research results in medical applications by using GC-MS, especially the achievement of non-invasive or minim invasive advanced methods of diagnosis and treatment of infants and children. A minim invasive diagnosis of the inborn metabolic error diseases as phenylketonuria (PKU) and maple syrup urine diseases (MSUD), the development and validation of the diagnosis method for cirrhosis and hepatitis by SIM-GC/MS (the caffeine test), quantitative determination of anesthetics in surgery rooms, non-invasive theophylline determination by using isotope dilution mass spectrometric techniques are presented. The selected ion monitoring (SIM) mode is used for quantitation at ppb level. Isotopic dilution (ID) GC-MS methods for diagnosis and monitoring patients suffering of different diseases offer very precise quantitative determination at trace level [1,2]. Quantitative analysis was performed by regression curve method and by using matrix calculation. The validation of the methods is also presented. Rapid medical intervention is essential for a successful outcome.</p>

	<p>[1] C. Mesaros, A. Iordache, O. Cozar, C. Cosma, M. Culea, Romanian J. Biophys. 20, (2010) 71. [2] M. Culea, Medical Physics, Chapter 1, Mass spectrometry. Medical applications, 2012 Nova Science Publisher Inc.</p>
<p>I-3</p>	<p style="text-align: center;">Studies of proton transfer dynamics in biological systems Janez Mavri^{1,2}</p> <p>¹<i>Laboratory for Biocomputing and Bioinformatics, National Institute of Chemistry, Hajdrihova 19, SI-1000 Ljubljana, Slovenia</i> ²<i>EN-FIST Centre of Excellence, Dunajska 156, SI-1000, Ljubljana, Slovenia</i></p> <p>In this contribution progress of recent studies of proton transfer dynamics in the systems of biological interest will be presented. Histamine belongs to a family of biogene amines and is mostly known for its role as an inflammation mediator, neuromodulator and neurotransmitter. We modeled the nature of monoprotonated histamine hydration by using Car-Parrinello molecular dynamics. We studied vibrational spectrum associated with the NH stretching of the ring NH and amino group by a posteriori quantization of molecular motion. The effects of deuteration were considered. The calculated spectra are in very good agreement with the experiment [1]. Additional insight into the nature of hydration of histamine was obtained by the microsolvation study [2] Nuclear quantum effects in enzymatic reactions and in particular the effect of the donor-acceptor distance on the rate constant will be critically discussed. Recently it was proposed that compression of this distance gives rise to enhanced tunneling. Some authors argued that this proposal is consistent with pressure effects on enzymatic reactions, and that the observed pressure effects support the idea of vibrationally enhanced catalysis. However, a careful analysis of the current works reveals serious inconsistencies in the evidence presented to support these hypotheses. Apparently, tunneling decreases upon compression. Relevance of nuclear quantum effects for receptor binding and activation, in particular the results for histamine H2 receptor, will be discussed [4].</p> <p>[1] J. Stare, J. Mavri, J. Grdadolnik, J. Zidar, Z.B. Maksic and R. Vianello, J. Phys. Chem. B. 115 (2011) 5999-6010. [2] R. Vianello and J. Mavri, New J. Chem. 36 (2012) 954-962.</p>
<p>I-4</p>	<p style="text-align: center;">Optimization of the analgesic pharmacodynamic effects using polymeric-drug nanoparticulate systems Liliana Tartău¹, Viorel Melniș²</p> <p>¹<i>“Gr. T. Popa” University of Medicine and Pharmacy Faculty of Medicine Pharmacology-Algesiology Department, Universitatii Street No. 16, 700115, Iasi, Romania</i> ²<i>“Alexandru Ioan Cuza” University, Blvd. Carol I, 11 A, 700506, Iasi, Romania</i></p> <p>We aimed to realize a meta-analysis regarding some possibilities for optimizing the pharmacodynamic effects of analgesic drugs using different polymeric systems. Application of nanotechnology in substance delivery systems development has opened up new areas of research in sustained release of various drugs. The important technological advantages of nanoparticles used as drug carriers are high stability, high carrier capacity, feasibility of incorporation of both hydrophilic and hydrophobic substances, and feasibility of variable routes of administration. One of the most interesting fields of applying nanotechnology consists in experimental and clinical nociception. The complex antineoplastic-analgesic nanoparticles may be especially helpful for the treatment of cancer conditions, usually accompanied with mild or severe pain. The development of analgesic drugs loaded nanoparticulate systems may represent a future challenge to achieve promising agents for regional drug delivery, especially in inflammatory and painful conditions. One of the classic examples consists of entrapment efficiency and active substance release of a lipophilic drug model, diclofenac or flurbiprofen, from nanocapsules, nanospheres, and nanoemulsions, using materials such as surfactant (pluronic F68) and polymer (poly lactic co glycolic acid).</p>

From all nanoparticulate systems liposomes presented some advantages represented by the low number of excipients used in their formulations, the simple procedures for preparation, a high physical stability, and the possibility of sustained drug release that may be suitable in the treatment of chronic diseases. Other important aspect is represented by the possibility of using polymers, like polyesters obtained from lactic or glycolic acid, and polyamides derived from amino acids, for the controlled release of analgesics to cross the blood-brain barrier. Target delivery of drug molecules to the brain is one of the most challenging research areas in pharmaceutical science. Poly (butyl cyanoacrylate) nanoparticles represent the only nanoparticles that were so far successfully used for in vivo delivery of drugs to brain. Polybutylcyanoacrylate nanoparticles coated with polysorbate-80 have been shown to

O-1 Silver nanoparticles healing mechanism on tissues: an adult stem cell stimulation mechanism ?

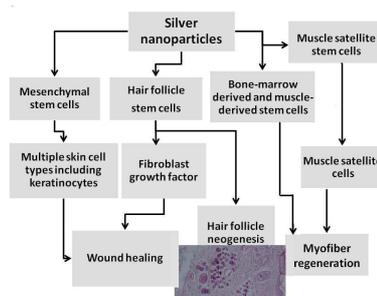
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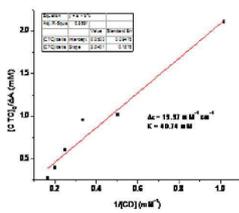
The main hypothesis, which is going to be detailed in this paper, is that silver nanoparticles work by activating adult stem cells of mesodermal and ectodermal origin in vivo. Some research data on regeneration of hair follicles in rabbit skin have proven an accelerated healing of surgical wounds and a process of hair follicle neogenesis, produced by subcutaneous implantation of some nanofibers functionalized with silver nanoparticles. Also, in an experimental injury model of rat striated muscle, the use of an oily nanodispersion of silver showed an improved histological aspect of healed muscle comparing to placebo. Literature data show the stimulation in vitro of mesenchymal stem cells by silver nanoparticles. Although silver nanoparticles do not produce mesenchymal stem differentiation in vitro, the healing of cutaneous lesions could be accelerated only by interleukin 6 and 8 secreted by mesenchymal stem cells under the action of these nanoparticles.



Possible action of silver nanoparticles on adult stem cells

More than that, without proliferation and differentiation of hair follicle stem cells the process of hair follicle neogenesis found in our studies would not be possible. If our hypothesis is confirmed, it will bring a new perspective of silver nanoparticles, used in plastic and reconstructive surgery, degenerative diseases and anti-aging therapy. This hypothesis can be strengthened using specific histological methods concerning the dynamics and evolution of the stem cells in injured tissues, which are treated with pharmacological preparations containing nanoparticulate silver.

[1] Jun Tian, Kenneth KY Wong, Chi-Ming Ho, Chun-Nam Lok, Wing-Yiu Yu, Chi-Ming Che, Jen-Fu Chiu, Paul K.H. Tam. Topical Delivery of Silver Nanoparticles Promotes Wound Healing. ChemMedChem. 2007; 2:129 – 136.

<p>O-2</p>	<p align="center">Cyclodextrin complexes for increasing drug molecule efficiency Anton Airinei¹, Nicusor Fifere¹, Claudia Nadejde², <u>Dorina-Emilia Creanga</u>² ¹Physics, "P. Poni" Institute of Macromolecular Chemistry, Iasi, Romania ²Physics, "Al. I. Cuza" University, Iasi, Romania</p> <p>Considering cyclodextrin capacity to interact with other chemical structures, an application in the field of drug delivery was designed, focused on the issue of tetracycline low hydrosolubility. Hydrochloric chlortetracycline (CTC) was shown to form host-guest complex with beta-cyclodextrin (bCD), by mathematical description of the structures and physico-chemical features. Infrared and UV-Vis absorption spectra, for different concentration arrays of the two molecule aqueous solutions, allowed the evidence of the two solutes intermolecular interactions. The FTIR data have evidenced the critical infrared region for band intensity changes to the graduated increase of CTC/bCD inclusion formation. The electronic absorption spectra provided data regarding the dominancy of the interaction between one CTC and one bCD molecule (linear relationship, Fig. 1) comparatively to the interaction between one bCD and two CTC molecules in solutions (non-linear dependence). The host-guest complex represents a practical pathway to enhance the hydrosolubility of CTC due to bCD hydrophilic external ring surface and consequently to ensure its increased antimicrobial properties. Further, the magnetically targeting by means of CTC-bCD attachment to magnetic nanoparticles is intended, based on previous evidence of magnetite coating with bCD shell.</p> <p>Acknowledgement: This research was partially supported by the project POSDRU /89/1.5/S/63663.</p> <div style="text-align: center;">  <p>Spectral data processing for the evaluation of the host-guest interaction</p> </div>
<p>P-1</p>	<p align="center">Preparation of Chitosan and Gelatin Based Microcapsules by Ionic and Covalent Crosslinking in O/W/O Emulsion <u>Mihaela Nicoleta Holban</u>¹, Catalina Anisoara Peptu², Anca Niculina Jatariu (Cadinouiu)², Marcel Popa², Valeriu Sunel¹ ¹Faculty of Chemistry, AL.I.CUZA University, Iasi, Romania ²Faculty of Chemical Engineering and Environmental Protection, Gheorghe Asachi Technical University of Iasi, Iasi, Romania</p> <p>Micro or nanoparticles are often preferred as drug carriers, as they present enhanced capacity of drug release in a controlled manner [1]. Also they improve the stability of the loaded drugs and their biocompatibility and biodegradability. Micro or nanocapsules present certain advantages as drug delivery systems due to high drug encapsulation efficiency, shell protection against degradation factors and reduction of tissue irritation [2]. The aim of the research is to prepare and characterize core-shell chitosan and gelatin microcapsules using a double crosslinking in double emulsion technique. Chitosan (CS) of low molecular weight, gelatine type A (G), chloroform, toluene, Span80, Tween 80, sodium sulphate, glutaric aldehyde, caffeine and clotrimazole were purchased from Sigma-Aldrich. The microcapsules were prepared through a double emulsion-chemical crosslinking method, as following: an oily phase constituted of chloroform is added drop wise into the aqueous phase (a solution of chitosan and gelatin of different weight ratios in 2% acetic acid solution) and dispersed using an Ultra Turrax. The new formed o/w emulsion is further dispersed into a large quantity of toluene and a sodium sulphate aqueous solution is added drop wise and</p>

	<p>further homogenized. Glutaric aldehyde extracted toluene is added drop wise for the interfacial covalent crosslinking to take place. Finally, the microcapsules are sedimented by centrifugation and repeated washings with acetone and water and then dried at room temperature. The double crosslinking is justified by a better stability of the polymeric core. The FT-IR spectra showed the presence of the covalent and ionic crosslinking (the new formed imines groups) for both polymers. SEM micrographs show the preparation of spherical shape and smooth surfaces of individual capsules. The particle size analyse indicated the preparation of capsules under 5 microns with good polydispersity. The swelling characteristics were found to be dependent on the polymer composition (weight ratio) and nature and preparation parameters. The drug loading and release capacity of hydrophilic model drug (caffeine) was influenced by the swelling capacity and the properties of the new material.</p> <p>[1]. L. Cruz, L.U. Soares, T.D., Costa, G. Mezzalira, N.P. da Silveira, S.S. Guterres, A.R. Pohlmann, Int. J. Pharm. 313, 198-205 (2006). [2]. N. Anton, J.P Benoit, P. Saulnier, J. Control. Release 128, 185–199 (2008).</p>
<p>P-2</p>	<p style="text-align: center;">Effects of colloidal suspensions on normal and tumor cell lines Elena Alina Tăculescu^{1,2}, Florina Maria Bojin³, Robert Ianoș¹, Virgil Păunescu³, Cornelia Păcurariu¹</p> <p style="text-align: center;">¹“Politehnica” University of Timisoara, Faculty of Industrial Chemistry and Environmental Engineering, Victoriei Square No. 2, RO-300006, Timisoara, Romania ²Romanian Academy – Timisoara Branch, Lab. Magnetic Fluids, Center for Fundamental and Advanced Technical Research, Bv. Mihai Viteazu No. 24, RO-300223, Timisoara, Romania ³“Victor Babes” University of Medicine and Pharmacy Timisoara, Department of Functional Sciences, 2A Eftimie Murgu Square, RO-300041, Timisoara, Romania</p> <p>Background: Magnetic nanoparticles (MNPs) offer new opportunities for developing effective drug delivery systems tailored for diverse <i>in vivo</i> applications. External magnetic field can be applied to the chosen site to attract MNPs from blood circulation. Before using them for <i>in vivo</i> studies, extensive <i>in vitro</i> assays should be performed for understanding the effects of these nanoparticles on both normal and tumor cells.</p> <p>Materials and methods: We developed colloidal suspension consisting of MNPs obtained by combustion method covered with oleic acid (OA) and dispersed in phosphate buffered saline (PBS). We used 4 concentrations of MNPs on bone marrow-derived human adult mesenchymal stem cells (MSCs) and SK-BR3 tumor cell line and evaluated their effect on cellular viability at 72 hours using the MTT <i>in vitro</i> toxicology assay. Flowcytometric analysis investigated expression of characteristic surface markers CD90, CD73, CD29 and CD44 for MSCs, and Her2 and CD29 for SK-BR3 tumor cells.</p> <p>Results: Electron microscopy (SEM) showed that MSCs developed cellular protrusions - microtentacles when left in contact with (MNPs) for 72 hours which is usually associated with increased adhesion capacity. On the other hand, SK-BR3 tumor cells presented a very unusual behavior excluding the nucleus and the cells were enucleated, not associated with MNPs concentration.</p> <p>Expression of characteristic stem cell markers – CD90 and CD73 was decreased for MSCs, while the expression of adhesion molecules (CD29 and CD44) on stem cells surface was almost abolished. Tumor cells increase their aggressive potential by highly expressing Her2 oncoprotein on the cellular surface, while the cells expressing adhesion molecule CD29 are decreasing.</p> <p>Conclusions: The MNPs used in this study proved to be compatible to the <i>in vitro</i> culture conditions of both normal and tumor cells. Tumor cells are enucleated by MNPs and lose their adhesion abilities, while MSCs are developing anchorage structures which make them more resistant to the chemical stress.</p>

	<p>Keywords: magnetic nanoparticle, combustion method, viability, MSCs, morphologic changes.</p>
<p>P-3</p>	<p align="center">Psyllium/polyvinyl alcohol matrix composite for morin as dietary supplement</p> <p align="center">Marcela-Corina Rosu¹, Lidia Rednic¹, Ioan Bratu¹</p> <p align="center">¹<i>Physics of Nanostructured Systems, National Institute for Research and Development of Isotopic and Molecular Technologies, Cluj-Napoca, Romania</i></p> <p>Psyllium is a natural active polysaccharide, a fibers source that is usually used as therapeutic and drug delivery agent [1]. Polyvinyl alcohol (PVA) is nontoxic and biocompatible providing good mechanical strength to polysaccharide-based hydrogels [2]. The mixing of these polymers leads to development of a potential drug delivery system that combines physical and mechanical properties of the polymer-based materials. Morin, a natural flavonoid compound, has been found with antioxidant, anti-inflammatory, anti-allergic, anti-microbial properties and that also exhibits anti-tumor and cardiovascular protection [3]. The bioactivity of morin promotes it as dietary supplement in cancer, hypertension and various other chronic diseases. Even if the higher concentration for prolonged period of morin did not cause toxicity, as therapeutic dose in some disorders such as chronic venous insufficiency, its controlled release is desirable [4]. In this respect, the present experimental study was aimed the investigation of psyllium/PVA composite in terms of structural (FTIR) and physical-chemical (swelling behavior as a function of time and pH) and in the same time, its evaluation by spectrophotometric analysis for controlled morin loading/release behavior under different pH conditions at 37°C. The results showed that the psyllium/PVA composite could be an important candidate for controlled and sustained the morin delivery system in the dietary supplement health act.</p> <p>[1] B. Singh, Int J Pharm 334 (2007) 1–14 [2] P. Basak, B. Adhikari, J Mater Sci Mater Med 20 (2009) S137–S146 [3] J.W. Kim et al., J Biochem Pharmacol 77 (2009) 1506–1512 [4] R.S. Bezwada, Patent application 20120010284, 2012</p>
<p>P-4</p>	<p align="center">Electrochemical characteristics of calcium-phosphatized AZ31 Magnesium alloy in 0.9% NaCl.</p> <p align="center">Branislav Hadzima¹, Filip Pastorek¹, Dagmar Faktorová²</p> <p align="center">¹<i>Department of Materials Engineering, University of Žilina, Žilina, Slovak Republic</i> ²<i>Department of measurement and applied electrical engineering, University of Žilina, Žilina, Slovak Republic</i></p> <p>One of the magnesium alloys main application problem is their high reactivity in common environments. Conversion layers creation on the magnesium alloys surfaces is the way for corrosion rate decreasing and simultaneously decreasing of hydrogen evolution that is a problem for some applications, e.g. biodegradable material parts . This article deals with evaluation of calcium-phosphate layer influence on electrochemical characteristics of AZ31 magnesium alloy in 0.9% NaCl solution. Calcium phosphate layer was processed using electrochemical way in a solution containing 0.1M Ca(NO₃)₂, 0.06M NH₄H₂PO₄ and 10ml/l of H₂O₂. Layer processing was monitored by current density measurement and studied by light microscopy evaluation. The influence of phosphate layer processing on electrochemical characteristics was evaluated by potentiodynamic measurements and by electrochemical impedance spectroscopy during exposition of surfaces in 0.9% NaCl up to 168 hours. Measured curves were analysed by Taffel analyse and by method of equivalent circuits. It has been reported that polarization resistance of phosphatized surface is about 25 times higher than that of non-treated surface.</p> <p>The research is supported by European regional development fund and Slovak state budget by the project ITMS 26220220048 (call OPVaV-2008/2.2/01-SORO). Work has been parially</p>

	supported from Slovak Research and development agency APVV by Bilateral project SK-RO-0015-10.
P-5	<p style="text-align: center;">Synthesis and characterization of HAp-ZnFe nanocomposites <u>A.M. Cantaragiu</u>¹, C. Gheorghies¹, V.T. Romila (Gruia)¹, L.P. Georgescu¹ ¹ <i>Chemistry, Physics and Environment, "Dunarea de Jos" University, Galati, Romania</i></p> <p>By incorporation of HAp nanoparticles into the ZnFe metallic matrix the HAp-ZnFe advanced nanostructures coatings with superior chemical and mechanical properties are obtained. These coatings were obtained by electrochemical method from an alkaline electrolyte solution. The effects of various parameters such as, pH, temperature, current density and chemical composition of the plating bath during the electrochemical deposition process on HAp nanoparticles distribution were studied by evaluating the morphology and electrochemical behavior. Morpho-structural characterization by means of the scanning electron microscopy technique was performed. Electrochemical assessment by means of cyclic voltammetry technique was achieved.</p> <p>Brooman, E.W., Compliant Electrodeposited and Electroless Nano-Structured and Nano-Composite Coatings to Replace Chromium Coatings, <i>Galvanotechnik</i>, 97(1), p. 58-66: 2006.</p>
P-6	<p style="text-align: center;">Determination of compact bone mineral volume fraction using Bruggeman EMA model <u>Ioana Veronica Ciuchi</u>¹, Cristina Stefania Olariu¹, Liliana Mitoseriu¹ ¹ <i>Department of Physics, Alexandru Ioan Cuza University, Iasi, Romania</i></p> <p>At the structural level, bones are composed of organic and inorganic compounds and water, being considered as a bio-composite material with a highly structure. The organic part consists mainly from a network of collagen and proteins, while the inorganic part is mainly composed by HydroxyApatite (HA) and a small percentage of other minerals incorporated into the structure. Mineral phase represents 65% of weight of the dried solid substance and the rest is represented by the organic phase, which consists mostly of Collagen type I (about 90%) [1]. There are two independent parameters which are used to describe the composition of bone: bone volume fraction (BV) and bone mineral density (BMD). BDM is a medical term reflecting the strength of bones and referring the amount of matter per surface of analyzed bone. Mineral Bone Volume fraction is necessary for investigate aging bone structure of humans, in modeling, remodeling and for monitoring the net loss of bone mass [2]. Different studies showed excellent correlation between electric, dielectric and mechanical properties of the bone and a strongly dependence between these parameters and bone mineral composition [3]. Based on the Bruggeman EMA model, our work proposes an analytical method in order to determine mineral volume fraction from a bone tissue sample using complex dielectric data. General EMA models assumed that a composite material consists from two or more phases: one forms the background (environment) and the others and forms the embedded guest phase (the inclusion phases). Compact dried bone can be considered as a composite material formed by an inorganic part (mineral phase), by an organic part (Collagen) and a phase represented by pores. Measuring the effective permittivity of the whole bone sample and of the constituent phases, we determine the mineral volume filling fraction using Bruggeman EMA model. Obtained results were compared to experimentally determined results from SEM sample image microstructure and with other results from literature. In spite of its simplicity, the method provides a very good approximation for compact bone mineral volume fraction.</p> <p>Acknowledgement: A part of this work was supported by POSDRU/89/1.5/S/63663 Project.</p> <p>[1] F. H. Martiniet al, Human Anatomy, New Jersey, ISBN: 978-0321-586-483, 2003 [2] G. Bevill et al., Bone, vol. 39, 6, 1218 – 1225, 2006 [3] P. A. Williams, S. Saha, Annals of Biomedical Engineer, vol.24, pp. 222 – 233, 1996</p>

P-7 A new approach to the comparison of microwave methods used at dielectric constant measurement

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The paper describes experimental results from the area of dielectric constant measurements. A theoretical background of experimental techniques for the used methods is given. In addition to the brief overview of experimental techniques the most used methods are selected with the evaluation of their advisability for specific materials. In the most cases waveguide practices are used. An extra attention is given to experiments with biological tissues with regard to the microwave interaction with tumoral tissues and from this area also measurements results of temperature dependence of dielectric constant value of biological tissues [1] are presented. In this context a special attention is given to the measurement of dielectric properties of glucose. The modified Poley's method is presented for unambiguous determination of biological materials properties. A special attention is paid to the mathematical processing of scattering - S parameters obtained from the network analyzer by finding out the proper analytical method for the dielectric constant calculation. In addition to that, some selected comparisons with classical methods for dielectric constant determination were performed for assuming the correctness of results.

Acknowledgements: This work has been done in the framework of APVV Bilateral project SK-RO-0015-10.

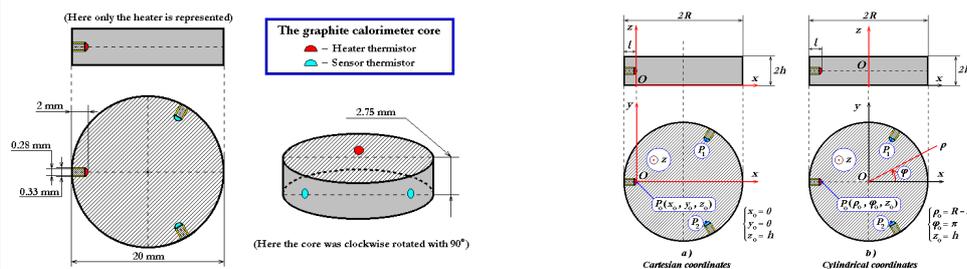
D. Faktorová: Microwave Characterisation of Frequency and Temperature Dependence of Beef Bone Dielectric Properties Using Waveguide Measurement System. Proc. Measurement 09 Conference, Smolenice, Slovak Republic, 2009, pp.402-405.

P-8 3D-modeling of temperature gradients in a 3-body Domen-type calorimeter for absorbed dose measurements

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¹Solid State and Theoretical Physics, "A.I.Cuza" University, Iasi, Romania

The effect of thermal gradients that appear in the core of a Domen-type absorbed-dose calorimeter during an electrical calibration run is revised using the finite element numerical analysis. The local thermal modelling that is the method allowing for spatio-temporal distribution of temperature within the core combined with both a careful analysis on what really happens when a certain amount of electrical power is dissipated in a NTC heating thermistor and the consideration of heat loss through radiation from the core surface have led to results which are in agreement with those obtained from experimental measurements and reported in the literature.

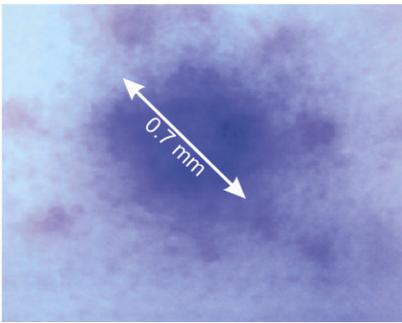
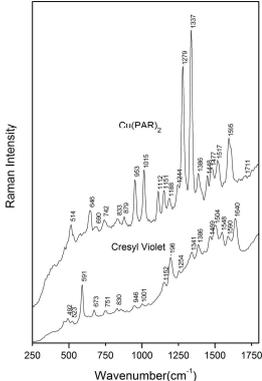


Schematic core structure of the actual graphite calorimeter operating at ENEA.

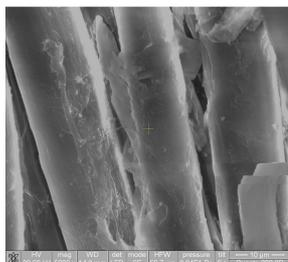
Spatial orientation of the Cartesian and cylindrical coordinates

	<p>Keywords: graphite calorimetry, thermal modelling, temperature gradients. PACS: 29.40.Vj, 44.40.+a</p>
<p>P-9</p>	<p>Application of spectroscopic techniques for studying the effects of non-thermal plasma on biomacromolecules <u>Roxana Jijie</u>¹, Ionut Topala¹, Valentin Pohoata¹ ¹<i>Faculty of Physics, Alexandru Ioan Cuza University, Iasi, Romania</i></p> <p>Plasma healthcare is a broad interdisciplinary field between physics, chemistry, biology and medicine. It is known that plasma components, such as charged particles (electrons and ions), ultraviolet (UV) photons, radicals and excited species generated in plasma and at the surface of region irradiated interact strongly with biomolecules, cells and tissues. To design an efficient plasma treatment for usual clinical procedures it is important to find safe experimental windows for all plasma parameters, such as source properties (driving voltage pulse frequency, amplitude, shape), plasma properties (temperatures, densities), exposure distance and gas mixture. The scope of this study was to investigate the effects induced by helium atmospheric pressure plasma jet (APPJ) on the bovine serum albumin (BSA A4503, Sigma Aldrich) structure. The BSA powder was treated helium plasma with constant gas flow rate (3 L/min) for 60 seconds. Plasam was generated by high voltage pulse (8 kV amplitude) with increasing pulse repetition rate from 2 to 8 kHz. Rayleigh scattering and intrinsic/extrinsic fluorescence spectroscopy were selected to study the effect of non-thermal plasma on BSA. The spectroscopic measurements were carried out using an double monochromator spectrofluorometer (SLM 8000 Spectrofluorometer). Our experimental results show a negative correlation between the degree of BSA structure modification, tested by aggregation experiments or fluorescence spectroscopy, and frequency of the high voltage pulses that drives the plasma jet.</p>
<p>P-10</p>	<p>Electromagnetic biosensor for glucose concentration measurement <u>Dumitru-Daniel Herea</u>¹, Horia Chiriac¹, Nicoleta Lupu¹ ¹<i>MDM, National Institute of R&D for Technical Physics, 47 Mangeron Boulevard, 700050, email: dherea@phys-iasi.ro, Iasi, Romania</i></p> <p>A new low-frequency biodetection approach was designed and tested for measuring glucose concentration. The electromagnetic parameters of the measurement coil, such as resonance frequency, were optimized to acquire a high sensitivity of the biosensor. Dielectric changes occurring in the liquid samples were investigated by using a single 21-turns coil that avoids the electric contact with tested samples. Glucose-oxidase, the specific enzyme for glucose catalysis, was used to induce dielectric changes in water-glucose samples through the final products of the glucose-oxidase-mediated reaction between glucose and oxygen. The maximum impedance variation was about 300 %, the sensor's sensitivity was $195 \cdot 10^3 \Omega/\text{mg} \cdot \text{ml}^{-1}$, whereas the linearity ranged between 0.0078 - 0.125 mg/ml. The study pointed also out that ions and, to a smaller extent, non-specific enzymes, antibodies, and glucose can modify by themselves the dielectric properties of the samples and, therefore, the sensor's impedance, warning on the possibility that blood samples, containing plasma proteins and ions, could lower the sensor's sensitivity. However, the GOx-related increase of ions should have an added-effect on the dielectric properties of a blood sample, emphasizing that our impedance sensor potentially allows for a combined invasive/non-invasive approach to measure out-of-body blood glucose. A skin-contact non-invasive glucose biosensor for sweat glucose measurement could also take some practical advantages from our results to improve the glucose sensing. Moreover, other methods making use of enzyme-mediated processes to investigate specific substrate catalysis by measuring dielectric changes of the analyzed samples can take some benefits from such an approach.</p>

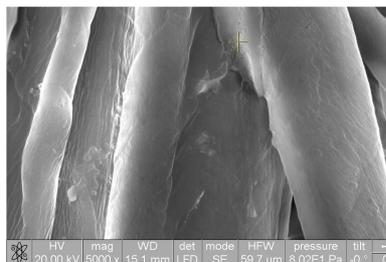
	<p>I.Caduff A., Hirt, E., Feldman, Yu., Ali, Z., Heinemann, L., 2003. First human experiments with a novel non-invasive, non-optical continuous glucose monitoring system. <i>Biosens. Bioelectron.</i> 19, 209-217.</p>
<p>P-11</p>	<p style="text-align: center;">In vitro study regarding the cytotoxicity of some TiNbZr alloys L. Dragan¹, C.E. Cotrutz², S. Strugaru², P. Avram¹, <u>G.L. Pintilei</u>¹, C. Munteanu¹ ¹<i>Faculty of Mechanical Engineering, Gheorghe Asachi Technical University, Iasi, Romania</i> ²<i>Faculty of Medicine, "Gr. T. Popa" University of Medicine and Pharmacy, Iasi, Romania</i></p> <p>The purpose of the present study is to investigate the behavior of human fibroblast-like adherent cells in close contact with three different composition alloys of Ti-Nb-Zr. New Ti alloys have been elaborated and evaluated for biomedical applications as part for the well-known Ti6Al4V alloy. Although these alloys offers excellent mechanical and corrosion properties, it includes the cytotoxic vanadium compound. Oxidation film is responsible for corrosion resistance of this material; this resistance depends on low metal ion release even in aggressive or biologically active environments. Surface treatment methods were applied by various researchers in order to enhance the corrosion resistance and biocompatibility of Ti alloys. Material and methods: we have tested three different samples, Ti23Nb13Zr, Ti18Nb18Zr, Ti13Nb23Zr alloys. We are considering these three alloys as samples 1, 2 and 3 (S1, S2, S3). For the considered materials, we have obtained the results of the two performed tests that are the direct contact inhibition test and the MTT test. For the samples that are in direct contact with the cells we have approached two techniques: material samples tested at 15 hours from well seeding with cells and, in a separate plate, material samples seeded with proliferating cells. In vitro tests were performed on a Human Osteosarcoma cell line; direct contact inhibition tests and survival tests were realized. Results: Cell toxicity seem to be influenced either by the amount of each compound in the allow but also by the different behavior during processing. We have observed that, while S1 and S2 samples show very good and moderate biocompatibility respectively, the S3 material showed some biocompatibility issues. Not only the composition of the S3 alloy but also the surface properties will require further investigation in order to provide new data for biocompatibility improvement.</p>
<p>P-12</p>	<p style="text-align: center;">Biocompatibility evaluation for some new Ti-Nb-Zr-Ta alloys L. Dragan¹, C. Axinte¹, S.C. Strugaru¹, C. Munteanu¹, <u>B. Istrate</u>¹, G.N. Basescu¹ ¹<i>Faculty of Mechanical Engineering, Gheorghe Asachi Technical University, Iasi, Romania</i></p> <p>The study aims to assess three different compositions of Ti-Nb-Zr-Ta alloys by performing in vivo biocompatibility tests on Wistar adult rats, following intraosseous and subcutaneous implantation. Material and methods: We have examined three femoral sections for each sample; all samples included the specific wires from A1, A2 and A3 wires. We have performed in vivo biocompatibility tests on Wistar adult rats, by femoral implantation of the selected metallic wires and of the coin-like samples for subcutaneous implantation. Periimplant mineralization was evaluated by a fluorescent marker with good osseous absorption, as oxytetracyclin. To measure soft tissues reaction to selected alloys, we have performed subcutaneous implantation followed by blood immune primary response, at 4 and 8 weeks following implantation. Estimation of the white blood cells count (WBC), the phagocytic activity and the serum complement activity. Among the tested alloy samples, A1 showed a better mineralization in periimplant areas, we may assess that A1 sample shows a better biocompatibility than A2. A3 sample shows poor biocompatibility, by a continuous activation of the complement system, even at 8 weeks from implantation, according to the witness group. Results: Following intraosseous and subcutaneous implantation, the some of the tested samples show an accelerated mineralization at the interface alloy-material and also a good biocompatibility regarding the blood parameters response. We may conclude that, following intraosseous and subcutaneous implantation, the sample</p>

	<p>A1 shows an accelerated mineralization at the interface alloy-material and also a good biocompatibility regarding blood parameters response. Further studies will detect the ability of these proposed alloys to be tested in order to improve biocompatibility, both on bone or soft tissue level.</p>
<p>P-13</p>	<p style="text-align: center;">On-Plate SERS detection in TLC separation <u>Krisztian Herman</u>¹, Nicoleta E. Mircescu¹, Vasile Chis¹, Nicolae Leopold¹ ¹Faculty of Physics, Babes-Bolyai University, Cluj-Napoca, Romania</p> <p>A new detection approach for surface-enhanced Raman (SERS) detection of the constituents of a mixture of analytes after thin layer chromatography (TLC) separation is presented. After establishing a viable protocol for the TLC separation of the analytes used, crystal violet, cresyl violet, bixine, 4-(2-pyridylazo)resorcinol (PAR) and its metal complex with copper, a SERS active silver substrate was created directly on the thin silica film of the chromatographic plate. This was achieved by pretreatment of the TLC plate with a 10⁻² M silver salt solution before the separation was performed. After separation, the laser of the Raman spectrometer was focused on the spots on the plate.</p> <p>Due to photo-reduction of the silver on the plate, a silver substrate, shown in Fig. 1, formed almost instantaneously permitting the SERS spectra registration of the separated analytes (Fig.2). A 5×10⁻⁶ M detection limit was observed for the PAR metal complex. The proposed technique, TLC-SERS, is therefore a viable and reliable alternative to more expensive methods and time consuming procedures.</p> <p>Keywords: TLC, SERS</p> <p>Acknowledgement This work was supported by the Babeş-Bolyai University, project number 30068/05/19.01.2012.</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div data-bbox="389 1128 791 1451" style="text-align: center;">  </div> <div data-bbox="979 1099 1241 1480" style="text-align: center;">  </div> </div> <p>Fig.1. Picture of the SERS-active silver spot created on-plate by photo-reduction of silver nitrate. Fig.2. SERS spectra of Cu(PAR)₂ complex and cresyl violet recorded on-plate after TLC separation.</p>
<p>P-14</p>	<p style="text-align: center;">Obtaining of advanced functionalized ecotextiles dyed with natural colorants extracted from bilberry fruit <u>Diana Coman</u>¹, Simona Oancea², Narcisa Vrinceanu^{1,3} ¹Department of Industrial Machines and Equipments, "L.Bлага" University of Sibiu, Sibiu, România ²Department of Agricultural Sciences, Environment and Food Industry, "L.Bлага" University of Sibiu, Sibiu, România ³Department of Materials Chemistry, "A.I.Cuza" University of Iasi, Iasi, România</p> <p>The study is aiming at achieving and characterization of a novel textile material consisting of a composite, meaning a previously β-cyclodextrin grafted cotton fiber substrate dyed with a natural dye. The last one was extracted from bilberry Vaccinium myrtillus fruit by using hydro-alcoholic solutions. Textile samples have been dyed in two modes: a standard method - exhaustion and the non-conventional one -</p>

ultrasonication. The main result and characterizing aspect of the research result in the influence of the two different dyeing procedures of cotton fibrous supports previously grafted with an inclusion compound of β -cyclodextrin, onto the relationship between the morphological, structural and chemical attributes of the obtained specimens. Extra analysis, such as: colorfastness as well as washing and rubbing fastness have been performed, in order to quantify the stability of the dyeing procedures. The morphological, structural and chemical properties of the samples were examined, in terms of a co-assisted investigation system: SEM images for the morphology, EDX analysis for surface composition, FTIR spectroscopy and X-ray diffractometry for structural samples features.



SEM image for cotton sample grafted with cyclodextrin as inclusion compound, and dyed by standard procedure- exhaustion, dyed with bilberry extract



SEM image for cotton sample grafted with cyclodextrin as inclusion compound, dyed by non-conventional procedure, with bilberry extract

According to the results, the performance of the fabrics ecodyed by ultrasonication method possesses good washing fastness. X-ray diffraction results have indicated that the samples dyed by ultrasonic method exhibited a more ordered structure but fairly less fastness than the specimens dyed by exhaustion method. Future aspects of our research: using of ecotextiles – advanced functional materials, contain an array of health-promoting benefits and environmental protective effects in textile industry, and functionalization with β -cyclodextrin of textile supports as encapsulation pretreatment, can be applied for many other natural extracts in dyeing technology.

N.A. Ibrahim, A.R. El-Gamal, M. Gouda, F. Mahrous, A new approach for natural dyeing and functional finishing of cotton cellulose, Carbohydrate Polymers Vol. 82, Issue 4, 11 November 2010, pp. 1205-1211;

P-15 WIRIS on the a MOODLE platform, a powerful instrument for the online processing of experimental data

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In the various activities of research, didactical and technical activities, an increasing role have the free softs or softs which can be used for low prices. The online platforms can insure the advantage that on the same module or block on the web page several researchers situated at different locations can work with equal rights. The moodle platform (Modular Object-Oriented Dynamic Learning Environment) has grown dramatically in the last period and offers cooperation instruments for various scientific activities, research, didactic, economic, social, etc. activities. The platform is easy and quick to install, being entirely free. On the latest generations, starting from the generation 2.0, strong mathematical instruments were included. A powerful instrument is the WIRIS plugin. This instrument allows us to perform mathematical calculation, complex calculation, direct on the platform in Internet regime, that is from distinct locations. The paper presents the processing of experimentally obtained data, in a laboratory mounting for the study of the efficiency of the ozone generation process through corona discharge. The laboratory mounting consisted in an ozone generator,

	<p>data acquisition board and a computer (personal computer type). The data acquired during the experiment were saved in data files. Subsequently they were processed in two distinct modes, i.e.: a) through the driver of the data acquisition board, b) through the MATLAB program, c) through the WIRIS program incorporated in the Moodle platform. The graphs generated through the three options are overlapping, within the limits of experimental errors. This fact proves that WIRIS can be used in research activities, working directly on the net.</p>
<p>P-16</p>	<p>Wine clarification by mean of highly ordered silica mesoporous materials <u>Violeta Niculescu¹, Andreea Iordache¹, Roxana Ionete¹, Nadia Paun¹, Viorica Parvulescu², Monica Culea³</u> ¹<i>Research-Development, National R & D Institute for Cryogenics and Isotopic Technologies- ICIT Rm. Valcea, Ramnicu Valcea, Romania</i> ²<i>Surface Chemistry and Catalysis, "Ilie Murgulescu" Institute of Physical Chemistry, Romanian Academy, Bucuresti, Romania</i> ³<i>Physics Faculty, Babes-Bolyai University, Cluj-Napoca, Romania</i></p> <p>Since the discovery of highly ordered M41S family mesoporous molecular sieves in 1992, considerable attention has been focused on tailoring the chemical composition of these materials via the surfactant templated hydrothermal synthesis [1, 2]. Highly ordered large pore SBA-15 was synthesized by co-condensation of tetraethylorthosilicate (TEOS) and 3-aminopropyltriethoxysilane (APTES) using an amphiphilic block copolymer as the structure-directing agent. This mesoporous material exhibits a type IV nitrogen adsorption-desorption isotherm and has a specific surface area of 1108 m²/g. The adsorption properties of the calcined mesoporous silica SBA-15 material, as a consequence of the presence of silanol groups that are active sites for adsorption, were evaluated in the clarification process of two types of red wines. The purpose of this study was the investigation of the total polyphenols content (reduction), the selectivity and stabilization for some compounds (phenolic acids, epicatechin, catechin) and the chromatic characteristics of wine.</p> <p>[1] D. Zhao, J. Feng, Q. Huo, N. Melosh, G. H. Frederichson, B. F. Chmelka and G. D. Stucky, <i>Science</i>, 279, 548 (1998). [2] A. M. Silvestre-Albero, E. O. Jardim, E. Bruijn, V. Meynen, P. Cool, A. Sepulveda-Escribano, J. Silvestre-Albero, F. Rodriguez-Reinoso, <i>Langmuir</i>, 25, 939 (2009).</p>
<p>P-17</p>	<p>A novel method for the production of calcium phosphate biomaterials <u>Alfonso Nastro¹, Francesco Lamomaca², Domenico Grimaldi²</u> ¹<i>Department of Territorial Planning, Univeristy of Calabria, Arcavacata di Rende, Italy</i> ²<i>Department of Electronic System and Computer Science, Univeristy of Calabria, Arcavacata di Rende, Italy</i></p> <p>Calcium phosphates, with particular reference to hydroxyapatite, have been used during the last years as spacer or filter to the defected bones in orthopedic surgery and in several oral and maxillofacial applications. Generally, these materials are obtained through sintetization processes. Sinterized hydroxyapatite differs from that of the natural bone component because of its high crystallinity, so it hardly integrates in the bone turnover after implantation. Aim of this research is therefore to set up a new method for the preparation of calcium phosphate manufacts characterized by a low crystallinity. The method is based on hydrothermal treatment at relatively low temperatures of pre-shaped mixtures of calcium phosphates. The hardening of the materials is attending though dissolution and precipitation reactions resulting in a very limited increase of the crystallinity of the original calcium phosphate powders. Besides, the low temperature of the hydrothermal treatment, offers new interesting possibilities of introducing in the starting mixture collagenic components of the bone which would not be altered during the hardening process and could contribute to the osteo-inductive properties of the final product. All calcium phosphate manufacts were characterized by X-ray powder diffraction (XRD), Hardness Vickers test (HV), scansion electron</p>

microscope and porosity evaluation. HV tests were carried out by Microhardness tester (Type M) Shimadzu; the porosity was evaluated by a mercury porosimeter (Porosimeter 2000) Carlo Erba. The XRD, HV test and porosity evaluation methods were used to study two samples selected as reference: a sample of compact bovine bone and a sample of commercial calcium phosphate, employed as filter in orthopedic surgery. Experimental results above quoted shows that it is possible to obtain, through hydrothermal treatment, calcium phosphate manufactures which have mechanical, chemical and physical characteristics much similar to the human bone ones.

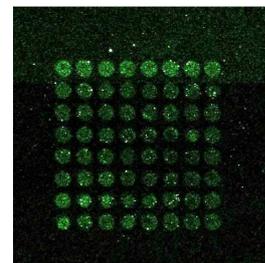
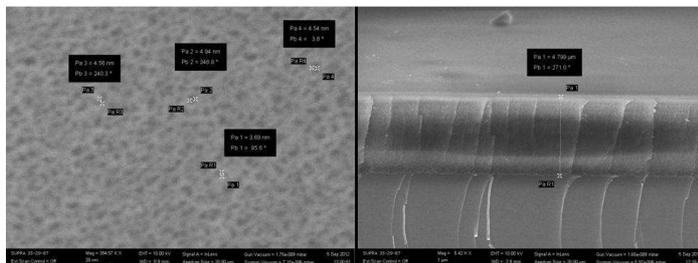
P-18

Dual Detection Biosensor Based On Porous Silicon Substrate

Monica Simion¹, Mihaela Kusko¹, Iuliana Mihalache¹, Adina Bragaru¹

¹Laboratory of Nanobiotechnology, National Institute for Research and Development in Microtechnologies (IMT), Bucharest, Romania

Due the internal surface/volume ratio high ($100\text{m}^2/\text{cm}^3$) porous silicon became in last years a good candidate material as substrate for biosensor application. This properties combine with versatility of surface chemistry functionalization permits a great number of molecules to be captured on a well defined area[1]. This paper reports a dual detection method for protein recognition process. A nano-porous silicon (PS) substrate was prepared by electrochemical etching of p (100) silicon wafer using fluorhydric acid as electrolyte[2]. SEM characterization of PS surface revealed a pore size 5-10nm and layer thickness 5microns (Fig.1). PS surfaces ($4\text{cm}^2/\text{samples}$) were silanized in 1% APTES (3-aminopropyltriethoxysilane) solution at room temperature during 3 h for PS and FTIR verification was made. For bio molecular recognition was used biotin-streptavidin couples. Biotin was deposit on the PS/APTES surface using a microarray plotter in an 8x8 matrix configuration with spot diameter 250 microns. After incubation and blocking process streptavidin label with CY3 fluorofor interact with biotin.



SEM images of porous silicon (PS) a) top view; b) cross section

Scanned image with biotin-streptavidin-Cy3 on porous silicon.

Analysis and detection of biotin –streptavidin interaction was performing using two alternative methods. The array configuration and straptavind label was suitable for florescent detection using a scanning laser. A florescent image was record (Fig.2) and analysed with specific software for conversion of florescent signal in quantifiable value. This methods give information if the reaction take place and also about uniformity of it on the surface. As alternative method was used impedance spectroscopy measurement (IS). The PS surface with a supported film in contact with the aqueous phase exhibits a complex capacitance composed of at least three sub-layers, and the impedance spectra suffer supplementary changes due to the charge interaction between the two biomolecules[3]. Ps substrate was analysed in parallel with a glass substrate and both analysis methods indicate high efficiency in biomolecule immobilization on PS substrate and an enhanced of florescent and impedance signal.

M. Kusko acknowledges the support of the contract number POSDRU/89/1.5/S/63700

	<p>[1] doi:10.1016/j.bios.2004.09.031 [2] doi: 10.1109/JPHOT.2012.2201461, 1943-0655/\$31.00 _2012 IEEE [3] doi:10.3390/s120303449</p>
<p>P-19</p>	<p style="text-align: center;">Synthesis And Characterization Of Polymer-Coated Magnetic Nanoparticles For Biomedical Applications</p> <p style="text-align: center;"><u>Alfonso Nastro</u>¹, Gigel Nedelcu², Luigi Filippelli³, Cesare Oliviero Rossi³, Felicia Iacomi² ¹ <i>Dipartimento di Pianificazione Territoriale, University of Calabria, Cosenza Rende, Italy</i> ² <i>Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i> ³ <i>Dipartimento di Chimica, University of Calabria, Cosenza Rende, Italy</i></p> <p>Magnetic nanoparticles have been used frequently lately in medical applications such as magnetic fluid hyperthermia for treatment of tumors, contrast agents for magnetic resonance imaging, in magnetic separation of blood components or as agents for targeted drug release. Attention is paid especially magnetite nanoparticles due to their special properties. These particles are superparamagnetic, have a high magnetic susceptibility and high coercivity, they also are nontoxic to the body's internal environment and production costs are low. Another advantage is that their surface can be modified easily by creating a layer of polymer can be functionalized with various biomolecules. Methods for preparation of magnetite nanoparticles are chemical coprecipitation, hydrolyzation, mechanical grinding, microemulsions, etc. But chemical coprecipitation method seems the most productive, simple and cheap. Also through this method several parameters can be controlled including temperature and pH to obtain desired particle sizes and shapes. This paper shows the synthesis of magnetic nanoparticles coated with poly(methyl methacrylate) (PMMA), polymer that creates surface functional groups. Magnetite nanoparticles were prepared by coprecipitation of Fe²⁺ and Fe³⁺ salts using aqueous solution of NaOH. Then nanoparticles were coated with poly(methyl methacrylate) by emulsion polymerization process. As comonomer were used methyl methacrylate (MMA) and acrylic acid (AAc), potassium persulfate (KPS) as an initiator and sodium dodecyl sulfate (SDS) as a surfactant. Samples were characterized by FTIR (Fourier Transform Infrared Spectroscopy), SEM (Scanning Electron Microscopy), NMR spectroscopy and rheometry.</p> <p>[1] GUPTA, A. K., WELLS, S., Surface-Modified Superparamagnetic Nanoparticles for Drug Delivery: Preparation, Characterization, and Cytotoxicity Studies, IEEE Transactions on Nanobioscience, 2004, 3, 1. [2] WEISSLEDER, R., BOGD</p>
<p>P-20</p>	<p>The distribution study in vital organs of silver nanoparticles ingested by rats</p> <p><u>Luiza Budeanu</u>¹, Liliana Tartau², Viorel Melnig¹ ¹ <i>“Alexandru Ioan Cuza” University, Blvd. Carol I, 11 A, 700506, Iasi, Romania</i> ² <i>“Gr. T. Popa” University of Medicine and Pharmacy Faculty of Medicine Pharmacology-Algesiology Department, Universitatii Street No. 16, 700115, Iasi, Romania</i></p> <p>The study is realized in conditions in which the alternative medicine promoting the ingestion therapy of silver colloidal solutions . Oral administration to rats of Ag nanoparticles (Ag NPs) is a relevant route of exposure and NPs distribution study in vital organs. Using bright field (BF) and dark field (DF) optical microscopy technics have been observed the risk distributions of Ag NPs in different organs and morphological changes at the level of these. The results of study show the presence of Ag NPs at brain, liver and stomach vital organs.</p> <p>[1]. Chen, X., Schluesener, H.J. (2008) Nanosilver: A nanoparticle in medical application. Toxicology Letters, 176:1-12. [2]. Lok, C.N., Ho, C.M., Chen, R., He, Q.Y., Yu, W.Y., Sun, H., et al. (2007) Silver nanoparticles: partial oxidation and antibacterial activities. Journal of Biological Inorganic Chemistry, 12:527-534.</p>

	<p>[3]. Wijnhoven, S.W.P., Peijnenburg, W.J.G.M., Herberts, C.A., Hagens, W.I., Oomen, A.G., Heugens, E.H.W., et al. (2009) Nano-silver - a review of available data and knowledge gaps in human and environmental risk assessment. <i>Nanotoxicology</i>, 3:109-138.</p> <p>[4]. Florence, A.T. (2005) Nanoparticle uptake by the oral route: Fulfilling its potential? <i>Drug Discovery Today. Technologies</i>, 2:75-81.</p>
<p>P-21</p>	<p>Optical activity enhancement of gold nanoparticles by exposure in light <u>Daniela Pricop</u>, Viorel Melnig <i>Faculty of Physics, "Al. I. Cuza" University, 11A, Carol I Blvd., 700506, Iasi, Romania</i></p> <p>The main disadvantage of gold nanoparticles (Au NPs) in imaging applications, due to the local plasmon resonant effect (LPR), is the decreasing in time of this effect due to metal oxidation processes at nanometer level. Our studies have shown that the LPR effect can be enhanced through visible irradiation. The irradiation on an interval of 11 hours showed that the absorption maximum intensity of the 530 nm characteristic band increases about 8 times. The best results was obtained for Au NPs functionalized with chitosan; medium molecular weight (MW) and practical grade MW. For these NPs systems, the position of the absorption peak has not changed which shows that this treatment does not affect the solutions stability.</p>

TOPIC 2

Functional Materials. Processing and Characterization

I-1**Magnetocaloric effect in 3d transition metals based intermetallic and oxidic compounds**Romulus Tetean¹¹*Faculty of Physics, Babes-Bolyai University, Cluj Napoca, Romania*

Magnetic refrigeration based on magnetocaloric effect, (MCE), is a revolutionary, efficient and environmentally friendly cooling technology in a large temperature range from low to room one. In recent years there was a growing interest in magnetic cooling at room temperature, but only a few examples of cooling units have been presented so far. Consequently a broad application of this technology is not yet established. The so far small application spectrum is mainly due to several intrinsic material properties, which are difficult to control or to optimize independently in bulk material. These include for instance chemical composition, crystal structure, and magnetic properties of the respective compound as well as its macroscopic thermal capacity and conductivity. The characteristic properties of the MCE - the change of the magnetic part of the entropy and the resulting adiabatic temperature change depend on the absolute temperature and the amplitude of the external magnetic field change. Materials the magnetization of which changes fast with temperature possess a relatively high MCE. The structural, magnetic and magnetocaloric properties in transition metals based compounds, intermetallic and oxides, are reported. All of the investigated samples are ordered below a certain temperature. As examples the magnetic and MCE properties of the cubic NaZn₁₃-type La_{0.7}Nd_{0.3}Fe_{13-x}Si compounds, Tb₈Co_{16-X}A with A=Al or Cu compounds, R_{1-x}MMnO₃ manganites, where R = rare-earth metal and M = Ca, Sr and double layered compounds La_{1.2}R_{0.2}Ca_{1.6}Mn₂O₇ are presented. The large ΔS_M values were obtained for samples witch present a first-order character of the transition at TC. The potential use of these materials in magnetic refrigeration is discussed.

O-1**Hydroxylation of atomic force microscopy probes by H₂O plasma treatment**Lucel Sirghi¹, Aurelia Apetrei¹, Marius Dobromir¹¹Department of Physics, "Al. I. Cuza" University, Iasi, ROMANIA

Atomic force microscopy (AFM) is a powerful technique for the study of surface forces in various fields of science as material science, biology, chemistry, etc. [1]. One of the major problems encountered in such studies is lack of control of surface chemistry of the AFM probes, the surface forces being strongly dependent on the chemistry of surfaces. Use of chemically functionalized AFM probes has led to the development of Chemical Force Microscopy, a technique used to discriminate chemically different regions on a sample surface [2]. In molecular biology, chemically functionalized AFM probes are used to covalently bind biomolecules to AFM probe and sample surfaces in single-molecule studies of molecular interactions and molecule stretching experiments [3]. The present work uses low-pressure plasma in water vapor to clean and generate hydroxyl functional groups on silicon oxide surfaces of AFM probes. Hydroxylation of the AFM probe surfaces has been obtained by exposing the AFM probe surfaces to the negative glow plasma of a d. c. discharge in water vapour at a pressure of 0.2 Torr.

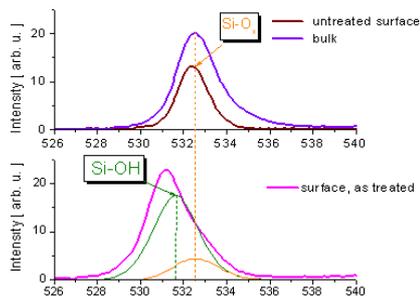
The AFM probe surface hydroxylation has been confirmed by analysis of X-ray photoelectron spectroscopy (XPS). Figure 1 shows the O1s peak recorded for the bulk material (Si₃N₄), untreated surface, and probe surface immediately after plasma treatment. The plasma functionalized AFM probes were used in an AFM study of hydrogen bond formation between the hydroxylated AFM tip and a supported lipid bilayer (SLB) of phosphatidylcholine in aqueous NaCl solution (0.1 M) at neutral pH. The AFM force microscopy measurements of the pull-off force between the hydroxylated AFM tip and SLB were performed at different values of contact time and maximum impingement force.

[1] M. Greene, C. Kinser, D. Kramer, L. Pingree, M. Hersam, *Microscopy Research and Technique* 64 (2004) 415–434.

[2] C. D. Frisbie, L. F. Rozsnyai, A. Nay, M. S. Wrighton, C. M. Lieber *Science* 265 (1994) 2071.

[3] P. Hinterdorfer, *Methods Cell Biol.* 68 (2002) 115-139.

* Work supported by CNCISIS, IDEI Research Program of Romanian Research, Development and Integration National Plan II, Grant no. 267/2011



XPS spectra of O1s state for bulk, untreated, and plasma treated AFM probe surfaces

O-2**New approach on the role of a polymer matrix in the strong texturation of zno nanopowders**Narcisa Vrinceanu^{1,2}, Florin Brinza¹, Aurel Pui¹, Eveline Popovic¹, Diana COMAN²¹Materials Chemistry, "Al.I.Cuza" University of Iasi, IASI, România²Department of Industrial Machines and Equipments, "L.Blaga" Univesrity of Sibiu, Sibiu, România³Department of Industrial Engineering, "Gh.Asachi" University of Iasi, IASI, România

The present study investigates the efficiency of a new synthesis sol-gel method

providing both architectural structure and stability/stabilization of strong textures consisting of ZnO nanoparticles dispersions, using a polymer matrix, meaning a cyclic oligosaccharide, β -cyclodextrin (i.e. MCT- MonoChloroTriazinyl- β -cyclodextrin). ZnO has been synthesized by reacting of zinc nitrate with sodium hydroxide in the presence of MCT (monochlorotriazinyl- β -cyclodextrin, MCT- β -CD) by a facile wet-chemical method. Synthesized powder was investigated using X-ray diffraction technique and scanning electron microscopy. X-Ray diffractogram revealed some crystalline plans of ZnO - MCT complex structure. SEM images show a lamellar structure similar to biogenic calcites in the presence of echinoderm intracrystalline proteins.

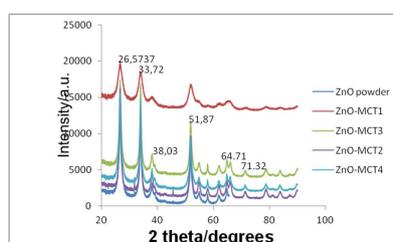


Figure 6 XRD pattern of nano ZnO entrapped in different concentration of MCT (MonoChloroTriazinyl- β -cyclodextrin); a - ZnO-MCT1 ; b - ZnO-MCT2;c - ZnO-MCT3; d- ZnO-MCT4

Presence of MCT- MonoChloroTriazinyl- β -cyclodextrin during ZnO nucleation can ensure formation of micro-pellets with nanometric thickness. This texture is in according with the morphology of the single crystal elements, suggesting that MCT may also have influence in the shape of the crystal during its growth. The study demonstrates the fundamental role playing by polymer involving in the synthesis in the patterning/architecture/designing of ZnO composites. The lamellar structure/morphology of obtained samples proved the biomimetic/biogenic/nature assembled aspect of the present study.

[1]Taubert A, Palms D, Weiss OO, Piccini M-T, Batchelder DN. Chem. Mater. 2002; 14:2594

[2]Huang MH., Wu YY, Feick HN, Tran N, Weber E, Yang PD. Adv. Mater. 2001; 13:113

O-3

Research regarding influence of plasma treatment of a bamboo knitted fabric onto surface attributes

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¹Department of Industrial Engineering, "Gh.Asachi" University of Iasi, IASI, România

²Textile Department, University of Lille, Lille, France

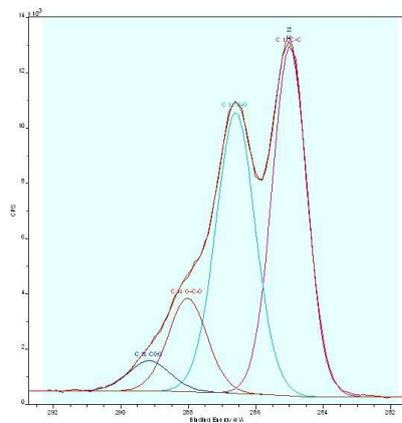
³GEMTEX Laboratory, Ecole Nationale Supérieure des Arts et Industrie Textiles'' (ENSAIT), Roubaix, France

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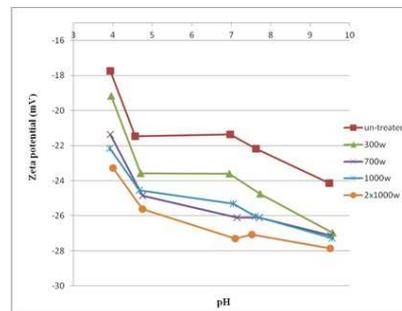
⁵Department of Industrial Machines and Equipments, "L.Blaga" Univesrity of Sibiu, Sibiu, România

The main characterizing aspect of the present study relies on the effects of atmospheric air-plasma treatments on knitted bamboo fabric. These effects have been highlighted by surface analysis methods: wettability and capillarity methods, as well as zeta potential and XPS spectroscopy. The motivation of this research was generated from the idea that hydrophilic properties of cellulose fibers are essential for the finishing treatments. In the case of bamboo fibers, plasma treatments require an improvement in hydrophilic characteristics and dyeing ability. The objective of this paper was to increase the polarity of the bamboo fiber surface, in order to increase the

amount of microcapsules that can be applied and therefore to increase the product efficiency. The methodology reported here deals essentially with the study of the influence of atmospheric plasma treatments on knitted bamboo textile structures, with varying plasma treatment power.



Deconvoluted XPS spectra for carbon (C1s), for plasma treated sample



Zeta potential - pH plots for bamboo knitted fabrics with atmospheric air-plasma treatment

The qualitative and quantitative evaluation of the effect of the plasma treatment on fabric surface properties used XPS, zeta potential to analyze surface energy and electric parameters, while the hydrophilic characteristics were determined through the measurement of the contact angle and water absorption rate. The outcome of this research can be summarized in diminishing of water contact angle on plasma-treated bamboo knitted from 81% to 33%, indicating an increase in the surface energy of bamboo fibers due to changes in the fiber surface chemical nature, which was confirmed by XPS analysis. The paper also identifies the possible reactions in the molecular chain of bamboo fibers, taking place after the air-plasma treatment.

Persin Z., Stenius P., and Kleinschek K.S., 2011. Estimation of the surface energy of chemically and oxygen plasma-treated regenerated cellulosic fabrics using various calculation models, *Text. Res. J.*, 81(16) 1673–1685.

O-4

Quantization of pre-edge peaks in near-edge X-ray absorption fine structure spectroscopy of transition metal oxides

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¹*Nanoscale Condensed Matter Physics, National Institute of Materials Physics, Magurele, Romania*

A new, versatile method for quantization of integral amplitudes of pre-edge peaks in X-ray absorption fine structure (XAFS) is proposed. The origin of these peaks is ascribed to dipole-forbidden $1s \rightarrow 3d$ transitions, therefore their analysis may prove some insight the 3d population of the absorbing atoms. This method is applied on model compounds, such as variable stoichiometry oxides. The specific cases analyzed are iron oxides: Fe₂O₃, Fe₃O₄, FeO; vanadium oxides: VO, V₂O₃, VO₂, V₂O₅; titanium oxides: TiO₂, TiO. The key of this integral amplitude analysis is to find the good procedure for simulating the absorption threshold (see Fig. 1), based on preliminary work from X-ray absorption of isolated atoms or molecules to several solids [1,2]. When properly isolated, the pre-edge peaks offer a powerful information (Fig. 2): their integral amplitude are to a good approximation proportional to the number of 3d vacancies, hence to the ionization state of the absorbing cation. It is proven also that this procedure may be extended to the case of metals. Therefore, this method provides similar information as the X-ray photoelectron spectroscopy (XPS) method [3]; nevertheless, no limitation to the outermost few atomic layers occurs in

this case, since absorption or fluorescence measurements have a probing depth in the micrometer range.

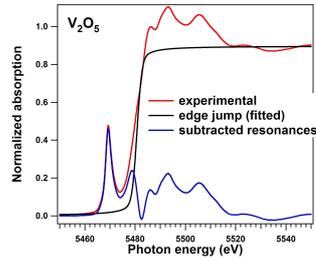


Fig. 1. Example of pre-edge peak isolation procedure for vanadium sesquioxide.

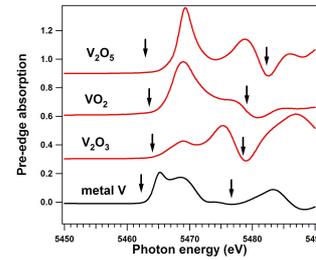


Fig. 2. Plot of isolated pre-edge peaks at the V K-edge for all vanadium ionization states.

Therefore, information on the same quality as that provided by XPS may be obtained with bulk sensitivity and without complicated ultrahigh vacuum machines. Work on strongly outgassing samples or on samples whose properties may be modified under vacuum (e.g. strongly contaminating) is possible with this XAFS-related method. The main disadvantage of this method is that it requires a tunable, high resolution monochromatized X-ray source, provided by synchrotron radiation; however, it can be shown that even laboratory XAFS installations are able to provide spectra with sufficient resolution for successful application of this new method.

[1] C.M. Teodorescu, R.C. Karnatak, J.M. Esteva, A. El Afif, J.P. Connerade, *J. Phys. B: At. Mol. Opt. Phys.* 26, 4019 (1993)

[2] C.M. Teodorescu, A. El Afif, J.M. Esteva, R.C. Karnatak, *Phys. Rev. B* 63, 233106 (2001)

O-5

New insights on nanoscale interface reactions in magnetoelectric composites

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¹Physics, Alexandru Ioan Cuza University, Iasi, Romania

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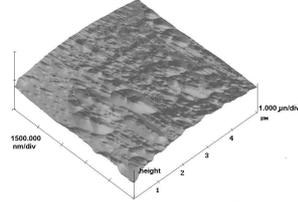
The nanoscale coating of particles of a material with a dissimilar compound is an effective tool to engineer its surface, microstructural characteristics and functional properties. The method of using core-shell powders followed by an appropriate method of sintering is a very successful route to obtain desired microstructures with various degrees of connectivity in ceramic composites. Core-shell multiferroic formed by a magnetic core (Fe_2O_3) and a ferroelectric shell (BaTiO_3) were prepared and then densified either by classical sintering at various temperatures (1050°C - 1150°C) or by spark plasma sintering [1]. By employing various sintering strategies, dense and homogeneous ceramics were produced with: (i) di-phase compositions with fully isolated hematite regions within a BaTiO_3 matrix (0-3 connectivity), (ii) multi-phase compositions, as result of the interface reactions between constituents. Besides the properties of the parent materials Fe_2O_3 and BaTiO_3 , variable amounts of secondary phases (Fe_3O_4 , $\text{BaFe}_{12}\text{O}_{19}$ and $\text{Ba}_{12}\text{Fe}_{28}\text{Ti}_{15}\text{O}_{84}$) have driven to new functional properties in the ceramic composites. Dielectric, tunability and magnetic properties were determined and discussed in correlation with the sample microstructures, composition and degree of connectivity. The dielectric tunability was determined for the best dielectric composites and multipolar contributions to the dielectric non-linearity were found. Peculiar magnetic properties, including “wasp-waisted” constricted $M(H)$ loops were determined as result of the formation of magnetic phases with contrasting magnetic coercivities (hard and soft phases). The present results demonstrate the usefulness of the core-shell approach in driving new functional properties in

	<p>multifunctional composites by an appropriate control of the in situ solid-state nanoscale interface reactions.</p> <p>Acknowledgements: This work was supported by the Romanian CNCS-PNII-PCCE-2-2011-0006 grant under the RAMTECH centre.</p> <p>References: [1] M.T. Buscaglia et al., Chem. Mater. 22, 4740–4748 (2010)</p>
<p>O-6</p>	<p align="center">Accelerators For Advanced Applied Research Installed At IFIN-HH Magurele-Romania</p> <p align="center"><u>Dan Gabriel Ghita</u>¹</p> <p align="center"><i>¹Nuclear Physics Department, Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), Magurele, Romania</i></p> <p>Two new electrostatic accelerators were recently installed in IFIN-HH. A 1 MV HVEE Tandetron AMS system was already commissioned. This is dedicated for ultra-sensitivity mass measurements for C, Be, Al and I elements using the accelerator mass spectroscopy technique. The results of the acceptance test showed great measurement accuracy and precision. A 3 MV HVEE Tandetron, currently being installed, is dedicated to IBA (ion beam analysis) and implantation techniques. All these techniques make great tools for research in advanced material science.</p>
<p>P-1</p>	<p align="center">Some correlations between structural, morphological and optical properties of ZnO thin films obtained by thermally oxidized metallic zinc films</p> <p align="center"><u>Dragos Ioan Rusu</u>¹, George Rusu¹, Dumitru Luca¹</p> <p align="center"><i>¹Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i></p> <p>ZnO thin films prepared by thermal oxidation in air at different temperature and for different times and rates of the vacuum evaporated metallic zinc films were investigated by X-ray diffraction, atomic force microscopy and UV-VIS-NIR spectroscopy. The ZnO thin films were polycrystalline having a wurtzite structure with preferentially oriented (002) planes parallel to substrate surface. Based on the XRD studies, some important structural parameters (lattice parameters of the hexagonal cell, crystallite size, Zn-O bond length, residual stress, etc.) of the films were determined. The AFM studies of the surface morphology, revealed a columnar structure. The optical energy bandgap has been calculated from the absorption spectra and are in the range 3.17 – 3.19 eV. The dependence between the structural, morphological and optical characteristics of the obtained ZnO films and the thickness, oxidation temperature, oxidation time and rate of the metallic zinc films is discussed.</p>
<p>P-2</p>	<p align="center">Ageing of low field dielectric constant in Ce-doped BaTiO₃ based solid solution</p> <p align="center"><u>Alexandra Maria Neagu</u>¹, Geanina Apachitei¹, Lavinia Petronela Curecheriu¹</p> <p align="center"><i>¹Faculty of Physics, "Al. I. Cuza" University, Iasi, Romania</i></p> <p>The ceramics based on barium titanate (BT) are important materials for various electronic devices due to their high dielectric constant and volumetric efficiency. The dielectric properties of barium titanate ceramics are strongly dependent on parameters like: grain size, density impurities and structural defects. Barium titanate doped with Zr, Hf, Ce, Y and Sn, shows an improvement of dielectric performances, very high permittivity, piezoelectric and pyroelectric constants. These dopants also modify the grain size and change the phase transition temperature and the ferro-para phase transition becomes diffuse.</p>

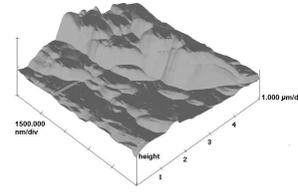
	<p>Ageing properties of weak field dielectric constant and losses of 20% Ce-doped BaTiO₃ based solid solution are studied, and compared with those of pure tetragonal BaTiO₃ ceramics. At room temperature, the ageing process develops following two different mechanisms: a thermally activated ageing process in pure tetragonal ceramics and a defects diffusion for the doped ceramics. We consider that the main reason for the different ageing mechanisms is the crystalline symmetry, which influences the twinning process and the domain-wall dynamics. Our results prove that ageing of 20%Ce-doped BaTiO₃ based solid solution ceramics depends on temperature by intermediate of the phase symmetry, which imposes the twinning rate and rearrangement of ferroelectric domains minimizing the elastic energy of the lattice.</p> <p>Acknowledgements: This work was financial supported by CNCS-UEFISCDI PN-II-ID-PCE-2011-3-0745.</p> <p>[1]V. Tura and L. Mitoseriu, Ageing of low field dielectric constant and losses in (Hf, Zr)-doped BaTiO₃ ceramics, Europhys. Lett, 50 (6), pp.810-815 (2000)</p>
<p>P-3</p>	<p style="text-align: center;">Combined approach to study of Sn doped BaTiO₃ ceramics <u>Nadejda Horchidan</u>¹, Adelina C. Ianculescu², Mihai V. Pop¹, Liliana Mitoseriu¹ ¹<i>Department of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i> ²<i>Department of Oxide Materials Science & Eng, Polytechnics University Bucharest, Bucharest, Romania</i></p> <p>The solid solutions of BaTiO₃ have high values of the permittivity, piezoelectric and pyroelectric constants and the lack of macroscopic hysteresis P(E) loop. These systems are environment-friendly lead free dielectrics with performances which tend to be similar to those of many Pb-based electroceramics. Sn-substituted BaTiO₃ solid solutions are valuable candidates for high permittivity and high field applications. In our previous research [1] we found that, for Sn concentrations between 0.1÷0.15, there are possible superpositions of phases at room temperature. These compositions [2] have improved properties but, on the other hand, they are sensitive to the method of preparation, the effects of granulation or the porosity. In the present study, we used 1400⁰C sintering temperature, in order to reduce the porosity and grain boundary effects. BaSn_xTi_{1-x}O₃ ceramics with compositions of x ∈ [0, 0.2] have been prepared by solid state method and sintered at 1400⁰C for 4 hours. Pure perovskite phase, high density and high degree of homogeneity were obtained for all the investigated ceramics. A ferroelectric-relaxor crossover is obtained by increasing the degree of substitution x, with compositional-dependent shifts of the structural transition temperatures by comparison with ones of the pure BaTiO₃. To provide new insights into the superposition of phases and the identification of composition-induced changes of the structural phase transitions it was used Raman analysis. Dielectric constant of BaSn_xTi_{1-x}O₃ is field dependent: all the compositions are tunable at room temperature and the values of their relative tunability and polarisation contributions to the tunability depend on the Sn concentration. Also, P(E) dependences at room temperature for all compositions were obtained. With Sn addition, the cycle area shrinks with a tendency to the superparaelectric state (P_r and E_C decreases).</p> <p>Acknowledgements: The financial support from ESF-POSDRU 88/1.5/S/47646 and CNCS-UEFISCDI-PN II-ID-3-2011-0745 are highly acknowledged.</p> <p>[1] N. Horchidan et al., J. Alloys Compd. 509, 4731 (2011) [2] X. Wei et al., Mat. Sci. Eng. B. 137(1-3), 184 (2007)</p>

<p>P-4</p>	<p align="center">Ferroelectric and dielectric properties of ferrite-ferroelectric ceramic composites</p> <p>Alexandra Maria Neagu¹, Cristina Elena Ciomaga¹, Mihai Valentin Pop¹, Sorin Tascu², Carmen Galassi³, Liliana Mitoseriu¹</p> <p align="center">¹Physics, "Al. I. Cuza" University of Iasi, Iasi, Romania ²Physics, "Al. I. Cuza" University of Iasi, Res. Ctr. Adv. Mat. & Technol., Iasi, Romania ³CNR, CNR -ISTEC, Faenza, Italy</p> <p>A series of xNiFe₂O₄-(1-x)PZT with x=2, 5, 10, 20, 30, 40, 50, 60, 70 wt% (where PZT=Pb(Zr_{0.47}Ti_{0.53})O₃) have been prepared in situ by sol-gel method by using PZT-based template powders [1]. The constituent phases of the composite systems and the grain size were investigated by X-ray diffraction (XRD). The preparation method followed by a conventional sintering ensures a better mixing and much more dense, well-developed and homogeneous microstructures, observed by scanning electron microscopy (SEM). The variation of dielectric constant (ϵ', ϵ'') with frequency in the range of 1Hz to 1 MHz at room temperature and also with temperature at different frequencies were studied. Debye relaxation peaks were observed at intermediate frequency range. Maxwell-Wagner phenomena present at low frequency explain the space charge effect due to the heterogeneous PZT and NF grain boundary in the structure. The electrical conduction and dielectric behaviour of the ceramic composites vary with the ratio of the two phases. The dielectric responses show a Debye relaxation in the range of 10²-10⁴Hz and a Maxwell-Wagner relaxation for frequencies below 10Hz. Using impedance spectroscopy, we can easily separate the contribution from the grain or grain-boundary and observed that with increasing the addition of ferrite phase the composites present more than one semi-circle, in the complex impedance plot, demonstrating that the ceramic samples present some degree of local electrical heterogeneity even if they are homogeneous from structural and compositional point of view. It is experimentally found that the dielectric constant and piezoelectric constant (d_{33}) get bigger with increasing of the addition of ferroelectric phase, as a consequence of the sum property. The electric hysteresis loops measurements show weak ferroelectric property.</p> <p>Acknowledgements: This work was financial supported by CNCSIS-UEFISCSU, project number PN II-RU TE code 187/2010 and RAMTECH Centre (162/15.06.2010 of POS CCE – A2-O2.1.2).</p> <p>[1] Ciomaga C.E et al., Preparation and magnetoelectric properties of NiFe₂O₄-PZT composites obtained in-situ by gel-combustion method, J. Eur. Ceram. Soc. 32, 3325–3337, 2012</p>
<p>P-5</p>	<p align="center">Patterning and characterization of polyester fabrics surface</p> <p>Gianina Broasca¹, Daniela Farima¹, <u>Narcisa Vrinceanu</u>^{2,3}, Alexandra Nistor⁴, Christine Campagne⁵, Mihai Ciocoiu¹</p> <p align="center">¹Department of Industrial Engineering, "Gheorghe Asachi" Technical University of Iasi, Iasi, România ²Departament of Materials Chemistry, "Al.I.Cuza" University of Iasi, Iasi, România ³Department of Industrial Machines and Equipments, "L.Bloga" Univesrity of Sibiu, Sibiu, România ⁴Departament of Biochemistry, "P.Poni" Institute of Macromolecular Chemistry, Iasi, România ⁵GEMTEX, „ Ecole Nationale Supérieure des Arts et Industrie Textiles” (ENSAIT), Roubaix, France</p> <p>In the textile areas, technologies related to superhydrophobic treatments have recently attracted considerable attention due to their potential applications in medical devices as well as industrial materials. A surface whose water contact angle exceeds 150° is called a superhydrophobic surface. Taking into consideration that the wettability of a solid surface is determined by two parameters, the chemical</p>

composition and the geometrical structure of a rough surface, the synergetic effect of these two factors are often used to pattern superhydrophobic textiles. The present paper reveals the analysis of surface attributes, like: roughness/topography, morphology and thermal stability of PES textile materials surfaces treated with different concentrations of zinc oxide suspensions, through dispersion of active agent in methanol, with direct involvements onto comfort effect.



The AFM cross-sectional analysis of: a - PES/ 7% ZnO composite (using water as dispersin medium)



The AFM cross-sectional analysis of: PES /7% ZnO + methanol composite, for 48 hours

This treatment has been performed through a padding process, aiming at obtaining of a textile with water barrier attributes, as well as achieving of optimal values in terms of comfort. To emphasize the novel obtained surface attributes, co-assisted characterizing techniques have been involved, meaning: scanning electron microscopy, elemental composition through EDX measurement, thermogravimetric analysis.

1. M.Yu, G. Gu, W.D.Meng, and F.L Qing, Appl. Surf. Sci. 253, 3669 (2007); 2. I. S. Woodward, W.C.E.Schofield, V. Roucoules, T.J. Bradley, and J.P.S. Badyal, Plasma Chem. Plasma P., 26, 507 (2006)

P-6 EMA and FEM modeling of dielectric properties of anisotropic porous PZT ceramics

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Porous PZTceramics are among the most used material in modern electromagnetics industry because of their excellent electric and electromechanical properties. There are some applications where the porosity is generally detrimental, because it causes dielectric and mechanical properties reduction. For example, a controlled porosity in the material volume can considerably improve the performances of ultrasonic devices (from industrial or medical domain). It is important to have a lower porosity (from mechanical point of view) and to control the dielectric properties of composite, by controlling the pores' shape. Our paper studies the influence of the oriented pores on the dielectric permittivity of PZT compounds with different porosity degrees (5%, 10%, 20% and 40% vol). The porous PZT composites with aligned pores were analysed (Fig.1.(a)). The porous material can be considered as a two phase composite: the ceramic (phase 1) and the air pore (phase 2). Effective Medium Approximation models (EMA) which take into account different shape of pores and their preferential orientation [1] where used to estimate, to compare and to anticipate the effective permittivity of the porous ceramic systems.

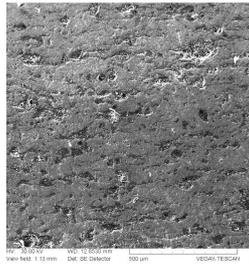


Fig.1.(a)

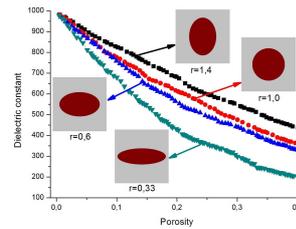


Fig.1.(b)

Also, the Finite Element Method [2] was used to simulate the electric field distribution inside the porous ceramics and to explain and understand the materials' dielectric response (Fig.1.(b)). Applied electric field is perpendicular oriented on the long axes of the pores. Knowing the dielectric properties of the dense PZT probe and air, we simulate the dielectric response of the PZT porous composites and compare the simulated results with the measured one. As parameter, we vary the ellipsoids shape by varying the aspect ratio between vertical and horizontal ellipsoids semi-axis $r=a_z/a_x$. The oriented cylindrical pores give the lowest effective permittivity than a composite with spherical pores. Controlling the level of porosity and the pore shape and orientation into material, it can be obtained a controllable effective permittivity.

Acknowledgements: Part of this work was supported by POSDRU/89/1.5/S/63663 and PCCE II ID PCCE 2001 - 2 - 0006 Projects.

[1] S. Girdano, Effective medium theory for dispersions of dielectric ellipsoids, Journal of Electrostatics, vol. 58, pp. 59 – 76, 2003

[2] O. C. Zienkiewicz, R.L. Taylor, The Finite Element Method. Basic Formulation and Linear Pr

P-7

Structural properties of Cr substituted cobalt ferrite nanoparticles

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Cobalt ferrites are promising materials for magneto-mechanical strain sensing and actuating applications because of their high magnetostrictive properties. From technical point of view, apart from magnetostriction, the strain derivative, being the figure of merit, is an important characteristic for sensor applications. Though the pure cobalt ferrite exhibits a reasonable magnetostriction up to 180 ppm, its strain derivative is relatively very low. Therefore, substituted cobalt ferrites find the key in deriving the desired properties such as high magnetostriction λ , high sensitivity of magnetic induction to applied stress, chemical stability and low cost for magneto elastic sensors. Modification of other essential parameters like magneto mechanical hysteresis and Curie temperature also helps in understanding the phenomena and mechanisms involved in the development of better sensor materials. As part of this research, the present paper deals with the synthesis of Cr substituted cobalt ferrite nanoparticles and their structural properties leading to cation distribution. A series of samples with the composition $\text{CoCr}_x\text{Fe}_{2-x}\text{O}_4$ where $x = 0.00$ to 0.25 in steps of 0.05 has been prepared by sol-gel autocombustion method. Structural characterizations were made using X-ray diffraction, DSC-TGA and FTIR spectra. The samples exhibit spinel crystal structures. The broadness of the XRD peaks demonstrate that the particles are in nano regime, with size ranging from 20-40 nm. The decrease in the ratio of intensity I_{220}/I_{222} has been observed. Since the integrated intensity of (220) reflection depends exclusively on the cations occupying A sites and the intensity of (222) reflection depends on the

	<p>cations occupying B sites only, a reduction in the I220/I222 ratio is interpreted in terms of partial occupation of chromium ions into the A-sites. This in turn is expected to enhance the magnetostrictive properties. FTIR spectra supports the arguments made through XRD data. Cation distribution of the system was given from these measurements.</p>
<p>P-8</p>	<p>Preparation by hydrothermal synthesis and photocatalytic properties of $\text{Bi}_2\text{Fe}_4\text{O}_9$ particles</p> <p><u>Felicia Gheorghiu</u>¹, Maria Teresa Buscaglia², Vincenzo Buscaglia², Cristina G. Pastravanu³, Eveline Popovici³, Liliana Mitoseriu¹</p> <p>¹<i>Department of Physics, Alexandru Ioan Cuza University, Blv. Carol I, nr.11, 700506, Iasi, Romania</i></p> <p>²<i>Dipartimento di Ingegneria Chimica e di Processo, Institute for Energetics & Interphases-CNR, Via de Marini no.6, Genoa I-16149, Italy</i></p> <p>³<i>Department of Materials Chemistry, Alexandru Ioan Cuza University, Blv. Carol I, nr.11, 700506, Iasi, Romania</i></p> <p>In the present study, particles with different $\text{Bi}_2\text{Fe}_4\text{O}_9$ micro/nanostructures with a few particular morphologies obtained under specific hydrothermal synthesis conditions were investigated. The processing parameters (such as NaOH concentration, reaction temperature and reaction duration time) have a strong influence on the phase formation and on the particle morphology. $\text{Bi}_2\text{Fe}_4\text{O}_9$ particles produced by using 6M or 9M NaOH crystallize as orthorhombic phase with space group Pbam. The formation of $\text{Bi}_2\text{Fe}_4\text{O}_9$ particles depends on the processing parameters, which also lead to different morphologies: flower-like nanoplatelets, hierarchical microstructures, perfectly square platelets single crystals, etc. The photocatalytic properties are dependent on the micro/nanostructural characteristics. After 180 min under UV light irradiation ($\lambda=254$ nm) with $\text{Bi}_2\text{Fe}_4\text{O}_9$ samples, the degradation rate of Rose Bengal (RB) was in the range of 52-61%, with slightly different rates in various time regions, for different microstructures.</p>
<p>P-9</p>	<p>New single-phase multiferroic: $\text{Ba}_{12}\text{Fe}_{28}\text{Ti}_{15}\text{O}_{84}$ self assembled perovskite-spinel multilayer structure</p> <p><u>Alexandra Maria Neagu</u>¹, Lavinia Petronela Curecheriu¹, Geanina Apachitei¹, Giovanna Canu², Catalin Harnagea³, Liliana Mitoseriu¹, Vincenzo Buscaglia¹</p> <p>¹<i>Physics, "Al. I. Cuza" University, Iasi, Romania</i></p> <p>²<i>Electroceramics, Institute of Energetics and Interphases (IENI)-CNR, Genoa, Italy</i></p> <p>³<i>INRS-Energie, Matériaux et Télécommunications, University of Québec, Québec, Canada</i></p> <p>Multiferroic materials have always been of great interest to researchers due to their potential for multifunctional applications, such as actuators, switches, magnetic field sensors, or new types of electronic memory devices [1]. Barium polytitanates are well known for their good dielectric properties (high dielectric permittivity and small losses) while iron oxides are materials with impressive magnetic properties. Therefore, mixed Ba-Ti-Fe oxides are highly regarded as multifunctional materials with both dielectric and magnetic properties. Recently, ceramic quaternary ferrites $\text{Ba}_{12}\text{Fe}_{28}\text{Ti}_{15}\text{O}_{84}$ were prepared via solid state reaction synthesis route for the first time. The most intriguing aspect of this compound is its multilayered structure (monoclinic C2/m), which consists of self assembled perovskite-like building blocks, linked by an intermediate layer (containing a mixture of titanium and iron ions) to spinel-like building blocks.</p> <p>The aim of the present study is to investigate the magnetic properties, and possible ferroelectric behavior. The magnetic characterisation of the $\text{Ba}_{12}\text{Fe}_{28}\text{Ti}_{15}\text{O}_{84}$ ceramic was recently reported, indicating a ferro/ferrimagnetic behaviour at room temperature with a saturation magnetisation of $\sim 12.5 \text{ A}\cdot\text{m}^2\text{kg}^{-1}$, coercivity of $\sim 1592 \text{ A}\cdot\text{m}^{-1}$ (20 Oe) and Curie temperature of $\sim 420 \text{ K}$ [2]. The dielectric properties indicate a</p>

	<p>semiconducting behaviour influenced by polaron hopping conductivity associated to the $\text{Fe}^{2+}/\text{Fe}^{3+}$ valence state variations. The local ferroelectricity tested by AFM-piezoresponse experiments revealed local incomplete poling and switching with clockwise loops in various positions. Although a typical ferroelectric behavior was not clearly demonstrated, the observed properties might result from a combination of BaTiO_3-like ferroelectric order within perovskite layers with non-ferroelectric behavior of the spinel layers and charge defect-associated effects.</p> <p>[1] J. Ma et al., Adv. Mater. 2011, 23, 1062–1087 [2] L.P. Curecheriu et al., J. Phys. D: Appl. Phys. 44 (2011) 435002 (9pp)</p>
<p>P-10</p>	<p>Implementation of FORC measurements for ferroelectric ceramics: circuit design and numerical analysis</p> <p>Mihai Valentin Pop¹, Laurentiu Stoleriu¹, Nadejda Horchidan¹, Liliana Mitoseriu¹ ¹<i>Department of Physics, Alexandru Ioan Cuza University, Blv. Carol I, nr.11, 700506, Iasi, Romania</i></p> <p>The Preisach model and First Order Reversal Curves formalism were largely applied for describing the switching properties of ferroics, particularly ferromagnetics, superconductors, spin glasses and recently, polarization and piezoelectric responses in ferroelectrics [1, 2]. Piezoresponse force microscopy and spectroscopy have emerged as powerful techniques for probing local polarization switching on free surfaces and vertical and lateral ferroelectric capacitor structures on the nanometer scale [2]. However, the macroscopic FORC analysis in bulk ferroelectrics and its relationship with local switching properties imposes the use of very high voltages and the implementation of an automatic system for FORC data collection and P(E) loops which is non-trivial and not yet implemented in industrial equipments. Still in 2011 new circuitry was proposed for the determination of macroscopic P(E) loops of ferroelectrics. In the present work, an experimental setup to determine the FORC and P(E) loops characteristics for bulk ceramics (using high voltages) was designed and built and then tested on data collected for various BaTiO_3-based ceramics. The setup consists of an arbitrary waveform generator, a HV amplifier, a digital storage oscilloscope and a custom made, low cost, HV interface. The latter includes a modified Sawyer Tower circuit and galvanic isolation between the HV front end and the oscilloscope. A direct signal for the charge Q which passes through the sample is provided by the measuring circuit (integrator). Signals proportional to the applied E and the measured Q are optically isolated by means of two identical optical isolation amplifiers. Optional method of compensation for R and linear C components of samples is also implemented. Synchronization of the experiment with data acquisition is assured with a trigger based technique. Subsequently, the acquired data is processed. A PC is used for generating waveforms for P(E) loops and FORC forcing signals, which are loaded into the AWG, and for software implementation of FORC formalism.</p> <p>Acknowledgements: This work was supported by the Romanian grant PN-II-ID-PCE-2011-3-0745. The collaboration within COST MP0904 Action is highly acknowledged.</p> <p>[1] A. Stancu et al., Appl. Phys. Lett. 83, 3767 (2003); L. Mitoseriu et al., J. Eur. Ceram. Soc. 26, 2915 (2006); L. Stoleriu et al., Phys. Rev. B 74, 174107 (2006) [2] Y. Kim et al., ACS Nano 6, 491 (2012);</p>
<p>P-11</p>	<p>FORC analysis, polarization reversal and sub-switching properties of morphotropic phase boundary PZT ceramics</p> <p>Mihai Valentin Pop¹, Laurentiu Stoleriu¹, Liliana Mitoseriu¹, Carmen Galassi² ¹<i>Department of Physics, Alexandru Ioan Cuza University, Blv. Carol I, nr.11, 700506, Iasi, Romania</i> ²<i>Institute of Science & Technology for Ceramics, ISTECCNR, Via Granarolo no. 64, I-48018, Faenza, Italy</i></p>

Dense $\text{PbZr}_{1-x}\text{Ti}_x\text{O}_3$ ceramics with compositions in the range of the Morphotropic Phase Boundary ($x=0.47, 0.52, 0.535$ and 0.545) have been prepared by solid state reaction (calcinations at $800\text{-}850^\circ\text{C}/4\text{h}$). Dense (relative density above 95-98%) and homogeneous microstructures containing large grains of $30\text{-}50\mu\text{m}$ resulted after sintering at temperatures of $1200\text{-}1250^\circ\text{C}$ for 2h. The particularities of the switching characteristics at room temperature of these $\text{PbZr}_{1-x}\text{Ti}_x\text{O}_3$ ceramics were analysed by using the First Order Reversal Curves (FORC) diagrams [1], while the sub-switching (Rayleigh) [2] region and partial switching processes by the investigation of the reversal part of the FORC distribution. A change of the switching characteristics detected by the FORC diagrams as related to the structural change from rhombohedral to tetragonal symmetry takes place when increasing x (Fig. 1). The tetragonal $\text{PbZr}_{0.445}\text{Ti}_{0.545}\text{O}_3$ shows excellent switching properties, with $\text{Pr}=25\mu\text{C}/\text{cm}^2$ with a very small and non-distributed reversible component. When reducing x , the FORC distribution is more dispersed and shows a strongly reduced irreversible polarization. The composition $\text{PbZr}_{0.53}\text{Ti}_{0.47}\text{O}_3$ still presents a ferroelectric character, but with reduced polarization, and non-saturated FORCs with large reversible component, probably caused by a field-induced antiferroelectric-ferroelectric transition.

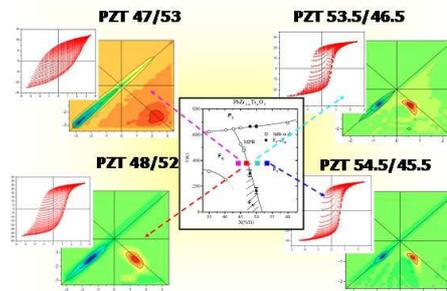


Fig 1. P(E) and FORC diagrams for PZT ceramics with compositions around MPB

Ackn: Work supported by Romanian grant PN-II-ID-PCE-2011-3-0745. Collaboration within COST MP0904 Action is highly acknowledged.

- [1] A. Stancu et al., Appl. Phys. Lett. 83, 3767 (2003); L. Mitoseriu et al., J. Eur. Ceram. Soc. 26, 2915 (2006); L. Stoleriu et al., Phys. Rev. B 74, 174107 (2006)
 [2] D.V. Taylor & D. Damjanovic, J. Appl. Phys. 82, 1973 (1997)

P-12

Investigation of the ferroelectric-relaxor crossover in Ce-doped BaTiO_3 ceramics by impedance spectroscopy

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In alternative to Pb-based relaxors, BaTiO_3 - solid solutions obtained by the addition of ions as Sn, Hf, Ce, Y and Zr have a simple formula and similar crystalline structure and shows ferroelectric relaxor behaviour in certain conditions. From this point of view, these systems are good candidates for investigating in depth the physical nature of the ferroelectric-relaxor crossover and to elaborate models to explain the relaxor characteristics induced by the addition of homovalent substitutions in the BaTiO_3 matrix. Among the BaTiO_3 -based ferroelectric relaxors, Ce-substituted ones hold a special position, because cerium ion can enter into the perovskite BaTiO_3 lattice in two oxidation states, as Ce^{3+} or Ce^{4+} . The effective ionic radius of Ce^{3+} (0.134 nm) is similar to one of Ba^{2+} ion (0.161 nm) and, therefore, Ce^{3+} will be preferentially incorporated onto Ba-site. Ce^{4+} with an ionic radius of 0.087 nm, closer to one of

	<p>Ti⁴⁺ (0.0605 nm), will preferentially substitute Ti-sites. In the present work, Ba(Ti_{1-y}Ce_y)O₃ ceramics with nominal compositions y=0.06; 0.1; 0.2; 0.3 were prepared by mixed oxide method and sintered at 1540°C for 6 hours. X-ray diffraction data showed the phase purity and SEM images demonstrated homogeneous microstructures (average grain size of ~1µm) and well-defined grain boundaries. Impedance spectroscopy in the temperature range of (22 to 200)°C shows a composition-induced ferroelectric-to-relaxor crossover with compositional-dependent shifts of the structural transition temperatures by comparison with ones of the pure BaTiO₃.</p> <p>Acknowledgments: The financial support of the POSDRU 107/1.5/S/78342 and CNCS-UEFISCDI-PN II-ID-3-2011-0745 grants are acknowledged.</p>
<p>P-13</p>	<p align="center">Investigation of electrical properties of Mg_xNi_{1-x}Fe₂O₄ spinel ceramics and applications</p> <p align="center"><u>Zina Violeta Mocanu</u>¹, Mirela Airimioaei^{2,3}, Cristina Elena Ciomaga¹, Florin Tudorache¹, Lavinia Petronela Curecheriu¹, Liliana Mitoseriu¹</p> <p align="center">¹<i>Department of Physics, Alexandru Ioan Cuza University, Iasi, Romania</i> ²<i>Department of Chemistry, Alexandru Ioan Cuza University, Iasi, Romania</i> ³<i>Dept. Chemistry & Process Engineering, University of Genoa, Genoa, Italy</i></p> <p>Large-scale applications of ferrites have promoted the development of various chemical methods for preparation and an increased interest in understanding their functional characteristics. Among different types of ferrites, MgFe₂O₄ enjoys a special attention because of its vast applications in high-density recording media, heterogeneous catalysis, adsorption, sensors and magnetic technologies, while NiFe₂O₄ are one of the most important ferrites with reversed spinel structure. From this point of view, it is highly interesting to perform a systematic study of the effect of the Mg substitution on to the Ni-ferrite. In the present paper the electrical properties of magnesium-substituted nickel ferrite having the general formula Mg_xNi_{1-x}Fe₂O₄ (x=0; 0.17; 0.34; 0.5; 0.66; 1) sintered at 1200°C/2h, has been studied as a function of magnesium ion concentration. The dielectric properties and humidity sensitivity have been investigated as a function of frequency and temperature. The results were interpreted in terms of Maxwell-Wagner phenomena and conductivity mechanism. The activation energy for the conduction and its variation with the Mg degree of substitution has been investigated in detail. The conduction mechanism was found to be caused by the hopping of both electrons and holes. The high-temperature dependence of conductivity shows a change of slope that is attributed to the hole hopping in tetrahedral sites of ferrite. The anomalous frequency dependence of the real part of permittivity can be explained on the basis of hopping of both electrons and holes. The electrical modulus analysis shows the non-Debye nature of the Mg-doped Ni ferrites.</p> <p>Acknowledgments: The financial support of the POSDRU 107/1.5/S/78342 and CNCS-UEFISCDI-PN II-ID-3-2011-0745 grants are acknowledged.</p>
<p>P-14</p>	<p align="center">Rapidly Quenched Magnetic Shape Memory Alloys with Super-elastic Properties</p> <p align="center"><u>Firuta Borza</u>¹, Adrian L. Paraschiv², Leandru Ghe. Bujoreanu², Nicoleta Lupu¹</p> <p align="center">¹<i>Magnetic Materials and Devices, National Institute of Research and Development for Technical Physics - IFT Iasi, Iasi, România</i> ²<i>Faculty of Materials Science and Engineering, "Ghe. Asachi" Technical University of Iasi, Iasi, România</i></p> <p>Polycrystalline alloys with superelastic properties such as Fe-Ni-Co-Al systems have been developed as magnetic shape memory alloys (MSMAs) which, because of their small temperature dependence of their superelasticity over a wide temperature</p>

	<p>range makes them very important for practical applications [1]. One major drawback of existing MSMA is the high costs involved due to raw materials and forming and machining. Due to this drawback, the need to employ faster and cost effective routes for processing has occurred. This work aims to resolve these problems by fabricating these novel, intelligent, high-performance shape memory materials which possess simultaneously high ductility, excellent magnetic characteristics and enhanced super-elastic properties that offer multifunctionality, fast response, smaller size, and reliability for application as integrated multifunctional sensing-actuating systems for various applications. Our approach includes an innovative idea for improving material's performance, i.e. the use of a novel technique, rapid quenching from the melt, for the fabrication of these magnetic shape memory materials as ribbon-shaped and bulk-shaped materials. Thus Fe-28at%Ni-17at%Co-11.5at%-Al-2.5at%Ta-0.05at%B ribbons have been prepared by melt spinning technique rectangular ingots by injection moulding. Scanning electron microscopy (SEM) and electron backscatter diffraction, thermomagnetic, and magnetic measurements have been performed to assess the structural and magnetic differences between the as cast sample. The SEM analysis indicates the formation of relatively large grains (tens of micrometers) in the samples. The thermomagnetization curves, obtained while heating at a rate of 15°C/min, give the Curie temperature of the ribbon samples of about 220°C, while the Curie temperature of the rectangular ingot is of the order of 330°C. The magnetization curves indicate that the bulk specimen presents a higher magnetization value as compared to the ribbon- shaped samples.</p> <p>T. Omori, K. Ando, M. Okano, X. Xu, Y. Tanaka, I. Ohnuma, R. Kainuma, K. Ishida, Superelastic Effect in [1] Polycrystalline Ferrous Alloys, Science 333, 68-71 (2011)</p>
<p>P-15</p>	<p>Modified lanthanum manganite nano-perovskites for catalyst applications Nicolae Rezlescu¹, Elena Rezlescu¹, Corneliu Doroftei^{2,1}, Paul Dorin Popa¹, Maria Ignat³ ¹Physics, National Institute of Research and Development for Technical Physics, Iasi, Romania ²Faculty of Physics, "Al. I. Cuza" University, Iasi, Romania ³Faculty of Chemistry, "Al. I. Cuza" University, Iasi, Romania</p> <p>Volatile organic compounds (VOCs) are the main source of air polluting. Catalytic combustion is the most generally used method for the removal of VOCs. Several ABO₃ perovskite catalysts (A = La, Y and B = Mn, Co, Fe) were found to be active in the total oxidation of VOCs. Many investigations have been focused on the pure and doped lanthanum manganite perovskites. Little attention has been paid to the catalyst properties of lanthanum manganites containing divalent ions such as Pb²⁺, Ca²⁺ and Mg²⁺. The effects of excess divalent ions (Ca²⁺ and Mg²⁺) in La_{0.6}Pb_{0.4}MnO₃ manganite perovskite on the morphological and structure properties are investigated in this study. Nanometer particles of La_{0.6}Pb_{0.4}MnO₃ and La_{0.6}Pb_{0.4}Me_{0.2}MnO₃ (where Me = Mg and Ca) with perovskite structure were prepared by self-combustion method and heat treatment at 1000°C in air. Structure, specific surface area and grain size were determined using XRD, nitrogen adsorption (BET) and SEM analysis. X-ray diffraction evidenced the crystallinity and the nanosize of the perovskite crystallites. By adding Mg or Ca to La_{0.6}Pb_{0.4}MnO₃ a significant decrease in the particle size was detected by SEM. The reasonable values for surface area were obtained (of about 8.5 m²/g). The manganite perovskite powders have been tested in the catalytic combustion of three diluted gases: acetone/air, ethanol/air and methanol/air. The experimental results revealed that the catalytic combustion of the gases over the surface of the three perovskites can start at much lower temperatures than in the normal combustion. The presence of weakly bound oxygen species on the perovskite surface as well as the nanostructure of the material can explain the obtained results.</p>

<p>P-16</p>	<p>On tungsten thin films properties and their relation with transport process of the sputtered atoms in a DC high power pulse magnetron discharge <u>Vasile Tiron</u>¹, Valentin Pohoata¹, Gheorghe Popa¹, Catalin Vitelaru² ¹<i>Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i> ²<i>Advanced Surface Processing and Analysis by Vacuum Technologies, National Institute for Optoelectronics, Magurele, Romania</i></p> <p>In sputtering process, the thin films properties are highly dependent on the interaction between the adatoms and the substrate. This interaction is affected by species mobility on the surface, which depends on the substrate nature and temperature, deposition rate, and the energy of the arriving atoms. The transport of sputtered particles in a magnetron discharge is of considerable interest for optimizing the deposition technique with respect to both deposition rate and control of the thin films properties. Information about sputtered atoms transport and time-averaged energy distribution function were obtained by using tuneable diode – laser induced fluorescence (TD – LIF) technique. We compare the time-averaged velocity distribution functions of the sputtered metal atoms, deposition rate and the properties of tungsten thin films obtained by dc magnetron sputtering (DCMS) and high power pulse magnetron sputtering (HPPMS) in parallel and perpendicular direction to the target surface. Time-averaged velocity distribution functions of the sputtered metal atoms and deposition rate was measured at 20 mm distance from the race track, in axial and radial direction for 10 mTorr and 30 mTorr argon gas pressure, respectively. In HPPMS operation mode, 8 μs pulses of approximately 900 V were used at a repetition frequency of 1 kHz, resulting in a peak current of about 15 A and an average power of 60 W. The deposition rate, surface morphology and roughness of the deposited thin films were investigated using scanning electron microscopy (SEM) and atomic force microscopy (AFM). The measured deposition rate and particle fluxes indicate that a substantial amount of sputtered material is being transported sideways in both HPPMS and DCMS system. The films deposited at low gas pressure and by HPPMS system are likely to be denser and smoother due to the energetic bombardment, especially for substrate perpendicular to the target surface.</p>
<p>P-17</p>	<p>Intermolecular interactions of some carboethoxy-anilido-methylids in solutions <u>Valentina Closca</u>¹, Mihaela-Liliana Ivan¹, Dana-Ortansa Dorohoi¹ ¹<i>Alexandru Ioan Cuza University, Faculty of Physics, 11 Carol I Blv., RO-700506, Romania</i></p> <p>Two carboethoxy anilido-methylids with pyridine, respectively iso-quinoline heterocycle were studied from the point of view of the correlation between the structural and the spectral features. The solvatochromic analysis showed that in the aprotic solutions the universal interactions are dominant, while in the protic solvents specific interactions of the type proton change between the ylid carbanion and the –OH group of these solvents. The theories regarding the solvent influence on the electronic absorption spectra applied to the spectral data allow to determine the electric dipole moment in the excited state of the studied ylid and to estimate the contribution of the specific interactions to the spectral shift. The electro-optical characteristics of the studied ylid in its ground electronic state were established by HyperChem 8.0.6. The data obtained by quantum mechanical computations were used for determination of the electric dipole moment in the excited state of the ylid under the study. The wavenumbers measured in some ternary solutions were used to establish the composition of the first solvation shell for the carboethoxy anilido -methylids under the study. The composition of the first solvation shell of the studied ylids differs from the concentration of the solvents in the entire solution.</p>

<p>P-18</p>	<p>Synthesis and characterization of functional Ni-doped ZnO thin films Alicia Petronela Rambu¹, Laura Ursu², George G. Rusu¹, Nicoleta Iftimie³, Felicia Iacomi¹ ¹<i>Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, România</i> ²<i>Petru Poni Institute of Macromolecular Chemistry, Iasi, România</i> ³<i>National Institute of Research and Development for Technical Physics, Iasi, România</i></p> <p>Zinc oxide is recognized as one of the most important semiconducting material used for different technological applications. Some properties such as: large band gap (3.37eV at room temperature), large excitonic binding energy (60 meV), optical transparency, chemical stability, hardness and piezoelectricity recommend the use of ZnO for a large area of applications. There are various reports regarding the role of doping with atoms of different elements on the properties of ZnO thin films. The Group III elements (Al, In, Ga, B) have been widely used as dopants for ZnO films and it was proved that major changes in their electrical and optical properties are induced. On the other hand, the study of the properties of dilute magnetic semiconductor (DMS) has become an active area of research as such materials are the potential candidates for the emerging field of spintronics. The main goal of this work includes the investigations of structural, optical and gas sensing properties of NZO thin films, prepared using spin coating method, as a function of Ni content. X-ray diffraction (XRD) patterns of studied samples show that the films posses a polycrystalline structure. Surface morphology investigations indicated that surfaces features are changing by increasing the dopant concentration. Optical investigations were performed and it was observed that, optical transmittances, in visible domain, and band gap energy, estimated by Tauc's method, are decreasing while Ni concentration increases. Also, gas sensing measurements were performed and it was observed that investigated films are most sensitive to ammonia against acetone, LPG and ethanol. An increase of gas sensitivity with increase of Ni concentration was observed and it was concluded that morpho-structural changes induced by addition of Ni in ZnO structure are responsible for gas sensing characteristics.</p> <p>Acknowledgements: This work is part of the researches of the grant POSDRU/89/1.5/S/49944 and under financial support of this.</p>
<p>P-19</p>	<p>CaAILDH as matrix for admixtures in concrete Maria Gaburici¹, Horia Chiriac¹, Nicoleta Lupu¹ ¹<i>MDM, National Institute of R&D for Technical Physics, 47 Mangeron Boulevard, 700050, email: mgaburici@phys-iasi.ro, Iasi, Romania</i></p> <p>The most common admixtures for cement and concrete include accelerators, superplasticizers, set retarders and air entraining agents. Controlling the timing of the availability of the admixture in cement system is very important for technological performance. Controlled-release technology represents a route to prolong delivery of immobilized chemical reagents while maintaining their concentration over a specific time period. Layered double hydroxides (LDH) represent one of the phases that form during cement hydration and their physical and chemical properties permit the obtaining of functional materials with specific characteristics for targeted applications. The synthesis of CaAILDH was realized by co- precipitation method, using solutions of Al(NO₃)₃·9H₂O and Ca(NO₃)₂·4H₂O. As superplasticizer was used citric acid (a hydroxilated carboxylic acid) in combination with the polymer ERCOL immobilized in the LDH structure by reconstruction method. The anionic clay CaAILDH and composite CaAILDH-citrate -ERCOL were characterized by Scanning Electron Microscopy (SEM) and BET which indicate the particle size between 50-120 nm and a specific surface area of 82.4 m²/g for CaAILDH as precursor material and 70,9 m²/g for the obtained hybride. The intercalation of the two organic components was proved by X-ray diffraction analysis and FTIR spectra. In order to test the ability of the prepared</p>

	<p>composite to release the organic admixture, the deintercalation process was realized by exposing the composite to a simulated concrete pore solution at room temperature, namely in sodium hydroxide solutions of different concentrations under moderate stirring. In the 0.1 M NaOH after 2 h the organic compounds are eliminated and, at the greater concentration of NaOH, the deintercalation process is faster.</p> <p>L. Raki, J.J. Beaudoin, L. Mitchell, Layered double hydroxide-like materials: nanocomposites for use in concrete, <i>Cement and concrete research</i>, 34(9), 2004, 1717-1724.</p>
<p>P-20</p>	<p align="center">Magnetorheological fluids based on polymer coated iron particles George Stoian¹, Horia Chiriac¹</p> <p align="center">¹<i>Magnetic Devices and Materials, National Institute of Research & Development for Technical Physics, Iasi, Romania</i></p> <p>Magnetorheological (MR) fluids are suspensions of magnetically polarizable particles in a magnetically neutral fluid, usually mineral or silicone oil, characterized by their ability to reversibly change from a linear viscous fluid with free flow to a semi-solid material with controllable yield stress when placed in magnetic field. One problem to be solved when using such fluids in applications is given by the aggregation and sedimentation of the magnetic particles. In order to resolve aggregation and sedimentation problem of iron particles for magnetorheological fluids, polymer (PMMA) coated composite magnetic particles were synthesized via a dispersion polymerization method using iron particles dispersions in methyl methacrylate monomer, and then using the product as a dispersed phase of MR fluids. External and internal morphology of the produced particle was observed using scanning electron microscope (SEM) and focused ion beam (FIB). Magnetic measurements of the iron particles and polymer coated iron particles were performed by means of a VSM. Rheological properties with and without external magnetic field were investigated using a commercial rotational rheometer (Physica MCR101 from Anton-Paar) with the MR device (MRD 180). Flow and viscoelastic properties of the MR fluids were analyzed.</p> <p>The sedimentation ratio of the magnetorheological fluids based on pure iron particles and PMMA coated particles were compared to each other, in which the sedimentation curve of pure iron based MR fluid displayed faster sedimentation than PMMA encapsulated iron based MR fluid due to the density difference between pure iron and PMMA coated particles.</p> <p>Also, a discussion on how to improve the magnetorheological fluids stability without affecting its rheological performances in magnetic field is presented.</p> <p>[1] Z. Cao, W. Jiang, X. Ye and X. Gong, <i>Journal of Magnetism and Magnetic Materials</i>, Volume 320, Issue 8, (2007) p. 1499-1502</p>
<p>P-21</p>	<p align="center">The Meyer-Neldel Rule in TiO₂ Films with Different Fe Content Daniel Florea¹, Dumitru Luca¹, Catalin Adomnitei¹, Cristian Mihail Teodorescu², Diana Mardare¹</p> <p align="center">¹<i>Faculty of Physics, "Alexandru Ioan Cuza" University, Iasi, Romania</i> ²<i>Institute of Materials Physics, Institute of Materials Physics, Magurele, Romania</i></p> <p>Amorphous titania thin films with increasing Fe content have been prepared by RF magnetron sputtering. X-ray absorption spectroscopy revealed modifications of both local structures/environment of the Ti and Fe atoms, with formation of phases containing amorphous material and a magnetite-like phase. The films became smoother by doping, as revealed by the Atomic Force Microscopy. The optical band gap values, obtained from optical transmittance measurements, decrease by increasing the Fe content in the films, from 3.3eV for the undoped sample till 2.2eV for the sample with the highest Fe content. The temperature dependence of the electrical conductivity of the</p>

	<p>films was investigated for temperatures higher than half of the Debye temperature ($T > 391$ K). It was found that the electrical conductivity in the amorphous Fe/TiO₂ films obeys the Meyer-Neldel rule. The origin of this behaviour is explained on the basis of the multi-phonon assisted hopping model.</p>
<p>P-22</p>	<p style="text-align: center;">The structural transformation of the ceramic layer ZrO₂/20%Y₂O₃, obtained by thermal spraying after heat treatment</p> <p style="text-align: center;"><u>Laura Geanina Pintilei</u>¹, Florin Branza², Gica Narcis Basescu¹, Sorin Claudiu Iacob Strugariu¹, Bogdan Istrate¹, Corneliu Munteanu¹</p> <p style="text-align: center;">¹<i>Faculty of Mechanical Engineering, "Gheorghe Asachi" Technical University of Iasi, 61-63 Prof.dr.doc. D. Mangeron, 70050 Iasi, Romania</i></p> <p style="text-align: center;">²<i>Faculty of Physics, Alexandru Ioan Cuza University, 11 Carol I Blvd. 700506 Iasi, Romania</i></p> <p>Heat treatments applied to superficial layers obtained by atmospheric plasma spraying are aimed at structural changes and removal of defects caused during spraying. Through heat treatments of acquiring pursues physical-mechanical characteristics, chemical or technical knowledge required by the terms of use. In this paper presents a new concept of thermal barrier coating sprayed by preventing exfoliation and consist of a ceramic layer ZrO₂/20%Y₂O₃ and one of adherent layer Ni-22wt% Cr-10wt% Al-1wt% Y, deposited by atmospheric plasma spraying (APS), on specimens of Ni super alloy used in the manufacture of turbine blades. Ceramic powder type ZrO₂/20%Y₂O₃ is recommended for superficial deposits obtained as layers behave very well as a thermal insulator and presents a high thermal wear resistance at temperatures above 1000°C. In this paper are a heat treatment applied on layers obtained by atmospheric plasma spraying, by cooling it with the jet of air at a pressure of 100 bar after maintaining at 1000°C of temperature at intervals of 5, 10 or 15 hours After heat treatment the surfaces were analyzed microstructurally and morphologically by electronic microscopy, and in terms of the phase composition by X-ray diffraction. After the heat treatment was an increase in grain size of the surface layer by the formation of "bridges" between neighboring splats that had the effect of closing the initial micro cracks produced during spraying. The structure obtained by thermal spraying with the appearance of splats oriented in thermal gradient direction relaxes after applying heat treatment emphasizing much more clearly in their sequence.</p>
<p>P-23</p>	<p style="text-align: center;">Behavior to high speeds heating-cooling of ceramic multilayer multifunctional structures based on the zirconie partial stabilized with yttria</p> <p style="text-align: center;"><u>Laura Geanina Pintilei</u>¹, Victor Manoliu², Gheorghe Ionescu², Gica Narcis Basescu¹, Sorin Claudiu Iacob Strugariu¹, Corneliu Munteanu¹</p> <p style="text-align: center;">¹<i>Faculty of Mechanical Engineering, "Gheorghe Asachi" Technical University of Iasi, 61-63 Prof.dr. doc. D. Mangeron Blvd. , Romania</i></p> <p style="text-align: center;">²<i>Materials laboratory, National Institute for Aerospace Research , Bucuresti, Romania</i></p> <p>Advanced materials intended for application in aerospace, power, metallurgical industries impose composite functional materials and new methods and installations to test them. Thermal barrier coatings (TBCs) are widely used to protect components and remain the most effective thermal insulation approach and their development was focused on partial stabilized zirconia. Within the work is used zirconia partial stabilized with 20% yttria in place of the classic TBC stabilized with 7-8%. In order to evaluate the behavioral assessment of TB protection, attesting installation was designed and realized by the INCAS, for cooling-heating speeds up to 1000C/s, installation included in the experimental program. In view to evidence the structural changes, inter and interfacial induced by thermal shock with high thermal gradients were presented the results of investigations of SEM-EDS electronic microscopy.</p>

<p>P-24</p>	<p align="center">Functional characterization of Ni_{1-x}Co_xO thin films deposited by spin-coating</p> <p align="center">G. Calin¹, C. Doroftei¹, M. Irimia¹, F. Iacomì¹</p> <p align="center">¹<i>Faculty of physics, "Alexandru Ioan Cuza" University of Iasi, Iasi, Romania</i></p> <p>NiO and Co₃O₄ are p-type semiconducting oxides extensively studied. Physical properties of thin films of oxide semiconductors and transparent conducting recommend using these materials successfully for a number of applications: in catalysis, electrochromic display devices, gas sensors, magnetic sensors as active elements in transparent electronics. It was found that mixed oxides of nickel and cobalt are more conductive in comparison with either of the two end members [1, 2]. Thus these materials are more attractive in terms of practical applications. In this study we report results on some functional properties (sensitivity to gas and vapours, magnetoresistance) of Ni_{1-x}Co_xO (x = 0.3-0.9) thin films deposited by spin-coating on glass substrate. A good crystallinity of the layers was obtained after a heat treatment in air to 400 °C for 2 hours. Thin films sensitivities in a series of gases (C₂H₅OH, CH₃OH, CH₃COCH₃, C₄H₁₀, LPG) was carried out in the temperature range 423 K-623 K. Thin film magnetoresistive properties were investigated in a 2T magnetic field and a temperature range 77-400 K. It was established that at certain Co contents thin films exhibit high sensitivities to certain gases and are ferromagnetic.</p> <p>ACKNOWLEDGEMENT This work was supported by the POSDRU/88/1.5/S/47646 and POSDRU/89/1.5/S/49944.</p> <p>[1] K. Domansky, A. Rose, W. H. Gover, G. J. Exarhos, Mater. Sci. Eng., B 76 (2000) 161. [2] S. Goodwin-Johansson, P. H. Holloway, G. McGuire, L. Buckley, R. Cozzens, R. Schwartz, G. J. Exarhos, Proc. SPIE 3967 (2000) 225.</p>
<p>P-25</p>	<p align="center">The Influence of Different Cr Content on the Properties of TiO₂ Thin Films</p> <p align="center">Daniel Florea¹, Catalin Adomnitei¹, Nicoleta Ciornei², Dumitru Luca¹, Alina Manole¹, Marius Dobromir¹, Mihaela Girtan³, Diana Mardare¹</p> <p align="center">¹<i>Faculty of Physics, "Alexandru Ioan Cuza" University, Iasi, Romania</i> ²<i>Faculty of Chemistry, "Alexandru Ioan Cuza" University, Iasi, Romania</i> ³<i>Photonics Laboratory, Angers University, Angers, France</i></p> <p>Undoped and Cr-doped titanium oxide thin films were obtained by RF sputtering. The films are polycrystalline, as revealed by X-ray diffraction studies. Depending on chromium concentration, they show mixed anatase/rutile phases, or pure rutile structures. Survey and narrow scan X-ray photoelectron spectroscopy spectra were recorded to derive the elemental composition and chemical state in the films' surface region. The optical transmittance and reflectance spectra of the films were investigated and the optical band gap was derived for each film. A shift of the optical band gap towards lower energies, by increasing the Cr content in the films, was observed. The electrical conductivity versus inverse temperature was studied in the temperature range 300-450K, in air and CO₂ atmosphere.</p>
<p>P-26</p>	<p align="center">Theoretical and spectral study of some vitamins</p> <p align="center">C.M. Scoban¹, L.M Ivan¹, D. Dorohoi¹</p> <p align="center">¹<i>Department of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i></p> <p>The optimized molecular geometry, the electro – optical properties and the vibration spectra of two vitamins: piridoxine (B6) and nicotinamide (B3) were established by using the molecular modeling program (Spartan). Two semi-empirical methods AM1 and PM3 were applied and the obtained theoretical results were</p>

	<p>compared in order to establish which are closed to the experimental data. The computing data are important in order to establish the chemical hardness, electrophilicity index and electronegativity of the studied vitamins. The obtained parameters can be correlated with the biological activity of the investigated molecules. The same difference of LUMO – HOMO indicates comparable effects of the vitamins in human body.</p>
<p>P-27</p>	<p align="center">Function graded materials obtained by gas carburizing method <u>Marius Catalin Criveanu</u>^{1,2}, Marco Actis Grande², Oana Gingu¹ ¹<i>IMST, University of Craiova, Craiova, Romania</i> ²<i>Dipartimento Scienza Applicata e Tecnologia, Politecnico di Torino, Torino / Alessandria, Italia</i></p> <p>The paper presents results of experimental research on sintered steels developed through a new process called gas carburizing (GCS) which consists in carburizing in gas (CH₄) of Fe DWP200 green powder compacts followed by sintering, both heat treatments were applied in the same thermal cycle. The results of researches on steels developed by carburization of Fe powder followed by sintering, revealed that this new method – GCS – allows obtaining steels with concentration and structure gradient, and this is reflected in their mechanical properties which combine features hypereutectoid steels with hypoeutectoid steels.</p> <p>Criveanu, M.C., Gingu, O., Sima, G., Mangra, M., Bucşe, I., Ciobanu, M., Ghermec, C., Properties of Sintered Steels Made from Fe Powders by Carburizing-Sintering Process, European Powder Metallurgy congress EUROPM 2009, 12-14 oct.</p>
<p>P-28</p>	<p align="center">Studies on the structural changes induced by annealing and gamma irradiation in iron rich mineral clays <u>C. Tabacaru</u>¹, V. Nica¹, M. Dobromir¹, M. Chipara², F. Iacomi¹, ¹<i>Faculty of Physics, Alexandru Ioan Cuza University, 11 Carol I Blvd., 700506-Iasi, Romania</i> ²<i>University of Texas Pan American, Edinburg, TX 78541, USA</i></p> <p>Mineral clay from Frumoasa county was structural analyzed and submitted to different treatments: gamma irradiation, annealing, annealing and gamma irradiation. Rietveld XRD, IR and electron spin resonance investigations evidenced that mineral clay from Frumoasa deposits, is composed merely from muscovite, kaolinite, montmorillonite and quartz, and is resistant to annealings until 723 K and gamma irradiation (kaolinite being the phase more affected by these treatments). By corroborating electron spin resonance spectra with XPS spectra, oxidation processes determined by annealing and reduction processes determined by gamma irradiation were evidenced.</p>
<p>P-29</p>	<p align="center">Influence of shot peening and anodizing on fatigue endurance of EN-AW-6082 aluminium alloy in gigacycle regime Viktor Škorík¹, Branislav Hadzima¹, František Nový¹ ¹<i>Department of Materials Engineering, Faculty of Mechanical Engineering, University of Žilina, Žilina, Slovak Republic</i></p> <p>Shot peening is a powerful method to enhance the fatigue performance of aluminium alloys. It is a cold working process in which the surface of metal part is bombarded with spherical particles. This process produces near surface plastic deformation leading to the development of work hardening and high magnitude compressive residual stresses. A uniform compressive stress in surface or near surface layer of metal increases the stress tolerance and prolong the service life of metal components under cyclical loading conditions. Anodized coatings are commonly applied to Al alloys to provide resistance to corrosion and wear. The electrolytic process of anodizing produces a controlled columnar growth of amorphous aluminium oxide on the surface of Al alloys, where the thickness of the oxide film is much greater than those formed naturally. Anodizing affects the fatigue life in various ways, with the</p>

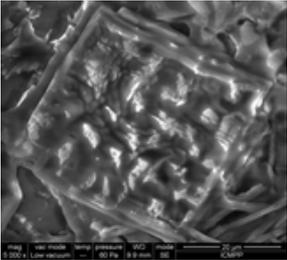
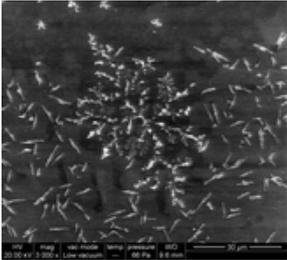
main effect being the encouragement of crack nucleation. The anodizing process produces a brittle and hard oxide film with inherent pores, which would readily crack when deformed. The combination of residual tensile stress and the relatively high modulus of the anodized layer could reduce the crack closure effect at the surface, and thereby affect early crack growth. The influence of shot peening and anodizing on the fatigue resistance of the wrought EN AW 6082 aluminium alloy was investigated in a very high cycle region. Specimens with as machined, shot peened and shot peened and anodized surfaces were subjected to the high frequency fatigue loading ($f \approx 20$ kHz, $R = -1$). The shot peening process effectively improved the fatigue resistance. The fracture surfaces after the fatigue loadings were evaluated using a light stereo and a scanning electron microscope. The tests results showed that the fatigue endurance of shot peened specimens is much higher than the endurance of shot peened and anodized specimens and as machined specimens. All fatigue crack nucleation sites were located on the specimens' surface. Multiple nucleation sites were observed in the specimens with shot peened and anodized surface.

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TOPIC 3

Fundamentals of Plasma and Laser-Material Interactions and Processing

<p>PI-1</p>	<p style="text-align: center;">Plasma surface interaction in material science Gheorghe Popa¹</p> <p>¹<i>Faculty of Physics, "Alexandru Ioan Cuza" University, Blvd. Carol I, no. 11, 700506 Iasi, Romania</i></p> <p>Nowadays plasma state of mater as medium for nuclear fusion plays a crucial role in future of the mankind energy supply but recent developments in material science also show that plasma properties may also play an important role in both synthesis and properties modification of various materials as solid, liquid or gas phase interacting with plasma state. Fusion physics and technology are interested in so called high temperature plasma. This application needs dedicate studies on phenomena involved in interaction of the high energy particles (broad energy range up to MeV/particle) and high fluxes or power surface density (order of 10 MW/m²) with solid surface, which have major consequences on both properties of the first wall material of the reactor and cooling of the thermonuclear plasma, respectively. On the other hand, the so called low temperature plasmas are used in various procedures and technologies for material synthesis or surface modification and treatments. Among these applications the sputtering and thin layer deposition is one of the most used technology at micro and nano-scale [1]. The aim of present paper is to present synthesis of experiments developed and results obtained by plasma physics group of faculty of physics in "Alexandru Ioan Cuza" University of Iasi on research of processes and phenomena taking place as result of plasma surface interaction in some specific devices as: Pilot Psi, magnetron discharges, laser ablation system and dielectric barrier discharges (DBD) [2].</p> <p>Acknowledgements: the financial support was achieved by Partnerships Research Program of Romanian Research, Development and Integration National Plan II, Grant no. 174/2012.</p> <p>[1] N. Marchack and J. P. Chang, J. Phys. D: Appl. Phys. 44 (2011) doi:10.1088/0022-727/44/17/174011 [2] G.J. van Rooij, V.P. Veremiyenko, et. al., Appl. Phys. Lett. 90, (2007) 121501</p>
<p>I-1</p>	<p style="text-align: center;">Processing and characterization of advanced materials by laser ablation techniques O.G. Pompilian¹, G. Dascalu², S. Gurlui², <u>C. Focsa</u>¹</p> <p>¹<i>Laboratoire de Physique des Lasers, Atomes et Molécules, Université Lille 1 Sciences & Technologies, 59655 Villeneuve d'Ascq, France</i> ²<i>Faculty of Physics, "Alexandru Ioan Cuza" University, 11 Blvd Carol I, 700506 Iasi, Romania</i></p> <p>Our group has developed for several years experimental and theoretical capabilities for the study of plasma ablation for nano-technology applications. Fundamental studies on laser ablation plasma plume dynamics have been performed both experimentally by optical (ICCD fast imaging, space- and time-resolved optical emission spectroscopy) and electrical (Langmuir probes, mass spectrometry) methods, and theoretically (development of a new model based on fractal concepts). These fundamental studies were further applied to the study of innovative materials of high interest for the nanotechnology field: pulsed laser deposition of chalcogenide glasses and magnetoelectric materials thin films. The deposited thin films have been characterized by various surface and solid state specific methods (TOF-SIMS, optical and mechanical profilometry, XRD, EDX, SEM, ellipsometry, Raman etc.). Another application is the study of the accelerated erosion of ceramic materials used in plasma space propulsion (Hall Effect Thrusters - HETs). These experiments were developed both in our laboratory and on a running HET at the national ground test facility PIVOINE-2G in Orléans, France. We will present an overview of these fundamental and applied studies [1,2].</p> <p>[1] P. Nica, M. Agop, S. Gurlui, C. Focsa, Eur. Phys. Lett., 89, 65001 (2010)</p>

	<p>[2]C. Ursu, O.G. Pompilian, S. Gurlui, P. Nica, M. Agop, M. Dudeck, C. Focsa, Appl. Phys. A, 101, 153 (2010)</p>
<p>O-1</p>	<p>Collagen immobilization on polyethylene terephthalate surface after helium plasma treatment</p> <p><u>Magdalena Aflori</u>¹, Mioara Drobota¹, Dan Gh. Dimitriu², Irina Titorencu^{1,3}, Valeria Harabagiu¹</p> <p>¹<i>Physical Characterization of Polymers, Petru Poni Institute of Macromolecular Chemistry, Iasi, Romania</i></p> <p>²<i>Faculty of Physics, "Alexandru Ioan Cuza" University, Iasi, Romania</i></p> <p>³<i>Biopathology and Pharmacology of Inflammation, The Institute of Cellular Biology and Pathology, Bucharest, Romania</i></p> <p>In this study, collagen immobilization preceded by helium plasma treatment was used to modify poly(ethylene terephthalate)surface. After plasma treatment, the films were incubated in a collagen - phosphate buffered solution. XPS measurements revealed the immobilization of collagen on PET surface, with an increase of the nitrogen content and a decrease of carbon content by increasing plasma-exposure time. Helium plasma was proved to be efficient for cross-linking [1], only etching and cross-linking of the polymer taking place during the treatment without introduction of chemical groups. The free radicals are forming at or near the surface and interact producing cross-linking structures and unsaturated groups.</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="459 913 746 1173">  <p>SEM image of collagen immobilization on collagen-buffer solution</p> </div> <div data-bbox="986 913 1273 1173">  <p>SEM image of 10 min plasma-treated PET</p> </div> </div> <p>Needle-like and dendrites of collagen formed on polymer surface due to the collagen buffer solution were evidenced by the SEM method. The collagen was uniformly immobilized on polymer surface at certain plasma treatment times. To investigate the cytocompatibility of the treated PET the EA.hy 926 endothelial cell line was used, all tested samples sustained endothelial cells development. Acknowledgment: The research leading to these results has received funding from the European Union's Seventh Framework Programme grant agreement n°264115 - STREAM.</p> <p>[1] M. Carmen Almazán-Almazán, J.I. Paredes, M. Pérez-Mendoza, M. Domingo-García, F.J. López-Garzón, A. Martínez-Alonso, J.M.D. Tascón, Journal of Colloid and Interface Science 293 (2006) 353–363</p>
<p>P-1</p>	<p>Low pressure inverter plasma system for surface engineering experiments</p> <p><u>Cristian Daniel Tudoran</u>¹</p> <p>¹<i>Department of Molecular and Biomolecular Physics, National Institute for Research and Development of Isotopic and Molecular Technologies, Cluj-Napoca, Romania</i></p> <p>The paper presents an activation study of the surface of graphite loaded EPDM type rubber with the help of a modern high-frequency cold plasma system. Due to its conductive properties, the graphite loaded EPDM rubber presents a special problem when it comes to activating its surface even with the plasma processes. The rubber sample may become a “third electrode” in the systems where the plasma is maintained between two electrode plates, and the risk of short circuit exists which can destroy the high voltage power source. In case of the microwave plasma systems, the graphite loaded EPDM rubber sample absorbs the microwave energy, rapidly heating itself</p>

	<p>beyond the degradation temperature. Because of such difficult to solve technical problems and its specific properties, the graphite loaded EPDM rubber can only be plasma treated in a dielectric barrier discharge (DBD) nonthermal (cold) plasma system.</p> <p>For this study, the plasma discharge was generated in high purity synthetic air at subatmospheric pressure (10 mbar) at a driving frequency of 1.5 MHz. Both generation principle and characterization of the discharge are presented. The characteristic temperatures of the discharge were determined by two methods: optical emission techniques and direct thermocouple measurements, and the temperature distribution inside the plasma column was studied using a modern method based on the use of LCD thermosensitive polymer foil. It was found that the kinetic temperature of the plasma is lower than 50 deg.C for an input power of 60W, making it an ideal tool for the surface functionalization of a large series of thermosensitive materials.</p>
<p>P-2</p>	<p align="center">Plasma parameters of argon and argon/molecular gas mixture plasmas produced in microwave discharge</p> <p align="center">Remus-Sorin Dobrea¹, Ilarion Mihaila¹, Gheorghe Popa¹</p> <p align="center">¹<i>Faculty of Physics, "Al. I. Cuza" University, Iasi, Romania</i></p> <p>The microwave discharge is an effective system to produce non-thermal plasma without electrodes in a rather wide range of gas pressure and nature. Nowadays, the microwave plasma discharges are used intensively for lot of applications such as film deposition [1], destruction and removal of the gaseous pollutants [2] or as sources of atomic and/or molecular ion species [3]. These discharges are also used in plasma-catalyst systems to maximize removal efficiency of various pollutants, or they can be used in various gas mixtures such as N₂, N₂-H₂ and Ar-N₂-H₂ for nitriding treatments of ferrous and nonferrous materials to improve corrosion resistance [4]. The major concern of this paper is to investigate the fundamental plasma parameter within the plasma volume, mainly related to electronic plasma component, when pure argon or argon-specific molecular gas mixture were used. The electron temperatures and densities of a microwave plasma discharge produced in Ar gas and Ar-N₂ or Ar-NO mixture were measured using cylindrical probe [5] and triple probe [6], respectively, inserted on the axial direction of the discharge tube close to the microwave applicator. The experimental device consists of a cylindrical quartz discharge tube (diameter of 50 mm and 40 cm in length), which was pumped down to a background pressure of 10-2 Torr, locally surrounded by applicator waveguide of the microwave system (2.45 GHz). The applied microwave power was within the range 50 W to 500 W and the total gas pressure was fixed at 0.5 Torr. The main conclusion of the work is that plasma produced in present microwave system is very inhomogeneous and needs precautions in using probe method for plasma parameters measuring. The triple probe method is more effective due to its remarkable time response in getting electron temperature and density of high energetic electrons, which form the high energetic tail of the energy distribution function and there the single probe has a low signal.</p> <p>[1]J.L.Jauberteau et all,Intern.J.Mass Spectrometry 228(2003)49-59 [2]D.Ighigeanu et all,Vacuum,77,4,11(2005)493-500 [3]L.Thomas et all, Plasma Chem.Plasma P.,17,No.2,(1997) [4]J.L. Jauberteau et all,J.Phys.D:Appl.Phys.35(2002) [5] R.H.Huddelstone and S.L.Leonard Plasma Diagnostic Techniques,Acad.,N.Y.,1965 [6]Sin-Li Chen and T.Sekiguchi,J.Appl.Phys.,36,8(1965)2363-2375</p>
<p>P-3</p>	<p align="center">Surface modification of polymers in relation to the spatial distribution of reactive oxygen species</p> <p align="center">Gabriela Borcia¹, Radu Cazan¹, Catalin Borcia¹</p> <p align="center">¹<i>Physics, Alexandru Ioan Cuza University, Iasi, Romania</i></p> <p align="center">We investigate here the relation between the surface properties of a plasma-</p>

	<p>modified polymer and the spatial distribution of reactive oxygen species. An atmospheric pressure dielectric barrier discharge (DBD), in an asymmetrical electrode configuration, is used to surface modify polymer materials, focusing on monitoring the homogeneity of the discharge and of the exposed surface. Tunable diode laser absorption spectrometry (TDLAS) offers the space-time profile of oxygen metastable atoms, representative of the distribution of the oxygen species within the area covered by the discharge. A wave-like dynamics of the metastable oxygen atoms creates a particular distribution, which relates to the radial profile of the surface properties of the treated polymer, mapped using atomic force microscopy (AFM), contact angle and X-ray photoelectron spectroscopy (XPS). The radial profile of the treated polymer film correlates to the oxygen species distribution, for DBD exposure duration depending on the specific property. Thus, the roughness modification shows that the surface homogeneity is ensured for exposure shorter than ~ 15 s, whereas the contact angle points to treatment times of at least 10 s in order to achieve surface homogeneous modification. Longer treatment has also to be taken into account in addition when considering the stability of the surface properties. The optimum DBD exposure should thus be selected to meet all the requirements, allowing for rapid, efficient, stable and homogeneous surface modification, and is of about 10 s in the present experimental arrangement. The dimensions and the radial profile of the treated surface have to be taken into account when targeting to surface-modify large samples. In this respect, the treatment parameters must be selected for each type of exposed substrate.</p>
<p>P-4</p>	<p style="text-align: center;">Silicon plasma processing for front surface textured solar cells</p> <p style="text-align: center;">R. Rebigan¹, A. Avram¹, F. Craciunoiu¹, R. Tomescu¹, M. Popescu¹, D. Cristea¹, M. Purica¹, P. Schiopu²</p> <p style="text-align: center;">¹..., National Institute of Microtechnologies Bucharest – IMT, Bucharest, Romania ²Faculty of Electronics, Telecommunications and Information Technology, Politehnica University of Bucharest, Bucharest, Romania</p> <p>Among different kinds of plasma etching processes, Inductively coupled plasma (ICP) has the advantage of providing high aspect ratio structures, with particular application in MEMS, MOEMS and textured surfaces fabrication for solar cells. In this paper we present the fabrication of silicon pillars in different sizes and shapes (cylindric and clepsydra with different heights) using ICP (Plasmalab System 100 from Oxford Instruments) dry etching processes with different parameter variations: pressure, gas debit, etching chemical species. The dry etching process (Bosch process) consist of 2 steps: a) deposition in order to pasivate the vertical walls and b) etch step. Table temperature was held constant at 15°C and He backside pressure was held at 10 Torr. The dry etching process parameters were varied to obtain the different etch shapes. In order to obtain the clapsydra profile, a second silicon wafer was placed between the processed wafer and the platen. This additional wafer increased the temperature at the surface of the processed wafer preventing the heat from being rapidly dissipated. The silicon pillars have been used for textured solar cells, to lower the loses by surface reflection of incident radiation and increase the optical active region of the solar cell, hence increasing device's conversion efficiency. The influence of pillars with different forms, sizes and heights (shown in figures below) has been investigated by recording the reflectance spectra on the silicon textured wafers in the spectral range (200 – 900) nm using double way UV_VIS_NIR spectrophotometer. The spectra analysis has shown that the reflectivity of the textured silicon surface using pillars has decreased to < 10% compared with the value of 35% for the silicon untextured surface.</p>

TOPIC 4

Magnetic Materials and Spintronics

<p>PI-1</p>	<p style="text-align: center;">Multiferroic tunnel junctions <u>Marin Alexe</u>¹ ¹<i>Max Planck Institute of Microstructure Physics, Weinberg 2, 06120 Halle, Germany</i></p> <p>Spin polarized transport in ferromagnetic tunnel junctions, characterized by tunnel magnetoresistance, have already proven a high application potential in the field of spintronics and in magnetic random access memories (MRAM). Until recently, in such a junction the insulating barrier played only a passive role keeping apart the ferromagnetic electrodes in order to allow electron tunneling. However, a new dimension was added to these devices by replacing the insulator with a ferroelectric material, which possesses permanent dielectric polarization switchable between two stable states. The obtained multiferroic tunnel junction (MFTJ) is a non-volatile memory device with four states, given by two possible ferroelectric polarization directions in the barrier and two different magnetization alignments of the electrodes. The present talk will address the fundamentals of multiferroic tunnel junctions. We will also show that due to the coupling between magnetization and ferroelectric polarization at the interface between a magnetic electrode and the ferroelectric barrier of a MFTJ, the spin polarization of the tunneling electrons can be reversibly and remanently inverted by switching the ferroelectric polarization of the barrier. Selecting the spin direction of the tunneling electrons by short electric pulses in the nanosecond range rather than by an applied magnetic field is highly relevant for spintronics, especially for spin-based information technology.</p>
<p>PI-2</p>	<p style="text-align: center;">What electron paramagnetic resonance tells us about the spin dynamics in diluted magnetic semiconductors? <u>L.M. Giurgiu</u>¹, O. Raita¹, A. Popa¹, D. Toloman¹ ¹<i>National Institute for Research and Development of Isotopic and Molecular Technologies, Donath 65-10, 400293 Cluj-Napoca, Romania</i></p> <p>Diluted magnetic semiconductors (DMSs) with the Curie temperature above the room temperature, which permit n or p-doping, have been the subject of great interest in the last decade owing to the perspectives opened by spintronics in the field of information technology and electronics. The properties of these materials are highly process-dependent and are affected by the synthesis conditions, doping degree, crystalline structure, magnetic clustering and dimensionality. Electron Paramagnetic Resonance (EPR) spectroscopy is a powerful tool to investigate the origin and nature of the observed ferromagnetism in DMSs due to its higher sensitivity which is required for the investigation of magnetic inhomogeneity, its selectivity to the microscopic structure of doping ion and its resonant character which allows one to easily eliminate undesired contributions and effects of phase inclusions. In the present contribution, we report our recent EPR investigations of magnetic semiconductors, especially TM – doped SnO₂ and ZnO micro and nanocrystalline compounds, where TM is one of the 3d transition magnetic ions: Mn, Co, and Fe. We will concentrate on the following informations revealed by EPR spectroscopy: (i) the local symmetry and local properties in the vicinity of TM impurities (ii) the detection of the ferromagnetic ordering as well as the existence of other magnetic species (iii) the incorporation degree of TM ions (iv) the influence of the TM concentration on EPR spectra (v) spin dynamics as function of the annealing temperature and dopant concentration.</p> <p>Acknowledgments This work was supported by CNCSIS-UEFISCSU, project number PNII-IDEI no.4/2010, cod ID-106.</p>

<p>I-1</p>	<p align="center">Relevance of Fe atomic volumes for the magnetic properties of Fe-rich metallic glasses</p> <p align="center">Imre Bakonyi¹</p> <p align="center">¹<i>Wigner Research Centre for Physics, Hungarian Academy of Sciences, Budapest, Hungary</i></p> <p>Fe-rich alloys often show unusual magnetic behavior. One interesting issue has been the indication of two different magnetic states, depending on the alloying component, both in crystalline [1] and amorphous [2] structural modifications. As another example, the complex magnetic behavior of Fe-rich Fe-Zr metallic glasses [3,4] can be mentioned. In this talk, we would like to contribute to a better understanding of these two peculiarities on the basis of the atomic volume $V(a\text{-Fe})$ that can be assigned to Fe atoms in Fe-metalloid (Fe-MD) and Fe – early transition metal (Fe-TE) glasses as deduced from an analysis of available density data for such amorphous alloys [5]. Based on a similarity of the amorphous and face-centered cubic (fcc) structures, the distinctly different magnetic behaviors of these two families of amorphous alloys are discussed in terms of the relative position of $V(a\text{-Fe})$ and the critical volume $V(\text{fcc}^*\text{-Fe}) = 11.7 \text{ \AA}^3/\text{atom}$ separating the so-called low-spin (LS) and high-spin (HS) state of fcc-Fe. For Fe-MD systems, $V(a\text{-Fe})$ is found to be definitely larger than $V(\text{fcc}^*\text{-Fe})$ whereas for Fe-TE systems $V(a\text{-Fe})$ is fairly close to $V(\text{fcc}^*\text{-Fe})$. In topologically disordered alloys, a distribution of atomic volumes is inherently present. Even if so, in Fe-MD glasses, the Fe atoms can be assumed to exhibit exclusively the HS state whereas in Fe-TE amorphous alloys a comparable fraction of Fe atoms can be either in the LS or the HS state. According to previous theoretical band structure calculations, an antiferromagnetic state can also be stable just around $V(\text{fcc}^*\text{-Fe})$. The simultaneous presence of Fe atoms with such a rich variety of magnetic states due to the specific position of the average of the atomic volume distribution can well explain the complex magnetic behavior observed in Fe-rich Fe-Zr metallic glasses. For more details, see Ref. 6.</p> <p>[1] L. Kaufman, E.V. Clougherty and R.J. Weiss, <i>Acta Metallurg.</i> 11, 323 (1963) [2] G. Xiao and C.L. Chien, <i>Phys. Rev. B</i> 35, 8763 (1987) [3] S.N. Kaul, V. Siruguri and G. Chandra, <i>Phys. Rev. B</i> 45, 12343 (1992) [4] H. Ren and D.H. Ryan, <i>Phys. Rev. B</i> 51, 15885 (1995) [5] I. Bakonyi, <i>Acta. Mater.</i> 53, 2509 (2005) [6] I. Bakonyi, <i>J. Magn. Magn. Mater.</i> 324, 3961 (2012)</p>
<p>I-2</p>	<p align="center">Ferromagnetic compounds stabilized on Ge(001) and Si(001) by molecular beam epitaxy</p> <p align="center">Nicoleta Georgiana Apostol¹, George Adrian Lungu¹, Ruxandra Maria Costescu¹, Marius Adrian Husanu¹, Dana Georgeta Popescu¹, Laura Elena Stoflea¹, <u>Cristian-Mihail Teodorescu¹</u></p> <p align="center">¹<i>Nanoscale Condensed Matter Physics, National Institute of Materials Physics, Magurele, Romania</i></p> <p>This contribution presents some of the first 'real' surface science experiments ever performed in Romania [1]. Since three years, a new ultrahigh vacuum setup (base pressure: low 10⁻¹⁰ to 10⁻¹¹ mbar) was commissioned and exploited. This setup consists firstly in a molecular beam epitaxy chamber with in-situ cleaning (sputtering, annealing up to 1500 K) and surface/interface synthesis: deposition cells, evaporation by electron bombardment, thin film growth monitoring by reflection high energy electron diffraction (RHEED), residual gas analysis (RGA). In-situ surface analysis is performed by low energy electron diffraction (LEED) and by Auger electron spectroscopy (AES). The preparation chamber is connected to two other analysis facilities: (i) a scanning tunneling microscopy chamber with atomic resolution, in-situ heating and cooling down to 77 K, with scanning tunneling spectroscopy facilities; (ii) a chamber dedicated to photoelectron spectroscopy, where standard and high resolution (below 0.4 eV full width at half maximum) X-ray photoelectron spectroscopy (XPS) may be performed with angular resolution, including X-ray photoelectron diffraction.</p>

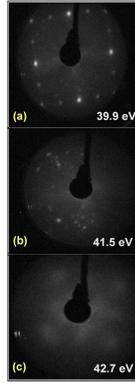


Fig. 1. Low energy electron diffraction (LEED) images of (a) clean Si(001), (b) Sm/Si(001) deposited at low temperature; (c) Sm/Si(001) deposited at high temperature.

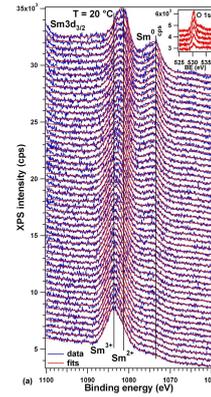


Fig. 2. X-ray photoelectron spectroscopy (XPS) survey of in situ contamination of a fresh Sm layer deposited on Si(001). A new assignment of the chemically shifted Sm 3d5 lines was proposed from this study.

Angle- and spin-resolved ultraviolet photoelectron spectroscopy measurements may also be performed, allowing the complete experimental derivation of the band structure for single crystal surfaces. Apart for spin-resolved photoelectron spectroscopy, magnetic measurements are performed in a separate setup using magneto-optical Kerr effect (MOKE). Different setups used by the group are the low energy electron microscopy (LEEM) combined with photoemission electron microscopy (PEEM), two X-ray diffraction facilities and a X-ray absorption fine structure (XAFS) setup. Relevant results by using all these combined techniques will be presented for Fe/Si(001) [2], Sm/Si(001) [3], Fe/Ge(001) and Mn/Ge(001) systems, all of them interesting for spintronics application. New surface ferromagnetic phases will be evidenced and the interplay between growth mechanism, surface reactivity, electronic structure, and magnetism will be discussed in all these cases. Perhaps the most sound result consists in the stabilization of cubic, room temperature ferromagnetic MnGe(001) compound.

[1] N.G. Gheorghe et al., Phys. Stat. Solidi B 248, 1919 (2011)

[2] N.G. Gheorghe et al., J. Mater. Sci. 47, 1614 (2012)

[3] R.M. Costescu et al., J. Mater. Sci. 47, 7225 (2012); N.G. Gheorghe et al., Appl. Surf. Sci., accepted

I-3 Current-induced magnetoresistance in $\text{La}_{1-x}\text{Ca}_x\text{MnO}_3/\text{BaTiO}_3$ composites

Iosif G. Deac¹

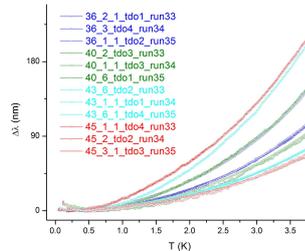
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We report the magnetotransport properties of the ferromagnet/ferroelectric-type composite $\text{La}_{1-x}\text{Ca}_x\text{MnO}_3/\text{BaTiO}_3$ ($x = 0.45$) [1]. We show that magnetic field dependence of resistivity in the composite shows unusual features with increasing amplitude of the dc current. The SEM and x-ray analysis proved that the two component phases keep their identity in the composite, with no sign of chemical interaction. The LCMO sample has the Curie temperature $T_C = 258$ K, the coercivity at 4.2 K, $H_C = 0.045$ T and the saturation magnetic moment $m = 3.42 \mu_B/\text{Mn}$, as found from magnetic measurements. These parameters are not significantly changed in the composite, suggesting again, the absence of interdiffusion of the two component phases. The investigated samples showed negative colossal magnetoresistance (CMR) effect. The composite exhibits high electroresistance (ER) and magnetocapacitance effects, while these were not found in the pure manganite sample. The measurements were carried out at various temperatures below and above the ferromagnetic transition temperature T_C , and they demonstrated that the electrical and magnetic properties of the composite are coupled. The increase of the electric current lead to a lower MR, while ER is reduced in

	<p>higher magnetic fields. The explanation of this behaviour was found in a magnetoelectric coupling effect induced by the introduction of the ferroelectric/piezoelectric BaTiO₃ in the ferromagnetic LCMO.</p> <p>I.G. Deac, I. Balasz, <i>Materials Chemistry and Physics</i> (2012), http://dx.doi.org/10.1016/j.matchemphys.2012.08.009 (in press).</p>
<p>I-4</p>	<p style="text-align: center;">Electric-field control of magnetic domain wall motion and local magnetization dynamics in ferromagnetic-ferroelectric heterostructures</p> <p style="text-align: center;"><u>Sebastiaan van Dijken</u>¹</p> <p style="text-align: center;">¹<i>NanoSpin, Department of Applied Physics, Aalto University School of Science, P.O. Box 15100, FI-00076 Aalto,, Finland</i></p> <p>Spintronic devices currently rely on magnetic switching or controlled motion of domain walls by an external magnetic field or spin-polarized current. Achieving the same degree of magnetic controllability using an electric field has potential advantages including enhanced functionality and low power consumption. Here, an approach to electrically control local magnetic properties, including the writing and erasure of regular ferromagnetic domain patterns and the motion of magnetic domain walls, will be discussed [1]. The method is based on recurrent strain transfer from ferroelastic 90° stripe domains in ferroelectric media to continuous magnetostrictive films with negligible magnetocrystalline anisotropy. The dominance of the magnetoelastic anisotropy in these ferromagnetic-ferroelectric heterostructures causes full imprinting of the ferroelectric domain pattern into the ferromagnetic counterpart and strong pinning of ferromagnetic domain walls onto narrow ferroelastic boundaries. As a result, the spin rotation, width, and chirality of the magnetic domain walls can be accurately tuned by a change in the direction or strength of the applied magnetic field [2]. Moreover, optical polarization microscopy of both the ferromagnetic and ferroelectric domain structures reveals that domain correlations and strong inter-ferroic domain wall pinning are maintained in an applied electric field. This leads to unprecedented electric-field control over the formation of ferromagnetic domains and the lateral motion of magnetic domain walls, an accomplishment that opens the way to electric-field driven spintronics. The experiments in this work are complemented by micromagnetic simulations to elucidate the physics of interacting ferromagnetic-ferroelectric domain walls.</p> <p>[1] T.H.E. Lahtinen, K.J.A. Franke, and S. van Dijken, <i>Nature Scientific Reports</i> 2, 258 (2012) [2] K.J.A. Franke, T.H.E. Lahtinen, and S. van Dijken, <i>Phys. Rev. B</i> 85, 094423 (2012)</p>
<p>I-5</p>	<p style="text-align: center;">Coherent spin and charge transport in single crystal magnetic tunnel junctions</p> <p style="text-align: center;"><u>Coriolan Tiusan</u>^{1,2}</p> <p style="text-align: center;">¹<i>Centre National de la Recherche Scientifique, Institut Jean Lamour/ Université de Lorraine, Nancy, France</i></p> <p style="text-align: center;">²<i>Department of Physics, Technical University Cluj-Napoca, Cluj-Napoca, Romania</i></p> <p>Within the area of Spintronics, rewarded in 2007 by the Nobel Prize in Physics, the magnetic tunnel junctions (MTJs) represent one of the most studied systems due to their huge integration potential in sensors and new generation of nonvolatile data storage devices. In single crystal magnetic tunnel junctions (MTJ), the electronic transport is strongly dependent on the band structure of the materials, the electrons being described by Bloch wave functions having the symmetries of the crystal. The tunneling transport is not only dependent on the electron spin but also on the symmetry of the propagating wave function. Interesting effects appear, related to the symmetry filtering within the barrier (symmetry dependent tunneling attenuation rates) or quantum confinement in multilayer structures where the symmetry dependent potential profile has been skillfully</p>

	<p>engineered [1-2]. We present here a brief overview on the physics related to the coherent spin and symmetry polarized transport in single crystal magnetic tunnel junction devices. The constituent thin films are elaborated by Molecular Beam Epitaxy and/or sputtering. Micrometric size MTJ devices are patterned by UV lithography and ion etching techniques. Two regimes are investigated. In the low barrier thickness regime (below 4 monolayers), the spin currents determine by spin torque effects an antiferromagnetic coupling. In the larger barrier thickness regime (above 4 monolayers), the tunnel magnetoresistance effects are investigated both in static and dynamic (low frequency) regime. We discuss the possibility to tune the transport characteristics by interfacial chemical and electronic structure engineering. Quantum coherence effects at room temperature related to symmetry filtering are also presented.</p> <p>[1] F. Greullet, C. Tiusan et al, Phys. Rev. Lett. 99, 187202, (2007). [2] D.Herranz, F.G. Aliev, C. Tiusan et al, Phys. Rev. Lett. 105, 047207 (2010)</p>
<p>O-1</p>	<p align="center">Magnetic and structural properties of nickel magnesium substituted lithium ferrites for microwave applications</p> <p align="center">Caltun O.F.¹, Ramesh M.², Rao G.S.N.², Samatha K.², Parvatheeswara Rao B.² ¹Dept. of Physics, A.I. Cuza University, Iasi, Romania ²Dept. of Physics, Andhra University, Visakhapatnam, India</p> <p>Lithium and substituted lithium ferrites have been found to be excellent materials in electronics and microwave industry due to their low cost, high saturation magnetization, high Curie temperature, high resistivity and low dielectric loss properties, which offer advantageous performance over the other spinel ferrites. Mixed lithium substituted ferrites are of special interest because of their applications in microwave devices such as isolators, circulators, gyrators and phase shifters. Several investigations, such as structural, electrical conductivity, thermoelectric power, elastic properties and dielectric behaviour, were made on the properties of mixed lithium ferrites with different substitutions. However, it appears there is not much attention made particularly on the electrical, magnetic and structural properties of nickel-magnesium co-substituted lithium ferrites. The main aim of this paper is to study the influence of nickel and magnesium co-substitution in place of lithium and iron on the electromagnetic properties for microwave applications. $\text{Li}_{0.5-x}\text{Ni}_x\text{Mg}_x\text{Fe}_{2.5-x}\text{O}_4$, where $x = 0.00$ to 0.25 in steps of 0.05, have been prepared using ceramic method. Characterizations of the samples were made using X-ray diffraction and a built-in Curie temperature set-up. Magnetization measurements were made using VSM, surface microstructures were recorded by scanning electron microscopy and the dielectric and induction measurements were carried out by impedance analyzer. The lattice constant has been observed to increase with the concentration, x. The variations of coercivity are in accordance with the variations of magnetocrystalline anisotropy. The co-substituted lithium ferrite with $x=0.15$ has shown the desirable electromagnetic properties such as maximum saturation magnetization, maximum resistivity, fine grain size and the minimum dielectric loss (at 8MHz) as compared to pure lithium ferrite; thus, this material finds itself suitable for microwave device applications. The results are discussed in the light of the existing mechanisms possible for understanding the behaviour of the ferrites.</p>
<p>O-2</p>	<p align="center">Doping evolution of the pairing state in $\text{Fe}_{1.02}\text{Te}_{1-x}\text{Se}_x$ superconductors as determined from penetration depth measurements</p> <p align="center">Andrei Diaconu¹, Jin Hu², Zhiqiang Mao², Leonard Spinu¹ ¹Department of Physics, University of New Orleans, New Orleans, USA ²Department of Physics and Engineering Physics, Tulane University, New Orleans, USA</p> <p>A systematic investigation of transport, magnetic and superconducting properties in various regions of the phase diagram of $\text{Fe}_{1.02}(\text{Te}_{1-x}\text{Se}_x)$ single crystals is</p>

described in [1]. Our work focuses on the properties of the bulk superconductive region as derived from the in-plane penetration depth measurements as a function of temperature. The London penetration depth is one of the most important characteristic parameter in type II superconductors as its temperature dependence can give information about the pairing mechanism. Precise measurements of the in-plane penetration depth λ_{ab} as a function of temperature using a tunnel diode oscillator technique [2] were performed in a dilution refrigerator down to a temperature of 50mK.



London penetration depth at low temperatures in FeSeTe

By using a set of two mutually coupled planar inductors the uniform probing ac field is along the c axis making the variation in susceptibility solely due to super-currents flowing in the ab crystallographic plane. The measurements performed in single crystals with Se concentration spanning from 36% to 45% revealed a power law dependence of the penetration depth with temperature. We found values between 1.8 and 2.4 for the power law exponent and a multi-gap type of behavior from the density of states. Also, the effects and importance of excess iron in such materials at very low temperatures is discussed.

[1] T. J. Liu, Nature Materials 9, 718–72 (2010)

[2] R. Prozorov, Phys. Rev. B 62, 115–118 (2000)

O-3

Electrical field induced spin state switching and colossal conductivity change in spin crossover materials.

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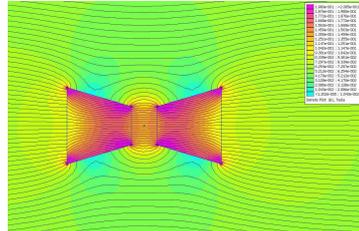
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Switching the electronic or magnetic states of molecules or assemblies of molecules is one of the foremost paradigms in molecular electronics. Up to now numerous switchable molecular compounds have been synthesized, involving different physical phenomena, but the common challenge remains the construction of active devices. In particular, devices based on charge transport properties attract a great deal of attention, due to the substantial technological developments accomplished to probe charge transport down to the single molecule level [1-4]. Here we focus on the charge transport properties of nano-objects displaying molecular spin-state switching. In this work we used electric-field-assisted directed assembly to organize high aspect-ratio spin crossover nanorods between interdigitated electrodes with a very high degree of alignment. The temperature-dependent current-voltage characteristics of each device revealed a bistability of the current intensity associated with the spin-state switching, providing appealing perspectives for nano-scale switching and memory devices. By

	<p>applying an external electrical field we succeeded, for the first time, to induce a spin state switching of the deposited particles. Finally, we show a change of six orders of magnitude, under a bias voltage of 20 V, in the thermal dependence of the current intensity.</p> <p>Acknowledgements Financial support from the grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-RU-TE-2011-3-0307 is acknowledged.</p> <p>[1] T. Mahfoud et al., Appl.Phys. Lett. 2011, 99, 053307. [2] M. S. Alam et al., Angew.Chem.Int. Ed. 2010, 49, 1159. [3] F. Prins et al. Adv. Mater., 2011, 23, 1545. [4] A. Rotaru et al., Chem. Commun.,2012, 48, 4163.</p>
O-4	<p>Magnetic and structural properties of Fe₆₅Co₃₅ alloys obtained by melting, high-energy milling and heat treatment</p> <p>Alexandru V. Trifu¹, Albert F. Takacs¹, Eugen Dorolti¹, Ionel Chicinas², Olivier Isnard³, Viorel Pop¹</p> <p>¹<i>Faculty of Physics, Babes-Bolyai University, Cluj-Napoca, Romania</i> ²<i>Materials Science and Technology Dept., Technical University of Cluj-Napoca, Cluj-Napoca, Romania</i> ³<i>Institut Néel, CNRS, Université Joseph Fourier, Grenoble, France</i></p> <p>The influence of milling and annealing conditions on the structural and magnetic behavior of mechanically-milled Fe₆₅Co₃₅ alloys has been studied. Samples were taken at different milling times in order to study the influence of milling time on structure and microstructure. By calorimetric studies (DSC), we found the internal stress relaxation temperature, the recrystallisation temperature and the structural order/disorder transition temperature. The width of the diffraction peaks was found to increase with milling time. The intensity of the characteristic diffraction peaks of the Fe₆₅Co₃₅-type phase increases significantly during annealing. Two types of annealing were performed: conventional heat treatment at 500, 550 and 600 °C for 2h and rapid annealing for a maximum of 3 minutes at 700, 750 or 800 °C followed by rapid quenching. The structure and microstructure, and hence the magnetic properties of the samples were controlled by the temperature and time of the heat treatment. This fact is supported by magnetic measurements which show an increase of magnetic permeability found to occur for samples which were annealed at 750 and 800 °C for up to 2 minutes. The increase of magnetic permeability results from crystalline structure refinement, changes in crystallite size and internal stress diminution.</p> <p>*This work was supported by the Romanian Ministry of Education and Research, Grant PN-II-RU-TE-2011-3-0048 and the POSDRU 89/1.5/S/60189 Postdoctoral Programs.</p>
P-1	<p>The influence of the additions and processing conditions on the magnetic properties and c-axis orientation of NdFeB thin films</p> <p>Maria Urse¹, Marian Grigoras¹, Nicoleta Lupu¹, Horia Chiriac¹, Firuta Borza¹</p> <p>¹<i>Magnetic Materials and Devices, National Institute of Research & Development for Technical Physics, Iasi, Romania</i></p> <p>The NdFeB thin film permanent magnets have been extensively investigated as promising candidates for magnetic micro-electro-mechanical systems (MEMS) and as various magnetic microdevice actuation components [1]. The hard magnetic properties of the NdFeB thin film magnets are known to be strongly dependent on processing parameters and additions [2]. Various metallic elements can be added to the NdFeB system with the aim of enhancing the hard magnetic properties. Among them, Mo or</p>

	<p>Mo-Cu combination are known to act in the sense of decreasing the grain growth and promoting the formation of nucleation sites, respectively. In this paper the influence of additions (Mo and MoCu) and processing conditions on the hard magnetic properties and c axis orientation of NdFeB thin films is studied. It is also studied the influence of embedding mode of additions (direct embedding by alloying or indirect embedding by stratification) in the NdFeB thin film volume. The total thickness of NdFeB film in single layer or multilayer variant, where embedding mode of additions is by stratification, is about 540 nm. Using Mo and Mo-Cu as additions, the NdFeB films present a strong increase of the coercive field (H_c), an increase of the remanence ratio (M_r/M_s), a decrease of the saturation magnetization (M_s) and an improvement of squareness of the demagnetizing curves. Good hard magnetic characteristics are obtained for NdFeBMo(1at.%) film and NdFeB film stratified with Mo-Cu (72 at.% Mo - 28at.% Cu) layers having thickness of about 4 nm. The roughness of substrates surface and the processing conditions of NdFeB thin films, including substrate temperature and deposition rate, have also a strong influence both on the hard magnetic properties and orientation of c axis of Nd₂Fe₁₄B phase [3]. NdFeB thin films with the c axis perpendicular to substrate were obtained for a deposition rate ≥ 0.9 nm/s, a temperature substrate $\geq 300^{\circ}\text{C}$, during thin film deposition, and an annealing temperature $\geq 650^{\circ}\text{C}$, after thin films deposition.</p> <p>[1] W.F. Li, A.M. Gabay, M. Marinescu-Jasinski, J.F. Liu, C. Ni, G.C. Hadjipanayis, J. Magn. Magn. Mater., Volume 324, Issue 7 (2012) 1391. [2] T. Okumoto, K. Yamasawa, X. Liu, et al., IEEE Trans. Magn., 41 (2005) 233. [3] S. L. Chen, W. Liu, Z. D. Zhang, and G. H. Gunaratne, J. Appl. Phys., 103 (2008) 023922.</p>
<p>P-2</p>	<p align="center">Spin filtering in graphene nanoribbons with Mn-doped boron nitride inclusions</p> <p align="center"><u>George Alexandru Nemnes</u>¹, Stefan Antohe¹</p> <p align="center">¹<i>Faculty of Physics, "Materials and Devices for Electronics and Optoelectronics" Research Center, University of Bucharest, Magurele, Romania</i></p> <p>The search for highly efficient spin injection and control motivated the effort for developing new low dimensional diluted magnetic semiconductors (DMS). We investigate the spin filtering effects in graphene nanoribbons, where inclusions of hexagonal boron nitride (BN) were introduced together with several transitional metal (Mn) magnetic impurities [1]. The embedded Mn-doped BN regions serve as quasi-0D DMS islands in the otherwise conducting graphene nanoribbon. Our first principle approach based on non-equilibrium Green's functions (see for example [2]) gives the polarization of the spin current for different structures and biases. Several spin configurations of the magnetic impurities are considered, revealing different behaviors in the spin resolved current. Some key aspects regarding spin switching effects, i.e. turning on and off the net spin current at different biases, are also discussed.</p> <p>[1] T.L. Mitran, Adela Nicolaev, G.A. Nemnes, L. Ion, S. Antohe, J. Phys.: Condens. Matter 24, 326003 (2012) [2] G.A. Nemnes, C. Visan, S. Antohe, Physica E 44, 1092 (2012)</p>
<p>P-3</p>	<p align="center">Flux concentrators with improved efficiency of the field detection limit for magnetoresistive sensors</p> <p align="center"><u>Nicolae-Cristian Rotarescu</u>¹, Horia Chiriac¹, Nicoleta Lupu¹, Andrei Jitariu¹</p> <p align="center">¹<i>MDM, National Institute of R&D for Technical Physics, 47 Mangeron Boulevard 700050, Iasi, Romania</i></p> <p>Magnetic flux concentrators are used to intensify magnetic field in the active region of a magnetic field sensor [1]. Also, these devices enhance the field sensitivity of several</p>

types of magnetic sensors: spin valves, magnetic tunnel junctions, Hall Effect sensors. We propose a study of the magnetic flux concentrator's geometric gain simulated with varying parameters of the flux concentrators (length, thickness, width). The simulations performed using a finite element method magnetics program (FEMM) allows to seek for the impact of these parameters on the gain factor.



Magnetic field lines- Flux Density

Also, the study was carried out to better understand the appropriate magnetic flux geometry. Particularly, to simulate the soft magnetic material, i.e. Permalloy, to be used as flux concentrators (Fig.1), a linear B-H relationship and a relative magnetic permeability in each axis were considered.

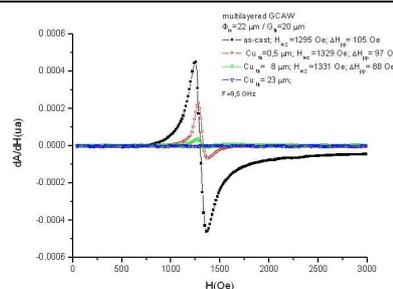
[1] Design of planar magnetic concentrators for high sensitivity Hall devices, M. Drljaca, F. Vincent, P. Besse, R. Popovic, Sensors and Actuators A 97-98, 10-14 (2002)

P-4 High frequencies absorption properties of multilayered CoFe-based GCAW

Gabriel Ababei¹, Horia Chiriac¹

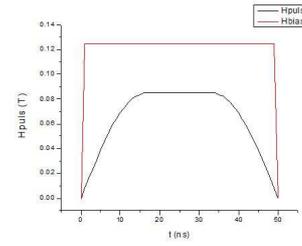
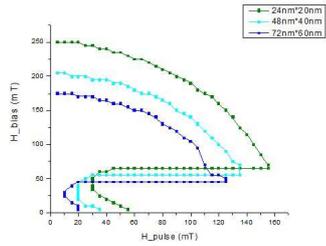
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Electromagnetic shielding is a currently critical issue linked to the biological protection by the maximum reduction of the effects of electromagnetic radiation on living organisms. The soft magnetic properties of glass coated amorphous magnetic microwires (GCAM) and have led to a large number of proposed applications especially in the field of smart composite materials to realize multifunctional materials for structural health monitoring, electronic devices and magnetic sensor devices. Another class of soft magnetic materials are multilayered GCAW obtained from as-cast GCAW followed by electroless chemical deposition of a copper metallic layer. The copper thicknesses (Cu_{th}) ranged from 0.5 μm to 23 μm were obtained by controlling the deposition time. The aim of this paper is to study of the influence of the thickness of the metallic layer of multilayered CoFe-based GCAW on the value of the high frequencies absorption properties in order to develop an absorbent material with selective electromagnetic shielding efficiency. The experimental methods used were the coaxial transmission line method and external d.c. magnetic field modulation technique. Experimental results indicate that the increasing of the thickness of the Cu layer will increase the value of the resonant magnetic field of the FMR frequency of the multilayered GCAW.



The influence of the thickness of the Cu layer

	<p>This work was supported by a grant of Romanian National Authority for Scientific Research, CNCSIS – UEFISCDI, project number PN-II-RU-PD-2011-3-0228.</p>
<p>P-5</p>	<p>Time dependent thermal stresses due to rapid cooling in a magnetic core - shell particle</p> <p><u>Iordana Astefanoaei</u>¹, Ioan Dumitru¹, Alexandru Stancu¹ ¹<i>Department of Physics, Alexandru Ioan Cuza University, Iasi, Romania</i></p> <p>Core-shell particles are used in different fields of engineering and science due to their special properties [1]. The core-shell structures are deeply studied in order to understand the influence of the thermal process on the magnetic properties [2]. The evaluation of induced thermal stresses can provide more information concerning the magnetic anisotropy, magnetic domains shape, switching mechanism etc. This paper is focused on the study of thermal stresses for a magnetic core- shell particle subject to a cooling process from the room temperature to a lower temperature. During the cooling process thermal stresses are induced in the core modifying the magnetic properties of the system. The induced thermal stresses in the core-shell system are due to both the thermal gradients and the difference between the thermal expansion coefficients of core and shell materials. The following aspects are analyzed both theoretically and in simulations: (i) The spatio-temporal distribution of the temperature during the cooling process. Imposing the thermal boundary conditions at the core- shell interface, the spatial and temporal evolution of the temperature was analyzed for different values of size parameters; (ii) The induced thermal stresses in the particle core was obtained using the differential equation of displacements and the determined spatio-temporal distribution of the temperature; The analytical model is able to predict the temperature profile and thermal stresses in the core-shell system. The thermal stresses depend on the radius of the metallic core and thickness of the shell, being negative due to the thermal contraction during the cooling process.</p> <p>Acknowledgement: The authors acknowledge the support given by Romanian CNCS - UEFISCDI project IDEI-EXOTIC No. 185/25.10.2011.</p> <p>[1] X. Batlle and A. Labarta, Journal of Physics D: Applied Physics 35, R15 (2002). [2] I. Astefanoaei, I. Dumitru, A. Stancu, Magnetism, IEEE Transactions on, 47,10 (2011).</p>
<p>P-6</p>	<p>Micromagnetic evaluation of thin film size on the critical curve of a synthetic antiferromagnetic</p> <p><u>Ciprian Pinzaru</u>¹, Laurentiu Stoleriu¹, Alexandru Stancu¹ ¹<i>Faculty of Physics, "Alexandru Ioan Cuza" University, Iasi, Romania</i></p> <p>Many technological applications are based on exchange coupling in hard layer composite media [1], under layer for perpendicular recording media [2], spin valves for magnetic read heads and sensors [3], MRAM memory and are using synthetic antiferromagnetic structures (SAF). A synthetic antiferromagnetic (SAF) consists of two ferromagnetic layers separated by a thin non-magnetic metal with a strong exchange coupling between layers (antiferromagnetic coupling). In equilibrium one expects that the two moments of the ferromagnetic layers are oriented along the same line but in opposite directions and as a result the magnetic field created by this structure is very weak and consequently the magnetostatic interactions with similar structures are negligible.</p>



Comparison of CC diagram in micromagnetic model

Sequence of applied field's components

The virtual absence of interactions between the SAF structures allows the increase of SAF based devices density without the occurrence of correlated switches of neighbor structures. One essential limit that was not really clarified was related to the unquestionable problem related to the possibility that the macrospin hypothesis is not a realistic. This is the main topic of this article. We have developed a detailed micromagnetic model of a SAF structure and using various field sequences we have identified the critical curve for this more realistic SAF structure CCs. Essentially, in this study we present besides the micromagnetic model and the technique used to model a realistic SAF structure the size effects on the CCs.

[1]S. Hernandez, M. Kapoor, and R. H. Victora, Appl. Phys. Lett. 90, 132505 (2007).

[2]S.C. Byeon, A. Misra, and W.D. Doyle. 4, IEEE Trans. Magn, Vol. 40, pp. 2386-2388, (2004).

[3]Veloso, P.P. Freitas, and L.V. Melo, IEEE Trans

P-7

Treatment temperature influence on the structure, electrical and magnetic properties of BaFe₁₂O₁₉ hexaferrite

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In the last years, hexaferrites have received great attention due to their special applications in various fields such as microelectronics, magnetic recording media, sensors, catalysis etc. [1,2]. In the present work, we investigate hexaferrite of BaFe₁₂O₁₉ which have submicron grain sizes due sol-gel-self-combustion preparation method. The aim of this research is the identification of electrical and magnetic properties variation of barium hexaferrite, sintered at 850°C, 900°C, 950°C, 1000°C and 1050°C respectively.

The structural properties were investigated using the X-ray diffraction and Scanning Electron Microscopy technologies. The electric properties were investigated with the LCR Meter in the frequency range of 20 ÷ 2×10⁶ Hz. The frequency dependence of permittivity and electrical conductivity was investigated. The magnetic permeability was investigated as a function on temperature and frequency.

The capacitive and resistive response in humid atmosphere of the studied ferrites shows that, the barium hexaferrite can be successfully used as the humidity sensors.

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References:

[1] H. Sözeri, Z. Durmuş, A. Bazkal, E. Uzsal, Mater. Sci. Eng., B 117 (2012) 949-955.

[2] F. Tudorache, P. D. Popa, F. Brinza, S. Tascu, Acta Phys. Pol. A 121 (2012) 95-97.

<p>P-8</p>	<p style="text-align: center;">Magnetic analysis of fired clays used for pottery</p> <p style="text-align: center;"><u>Tiberiu Adrian Salaoru</u>¹, Florica Matau¹, Ovidiu Chiscan¹, Sorin Tascu², Alexandru Stancu¹ ¹<i>Faculty of Physics, Center for Applied Research in Physics and Advanced Technologies (CARPATH), Alexandru Ioan Cuza University, Iasi, Romania</i> ²<i>Faculty of Physics, Research Center on Advanced Material and Technology, Alexandru Ioan Cuza University, Iasi, Romania</i></p> <p>An important source of information obtained from archaeological sites represents the ancient pottery. Analysing this pottery using magnetic methods can offer important amount of information about how has been fabricated, revealing firing parameters as maximum temperature achieved. Has been simulated in our laboratory pottery fabrication procedures for a systematic comparison with the material collected from Cucuteni culture [1] During the firing process followed by cooling of the pottery, temperature variation law can be different which reflect in magnetic properties of that pottery. We are trying to improve this connection between firing conditions and the magnetic properties of the collected sample. For this purpose we have fired samples made from clay typical used for pottery at different temperature and for different duration followed by a systematic study of coercitivity and saturation magnetization from processing of major hysteresis loops and we have found a clear connection which is important for establishing the original firing conditions of the unknown samples collected from ancient pottery. These firing conditions can be clarified also by performing a systematic study of Thermo Remanent Magnetization by measuring remanent magnetization while the sample is heated progressively. Combination of these studies could improve the accuracy of determination of the parameters of ancient treatment of the pottery.</p> <p>Acknowledgements We want to thank for support to FONDUL SOCIAL EUROPEAN, Program Operational Sectorial Dezvoltarea Resurselor Umane 2007-2013, project title: „Rețea transnațională de management integrat al cercetării postdoctorale în domeniul Comunicarea Științei. Construcție instituțională (Școala postdoctorala) și program de burse (CommScie)”, POSDRU/89/1.5/S/63663 from Alexandru Ioan Cuza, Iași University.</p> <p>[1] Florica Matau, Valentin Nica, Petronel Postolache, Irina Ursachi, Vasile Cotiuga, Alexandru Stancu, “Physical study of the Cucuteni pottery technology”, Journal of Archaeological Science, DOI: 10.1016/j.jas.2012.08.021;</p>
<p>P-9</p>	<p style="text-align: center;">Structural and functional investigations of hematite thin films grown by spin - coating</p> <p style="text-align: center;"><u>Gh. Zodieriu</u>¹, R. Bosinceanu¹, E. Vasile², I. Deac³, G. Constantinescu⁴, C. Doroftei¹, F. Iacomi¹ ¹<i>Alexandru Ioan Cuza University, 11 Bd. Carol I, RO-700506 Iasi, Romania</i> ²<i>METAV CD SA, RO-020011 Bucharest, Romania</i> ³<i>Babes Bolyai University, 1 Str. M. Kogalniceanu, RO-400084 Cluj-Napoca, Romania</i> ⁴<i>Jacobs University, College Ring 7, 28759 Bremen, Germany</i></p> <p>Nanostructured, hematite thin films (150 nm) were grown on a ceramic substrate by using a spin-coating method. The structure was analyzed by means of grazing angle X-ray diffraction (GAXRD, $\alpha=0.5^\circ$, Cu Kα radiation) which showed the hematite phase. The magnetic properties were studied as a function of temperature (5K – 300K) using a Vibrating Sample Magnetometer (VSM). The weak ferrimagnetic character of the hematite sample was observed. The temperature dependence of the magnetization during Zero Field Cooling (ZFC) and Field Cooling (FC) measurements was investigated and a blocking temperature around 15K was observed. The Electron Spin Resonance data collected from the full angular dependence evidenced the orientation of the easy-magnetization axis [1, 2]. The sensitivity to water vapors was also investigated.</p> <p>[1] L. A. Cano, J. F. Bengoa, S. J. Stewart, t R. C. Mercader, S. G. Marchetti, Synthesis of hematite nanowires using a mesoporous hard template, Hyperfine Interact (2010) 195 93 [2] E. Salabas: Structural and Magnetic Investigations of Magnetic Nanoparticles and Core-Shell Colloids, PhD thesis (Germany, 2004), p.25</p>

TOPIC 6

Materials for Energy and Environment

<p>PI-1</p>	<p align="center">Advances on Photocatalytic materials for indoor depollution processes</p> <p align="center">G. Kiriakidis^{1,2}, V. Binas¹</p> <p>¹ Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology (FORTH), P.O. Box 1527, Vasilika Vouton 71110, Heraklion, Crete, Greece ² University of Crete, Physics Department 71003 Heraklion, Crete, Greece</p> <p>Indoor air quality (IAQ) plays an important role on human health. Nitric oxides (NO and NO₂), and volatile organic compounds, VOCs (such as formaldehyde, benzene) are typical inorganic and organic indoor air pollutants. They normally originate from cooking, combustion, tobacco smoke, furniture, building materials. They may also associate with traffic pollutants from outside of the building and can cause serious health problems like drowsiness, headache, sore throat, and mind fatigue. The U.S. Environmental Protection Agency, USEPA (http://www.epa.gov/iaq), points out that indoor air pollution is a much greater risk to human health than outdoor air pollution particularly in big cities where the average person spends more than 90% of his time indoors. So, it is of vital importance to remove these pollutants in order to improve the indoor air quality for people's health. The most promising and effective method for air purification is Photocatalysis, a method considered as the most advance oxidation process to resolve environmental problems. Metal oxide semiconductors such as TiO₂ and ZnO are commonly used as photocatalysts. TiO₂ photocatalyst in particular has been extensively studied for air depollution due to its low cost, innocuousness, chemical inertness, and high photocatalytic efficiency under UV light. However, the UV light is only 0.001–0.05 W/m² in indoor illumination systems. To extend TiO₂ as photocatalyst to visible light region, it is necessary to dope TiO₂ with metals and nonmetals. In this work we will report on the synthesis and characterization of TiO₂ materials doped with transition metals in different concentrations capable to absorb and activate under visible light irradiation. We will report on Manganese (Mn) doped TiO₂ powders prepared by a modified sol gel method. The novelty of the reported material is that it acts as an effective pollutant reducing agent, is harmless to humans and suitable for indoor applications. The crystal structure, particle size, morphology, and porosity along with surface morphology and elemental analysis of the materials are presented and photocatalytic efficiencies are reported both for material in powder form and as additives.</p>
<p>I-1</p>	<p align="center">Application of some carbon based nanostructures in divertors coatings from fusion reactor</p> <p>V. Ciupina^{1,3,4}, I. Morjan², R. Vladioiu¹, C. P. Lungu², C Porosnicu², iI Jepu², G. Prodan^{1,4}, IM. Stanescu¹, A. Mandes¹, M. Contulov², V. Dinca¹, M. Prodan¹, V. Nicolescu⁵</p> <p>¹ Ovidius University of Constanta, 124 Mamaia Bld, Constanta, 900527, Romania ² National Institute for Laser Plasma and Radiation Physics, Magurele, 077125, Romania ³ Academy of Romanian Scientists, 54 Splaiul Independentei, 050094 Bucuresti, Romania ⁴ Institute for Nanotechnology and Alternative Energy Sources, 1 Aleea Universitatii, Constanta, 900527, Romania ⁵ CERONAV, 69A Pescarilor, 900581 Constanta, Romania</p> <p>In the current ITER design, the tiles made of carbon fiber composites (CFCs) are foreseen for the strike point zone and tungsten (W) and beryllium for other parts of the divertor region. This choice is a compromise based mainly on experience with individual materials in many different tokamaks. Also Carbon-Aluminum composites (C-Al) are the candidate material for the First Wall in ITER. The goal of this paper is to exchange, the C-Be thin films, with equivalent C-Al thin films. In this respect, it is necessary a solution for material synthesis and also find correct concentrations between carbon and aluminum. The Thermionic Vacuum Arch (TVA) method is suitable for the</p>

	<p>synthesis of wide range of materials, and more important is a low cost method that allow variation of concentration in one shot deposition.</p>
<p>I-2</p>	<p>Development of solar cell materials for Si-free thin film solar cells by preparation techniques for the mass production with low cost <u>Shizutoshi Ando</u>¹ ¹<i>Faculty of Engineering, Tokyo University of Science, Tokyo, Japan</i></p> <p>Now Si-based solar cells hold a market share of around 90%. We have been developing Si-free thin film solar cells and aim at rapid growth of a market share of that. Cu(InGa)Se₂ (CIGS) attracts much attention as a promising compound of the next generation high conversion efficiency thin film solar cells, because it has a large absorption coefficient of the order of 10⁵ cm⁻¹, which is approximately two orders of magnitude larger than that of crystal or amorphous silicon. Recently, CIS thin films were prepared by metalorganic decomposition (MOD) using metal naphthenates [1] to prepare large area solar cells applicable for the mass-production with low-cost. CIS films were grown by selenizing Cu-In precursors, which have been prepared by thermal decomposition of metal-naphthenates in Se ambient vapor. Recently, diethylselenide (DESe) was reported as a useful selenization source for the preparation of good crystallinity CIS thin films [2]. Therefore, the use of the selenization using DESe to prepare CIS in MOD method is expected to improve the crystallinity of thin films. And using this method, we expect preparation of CIS thin films with large area, mass-production and low-cost [3]. In addition to that, we we are developing the SnS-based and Fe₂O₃-based thin film solar cells as environmentally-benign and low cost for the next generation solar cells. SnS and Fe₂O₃ thin films were prepared by wet process methods (Chemical Bath Deposition, Electro-deposition and Spin-coating) using the solutions to prepare large area solar cells applicable for the mass-production with low-cost. In this presentation, we introduce the preparation examples of CIGS, SnS and Fe₂O₃ thin films as materials for solar cells of the next generation.</p> <p>[1] S. Merdes <i>et al.</i>, Thin Solid Films 516 (2008) 7335. [2] S. F. Chichibu <i>et al.</i>, J. Cryst. Growth 243 (2002) 404. [3] S. Ando <i>et al.</i>, Phys. Status Solidi C 6(5) (2009) 1038.</p>
<p>O-1</p>	<p>Pulsed Laser Ablation Modified Nafion/TiO₂ Membranes for Proton Exchange Membrane Fuel Cells <u>Daniela Ebrasu</u>¹, Mihai Varlam¹, Ioan Stefanescu¹, Ashok Vaseashta³, Gabriela Dorcioman², Emanuel Axente², Ion N. Mihailescu²</p> <p>¹<i>National Center for Hydrogen and Energy, National Research and Development Institute for Cryogenics and Isotopic Technologies - ICSI Rm. Valcea, RO-240050, ROMANIA, Ramnicu Valcea, Valcea</i> ²<i>Lasers Department, National Institute for Lasers, Plasma and Radiations Physics, 409 Atomistilor Street, PO Box MG-54, RO-77125, Magurele, Ilfov, ROMANIA, Magurele, Ilfov</i> ³<i>U.S. Department of State, Washington, DC USA, Institute for Advanced Sciences Convergence and International Clean Water Institute, NUARI, 13873 Park Center Rd. Suite 500, Herndon VA USA, Nuari, Herndon VA</i></p> <p>Nafion/oxide composite membranes were produced by pulsed laser ablation method using UV laser pulses generated by a COMPEXPro 205 KrF* excimer laser source $\lambda = 248$ nm and FWHM ≈ 25 ns. We selected TiO₂ material and distributed it uniformly over the surface of Nafion 112 membrane using 100, 250 and 500 laser pulses and an incident laser fluence set at 5 J cm⁻² were applied to improve the water retention property and corresponding proton conductivity under high temperature operating conditions. UV-Vis spectroscopy, scanning electron microscopy and Energy Dispersive X-Ray Spectroscopy (EDS) experiments indicated the oxides distribution in the composite membranes. Water uptake and proton conductivity characterizations</p>

	<p>were carried out of the Nafion composite membranes, and the results proved higher water uptake and an increased proton conductivity with compared Nafion 112 membrane at 120 °C, compared with Nafion 112 membrane. Finally, the composite membranes functionality was tested by current-voltage measurements using a home-made 11.2896 cm² active area fuel cell. Key words: Polymer Electrolyte Membrane Fuel Cell, Nafion, LASER Ablation, Membrane, EIS</p>
<p>O-2</p>	<p style="text-align: center;">Removal of methylene blue from aqueous solutions with magnetic iron oxide nanopowder</p> <p style="text-align: center;"><u>Oana Paska</u>¹, Cornelia Pacurariu¹, Robert Ianos¹</p> <p style="text-align: center;">¹<i>Faculty of Industrial Chemistry and Environmental Engineering, “Politehnica” University of Timisoara, Timisoara, Romania</i></p> <p>Iron oxides have a broad application potential in diverse areas including adsorbents for water depollution, catalysts, pigments, ferrofluids, magnetic resonance imaging, magnetic drug delivery, magnetic data storage media, etc [1]. Adsorption performances of one new adsorbent, iron oxide nanopowders with magnetic properties, was tested for removal of Methylene Blue (MB) cationic dye from colored water samples. Fe₃O₄ nanopowder with large specific surface area of (71.0 m²•g⁻¹) was prepared by combustion method using as starting materials iron nitrate nonahydrate (Fe(NO₃)₃•9H₂O) and sucrose (D-(+)-C₁₂H₂₂O₁₁) as fuel. Different independent parameters including initial pH values (6.0 ÷ 11.0), adsorbent dosage (0.5 ÷ 2 g•L⁻¹), temperature (25 ÷ 60°C) and contact time, have been investigated in order to find the optimum adsorption conditions. Desorption process of the adsorbed dye was also investigated using ethanol as the solvent. Both the adsorption and desorption process were quite fast. The major advantage of using magnetite (Fe₃O₄) as adsorbent is the simple and effective way of phase separation, using a magnet, due to its magnetic properties [1]. The adsorption kinetics of MB was investigated by different kinetic models, in order to provide information regarding the kinetic parameters and the mechanism of MB adsorption onto magnetite. Equilibrium data were fitted using different models, in order to determine the best correlation between the experimental and predicted values. The process presents high separation efficiency, is clean and safe and recommends magnetite as superior adsorbent for the removal of many contaminants, especially cationic dye, from polluted water.</p> <p>ACKNOWLEDGMENT This work was partially supported by the strategic grant POSDRU 107/1.5/S/77265 (2010) of the Ministry of Labor, Family and Social Protection, Romania, co-financed by the European Social Fund – Investing in people.</p> <p>[1] R. Ianoș, A. Tăculescu, C.Păcurariu, I. Lazău, Solution Combustion Synthesis and Characterization of Magnetite, Fe₃O₄, Nanopowders, J. Am. Ceram. Soc., (2012), 95, 2236-2240.</p>
<p>P-1</p>	<p style="text-align: center;">Applying the RVM method to study degradation of high power transformer insulation</p> <p style="text-align: center;"><u>C. Ilies</u>¹, D.E. Gavrilă¹</p> <p style="text-align: center;">¹, <i>University Politehnica Bucharest, Bucharest, Romania</i></p> <p>The main insulation of a transformer consists of insulating barriers placed in the oil of the tank. Composed of cellulose- paper, solid insulation begins to deteriorate from the first day of installation. Heat and moisture are the main factors that cause degradation of insulation, the components of the solid insulation having strong water absorption. Accumulation of water in insulating barriers and oil is one of the most difficult problems that appear in such systems. Most of the moisture is found in the cellulose. Water reduces electric strength of oil, increases the speed of depolymerisation of cellulose molecules and thus reduces tension of breakdown of</p>

solid insulation. It is universally accepted that the loss of 75% of the mechanical tension is the end of the life of transformer paper. At present it is considered that the replacement or restoration of oil and paper decontamination increase the life of a transformer. Analysis of oil samples allows obtaining information on his condition. The solid insulation can be evaluated only by analyzing samples taken directly from the isolation and it is necessary to open the transformer; this can not be performed in all cases. In contrast, is easier the replacement of the oil. Practically, there is no direct way of determining moisture content in transformer insulation and are used indirect methods. Among the most common electrical methods used for determining moisture content in solid insulation is Recovery Voltage Method (RVM). If a DC voltage is applied directly to the dielectric a period of time and then the material is short circuited a lesser period than during loading, after opening the circuit in dielectric will result a voltage called recovery voltage (RV). This tension is due to polarization and relaxation phenomena of the material. The insulation condition of two high power transformers was analysed. Each recovered tension was determinate with high impedance meter. The instrument was coupled to the low voltage terminal and the high voltage windings and the tank were grounded. RV initially increases, reaches a maximum and then decreases again; the time dependence of this voltage is RVM curve which is called polarization curve.

1. W.S. Zaengl, "Dielectric Spectroscopy in Time and Frequency Domain for HV Power Equipment", Part I, Theoretical Considerations, IEEE, Electrical Insulation Magazine, Vol.19, No.5, pp. 5-18, September/October 2003.

P-2

Investigation of anthocyanins adsorption from wine on SBA-15 using a HPLC method

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Anthocyanins are naturally occurring pigments responsible for the colour of many fruits, including grapes and for the colour of the young red wine, having usually a concentration in wine, between 350 mg/L up to 1500 mg/L [1]. The anthocyanins are extracted from the skins of black grapes during maceration, becoming responsible for the purple-red colour of young wines. During ageing, however, the levels of grape anthocyanins rapidly decrease as they react with a variety of other wine constituents. The purpose of this work was to investigate the evolution of anthocyanins concentration of a young red wine on treatment with mesoporous material SBA-15.

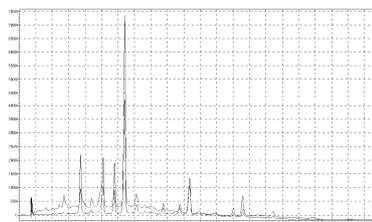


Figure 1. Chromatograms of red wine sample and methanolic extract at 518 nm

Chromatograms of red wine sample and methanolic extract at 518 nm.

Mesoporous silica SBA-15 has advantages for the adsorption of large molecules because of their large pore size (3-30 nm) and high specific surface area (500-1000

	<p>m²/g). The purely siliceous molecular sieve SBA-15 was synthesized hydrothermally and the typical gel molar composition was 1TEOS : 0.017P123: 5.95HCl : 194H₂O [2]. A rapid liquid chromatographic–diode array detection (LC-DAD) method was used for the analysis of the anthocyanins in a young red wine.</p> <p>[1]. RIBEREAU-GAYON P., The anthocyanins of the grapes and wines. Anthocyanins as Food Colors, Ed. Markakis P., Academic Press, New York, 1982, p. 209 [2]. ZHAO D. et. all, 1998, Science (Washington D.C.), 279, p. 548-552</p>
<p>P-3</p>	<p>DFT comparative study of organic dyes for TiO₂ dye-sensitized solar cells Corneliu I. Oprea¹, <u>Anca Dumbrava</u>², Boris F. Minaev³, Petre Panait¹, Fanica Cimpoesu⁴, Mihai A. Girtu¹</p> <p>¹<i>Department of Physics and Electronics, Ovidius University of Constanta, Constanta, Romania</i> ²<i>Department of Chemistry and Chemical Engineering, Ovidius University of Constanta, Constanta, Romania</i> ³<i>Department of Chemistry, Bogdan Khmelniisky National University, Cherkassy, Ukraine</i> ⁴<i>Department of Theoretical Chemistry, Institute of Physical Chemistry, Bucharest, Romania</i></p> <p>We report results of combined experimental and theoretical studies of organic dyes (betalains and coumarins) used as sensitizers for TiO₂ dye-sensitized solar cells (DSSCs). To analyze the compliance of the dyes with the main criteria that should be met by a dye to be used as TiO₂ sensitizer in DSSCs, we performed density functional theory (DFT) calculations, which provided the optimized geometry, electronic structure and electronic spectrum of the dyes in solution. We discuss the adsorption onto the substrate, the matching of the absorption spectrum of the dye with the solar spectrum, the energy level alignment with the semiconductor and the electrolyte, and the charge transfer to the substrate. By comparing the theoretical results with the experimental data we identify the betacyanins as the useful constituents of the betalain extracts and emphasize the role of extract purification. The comparison between the various coumarin dyes showed the role of the carboxyl group in improving the binding to the substrate and the matching of the absorption spectrum to the solar one. The coumarins with an additional conjugated chain follow more closely the criteria for sensitizing dyes, leading to higher performance DSSCs.</p>
<p>P-4</p>	<p>Fabrication of bulk heterojunction organic solar cells using different small organic molecules as electron acceptors. Iulia Salaoru¹, <u>Shashi Paul</u>¹, Zainab Alhashim¹</p> <p>¹<i>EMTERC, Faculty of Technology, DeMontfort University, Leicester, UK</i></p> <p>In the field of renewable energy technologies, solar cells are one of the fastest growing technologies. Traditional ways of harvesting this energy from the sun is through the use of inorganic materials such as silicon, CdTe and GaAs in solar cells. Despite the high conversion efficiency, these traditional inorganic solar cells are expensive due to their high costs of production. Solar cells from organic materials offer some important advantages, such as lightweight, potentially low-cost, environmentally friendly, no high temperature required during production and unlimited room for further material modification and improvement. Nevertheless, two significant problems of organic solar cells still need to be resolved; these include: a low power conversion efficiency (8% as compared to 29% for the best inorganic solar cells) and low stability. In this work, bulk heterojunction solar cells made of blend of photoconductive polymer poly(3-hexylthiophene) (P3HT) and few different small organic molecules [6,6]-phenyl-C61-butyric acid methyl ester (PCBM), Fullerene (C60) and Tetracyanoethylene (TCNQ) have been fabricated and their quality assessed by their power conversion efficiency.</p>

	<p>[1] P. Würfel: Physics of Solar Cells. New York: Wiley, 2004; [2] http://www.solarmer.com/; [3] H. C. Hesse, J. Weickert, M. Al-Hussein, L. Dössel, X. Feng, K. Müllen, L. Schmidt Mende, Solar Energy Materials and Solar,94, 2010.</p>
<p>P-5</p>	<p>Investigation of atmospheric pollution by LIDAR and other spectroscopic techniques</p> <p><u>Ovidiu-Gelu Tudose</u>^{1,2}, Dana-Ortansa Dorohoi¹, Ioan Balin^{1,2}</p> <p>¹<i>Faculty of Physics, Optics and Spectroscopy Department, Al.I.Cuza University of Iasi, Iasi, Romania</i></p> <p>²<i>Research and Development Department, SC EnviroScopY SRL, Iasi, Romania</i></p> <p>The impact of human activities on the global climate became in the last decades a great worldwide concern. In this context, understanding the dynamics of the Earth's climate became a great challenge of our time. The estimation of the relative contribution of the atmospheric trace constituents (CO₂, NO_x, SO₂, O₃, VOCs (volatile organic compounds)) requires observation and continuous monitoring of various physical and chemical parameters. In this research frame, this work refers to the implementation of a multi-wavelength LIDAR system at Science and Technology Park TehnopolIS (Iasi city - 47° 7'17.16"N, 27°34'15.35"E, ASL 60m). The LIDAR technique, based on laser-material interaction, offers three-dimensional concentration profiles of the air pollution, which are essential for the validation of distribution models for exhaust plumes or ozone distribution in the troposphere. Using a LIDAR with a depolarization module, real-time measurements for understanding the processes involved in cloud seeding, relevant for hail prevention and increase of rainfall are shown.</p> <p>This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectorial Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/CPP 107/DMI 1.5/S/78342].</p>
<p>P-6</p>	<p>Selective shielding multilayered material for high frequency radiation</p> <p><u>Gabriel Ababei</u>¹, Valeriu David², Vlad Dafinescu², Ionut Nica², Horia Chiriac¹, Alexandra Pica³</p> <p>¹<i>Magnetic Material, National Institute of Research and Development for Technical Physics, Iasi, Romania</i></p> <p>²<i>Faculty of Electrical Engineering, "Gh. Asachi" Technical University of Iasi, Iasi, Iasi</i></p> <p>³<i>Research Institute for Advanced Coatings, Bucharest, Romania</i></p> <p>Glass coated amorphous magnetic microwires (GCAW), known as soft magnetic materials are intensively studied due to their large utilization in sensors and electromagnetic shielding application [1]. The aim of the paper is to investigate the shielding effectiveness (SE) of a multilayered material with controlled selective shielding properties in the microwave frequencies range, based on CoFe-GCAW. The multilayered material allows the selective shielding of the electromagnetic radiation, simultaneously and selectively for several frequency bands, with the central radiation frequency controlled through the lengths of the microwires by combining the magnetic properties of the microwires with their geometrical distribution [2]. The shielding effectiveness of samples from the selective shielding multilayered material was determined using two methods namely the Electro-Metrics model EM-2107A shielding effectiveness test fixture which permits measurement in the 30 MHz to 1.5 GHz frequency range connected to a spectrum analyzer with tracking generator, and the free-space method in the 0.8 GHz to 3 GHz frequency range. The shielding effectiveness measurements results were SE= 4 dB to 9.5 dB for the samples with two layers, SE= 18 dB to 33 dB for sample with 14 layers, and SE= 36 dB to 48 dB for sample with 30 layers, respectively. This type of materials can be used as smart materials for microwave electromagnetic shielding and structural health monitoring.</p>

	<p>This work was supported by a grant of Romanian National Authority for Scientific Research, CNCSIS – UEFISCDI, project number PN-II-RU-PD-2011-3-0228.</p> <p>[1] H. Chiriac and T-A Ovari, Prog. in Mat. Science, 40, 333 (1996) [2] G. Ababei et al., Rev. of Scien. Instr., 83, 014701 (2012)</p>
<p>P-7</p>	<p align="center">Hydrophilic Properties of the Nb-Doped TiO₂ Thin Films Deposited by Spray Pyrolysis</p> <p align="center"><u>Catalin Adomnitei</u>¹, Daniel Florea¹, Ion Sandu², Mihaela Girtan³, Dumitru Luca¹, Valentin Nica¹, Diana Mardare¹</p> <p align="center">¹<i>Faculty of Physics, “Alexandru Ioan Cuza” University, Iasi, Romania</i> ²<i>ARHEOINVEST Interdisciplinary Platform, “Alexandru Ioan Cuza” University, Iasi, Romania</i> ³<i>Photonics Laboratory, Angers University, Angers, France</i></p> <p>Environmental protection is one of the most important problems of the humanity, at the moment. In this respect, concern for the development of alternative technologies has increased in the last few years; they are less polluting and maintenance costs are much lower. Photocatalysis is a promising method and can be used in the photodegradation of different polluting organic compounds existing on water and air. For a rapid evaluation of the films photocatalytic activity, wettability measurements are required, as long as the surface hydrophilicity is intimately associated with the oxidizing capacity, despite different mechanisms that rule these two features of the photocatalytic materials.</p> <p>In this paper we have studied the hydrophilic properties of the undoped TiO₂ and Nb doped ones. The films have been deposited by spray pyrolysis on ITO (Indium Tin Oxide)/glass substrates, under certain conditions. The as-deposited samples were amorphous, as revealed by X-Ray Diffraction (XRD) measurements. After annealing at 400°C for two hours, the anatase phase developed. The morphology was studied by Scanning Electron Microscopy. All the samples reached superhydrophilicity after exposing enough to UV radiation. A comparison of the hydrophilic properties of the undoped and Nb doped samples, as well as of the as-deposited and annealed films was made.</p>
<p>P-8</p>	<p align="center">Promising active materials for lithium-ion batteries</p> <p align="center">Ilona Senyk¹, <u>Ievgeniia Chaikovska</u>², Volodymyr Khomenko¹, Viacheslav Barsukov¹</p> <p align="center">¹<i>Department of Electrochemical Power Engineering & Chemistry, Kiev National University of Technologies and Design, Kiev, Ukraine</i> ²<i>Chemical Engineering, Research and Educational Center, Kiev, Ukraine</i></p> <p>Si, Sn, Al, and some other materials are the promising negative active materials for LIBs instead of the more popular flake graphite, which has an excellent cycle life and low price, but quite low theoretical capacity Q_{th}=372 mA×h/g. However, they have not received a practical application, since their large theoretical capacity is accompanied by sharp drop of capacity during the first few cycles. We have formulated the theoretical principles and developed some experimental composite anode materials [1, 2], which give possibility to reach a high level of capacity during the stable cyclization. An optimal choice of novel polymer binders plays an important role for the development of such composites. Today LiCoO₂ is the most popular positive active material for LIBs. However, it has a number of disadvantages (such as high cost; low specific capacity; toxicity and safety problems). Our team has an experience in synthesis and characterization of positive composite materials, based on the mixed oxides, as well as Fe phosphate. These materials can ensure quite high specific capacity, safety and acceptable price for LIBs.</p> <p>[1] V. Khomenko, V. Barsukov, J. Doninger, I. Barsukov, J. Power Sources, 165/2 (2007) 598-608. [2] V. Khomenko, V. Barsukov, Electrochimica Acta, 52, No 8 (2007) 2829-2840.</p>

<p>P-9</p>	<p align="center">Development and optimization of composite non-noble catalysts for oxygen reduction</p> <p align="center">Kostiantyn Lykhnytskyi¹, Volodymyr Khomenko¹, Viacheslav Barsukov¹</p> <p align="center">¹<i>Department of Electrochemical Power Engineering & Chemistry, Kiev National University of Technologies and Design, Kiev, Ukraine</i></p> <p>It is well known that Ag, Pt and other noble metals are typical catalysts towards the oxygen reduction reaction (ORR). A high cost of such catalysts is one of the key restraining factors for wide application of such efficient and environmental friendly Oxygen-Hydrogen fuel cells and (Air) Oxygen - Metal batteries (such as Air-Zn, Air-Mg, Air-Al and Air-Li). As it was shown in [1, 2] such conducting polymers as polyaniline (PANI) and polypyrrole (PPy) demonstrate some catalytic activity towards ORR, which proceeds by 2-electrone mechanism. Our recent investigations have shown that some mixed inorganic oxides of transition metals (like MnCo₂O₄, NiCo₂O₄, FeCo₂O₄, etc.) demonstrate quite good catalytic activity for ORR and H₂O₂ decomposition. It was founded that such novel class of carbon as graphitized carbon black (GCB) is very effective nano-structured carbon support for preparation of composites. SEM-EDS method was applied for identification of composition after the sol-gel method of synthesis. We have shown that the optimal mixed 2-component inorganic composite is NiCo₂O₄/GCB. Three-component composite “Polypyrrole/NiCo₂O₄/GCB” has demonstrated a maximum catalytic activity toward the ORR. The calculated number of electrons for ORR at such composite was n=3.8 using rotating disk electrode method. It is almost the same, as for Pt catalyst (n=4). Thus, it is possible to substitute noble catalysts for not expensive composite catalysts at least for alkaline solutions.</p> <p>[1] V.Z. Barsukov, V.G. Khomenko, et al. <i>Electrochim. Acta</i>, 2001, 46, 4083- 4094. [2] V.G. Khomenko, V.Z. Barsukov, A.S. Katashinskii, <i>Electrochim. Acta</i>, 2005, 50, 1675-1683.</p>
<p>P-10</p>	<p align="center">Surface Wettability of Titania Thin Films with Increasing Ni Content</p> <p align="center">Catalin Adomnitei¹, Daniel Florea¹, Nicoleta Cornei², Marius Dobromir¹, Andrei Victor Sandu³, Valentin Nica¹, Dumitru Luca¹ and Diana Mardare¹</p> <p align="center">¹<i>Faculty of Physics, “Alexandru Ioan Cuza” University, Iasi, Romania</i> ²<i>Faculty of Chemistry, “Alexandru Ioan Cuza” University, Iasi, Romania</i> ³<i>Faculty of Materials Science and Engineering, “Gheorghe Asachi” Technical University of Iasi, Iasi, Romania</i></p> <p>Titanium dioxide films are known for their hydrophilic and photocatalytic characteristics. Increasing surface area and doping can enhance their photocatalytic activity. We report here on Ni doped TiO₂ thin films, prepared on ITO/glass substrate by a spray pyrolysis technique. The as-deposited films were amorphous as revealed by X-ray diffractometry. To obtain polycrystalline structures, a heat treatment in air (60 min. at 400 °C) was performed. X-ray Photoelectron Spectroscopy and Scanning Electron Microscopy confirm the existence of Ni atoms in the TiO₂ matrix. The optical transmittance and reflectance spectra of the films were investigated and the optical band gap was derived for each film.</p> <p>Surface wettability investigation indicates that, by doping with Ni impurities in increasing quantities, there is a decrease in the hydrophilic properties. The initial contact angle decreases from 80 deg. toward values smaller than 10 deg. in 30 min. of irradiation, for the 1 at.% Ni-doped sample, and from 100 deg. toward 75 deg. for the 10 at.% Ni-doped sample. The optical band gap values, obtained from optical transmittance measurements, increase by increasing the Ni content in the films, and they are higher than those reported in the literature, probably due to the size quantum effects.</p>

<p>P-11</p>	<p align="center">Graphene – semiconducting polymer thin films for photovoltaic cells applications</p> <p align="center">L. Monica Veca¹, <u>Munizer Purica</u>¹, Mihaela Kusko¹, Ioan Stamatina², Catalin Ceaus²</p> <p align="center">¹Laboratory for Molecular Nanotechnology, National Institute for Research and Development in Microtechnologies IMT-Bucharest, Bucharest, Romania</p> <p align="center">²Faculty of Physics, University of Bucharest and ³Nano-SAE Research Center, Bucharest-Magurele, Romania</p> <p>The intrinsic similarity of graphene, the bidimensional material of one sp² hybridized carbon sheet, and fullerene is the main driving force of the current interests on using these new materials as acceptor material in organic photovoltaic cells. Graphenes are considered to be a competitive alternative to their fullerene counterparts due to both higher electron mobility than fullerene and their high work function which can enable higher open circuit voltages than those predicted for fullerene bulk heterojunction (BHJ) devices. Therefore, in this study colloidal solutions of few layer graphene have been synthesized, characterized by Raman spectroscopy, and subsequently used to prepare blends with semiconducting polymers. The nanocomposites thus obtained were then integrated as the active layer into the bulk heterojunction polymer photovoltaic cells and their current-voltage characteristics, under dark and illumination conditions, recorded. Understandings of recombination kinetics in polymer/graphene BHJ solar cells as well as the equivalent circuit of the system are also reported based on impedance spectroscopy measurements. The measurements were recorded over a frequency range of 100 mHz – 500 kHz with logarithmic point spacing, at a low AC amplitude of 20 mV (rms) to maintain the response linearity in open circuit conditions and at different bias DC voltages. In order to obtain the equivalent circuit, the data have been fitted using the ZSimWin 3.21 software. Furthermore, the capacitance-voltage measurements performed at 1kHz with 0.1 V step between -0.6 V and 1 V, both in dark and under illumination, have been used to analyze the band bending in proposed heterojunction structures, clearly revealed in Mott-Schottky characteristics, which further allow determining of flat-band potentials and doping levels.</p>
<p>P-12</p>	<p align="center">Nanoporous structured anodic TiO₂ as low reflective layer for silicon solar cells</p> <p align="center">E. Manea¹, C. Parvulescu¹, M. Purica¹, F. Comanescu¹, E. Budianu¹</p> <p align="center">¹..., National Institute for Research and Development in Microtechnologies, IMT-Bucharest, Bucharest, Romania</p> <p>The paper presents the integration of the nanostructured titan dioxide (TiO₂) thin films as antireflective (AR) layers into the fabrication process of the solar cells on monocrystalline silicon. The nanostructured TiO₂ thin films have been prepared by the anodization of the 90 nm Ti layer deposited by the sputtering method. The optical properties of the TiO₂ layers obtained on silicon and on SiO₂/silicon were determined by ellipsometry. The refraction index at 632 nm wavelength is 1.764 for TiO₂ on silicon and 1.66 for a sample with a 10 nm SiO₂ on silicon respectively. The transmittance of TiO₂ thin films on glass substrate is over 70% and the energy band gap is 3.70 eV. Nanoporous TiO₂ with pores of 6-12 nm obtained by anodization process, used as AR layer, displays a very low reflectance with a minimum of 0.88 % at 585 nm wavelength and less than 5 % for 500-700 nm spectral range. Silicon solar cells fabricated by integration of the Ti anodization process have been characterized. The values of the maximum output power (P_{max}) extracted from the current – voltage characteristics show that P_{max} of the TiO₂ layer cell is with 28% higher than P_{max} for classical solar cells with 120 nm SiO₂ AR layer.</p>

<p>P-13</p>	<p style="text-align: center;">Analysis and Interpretation of Lidar signals with Python Mihail Nicolae Dănilă¹, Silviu Gurlui¹ ¹<i>Department of Physics, Atmosphere Optics, Spectroscopy and Lasers Laboratory, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i></p> <p>In our days, a complex research of the atmosphere requires cutting-edge remote sensing techniques. The LIDAR (Light Detection And Ranging) and RADAR systems represent the main methods of profiling the atmosphere. The high spatial and temporal resolutions (3.5 meters and 1 minute respectively) and the possibility to monitor Earth's atmosphere to heights up to 100 kilometers, make the LIDAR a very attractive and necessary system. The variety of interactions between the atmospheric constituents and the radiation emitted by the LIDAR, allows the determination of the atmospheric variables of state (i.e. temperature, pressure, air density) and the determination of the aerosol concentration [1, 2]. The implementation of Python programming [3] for the analysis and interpretation of LIDAR signals was initiated in order to obtain the Range Corrected Signal Time Series, the atmosphere's molecular parameters and the atmospheric variables of state. The measurements were made with the mini-LIDAR system from the Atmosphere Optics, Spectroscopy and Lasers Laboratory, "Alexandru Ioan Cuza" University of Iasi, partner of the Romanian Atmospheric Research 3D Observatory (RADO).</p> <p>Acknowledgements: This work was supported by Romanian Atmospheric Research 3D Observatory (RADO). The financial support from the Grant POSDRU/89/1.5/S/63663 is highly acknowledged.</p> <p>[1] M. M. Cazacu, Ph. D. Thesis (2011); [2] A. Timofte, et al, EEMJ, vol. 10, No.1, 91 (2011); [3] The Python Tutorial - http://docs.python.org/tutorial</p>
<p>P-14</p>	<p style="text-align: center;">Synthesis And Characterization Of Co-Substituted Ferrite Nanocomposites For Sensing Applications Valentin Nica¹, Florin Tudorache¹, Daniel Gherca², Florin Brinza¹, Aurel Pui² ¹<i>Department of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i> ²<i>Department of Chemistry, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i></p> <p>Ferrites have received great attention due to their technological applications such as catalysts photoelectrical systems and gas sensors, microwave devices and biomedical applications. In this study, nanosized powders of $\text{Co}_x\text{Ni}_{1-x}\text{Fe}_2\text{O}_4$ (where x is 0, 0.25, 0.50, 0.75, 1) have been successfully prepared by co-precipitation method with carboxymethyl cellulose (CMC) as surfactant. The co-precipitation synthesis of nanocomposite ferrites was widely used as an efficient, low-cost, non-toxic route to control the structural properties and surface chemistry. As no many studies have been reported on these materials for using in sensors applications the knowledge in this field has been extended. The samples were characterized by powder X-ray diffraction (XRD), Raman spectroscopy, scanning electron microscopy (SEM-EDAX). We also evaluated the humidity sensing property among of their electrical properties. The effect of composition of the samples on the structure and sensitivity properties was investigated. Diffraction data confirmed high purity cubic lattice formation. Raman measurements revealed the addition of CMC functional groups on the surface of Co-Ni ferrites nanoparticles. The porosity is reflected in resistive and capacitive sensor response of cobalt-nickel ferrite samples under humidity action and could be a useful to humidity device detection.</p> <p>Acknowledgments Authors thank to "Research Center on Advanced Materials and Technologies - RAMTECH" created within the framework 162/15.06.2010 of POS CCE – A2-O2.1.2 and grant POSDRU/89/1.5/S/49944 for their technical and financial support,</p>

	<p>respectively.</p> <p>[1]. N. Rezlescu, E. Rezlescu, P. D. Popa, and F. Tudorache, A Model Of Humidity Sensor With A Mg-Based Ferrite, <i>J. Optoelectron. Adv. Mater.</i> Vol. 7, No. 2, p. 907 – 910 (2005).</p>
<p>P-15</p>	<p style="text-align: center;">WO₃/TiO₂ thin film bilayers for photocatalytics</p> <p style="text-align: center;">V. Dăscăleanu¹, D. Luca¹, D. Macovei² and C. M. Teodorescu²</p> <p style="text-align: center;">¹<i>Faculty of Physics, “Alexandru Ioan Cuza” University, 11 Carol I Blvd. 700506 - Iasi, Romania</i></p> <p style="text-align: center;">²<i>National Institute of Materials Physics, 105-bis Atomistilor St., Măgurele-077125, Romania</i></p> <p>Anatase TiO₂ is known as a low-cost photo-catalyst, a super-hydrophilic and bactericidal material. It lacks the possibility to be photo-activated with visible light, due to its high band gap (E_g = 3.2 eV, corresponding to an absorption edge wavelength of approx. 390 nm). To improve its photo-activation performances, so as to be able to using the blue-light radiation from the natural light, attempts have been reported by many authors [see the review in ref. 1]. Shifting the absorption edge of photo-catalytic titania towards visible range can be achieved via surface modification (like doping or enhancing the crystalline ordering). On the other hand, further increasing the catalytic activity of the mentioned materials can be done by increasing photo-generated electrical carrier lifetime (either by doping with rare-earth elements, or by designing special structures that are able to inject additional electrons and holes via the interface. Such hetero-junctions in bilayer structures of titania with SiO₂ or WO₃ have been proposed recently. For instance, by coupling TiO₂ with WO₃ (E_g = 2.8 eV) results in enhanced rate and increased lifetime of photo-generated charge carriers [2].</p> <p>We report here on a novel approach to prepare and characterize WO₃/TiO₂ photo-catalytic bi-layers by using a PVD setup [3]. The structure, chemical composition at interfaces, surface morphology and atomic ordering in the layered structure have been inferred from X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), atomic force microscopy (AFM) and extended X-ray absorption-edge fine structure (EXAFS). The results are discussed in terms of the synergic effect of materials' properties and interface phenomena.</p> <p>[1] A. Fujishima, X. Zhang, D. A. Tryk, <i>Surf. Sci. Reports</i> 63 (2008) 515–582. [2] M. Miyaguchi, A. Nakajima, <i>Adv. Mater.</i> 12 (2000), 1923-1927. [3] D. Luca, D. Mardare, F. Iacomi, C.-M. Teodorescu, <i>Appl. Surf. Sci.</i>, 252, 2006, p. 6122.</p>

TOPIC 7

Metamaterials. Applications

<p>I-1</p>	<p style="text-align: center;">Electromagnetic metamaterials <u>Raimond Grimberg</u>¹ ¹, National Institute of Research & Development for Technical Physics, Iasi, Romania</p> <p>It is well known that the electromagnetic response of conventional materials is depended on their molecular composition and usually have both/either the electronic permittivity (ϵ) and/or the magnetic permeability (μ) positive. Since the structure and composition of molecules and atoms are rather restrictive, the electromagnetic properties of conventional media are limited. In the past few years, new artificial media, called metamaterials have been developed that are capable of overcoming these restrictions. Metamaterials' subunits are much smaller than the wavelength at incident radiation such that an incident wave sees a homogeneous medium and not the geometry of the subunits. Therefore, the subunit of a metamaterial can be specifically designed to manufacture media with advantageous and novel electromagnetic properties such as extreme large ϵ and /or μ, negative ϵ and /or μ, negative refraction, chiral compartment. The possibility to tailor the electromagnetic response at media, in ways unheard at even just a few years ago, has given great vitality to a field offering possibilities as exciting as perfect lens, "Harry Potter"- style electromagnetic cloaks, media which permits to manipulate the evanescent waves, to improve the sensibility and spatial resolution of the electromagnetic nondestructive evaluation. The field is vast and rapidly developing in 2011 about 1200 papers on the topic where published, and the trend relative to the proceedings years indicators an growth rate of about 70% per annum. The presentation is focused on the triple aspects of metamaterials: theoretical aspects, experimental aspects and few results and applications.</p>
<p>P-1</p>	<p style="text-align: center;">FDTD simulations of dielectric based metamaterials as absorbants for terahertz and infrared bolometers <u>Cristian Kusko</u>¹, Mihai Kusko¹ ¹Dept. of Microphotonics, National Institute for R&D in Microtechnologies, Voluntari, Romania</p> <p>Metamaterials are periodic arrays of metallic or dielectric scattering elements whose sizes are much smaller than the wavelength of the incident radiation such that the approximation of effective medium can be applied. They possess salient properties like magnetic response at optical frequencies, negative refraction, slow group velocities and enhanced nonlinear effects. The response of metamaterials is due to the resonances appearing in their constitutive scattering elements which give rise to large imaginary parts of their effective refractive indexes. While this implies high propagation losses of the electromagnetic field, representing a major disadvantage of metamaterials for optical signal processing, they can be used in applications where highly absorbing layers are required. It was shown that a metallic metamaterial presents a strong absorption which is scalable over large bandwidth ranging from near infrared to mid-infrared with applications as absorbing layers for bolometers operating at these wavelengths [1]. Here we consider dielectric based metamaterials [2] consisting in lattices of scattering elements made of materials with high dielectric constants. In this case the resonant mechanism is described by Mie formalism. While materials like SrTiO₂ present a high relative permittivity at microwave frequency, polar dielectrics like LiTaO₃ at terahertz or SiC at mid-infrared frequencies present also large dielectric constants at frequencies associated with their phonon modes. By performing FDTD simulations, we compute the electromagnetic response of dielectric metamaterials based on these compounds and we investigate their applicative potential of being used as highly absorbing layers for bolometer applications.</p> <p>Acknowledgement - This paper is supported by Sectoral Operational Programme Human Resources Development, financed from the European Social Fund and by the Romanian</p>

Government under the contract number POSDRU/89/1.5/S/63700.

1. F. B. P. Niesler, J. K. Gansel, S. Fischbach, and M. Wegener, Appl. Phys. Lett. 100, 203508 (2012).
2. Qian Zhao, Ji Zhou, Fuli Zhang, Didier Lippens, Materials Today, 12, 60 (2009)

TOPIC 8

Nanostructures and Low Dimensional Systems

<p>PI-1</p>	<p style="text-align: center;">Growth and self-organisation of semiconductor nanostructures <u>Isabelle Berbezier</u>¹, ¹<i>IM2NP, CNRS - AMU, Marseille, France</i></p> <p>During the last decade, a significant progress has been made towards development of new processes for integrating nanostructured materials into novel micro- and opto-electronic devices. For most of the potential applications the nanostructures must be ordered and highly homogeneous in size in order to exploit the quantum effects for device applications. Recent advances in self-assembly mechanisms and understanding have been obtained recently¹. The talk first addresses the mechanisms of self-organisation of highly ordered Ge quantum dots by deposition on nano-patterned Si(001) substrates^{2,3}. It then focuses on a new fabrication process based on Ge QD self-assembly on SiO₂/Si(001) substrate nanopatterned. Patterning is used to create an array of ultra-small holes with high density (>10¹¹/cm²) in thin thermal SiO₂ layer on Si(001) substrate that serve during the subsequent step for the ordering of Ge NCs⁴. The latter are formed by dewetting during UHV in situ annealing⁵⁻⁶. In a second part we investigate the self-organisation of SiGe core-shell nanowires (NWs). We focus on the VLS growth of the NWs starting from a 2D array of gold clusters selectively deposited on FIB patterned SiO₂/Si substrate. We developed original processes to produce well ordered arrays of Au clusters that serve, during the subsequent deposition step, as seeds for the nucleation of the NWs. We show that the temperature range for the growth of NWs is extremely restricted in MBE growth conditions. Moreover, the effect of epitaxial strain on the growth direction of NWs is also revealed. We highlight the strain-driven evolution of the energy requested to create new facets at the trijunction between solid, liquid, and vapor. As a consequence, on Si (100) substrates, after a first vertical growth step, the Ge NWs rapidly kink and crawl along (110) directions of the substrate (see Fig. 2). Such a directional change was not observed during the growth of Si NWs. The combination of FIB patterning and MBE NWs growth, enable to gain fundamental understanding of the physical laws that govern NWs properties and how these laws can be harnessed to dramatically improve the future devices characteristics.</p>
<p>I-1</p>	<p style="text-align: center;">Static and Dynamic Interactions in 2D and 3D Magnetic Nanowires Arrays <u>Leonard Spinu</u>¹ ¹<i>Department of Physics and AMRI, University of New Orleans, New Orleans, USA</i></p> <p>Magnetic nanowires are an important class of magnetic nanostructured materials. One of the most important effects in magnetic nanowire arrays is the interwire magnetostatic interactions. In order to be able to understand the obtained experimental results reliable methods for interactions evaluation are needed. To quantify the effect of interactions one needs on the one hand a suitable method to experimentally vary the strength of interactions in arrays of magnetic nanowires and on the other hand a method to measure the effect of the interactions. In this study, we present a comprehensive investigation of magnetic interactions in two-dimensional (2D) and tridimensional (3D) arrays of magnetic nanowires. The 3D magnetic nanowire arrays were fabricated by electrodeposition of Ni in highly-ordered anodic alumina membranes. The static magnetic properties were probed using vibrating sample magnetometry following several measurements protocols. Interactions and static magnetization reversal of Ni nanowires arrays have been investigated by the first order reversal curves (FORC) method [1]. Several series of samples with controlled spatial distribution were considered including simple wires of different lengths and diameters (70 nm and 110 nm) and complex wires with single modulated diameter along their length [2]. Subtle features of magnetic interactions are revealed through a quantitative analysis of the local interaction field profile distributions obtained from</p>

	<p>FORC. The dynamic properties of interacting magnetic nanowire arrays were probed through angular dependent Ferromagnetic Resonance experiments. In the case of 3D arrays the FMR spectra at 300K and 4 K was measured using a commercial X-band FMR spectrometer. In the case of 2D nanowire arrays the FMR response was measured in the 1-20 GHz range using a broadband microwave vector network analyzer (VNA). The 2D nanowire arrays of homogenous widths Ni80Fe20 nanowires of thickness $t = 30$ nm, width $w = 300$ nm and length $L = 150$ μm were fabricated directly on top of a coplanar waveguide (CPW) using electron beam lithography followed by electron-beam deposition and lift-off process. The VNA is connected to CPW by a G-S-G-type microwave probe to obtain a high frequency response.</p> <p>Work at AMRI was supported by the NSF grants ECCS-1028547</p> <p>[1] A. Rotaru et al., Phys. Rev. B, vol. 84, p. 134431, Oct 2011. [2] J. H. Lim et al., J. Mater. Chem. vol. 20, 9246, 2010.</p>
<p>I-2</p>	<p>Droplet epitaxial GaAs quantum dots as single photon sources on silicon <u>Marco Abbarchi</u>^{1,2}</p> <p>¹<i>Quantum Dot Research Center, National Institute for Materials Science, 1-1 Namiki, Tsukuba 305-0044, Japan</i></p> <p>²<i>Physics Department and European Laboratory for Nonlinear Spectroscopy, Universita di Firenze, Via Sansone 1, 50019 Sesto Fiorentino (Firenze), Italy</i></p> <p>Droplet epitaxy (DE) is a non-conventional growth technique based on molecular beam epitaxy. This method, differently from strain-induced 3-dimensional nanostructures, enables the growth of lattice-matched and strain-free self-assembled III-V nanoemitters. Thanks to the versatility of the DE, different kinds of nanostructures can be realized: quantum dots, coupled quantum dots, quantum rings, multiple concentric quantum rings, quantum disks, as well as combinations of these different shapes. Moreover, DE enables the growth on different substrates orientations (such as the (100), (311)A, (111)A) and, most importantly, it makes possible the growth of bright III-V quantum emitters on substrates made of Silicon and Germanium. In this seminar I will introduce some features of growth and photoluminescence spectroscopy of single GaAs/AlGaAs DE nanostructures. In particular I will concentrate on quantum dots and concentric rings addressing some electronic and optical features showing single and correlated photon emission. Finally I will introduce recent advances in the growth of hybrid III-V/IV-IV quantum dots for the implementation of single photon sources up to 80 K on silicon substrate.</p>
<p>I-3</p>	<p>Quantum wires in lithium niobate : first realizations and characterizations Oleksandr Stepanenko¹, Emmanuel Quillier¹, Hervé Tronche¹, Pascal Baldi¹, Pierre Aschiéri¹, <u>Marc De Micheli</u>¹</p> <p>¹<i>LPMC, Université de Nice Sophia Antipolis, Parc Valrose 06108 Nice Cedex2, France</i></p> <p>The proton exchange technique allows fabricating a great variety of waveguides in Lithium Niobate. Recently we discovered that it was possible to realize highly confining waveguides in a controllable manner and without destroying the nonlinear and electro-optic properties of the crystal. With this technique, one can fabricate quantum wires in both X-cut and Z-cut wafers, and the properties of those will be presented as well as the possibility to combine this technique with periodic poling and photonic crystal fabrication.</p>

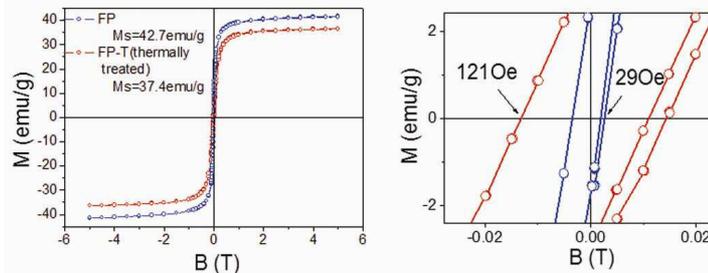
I-4

Core-shell magnetic nanoparticles with targeted properties

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Platinum and gold based magnetic nanoparticles offer an attractive potential for various bio-applications such as: magnetic separation, bioimaging, drug delivery, magnetic hyperthermia and laser ablation. Magnetic nanoparticles of Fe₃O₄, La_{0.67} Sr_{0.33} MnO₃ (LSMO) and Fe Pt alloy were coated with conjugated polymers and ZnS quantum dots to form core-multi-shell like structures. This way the saturation magnetization of these nanoparticles can be increased and adjusted. The process is based to the charge transfer coming from the semiconducting shell into the surface layers of magnetic nanoparticles which, in turn, produces an increase of the magnetic order inside the outer atomic layers. It is known that in case of bare magnetic nanoparticles the magnetic moments of the external layers are not correlated. The electrons transferred from the outer semiconductor shell reestablish the magnetic correlations inside the outer layers of the nanoparticles thus increasing the overall saturation magnetizations [1,2].



Hysteresis curves of Fe@Pt (FP) and thermally traded Fe@Pt (FP-T) nanoparticles. In case of FP-T nanoparticles an increase of the coercive field as a due to the formation of an FePt (L1₀) alloy intermediate shell is observed.

Superparamagnetic nanoparticles have a small, but non zero, coercive field. It can be increased by realizing core-shell structures formed by exchange coupled hard/soft magnetic cores and/or shells. Biomedical applications like hyperthermia require a rather superparamagnetic behavior with high saturation magnetizations and lower remanences but an adjustable increased coercivity is required for improved efficiency. This way, beginning from the core-shell Fe@Pt nanoparticles and by using a proper thermal treatment, an additional magnetically ordered FePt alloy shell with L₁₀ phase can be realized. The resulted coercivity of the system is increased with one order of magnitude. The properties of the composites were investigated by TEM, HRTEM, XRD, XPS, XAS and magnetization measurements.

[1] R Turcu, O Pana, A Nan, I Craciunescu, O Chauvet, C Payen, J.Phys.D:Appl.Phys.41,24502 (2008);
 [2]O. Pana, M.L. Soran, C. Leostean, S. Macavei, E. Gautron, C.M. Teodorescu, N. Gheorghie, O. Chauvet, J.Appl.Phys.111, 044309(2012)

O-1

Impurity levels in ε -GaSe single crystals doped with Eu

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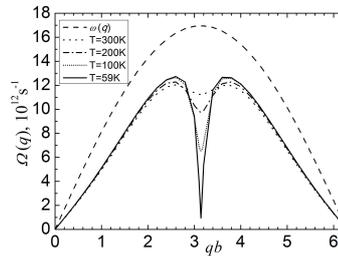
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In this work emission, photoluminescence (PL) and optical absorption spectra of ε -GaSe lamellas doped with Eu (from 0.02 to 1.00 at. %), at temperatures between 78

	<p>and 300 K, are studied. Single crystals were grown by Bridgman technique, from component elements, Ga (5N) and spectrally pure Se. During chemical synthesis of GaSe, Eu doping (addition of controlled amounts) has been performed. Structural features of GaSe (weak interaction between component Se-Ga-Ga-Se packings, in comparison with strong covalent bonding inside them) facilitate formation of at least 2 types of localized states. Eu impurity atoms (at low concentrations) do fill up Ga vacancies and form Eu^{3+} luminescent centres. For increased doping concentrations, impurity atoms (in free state) localize between stratified packings, or form chemical bonds with Se atoms belonging to neighboring packings. At 0.025 at. % Eu concentration, the absorption edge of GaSe lamellas has an excitonic nature. The edge absorption band with narrow contour was ascribed to $n = 1$ free excitons. The edge PL band corresponds to localized excitons with binding energy of about 10 meV. For doping concentrations from 1a 0.068 at. % to about 0.5 at. %, optical effects determined by Eu^{3+} centres become manifest. At photon energies greater than that of direct free excitons, a weaker absorption band is also emphasized. In this spectral range a PL band, intensity of which increases together with doping concentration, is also emphasized. At the same time, changes in the structure of impurity PL band occur, especially at about 1.0 at. % doping levels. From the analysis of PL thermal quenching, energy of impurity levels, through which nonequilibrium charge carrier recombination takes place, is determined.</p>
<p>O-2</p>	<p>The influence of the magnetically induced phase condensation on the static magnetization of aqueous magnetic colloids <u>Oana MARINICA</u>^{1,2}, Camelia DAIA³, Vlad SOCOLIUC³ ¹<i>Research Center for Engineering of Systems with Complex Fluids, "Politehnica" University of Timisoara, 1 M. Viteazu Ave., RO-300222, Timisoara, ROMANIA</i> ²<i>Faculty of Physics, West University of Timisoara, 4 V.Parvan Ave., RO-300223, Timisoara, ROMANIA</i> ³<i>Center for Fundamental and Advanced Technical Research, Romanian Academy - Timisoara Branch, 24 M. Viteazu Ave., RO-300223, Timisoara, ROMANIA</i></p> <p>The Langevin model for the magnetization of magnetic nanocolloids assumes that the magnetic nanoparticles are homogeneously dispersed in the liquid matrix. This assumption is no longer valid in the case of the magnetic nanocolloids that exhibit magnetically induced phase condensation, as a result of which the colloid becomes a nonhomogeneous biphasic system at equilibrium. The condensed phase drops, micron sized prolate ellipsoids elongated in the direction of the external magnetic field, float in the matrix of the depleted phase. Several types of aqueous magnetic colloids with magnetite nanoparticles were investigated. The size and shape statistics of the nanoparticles were determined from Transmission Electron Microscopy pictures. The statistics of the spontaneous clusters' hydrodynamic diameter were obtained from Dynamic Light Scattering measurements. The size and shape of the magnetically induced condensed phase drops were determined from Optical Microscopy observations. The temperature and magnetic field dependence of the magnetically induced phase condensation kinetics was investigated by means of Static Light Scattering experiments. The static magnetization curves of the samples were measured by means of Vibrating Sample Magnetometry. The magnetization curves of the magnetic colloid samples show abnormal high initial susceptibility. In the case of some samples, the static magnetization has hysteresis with zero coercive field and zero remanent magnetization. These findings are discussed in correlation with the information from Transmission Electron Microscopy, Dynamic Light Scattering, Optical Microscopy and Static Light Scattering investigations.</p> <p>Acknowledgements: We acknowledge the financial support of the PN-II-PT-PCCA-2011-3.2-0538 - MagNanoMicroSeal.</p>

<p>O-3</p>	<p>Analytic Study of Fermions in Graphene; Heun Functions and Beyond Marina-Aura Dariescu¹, <u>Ovidiu Buhucianu</u>¹, Ciprian Dariescu¹ ¹<i>Theoretical Physics, Al. I. Cuza" University, Iasi, Romania</i></p> <p>Recently, the so-called Heun functions have been intensively worked out, in a whole range of situations relevant to physics, chemistry and engineering. In the present paper, we focus on physically interesting cases which can be investigated using the corresponding series expansions, for some ranges of the parameters. Starting with the Dirac equation, we express the wave functions of massless fermions, evolving in orthogonal electric and magnetic fields, in terms of Heun Biconfluent functions. When these truncate to a polynomial form, one may easily compute the essential components of the conserved current density. For a vanishing electric field, we get the familiar Hermite associated functions and discuss the current dependence on the sample width. In the opposite case, corresponding to an electric static field alone, one has to deal with HeunB functions of complex variable and parameters.</p> <p>[1] F. M. Arscott, Heun's Equation, in Heun's Differential Equations (A. Ronveaux, Editor), Oxford University Press, Oxford and New York, 1995. [2] O. Buhucianu, Acta Physics Polonica B, 43, No. 3, (2012), 397-404.</p>
<p>O-4</p>	<p>New results in the theory of metallic ultra-thin films <u>Victor Barsan</u>¹ ¹<i>Theoretical Physics, Center for Nuclear Physics, National Institute of Physics and Nuclear Engineering, Magurele, Bucharest, Romania</i></p> <p>Modern experimental techniques allow the preparation of ultra-thin films, even with one or two monolayers. The physical behavior of films depends oscillatory on the number of monolayers. This fact might have interesting applications: for instance, as the work function of the film changes with the number of monolayers, the chemistry of the surface changes too. So, the chemistry of the surface can be tuned – a quite remarkable property. The calculation of physical properties of ultra-thin metallic films must be done using accurate solutions of the ‘particle-in-a-box’ problem. The approximation used till now in the literature cannot correctly describe these films. Examples of such accurate calculations are given in this contribution.</p>
<p>P-1</p>	<p>Effect of Peierls Phase Transition on the Phonons Spectrum in Quasi-One-Dimensional Organic Crystals Anatolie Casian¹, <u>Viorel Duscic</u>², Silvia Andronic¹ ¹<i>Faculty of Computers, Informatics and Microelectronics, Technical University of Moldova, Chisinau, Republic of Moldova</i> ²<i>Faculty of Physics and Engineering, State university of Moldova, Chisinau, Republic of Moldova</i></p> <p>The aim of this paper is to investigate the Peierls structural phase transition and its effect on the spectrum of phonons in quasi-one-dimensional organic crystal TTF-TCNQ (tetrathiofulvalinium-tetracyanoquinodimethane). The crystal model that takes into account two more important mechanisms of electron-phonon interaction is used. The first mechanism is similar to that of the polaron with the only difference that the question is about the induced polarization of the molecules surrounding the conduction electron. The second mechanism is similar to that of deformation potential. The ratio of the amplitudes of intensities of the first mechanism to the second one determines the parameter γ which is expressed through the crystal parameters. The scattering of electrons by impurities is neglected. In order to determine the renormalized spectrum of phonons $\Omega(q)$ the retarded Green function of the phonons has been calculated and the technique of Feynman diagrams for the Green function dependent on temperature has been applied. The numerical calculations of dependences $\Omega(q)$ for the parameter $\gamma = 1.6$</p>

and different temperatures are presented in the attached figure. Together with the dependences $\Omega(q)$, the dependence $\omega(q)$ for initial phonons in the interval $0 < qb < 2\pi$ (b is the lattice constant) is presented as well.



Numerical calculation of $\Omega(q)$ dependence for $\gamma = 1.6$.

It is seen that for whole interval of q the value of frequency $\Omega(q)$ is smaller than that of $\omega(q)$. This means that electron-phonon interaction diminishes the coefficient of lattice elasticity. In the vicinity of $qb \approx \pi$ the dependences $\Omega(q)$ obtain pronounced minimums whose depth increases together with temperature decrease. At $T = 59$ K $\Omega(q)$ becomes practically equal to zero. At this T in the middle of the interval $0 < qb < 2\pi$, when $qb = \pi$, a new edge of the Brillouin zone appears. As a result, the lattice constant doubles and the Peierls structural transition takes place. The critical Peierls temperature is equal to 59 K and corresponds to experimental data for the crystals of TTF-TCNQ.

P-2

Structure of Titania Aerogels by Reverse Monte Carlo Modeling

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Nanosized materials derived from TiO_2 have been extensively investigated for vast applications, including photocatalysis, and for the development of photoelectrodes used in solar-hydrogen production. [1]. Much attention has been spent to annealing-induced phase transformation from amorphous nanosized- TiO_2 to nanocrystalline ones (i.e. anatase or rutile). Generally, structure and photocatalytic activities of nanoparticles greatly depend on their size and on atomic short-range order. In our work, we report the effect of the temperature treatment on the microstructure of the nanocrystalline titania aerogels. Ultrafine (2 - 3 nm) titania aerogels nanoparticles show only diffuse scattering by conventional powder x-ray diffraction. We used wide-angle x-ray scattering (WAXS) to probe the atomic correlations in this amorphous material. The atomic pair-distribution function (PDF) derived from Fourier transform of the WAXS data was used for reverse Monte Carlo (RMC) simulations of the atomic structure of the small nanoparticles. Reverse Monte Carlo (RMC) modeling [2] provides a powerful method for deriving three-dimensional simulations of the atomic arrangements of disordered materials. The atoms in a periodic model are moved at random and the moves are accepted or rejected in such a way as to minimise the difference between experimental $S_{\text{exp}}(q)$ and RMC simulated $S_{\text{RMC}}(q)$ X-ray structure factor, respectively. The experimental $S_{\text{exp}}(q)$, has been obtained by PDF X-ray data analysis using the RAD computer program [3]. Structural properties of amorphous titania aerogels nanoparticles, heat treated at 450°C and 550°C, have been analyzed in detail through the radial distribution functions $G(r)$ resulted from the RMC modeling. The pre-existence of the anatase-like core may be critical to the formation of single-phase nanocrystalline anatase in crystallization of amorphous TiO_2 upon heating.

	<p>[1] E. Indrea et al. <i>J. Alloys Comp.</i> 483 (2009) 445-449 [2]. D A Keen et al. "Reverse Monte Carlo modelling of crystalline disorder", <i>J. Phys. Condens. Matter</i> 17 (2005) S15-S22. [3] V. Petkov, <i>J. Appl. Cryst.</i> 22 (1989) 387-389.</p>
<p>P-3</p>	<p>Photoluminescence of Gallium Monosulfide Lamellas Intercalated with Cd Iuliana Caraman¹, Elmira Vatavu², Liviu Leontie³, <u>Silvia Evtodiev</u>², Oxana Racovet¹ ¹<i>Faculty of Engineering, Vasile Alecsandri University of Bacau, Bacau, Romania</i> ²<i>The Laboratory of Scientific Research Photonics and Metrology Physics, State University of Moldova, Chisinau, Republic of Moldova</i> ³<i>Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i></p> <p>Gallium monosulfide (GaS) is a III–VI layered material with an indirect band gap of 2.521 eV at 78 K and of 2.5 eV at room temperature [1]. An increasing interest in the study of optical properties is seen over the last years, because it holds promise for visible photoelectronic device applications in visible range [2]. Concentration of electrons in undoped crystals, at 300 K, is under $2 \times 10^{13} \text{ cm}^{-3}$. P and Zn doping of GaS doesn't significantly influence concentration of free charge carriers. The prospect for using this material in photoelectronic applications requires increased concentration of majority charge carrier and obtaining <i>p</i>-type single crystals. It is also known that impurity atoms, at low concentrations, liquidate the structural defects present in metal sublattice, while at increased concentrations they localize preponderantly between stratified packings, thus creating two types of impurity levels. In this work photoluminescence (PL) of GaS lamellas intercalated with Cd from vapor phase is examined. The starting GaS single crystals were obtained by Bridgman technique from component elements Ga (5N) and S (spectrally pure). From bulk single crystals plan-parallel plates (lamellas), exhibiting optical transparency and mirrored surfaces, have been split along the cleavage planes. As obtained lamellas were annealed (under normal ambient conditions), at temperatures between 723 and 823 K, for 1 to 24 h. Photoluminescent emission, in temperature range 78–300 K, of both unintercalated and intercalated GaS samples has been analyzed. The PL spectrum of unintercalated samples, at 78 K, is composed of two bands, one located in the region of fundamental absorption edge, of donor-acceptor recombination nature and other, determined by conduction band (CB)-to-impurity recombination. Structure of PL bands maintains in the case of intercalated GaS samples: two bands, located at 2.14 eV and 1.95 eV, are emphasized. As the temperature increases from 78 to 300 K, complete PL quenching of edge bands and exponential quenching of CB-to-impurity recombination band take place. Energies of localized levels responsible for PL emission of original and intercalated crystals have been determined.</p> <p>[1] B. S. Razbirin, M. I. Karaman, V. P. Mushinskii, A. N. Staruchin, <i>Fiz. Tekh. Poluprovodn. (St.-Petersburg)</i> 7 (6) (1973), 1112–1116. [2] N. Okamoto, N. Hara, H. Tanaka. <i>IEEE Trans. Electron Devices</i> 47 (12) (2000) 2284-2289.</p>
<p>P-4</p>	<p>Photoelectric Effects in Heterojunctions Based on Lamellar III–VI Semiconductors and Metal Oxides <u>Igor Evtodiev</u>¹, Mihail Caraman¹, Gabriel Lazar² ¹<i>The Laboratory of Scientific Research Photonics and Metrology Physics, State University of Moldova, Chisinau, Republic of Moldova</i> ²<i>Faculty of Engineering, Vasile Alecsandri University of Bacau, Bacau, Romania</i></p> <p>At present there is great attention paid to the investigation of III–VI-based structures, motivated by possibility to use them as polarization-sensitive devices with wide spectral sensitivity, from 300 to 1000 nm. GaSe and InSe are most frequently used III–VI semiconductors for this purpose, because their energy gaps, of 1.9 and 1.2 eV, respectively, are situated in the region of maximum solar conversion efficiency.</p>

	<p>Specific structural features of GaSe and InSe enable relative displacement of the atomic planes (of Se and Ga/In) within the packages, leading to structures with a large concentration of native defects. Presence of these defects in III–VI heterojunction component determines high stability of its characteristics under exposure to high-energy radiations and particles. By heat treatment at temperatures (723–823 K), under normal ambient conditions or in oxygen rich atmosphere, native oxide (Ga_2O_3 and In_2O_3) layers with high electric conductivity and optical transparency up to the vacuum-UV frontier are formed on the samples surface. Freshly cleaved lamellar samples exhibit atomically flat surfaces, with closed valence bonds, which favor good adhesion of other metal oxides. In this work, optical and photoelectric properties of GaSe and InSe, as well as photoelectric characteristics, charge carrier transport mechanisms, relaxation and generation-recombination processes at the interface of GaSe (InSe)/[metal (Bi, Zn, Sn, Cu and Cd) oxide and native oxide] heterojunctions are studied. From the analysis of spectral and temperature dependences of photocurrent, energy level diagram illustrating recombination of nonequilibrium charge carriers was proposed. Technological parameters which significantly influence mean free path of charge carriers in the contact region of heterojunctions, as well as photon-to-current conversion efficiency are highlighted. The marked optical anisotropy of GaSe and InSe determines polarization photosensitivity of heterojunctions with the contact region parallel to C_6 axis of these materials. Through complex investigations suitability of III–VI/metal oxide structures for use in UV and X-ray receivers is emphasized.</p>
<p>P-5</p>	<p>Impurity levels in ϵ-GaSe crystals intercalated with Cd from vapor phase Liliana Dmiroglu¹, <u>Silvia Evtodiev</u>¹, Efimia Luchian¹, Iuliana Caraman², Marius Stamate², Liviu Leontie³</p> <p>¹<i>The Laboratory of Scientific Research Photonics and Metrology Physics, State University of Moldova, Chisinau, Republic of Moldova</i> ²<i>Faculty of Engineering, Vasile Alecsandri University of Bacau, Bacau, Romania</i> ³<i>Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i></p> <p>Impurity levels induced in GaSe by doping with group II (Zn and Cd) elements during chemical synthesis of compound are intensively investigated, own to encouraging perspective of using this material as base photoactive element in photovoltaic cells. Cd atoms at concentrations from 0.01 at. % up to 1.0 at. % engender both acceptor and deep donor impurity levels within GaSe forbidden band. During synthesis of GaSe, Cd atoms preponderantly occupy metal sublattice sites, and for increased concentration they localize between Se planes of neighboring Se-Ga-Ga-Se packings. Besides, Cd intercalated atoms are localized between stratified packings in either neutral state or generating Cd-Se valence bonds. In this work, from the analysis of luminescent (PL) emission in temperature range between 78 K and 300 K, as well as of PL thermal quenching, energy of deep localized levels, active in radiative recombination of nonequilibrium charge carriers is determined. Intercalation of GaSe lamellas with Cd was accomplished by submitting them to a heat treatment with duration from 10 min up to 24 h, in Cd vapor atmosphere, at temperatures from 723 K to 853 K. Cd concentration was varied by modifying annealing temperature and initial Cd amount within quartz ampoules. Structure of PL bands laying in the spectral regions of both direct and indirect excitons, as well as of impurity PL bands of intercalated samples was examined. Short intercalation treatment at 723–753 K strongly influences formation of shallow localized levels at which excitons with binding energy of ~ 10 meV are bound. Long annealing (24 h) at temperature 823–853 K leads to a rather large defect concentration that effectively shields the exciton bonds, including those of CdSe clusters. Temperature dependence of PL intensity is also analyzed and energy of recombination levels, through which respective bands are formed, is determined.</p>

<p>P-6</p>	<p>Optical properties of gallium tellurides (GaTe and Ga₂Te₃) in thin films prepared by vacuum thermal evaporation Liviu Leontie¹, Nicolae Spalatu², Mihail Caraman², Oxana Racovet² ¹<i>Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i> ²<i>The Laboratory of Scientific Research Photonics and Metrology Physics, State University of Moldova, Chisinau, Republic of Moldova</i></p> <p>GaTe and Ga₂Te₃ are stable binary phases of Ga–Te system, which at temperatures of 1097 K and 1063 K exhibit monoclinic and cubic structures, respectively. GaTe belongs to layered III–VI semiconductor group. Its crystals display easy cleavage in plan-parallel single crystalline lamellas of different thicknesses, ranging from micrometer down to nanometer size. Ga and Te atoms in cubic lattice of Ga₂Te₃ arrange so that 2/3 of the sites in the metal sublattice sites are occupied. Presence of large vacancy concentration in Ga₂Te₃ and of lamellar structures in GaTe determines to a great extent electric and optical properties of respective materials. GaTe and Ga₂Te₃ thin films were prepared by vacuum (5×10^{-5} Torr) thermal evaporation of compounds, previously synthesized from component elements Ga (5N) and Te (5N). Gallium tellurides films with thickness ranging from 0.1 μm up to 30 μm have been deposited on glass substrates, heated from room temperature to 473 K. For submicron thickness, GaTe and Ga₂Te₃ films with mirrored surfaces were obtained, while for thickness by 10 μm or more, granular structures are clearly emphasized. XRD analysis revealed polycrystalline character of both GaTe and Ga₂Te₃ samples. Transmittance and reflectance spectra, at 78 and 300 K, in the region of fundamental absorption edge, have been measured, from which the character of optical transitions has been established and optical band gap of films has been determined as a function of substrate temperature. From the analysis of interferential transmission spectra the dispersion of the refractive index in vicinity of the absorption edge of GaTe films has been determined. GaTe films exhibit direct optical transitions with increased optical band gap (E_g) from 1.58 to 1.62 eV, with decreasing substrate temperature from 473 K to 298 K. Ga₂Te₃ films display both direct transitions with $E_g = 1.3$ eV and indirect ones, with $E_g = 1.2$ eV at $T = 298$ K.</p>
<p>P-7</p>	<p>Fabrication of a periodic array of noble metal nanowires, partially embedded into an alumina template Sorina GARABAGIU¹ ¹<i>Nanostructured Physics Systems, National Institute for R&D of Isotopic and Molecular Technologies, Cluj-Napoca, Romania</i></p> <p>Anodic aluminium oxide (AAO) is used as template for the synthesis of some nanostructures (mainly nanotubes and nanowires), from various classes of materials: metallic, magnetic, polymeric, or even multilayer deposition of metals [1]. Metallic nanowires are embedded into the nanometric channels of an anodic aluminium oxide membrane by electrochemical deposition techniques. In the present work, I propose a simple method for the fabrication of a free standing array of noble-metal nanowires, using AAO as template. First, AAO was obtained by anodization of aluminium in oxalic acid. Then silver was deposited into the pores of AAO, using alternative current deposition technique. The final step was the controlled dissolution of alumina that surrounds the nanowires (using a method developed in our lab [2]), such as the tips of the wires stand freely, and the ends are embedded into the template. The remaining insulating template confers the nanowires electrical insulation. The array thus fabricated has potential applications in sensors and biosensors, as SERS substrate.</p> <p>[1] Ali Eftekhari - <i>Nanostructured Materials in Electrochemistry</i> -Wiley-VCH, 2008 [2] Garabagiu S., Mihailescu G. – <i>Materials Letters</i>, 65 (2011), 1648–1650</p>

<p>P-8</p>	<p style="text-align: center;">Structural modifications induced by the presence of the tetramethyldisiloxane moiety in Schiff base-Cu(II) complexes Alina Soroceanu¹, Maria Cazacu¹</p> <p>¹<i>Inorganic Polimers, Institute of Macromolecular Chemistry "Petru Poni", Iasi, Romania</i> ²<i>Inorganic Polimers, Institute of Macromolecular Chemistry "Petru Poni" City: Iasi, Iasi, Romania</i></p> <p>A series of new transition metal complexes based on ligands containing a tetramethyldisiloxane group have been investigated by X-ray single crystal diffraction. A critical analysis of the results was done to identify the structural modifications induced by the presence of this group, which possesses unusual features (Si–O bond length of 1.63 Å that is smaller as compared with the sum of ionic radii of the two involved atoms, high and variable bond angle around the O atom, ranging between 135 and 180° with an energy minimum at 145°). Samples containing appropriately pure organic flexible segments were considered as references.</p> <p>[1] D. A. Atwood, M. J. Harvey, Chem Rev., 2001, 101, 37. [2]. Y. Shimazaki, T. Yajima, F. Tani, S. Karasawa, K. Fukui, Y. Naruta, O. Yamauchi, J. Am. Chem. Soc., 2007, 129, 2559.</p>
<p>P-9</p>	<p style="text-align: center;">Preparation and investigation of potentiality of Co_xFe_{1-x}Fe₂O₄ for hyperthermia applications Anamaria Doaga¹, Alina Mihaela Cojocariu¹, Walid Amin², Florian Heib², Philip Bender³, Rolf Hempelmann², <u>Ovidiu Florin Caltun</u>¹</p> <p>¹<i>Faculty of Physics, Alexandru Ioan Cuza University, Iasi, Romania</i> ²<i>Physical Chemistry, Universität des Saarlandes, Saarbrücken, Germany</i> ³<i>Experimental Physics, Universität des Saarlandes, Saarbrücken, Germany</i></p> <p>Magnetic nanoparticles are more and more often used in different medical applications like materials for magnetic fluid hyperthermia. In this paper, we have explored the possibility of use of Co_xFe_{1-x}Fe₂O₄ nanoparticles ferrite, with x varying between 0-1, in hyperthermia. Water based ferrofluids of substituted ferrites Co_xFe_{1-x}Fe₂O₄ were prepared by co-precipitation method and characterized. The structural properties were determined by an X-ray diffractometer using CuKα radiation and a Transmission Electron Microscope. The crystallite size of the particles was calculated with Scherrer's formula and the values were found in the nanometers domain. With transmission electron microscope it observed the cubic shape of nanoparticles and the average particle size of the samples was in good accordance with those obtained from XRD. Magnetic characterizations of the nanoparticles were carried out at room temperature by using a vibrating sample magnetometer and show a superparamagnetic behaviour. The specific absorption rate (SAR) was measured by calorimetric method at two frequencies of 400 and 1950 kHz. It has been observed that the specific absorption rate value depends on the chemical formula, the applied magnetic fields and the frequency.</p> <p>D.H. Kim, D.E.Nikles, C.S.Brazel, Synthesis and characterization of multifunctional chitosan-MnFe₂O₄ nanoparticles for magnetic hyperthermia and drug delivery, J MATER 3 (2010) 4051-4065.</p>
<p>P-10</p>	<p style="text-align: center;">Optimisation of uniform zinc oxide nanowire growth conditions Nare Gabrielyan¹, <u>Shashi Paul</u>¹</p> <p>¹<i>Emerging Technologies Research Centre, De Montfort University, Leicester, UK</i></p> <p>Recently ZnO nanostructures have gained particular attention among many semiconductor nanostructures due to their profound application in many high-performance electronic devices, including light emitting diodes, photodetectors, solar cells, actuators and chemical and bio sensors. Although a variety of techniques have</p>

	<p>been used to fabricate these structures, aqueous growth technique using ZnO layer as a nucleation site has gained much attention due to no metal catalyst involvement in the process, thus reducing the risks of possible contamination. This work focuses on the optimisation of growth conditions for uniform and evenly distributed zinc oxide (ZnO) nanowire arrays. Nanowire growth is carried out by two step processes. Firstly a ZnO nucleation layer is deposited onto a silicon substrate by means of room temperature radio-frequency (RF) magnetron sputtering. Secondly ZnO nanowires are hydrothermally grown from the aforementioned layer using it as a nucleation template. Two sets of experiments have thoroughly been conducted in order to optimise the nanowire growth: (I) RF deposition of different thicknesses of ZnO nucleation layers followed by the corresponding hydrothermal growth step at the same conditions for each thickness and (II) the hydrothermal growth solution temperature variation for the nucleation layers of the same thicknesses. In addition, the hydrothermal growth duration influence has been studied and the competitive homogeneous and heterogeneous crystallization of the micro- and nanowires respectively. This study suggests that the nanowire size strongly depends on the nucleation layer thickness and structural properties, as well as solution temperature and growth duration. It also shows that the homogeneous crystallization becomes more obvious at higher growth temperatures.</p> <p>References</p> <p>[1] Gabrielyan, N., S. Paul, Proceedings of SPIE, 2012. 8414: art. no. 841407 [2] Gabrielyan, N., S. Paul, R.B.M. Cross, MRS Proceedings, 2010. 1201, pp. 295-300 [3] Cross, R.B.M., M.M. De Souza, and E.M. Sankara Narayanan, Nanotechnology, 2005. 16(10):p. 2188-2192 [4] Fan, Z. and J.G. Lu, Journal of Nanoscience and Nanotechnology, 2005. 5(10):p.1561-1573</p>
<p>P-11</p>	<p>Synthesis and functionalization of magnetic nanoparticles with possible application in drug delivery systems</p> <p>Alina Mihaela Cojocariu¹, Anamaria Doaga¹, Walid Amin², Eva Marie Prinz², Philip Bender³, Rolf Hempelmann², <u>Ovidiu Florin Caltun</u>¹</p> <p>¹Faculty of Physics, Alexandru Ioan Cuza University, Iasi, Romania ²Physical Chemistry, Universität des Saarlandes, Saarbrücken, Germany ³Experimental Physics, Universität des Saarlandes, Saarbrücken, Germany</p> <p>In the last few decades magnetic nanoparticles caught the attention of researchers due to their multifunctionality in cancer research, both in terms of the diagnostic and the treatment field. Nanoparticle systems are studied for applications in more specific disease detection, targeted drug delivery, enhancing the magnetic resonances images contrast, hyperthermia, etc. Nanoparticles seem to be a solution in developing new methods of targeted drug delivery through the use of nanotechnology. By functionalizing nanoparticles abnormal tissues can be identified and the medicine can be released with higher efficiency. The present study consists in the preparation, characterization and functionalization of $Mn_xZn_{1-x}Fe_2O_4$ ($x=0, 0.2, 0.4, 0.6, 0.8, 1$) ferrite nanoparticles. The ferrofluid was prepared by the method of co-precipitation and was characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), zetapotential and vibrating sample magnetometer (VSM). For achieving magnetic nanoparticles that could be used in biomedical applications, the fact that they have to be biocompatible and biodegradable has to be considered, regardless of the way in which they were functionalized and regardless of their different coatings. In our study the nanoparticles were coated with oppositely charged polyelectrolytes (PAH and PAA) using the layer-by-layer technique [1]. After coating with each layer, measurements of pH, zetapotential and Fourier transform infrared spectroscopy (FTIR) has been performed in order to confirm the binding between the polyelectrolytes and magnetic nanoparticles.</p>

[1]Gupta AK, Gupta M (2005) Synthesis and surface engineering of iron oxide nanoparticles for biomedical applications. *Biomaterials* 26:3995–4021.

P-12 Collision Induced Dissociation and Crossed Beam Scattering Studies of Oxygen Rich Iron Oxide Clusters

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In our laboratory, iron oxygen rich clusters were formed in gas phase through the mixing of laser ablation produced iron vapors with molecular oxygen. The formation efficiency and their stability were evaluated through mass spectrometry based collision induced dissociation experiments and theoretical structures for the most abundant species were obtained by *ab initio* calculations. The measured collision cross sections were found to be similar to geometrical cross section of the calculated structures for most species and the only discrepancy observed for FeO₁₀ was explained by its unusually higher stability.

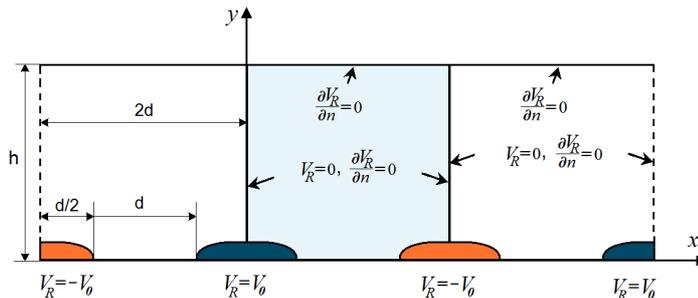
P-13 Flow rate influence on the nanoparticle distribution in microfluidic devices under dielectrophoresis

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Dielectrophoresis (DEP) in microchannels with interdigitated electrodes is one of the most promising tools used in the control of the nanoparticles manipulation in fluid media. Dielectrophoresis is a phenomenon that induces spatial movement of polarizable particle placed in a nonuniform electric field, depending on the electric properties of the particles and the surrounding medium. This paper presents a set of numerical results concerning the influence of flow rate on concentration distribution profile of nanoparticles suspended in a dense and viscous fluid in a microfluidic channel under DEP.



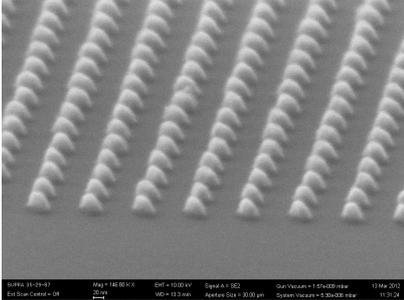
A schematic representation of computational domain with geometrical proportions and boundary conditions for the real part V_R of the electric potential.

The numerical study is performed in the frame of a two-dimensional mathematical model, the governing equations being solved, together with the appropriate boundary conditions, using a code based on the finite element method. This type of analysis leads to the optimization of the control parameters and is crucial in the designing process of an experimental microfluidic device with application in the separation of submicronic particles.

Crews N., Darabi J., Voglewede P., Guo F. & Bayoumi A., 2007. An analysis of interdigitated electrode

	<p>geometry for dielectrophoretic particle transport in micro-fluidics. <i>Sensors and Actuators B</i> 125, pp. 672–679.</p>
P-14	<p>Laser ablation of aluminum targets for nanoparticles generation Ileana Apostol¹, Dan Apostol¹, <u>Mihaela Bojan</u>¹, Victor Damian¹, Iuliana Iordache¹, Cristian Udrea¹, s Manoiu¹ ¹<i>laser, INFLPR, Magurele, Romania</i></p> <p>Generation of nanoparticles by laser ablation of solid targets situated in liquid took advantage in the last years due to the versatility of the method and cheap production set-up. The method can be applied to a large class of materials due to the possibility to ablate under the action of laser radiation very hard but also soft materials with a proper selection of incident laser radiation parameters, the possibility to induce high temperatures and high pressure in a very localized region, the high purity of the obtained nanoparticles and the in-situ nanoparticle storage in the surrounding liquid. Also the storage of the nanoparticles in suspension has the advantage of the possibility to use a high variety of liquids, but also to ensure a safe manipulation of the nanoparticles. We have used the so called laser ablation in liquids (LAL) method to produce nanoparticles from pure aluminum targets. The interest for aluminum and aluminum oxide nanoparticles is related with their exothermal oxidation reaction and hydrogen storage application for energetics. We have used a pulsed nanosecond Nd:YAG laser working at 355 nm to ablate the pure aluminum ingots situated in water. In order to select the proper irradiation conditions due to the strong dependence of the ablation process on the fluence/intensity of the laser radiation a preliminary study of the ablation print was realized with optical microscopy and white light interferometry. We have obtained nanoparticles with diameters of 3-5 nm, organized in clouds of 40 - 80 nm dimension but also nanoparticles of 20-40 nm, as the TEM analyses has evidenced. The incident laser fluence was in this case about 12 J/cm². Higher nanoparticles dimensions, between 16 and 90 nm were obtained for higher incident fluencies and a high number of laser pulses.</p>
P-15	<p>Synthesis and Structural Characterization of AAO/Cobalt Nanocomposite G. Calin¹, G. Zodieriu¹, E. Vasile², R. Trusca², F. Iacomi¹ ¹<i>Faculty of Physics, “Alexandru Ioan Cuza” University of Iasi, 11 Carol I Blvd. Iasi, Romania</i> ²<i>SC METAV-Research and Development SA, 31C A Roseti Street, Bucharest 2, Romania</i></p> <p>Metallic nanotubes have attracted the interest of researchers due to their fundamental importance and potential applications in nanodevices, sensors, catalysts and conversion / energy storage [1, 2]. AAO/Cobalt nanocomposite was obtained by using a sol-gel method that uses ultrasonic vibrations to induce the penetration of a colloidal solution through the pores of an anodized aluminum oxide (AAO) template. The AAO template, with the sol into its pores, was annealed at 648 K. The entire ‘dip–anneal–dip’ process was repeated three times. Finally, the metal nanotubes were formed by further annealing at 873 K in hydrogen atmosphere for 1 h. The morphology and structure of AAO matrix were investigated by using XRD and SEM methods. HRTEM and EPR analysis evidenced the formation of metal nanotubes in the AAO matrix.</p> <p>[1]Zhu Y C, Zheng H G, Li Y, Gao L S, Yang Z P and Qian Y T 2003 <i>Mater. Res. Bull.</i> 38 1829 [2]Wang Q T, Wang G Z, Han X H, Wang X P and Hou J G 2005 <i>J. Phys. Chem.</i></p>

<p>P-16</p>	<p>Nanostructured hybrid materials based on cellulose acetate and zinc oxide G. Calin¹, I. Stoica², L. Olaru², F. IACOMI¹, N. Olaru² ¹<i>Faculty of Physics, "Alexandru Ioan Cuza" University of Iasi, Iasi, 700487, Romania</i> ²<i>"Petru Poni" Institute of Macromolecular Chemistry, Aleea Grigore Ghica-Voda 41 A, Iasi, 700487, Romania</i></p> <p>ZnO nanoparticles are known for their antibacterial efficiency and photocatalytic activity under visible light. One can expect that these effects could be more pronounced when these nanoparticles are embedded in polymeric nanofiber matrices. In this paper a method is described for obtaining hybrid materials of cellulose acetate nanofibers containing ZnO nanoparticles, using for this purpose the electrospinning procedure. The process was performed in several steps: first, a "precursor" solution of ZnO nanoparticles was prepared by treating a solution of zinc acetate in 2-methoxyethanol with NaOH then heating the obtained Zn(OH)₂ solution at 60 °C for 2 h to convert Zn(OH)₂ to ZnO nanoparticles. The CA solution for electrospinning experiments was prepared using as a solvent the "precursor" solution of ZnO nanoparticles. Electrospinning of the obtained polymer solution gave cellulose acetate nanofibers of about 300 nm containing ZnO nanoparticles of about 20 nm. For comparison, films of CA with ZnO nanoparticles have been obtained from the same solution used for electrospinning. SEM and AFM methods are used to investigate the structure and morphology of the obtained composites. By thermal treatment at 150 °C for 5 h of CA film composites, a slight increase of ZnO nanoparticles size has been observed (to about 30 nm).</p>
<p>P-17</p>	<p>Magnetic and structural behaviour of R₂Fe₁₄B/α-Fe (R=Nd, Nd+Dy) magnetic nanocomposite Simona Gutoiu^{1,2}, Eugen Dorolti², Olivier Isnard³, Ionel Chicinas⁴, Ioan-Ovidiu Pana¹, Viorel Pop² ¹<i>Physics of Nanostructured Systems, National Institute for R&D of Isotopic and Molecular Tehnology, Cluj-Napoca, Romania</i> ²<i>Departamentul de Fizica Starii Condensate si a Tehnologiilor Avansate, Babes-Bolyai University, Cluj-Napoca, Romania</i> ³, <i>Institut Néel, CNRS, Joseph Fourier University, France, Grenoble</i> ⁴<i>Materials Sciences and Technology Dept, Technical University of Cluj-Napoca, Cluj-Napoca, Romania</i></p> <p>Nanocrystalline ferromagnetic materials exhibit magnetic properties which are interesting for fundamental researches in magnetism as well as for applications [1]. 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 [2]. This paper propose a crystallographic, compositional and magnetic study of exchange coupled hard/soft magnetic nanomaterials R₂Fe₁₄B / α-Fe (R=Nd, Nd+Dy) obtained by mechanical milling and annealing. In order to improve the crystallinity of hard magnetic phase and in the same time to hinder the increase of crystallites size of soft magnetic phase, tow type of annealing was done after milling. The first, conventional heat treatment was performed at temperatures range between 450 and 800 °C for long time. The second, rapid annealing was performed at temperatures between 700 and 800 °C for maximum 3 minutes. The better crystallographic and magnetic properties were found for rapid annealed samples. This behaviour was explained by a better crystallinity of hard magnetic phase and suitable crystallite dimensions of soft magnetic phase. The properties of the composites were investigated by X-ray diffraction (XRD) and X-ray Photoelectron spectroscopy (XPS). The magnetic behaviour was checked from hysteresis curves and dM/dH vs H plots.</p> <p>[1] O. Gutfleisch, A. Bollero, A. Handstein, D. Hinz, A. Kirchner, A. Yan, K. H. Muller and L. Schultz, J.</p>

	<p>Magn. Magn. Mater. 242-245, 1277 (2002). [2] E. F. Kneller, R. Hawig, IEEE Trans. Magn. 27 (1991) 3588.</p>
<p>P-18</p>	<p style="text-align: center;">Areas of EBL dots for Surface Enhanced Raman Spectroscopy</p> <p style="text-align: center;"><u>Teodora Ignat</u>¹, Adrian Dinescu¹, Mihaela Kusko¹, Florea Craciunoiu¹, Monica Simion¹, Adina Bragaru¹, Iuliana Mihalache¹</p> <p style="text-align: center;">¹Laboratory of Nanotechnology, IMT-Bucharest, Bucharest, Romania</p> <p>This paper highlight that lithographed gold nanoparticle (20nm high) with controlled sizes (from 50nm to 500nm) morphologies and positions obtained by EBL technique defined in compact $100 \mu\text{m} \times 100 \mu\text{m}$ areas on silicon substrate provide reproducible, stable and remarkably SERS spectra of 11-mercaptoundecanoic at 2mM concentration in aqueous solution due to plasmonic local-field enhancement. The metallization thickness and dimensions between gold dots were fabricated with different spacings (is varied from 50nm diameter with 50nm internanoparticle distance to 500 nm diameter with 50nm internanoparticle distance) necessary to form hot spots for tree different lasers excitation wavelength: 514nm, 633nm and 785nm.</p>  <p style="text-align: center;">Gold arrays</p> <p>The prepared gold structures on double side polished silicon substrate reveal the relations between plasmons resonance wavelength and laser excitation wavelength on three-dimensional nanostructures. Greater sensitivity on nanoparticle is reached by optimization of the parameters: the nanoparticle geometrical parameters, their optical properties, their functionalization protocol. The results, verificated rigorously by XRD, Impedance, Raman and FTIR Spectroscopys, suggest that this nanoparticles could be used for reproducible SERS/SEIRS sensor. Our study underlines the efficiency of gold nanoparticles arrays in plasmonic sensors for optical sensing and detection in liquid or gaseous environments.</p> <p>Schmidt M., Adv. Mater. 2012, 24, OP11–OP18</p>
<p>P-19</p>	<p style="text-align: center;">Core-Shell Platinum Based Manganite Magnetic Nanoparticles And Functionalized Composites</p> <p style="text-align: center;"><u>SERGIU MACAVEI</u>¹, OVIDIU PANA¹, LOREDANA SORAN¹, MARIA STEFAN¹, CRISTIAN LEOSTEAN¹, SIMONA GUTOIU¹, C BELE², C MATEA²</p> <p style="text-align: center;">¹LSFA, National Institute for R&D of Isotopic and Molecular Technologies, CLUJ-NAPOCA, ROMANIA</p> <p style="text-align: center;">²BIOCHIMIE, University of Agricultural Sciences and Veterinary Medicine, CLUJ-NAPOCA, ROMANIA</p> <p>Platinum based magnetic nanoparticles offer an attractive potential for various applications such as: magnetic separation of biomolecules, bioimaging, diagnostics, drug delivery system, magnetic hyperthermia for cancer therapy and data storage devices. A necessary step to achieve these goals is to obtain nanoparticles controlled properties. In the first stage of the present work, the following system was prepared and</p>

characterized: core-shell $\text{La}_{0.67}\text{Sr}_{0.33}\text{MnO}_3$ (LSMO) manganite nanoparticles covered with platinum (LSMO@Pt). The cores of LSMO@Pt nanoparticles were prepared by using a sol-gel method using diethylenetriaminepent- taacetic acid as the gelificant agent followed by Pt shell formation by using a seeding method. In view of further bio-applications, in the second stage, the nanoparticles were covered with an additional silica shell. The final composition of samples was determined by using X-ray Photoelectron Spectroscopy (XPS). By using SQUID and VSM techniques the magnetic properties as a function of the applied magnetic fields and temperature (field cooling and zero field cooling) reveled the superparamagnetic behavior of the these multi-shell systems. By surface modification of nano-sized silica external shell with different organic functional groups such as amino, thiol, carboxyl etc. some routes to obtain functional conjugated nanoparticles are opened. In the present case. In the second stage, the as prepared hydrophobic LSMO@Pt nanoparticles were redissolved in cyclo-hexane at room temperature and hexanol, Triton X-100 and distilled water were added into solution to obtain a microemulsion. Subsequently, TEOS was added under vigorous magnetic stirring into the system to form the silica shell structure. In order to conjugate BSA-FITC onto the surface of nanoparticles, APTS (3-aminopropyltrimethoxysilane) was used to functionalize the SiO_2 shell. Finally bovine serum albumine –fluorescein isothiocyanate (BSA-FITC) was covalently bound to the Fe@Au@SiO_2 / NH_2 system using EDC/NHS. Luminescent response of water dispersed nanoparticles was investigated by confocal microscopy.

P-20

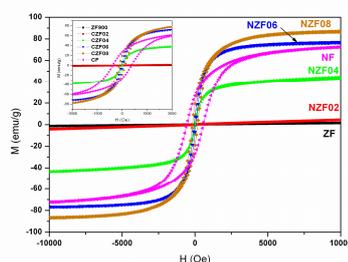
Magnetic and Dielectric Properties of Co-Zn Ferrite Nanoparticles

Tamara Slatineanu¹, Alexandra Raluca Iordan¹, Victor Oancea¹, Mircea Nicolae Palamaru¹, Ioan Dumitru², Cristin Petrica Constantin², Ovidiu Florin Caltun²

¹Faculty of Chemistry, Alexandru Ioan Cuza University of Iasi, Iasi, Romania

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Magnetic nanoparticles as Co-ferrite and Zn-ferrite draw increasing attention due to their remarkable magnetic and dielectric properties influenced by chemical composition, microstructure and processing conditions [1, 2]. Nanocrystalline powders of Co substituted Zn ferrite with the chemical formula $\text{Co}_x\text{Zn}_{1-x}\text{Fe}_2\text{O}_4$, $x=0, 0.2, 0.4, 0.6, 0.8, 1$, were synthesized by sol-gel autocombustion method using tartaric acid as fuel agent. The samples were sintered in static air atmosphere for 7 hours at 773K, 7 hours at 973K and 10 hours at 1173K. The organic phase extinction and the ferrite single-phase formation was monitored by means of FT-IR spectra analysis. The X-ray diffraction (XRD) patterns analysis confirmed the spinel single phase accomplishment.



Hysteresis curves at room temperature for $\text{Co}_x\text{Zn}_{1-x}\text{Fe}_2\text{O}_4$ series.

Crystallite average size, lattice parameter and cation distribution were estimated. Magnetic behavior of the as-obtained samples by means of M-H hysteresis measurements was studied (Fig.1). Dielectric properties of the $\text{Co}_x\text{Zn}_{1-x}\text{Fe}_2\text{O}_4$ series was the subject of a comparative study. The sample with $\text{Co}_{0.8}\text{Zn}_{0.2}\text{Fe}_2\text{O}_4$ exhibit the optimal magnetic and dielectric properties in agreement with the proposed cation distribution.

This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/88/1.5/S/47646] and [grant POSDRU /107/1.5/S/78342].

[1]A.K.M. Akther Hossain et al., J. Magn. Magn. Mater. 320 (2008), 1157–1162. [2] M. Sajjia et al., J. Alloy. Compd. 506 (2010), 400–406.

P-21

Some Effects Of Stirring Procedure On The Microstructural And Magnetic Characteristics Of Hydrocarbon Based Ferrofluid

Dorina Creanga¹, Paul Fannin², Cristian Pirghie³, Mihaela Racuciu⁴

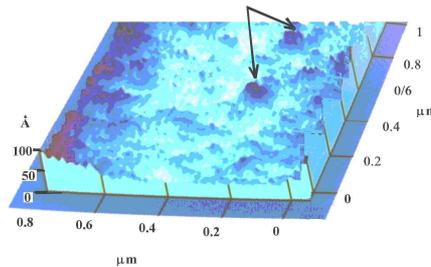
¹Physics, Al. I. Cuza University, Iasi, Romania

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⁴Sciences, Lucian Blaga University, Sibiu, Romania

Magnetic fluids are an important category of soft magnetic materials with various applications in technical and biomedical fields [1-3]. The availability of the preparation methods is balanced by the complexity of the actual procedure involved in the control of structure and properties of these advanced materials. The small ferrophase size as well as the width of its distribution curve need to be assured by the producer since it represent a “sine qua non” condition of magnetic fluid utilization. The stability of magnetic colloidal suspensions is strongly dependent on the solid phase granularity, as summarized by Rosensweig [1], and concerns: stability against sedimentation in a gravitational field, stability against magnetic field gradient, as well as stability against magnetic dipole attraction. Traditionally, steric repulsion among the ferrophase grains in hydrocarbons is controlled by using as surfactant the oleic acid molecules that attach their polar group (carboxyl) to iron ions of ferrophase while their long nonpolar tails are soluble in hydrocarbon carrier fluid. The basic procedure for ferrophase preparation Massart [2] was applied for the co-precipitation of ferric and ferrous oxides in alkali medium so that magnetite nanoparticles and possibly maghemite ones were prepared. Magnetic versus nonmagnetic stirring (for sixty minutes) was applied to favor chemical processes.



AFM image of magnetic fluid prepared by non-magnetic stirring

In both variants, after the solid phase separation the magnetic nanoparticles were coated with oleic acid at high temperature (over 80⁰C) in hexane under continuous (forty minutes), vigorous stirring and further kerosene was added as carrier liquid after hexane vaporization. Magnetic fluid properties (microstructural and magnetic characteristics) were investigated by transmission electron microscopy (TEM), atomic force microscopy (AFM), magnetization measurements and complex magnetic susceptibility measurements. According to the data provided by the ferrofluid sample investigation, the finest granulation, (Figure 1) as well as the highest magnetization were evidenced in the case of non-magnetic stirring applied during ferrophase nanoparticles co-precipitation. The magnetic fluid response to electromagnetic fields of various frequencies – that was studied by measuring the real and imaginary parts of its

magnetic susceptibility has led to smooth curves only in the case of non-magnetic stirring where the distribution histogram of physical diameter was the narrowest. So that the most stable ferrofluid samples are expected when magnetic stirring is avoided during magnetic nanoparticle precipitation.....

[1] R.E. Rosensweig, Ferrohydrodynamics, Cambridge University Press, Cambridge, (1985) [2] R. Massart, IEEE Trans. Magn., MAG-17, 1247 (1981)

P-22

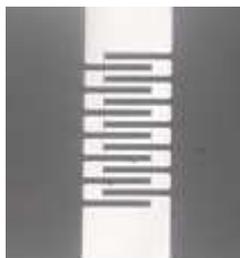
ZnO Interconnected Nanowire Networks Grown From Solution On Patterned Substrate For Integration Into Electronic Device

M. Purica¹, A. Dinescu¹, E. Budianu¹, V. Musat², M. Mazilu²

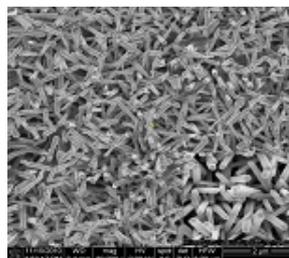
¹National Institute for R&D in Micro technologies, National Institute for R&D in Micro technologies, Bucharest, ROMANIA

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One-dimensional ZnO nanostructures are among of the most attractive nanomaterials for optoelectronic, photovoltaic and sensing devices applications because of their properties such as, direct wide band gap (3.37 eV), large exciton binding energy (60 meV), high sensitivity and selectivity for chemical species, high surface to volume ratio and their easy synthesis in the form of nanowires using low-temperature hydrothermal process. We report a method which combines e-beam lithography (EBL) and a low temperature (<100 oC) hydrothermal method to achieve localized growth of ZnO nanowires (NWs) on wide range of patterned inorganic substrates such as glass quartz, Si and SiO2/Si and ITO/glass . Our method for ZnO NWs patterned growth consists of the three stages: (1) configuration interdigitated metallic electrodes of 6 μm wide and 10 μm distance between electrodes from Cr/Au of 20/150 nm thickness using laser photolithography ; (2) substrate spin –coating with PMMA (hydrophobic polymer layer which inhibits growth) and defining the growth region using EBL ; (3) seeding the substrate with discontinuous dispersed ZnO nanoparticles and ZnO interconnected nanowire networks growth in aqueous solution of zinc nitrate hydrate and hexamethylenetetramine ([Zn2+]:HMT] =1:1) at 90 oC for 3 h.



Interdigitated Cr/Au electrodes on glass substrate and growth region defined in PMMA



SEM top view picture and magnified view (inset) indicates the connectivity between slanted NWs.

The quality of the ZnO NWs synthesized through the hydrothermal process has been characterized by SEM, Raman spectroscopy and XRD. Hexagonal ZnO NWs of typically ~ 100 nm diameter and ~ 2 μm long grew on the substrates along the c axis of the wurtzite crystal with different growth orientations. The ZnO NWs connect the two adjacent gold electrodes through forming complex interconnected nanowire networks as can be observed in the figure below. Current-voltage characteristics showed a photoconductive behavior and UV radiation and gas sensitivity.

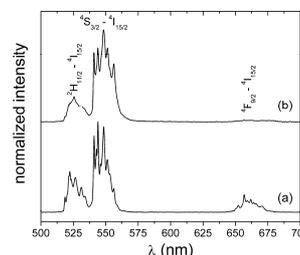
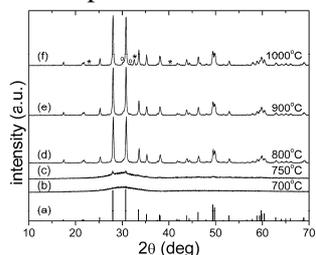
Investigation of emission properties of Er³⁺ and Yb³⁺ co-doped nanolangasite obtained by a sol-gel method

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¹Laboratory of Solid-State Quantum Electronics, National Institute for Laser, Plasma and Radiation Physics, Magurele, Romania

²Faculty of Applied Chemistry and Materials Science, University "Politehnica" of Bucharest, Bucharest, Romania

Langasite nanopowders doped with 1 at. % Er³⁺ and different Yb³⁺ concentrations (3, 4 and 5 at. %) have been synthesized by a modified Pechini route, for the first time to our knowledge. The sol-gel approaches were proposed as alternative techniques for the solid-state reaction due to their advantages: obtaining of desired oxides at lower temperature, small particles with narrow size distribution, better chemical homogeneity at molecular level and preservation of the compounds stoichiometry. In the method patented by Pechini [1], citric acid is used to chelate the metallic ions and ethylene glycol as both solvent and polyesterification agent leading to a polymeric resin-like precursor. The as-synthesized residue was annealed in air at various temperatures between 700°C and 1000°C for 5 h.



XRD patterns of LGS:Er(1%):Yb(3%) nanopowders treated for 5 hours at various temperatures: The extra-lines appearing for the sample annealed at 1000°C can be attributed to the LaGaO₃ phase (*) and Ga₂O₃ (o).

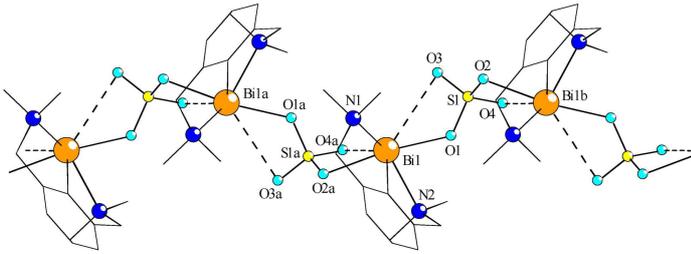
Luminescence spectra of LGS:Er(1%):Yb(3%) nanopowder annealed at 1000°C. (a) – excited at 973 nm; (b) excited at 365 nm.

The structure of the samples was investigated by powder X-ray diffraction (XRD) using a Rigaku MiniFlexII diffractometer. The XRD patterns of the LGS:Yb:Er samples annealed at 700°C suggest an amorphous nature and single-phase LGS lattice formation can be noticed at 800°C. By raising the temperature at 1000°C, besides the LGS phase, LaGaO₃(*) (perovskite) and possibly Ga₂O₃(o) phases are noticed (Fig. 1). These materials were characterized by optical spectroscopy. Diffuse reflectance spectra were recorded using the setup presented elsewhere [2]. The luminescence of the samples was excited in IR, at 973 nm with the laser diode DioMod980/30/400, and at 365 nm with the 350 W Xe-Hg Sciencetech lamp (Fig. 2).

[1]. M. P. Pechini, US Patent 3330697, 1967;

[2]. S. Georgescu, A. M. Voiculescu, et al., Romanian Rep. Phys. 62 (2010) 128.

Polymer Materials and Composites

<p>PI-1</p>	<p>Oligomers, layers and 3d supramolecular architecture in organopnicogen (M = Sb, Bi) chemistry <u>Cristian Silvestru</u>¹ ¹<i>Faculty of Chemistry and Chemical Engineering, Department of Chemistry, Babes-Bolyai University, 11 Arany Janos St., RO-400028 Cluj-Napoca, Romania, Romania</i></p> <p>The chemistry of organoantimony and –bismuth compounds raised continuous interest and studies related to several fields are prompted in relation to fundamental research, i.e. biological activities, uses in organic syntheses or preparation of precursors in advanced material science, catalysts etc. The structural chemistry of the organopnicogen(III) species is controlled by the Lewis acidic character at the metal centre. In addition to the normal covalent bonds (“primary bonds”), this results in intra- or intermolecular contacts (“secondary bonds or interactions”), usually established in presence of donor molecules or ions, and consequently in increased coordination numbers and different degrees of association (oligomers or polymers) of the molecular units. The degree of oligomerization can be controlled, at least in part, by two strategies. One is the use of bulky substituents which affords steric protection of the metal atom.</p> <div style="text-align: center;">  <p>$[\{2,6-(Me_2NCH_2)_2C_6H_3\}BiSO_4]_n$</p> <p>Fig. 1</p> </div> <p>Another strategy is to use one pendant arm ligands such as 2-(MeOCR₂)C₆H₄ (R = Me, CF₃) and 2-(Me₂NCH₂)C₆H₄, or “pincer” ligands like 2,6-(Me₂NCH₂)₂C₆H₃, 2,6-[MeN(CH₂CH₂)₂NCH₂]₂C₆H₃ and 2,6-(ROCH₂)₂C₆H₃ (R = Me, tBu). These ligands protect the metal centre not only sterically by increased coordination, but also reduce considerably the Lewis acidity by behaving as (C,E) or (E,C,E) ligands (E = O, N). In addition to intermolecular interactions between the metal and heavy atoms (halogens, chalcogens, nitrogen, etc.), further associations through hydrogen bonding, C-H•••π (Phcentroid) or M•••π (Phcentroid) contacts are possible. All these types of intermolecular interactions are common in the organometallic chemistry of heavier pnicogens (Sb, Bi) and various examples of resulted oligomers, chain polymers, layers or 3D supramolecular networks will be discussed.</p>
<p>I-1</p>	<p>Sophisticated evolved gas analysis for the characterization of polmyers by means of STA-FT-IR and STA-GC-MS <u>Markus Meyer</u>¹ ¹<i>NETZSCH-Gerätebau GmbH, Wittelsbacherstr. 42, 95100 Selb, Bavaria, Germany</i></p> <p>Thermal analysis provides perfect tools for the characterization of all kinds of polymers. Thermodynamic transitions, thermal stability, decompo-sition and chemical reactions are detected and quantified with high accuracy. Often, it is not sufficient enough to determine the mass and enthalpy changes resulting from a thermal treatment by Thermogravimetric Analysis (TGA) or Simultaneous Thermal Analysis (STA,</p>

	<p>simultaneous TGA + DSC, Differential Scanning Calorimetry). Additional information may be required about the volatile products evolved during chemical reactions, thermally induced transitions, evaporation, and decomposition in order to gain deeper insight into the nature, structure and composition of the materials. A thermobalance is the general basis for couplings. The vertical design with the sample above the balance allows the evolved gas to flow in the natural upward direction. A purge gas flow carries the volatiles in case of the Perseus STA-FT-IR from the gas outlet of the furnace directly to the heated gas cell of a FT-IR via a heated tube. The low volume of this short gas path guarantees fast response and is advantageous for condensable evolved gases. The FT-IR identifies gases with a changing dipole moment by their typical absorption spectrum. For STA-GC-MS (Gas Chromatography – Mass Spectrometry), the gases are transferred via a short heated transfer line to the gas sampling/gas injection system. GC is a high-resolution method for separating volatile compounds. The gas mixtures are separated based on the differences in component distribution between a stationary phase and a mobile phase. The Mass Spectrometer (MS) is a detection system at the outlet of the GC separation column and registers the time distribution of the separated gas components. The sophisticated software and library enable identification of the components. The GC-MS can work in a continuous mode with a fixed column temperature and short injection intervals or in the event-controlled mode. Several polymer application examples are presented in this work.</p>
<p>I-2</p>	<p style="text-align: center;">Polyhydrosilanes – a route to optoelectronics Liviu Sacarascu¹, Valeria Harabagiu¹, ¹Romanian Academy, "Petru Poni" Institute of Macromolecular Chemistry, 41 A Aleea Grigore Voda, 700486 Iasi, Romania</p> <p>Polysilanes - a class of inorganic (silicon - silicon main chain) - organic (substituted to silicon atom) hybrid polymer are characterized by σ - electron delocalization along the chain [1] that induces specific electronic photoelectrical and non - linear optical properties. Their physical properties are strongly dependent on the chemical nature of organic side groups attached to polysilane chain. Polymer with photoconductive, ionic, thermochromic, piezochromic, photorefractive, electrooptical and liquid-crystalline properties can be synthesized. These properties are of interest for building electronic devices, photodetectors, like emitting diodes and displays. The presentation deals with the synthesis (classical, microwave assisted Wurtz coupling of organohalogenosilanes) the structural effect on polymer properties as well as with their use in the preparation of stable metal nanoparticles [2].</p> <p>[1] D. Miller, J. Michl, Chem. Rev. 89 (1989) [2] L. Sacarascu, M. Simionescu, G. Sacarascu, G. Hitruc, J. Nanopart. Res. 13 (2011) 997</p>

O-1

Morphology maps of ice-templated hydrogels based on chitosan

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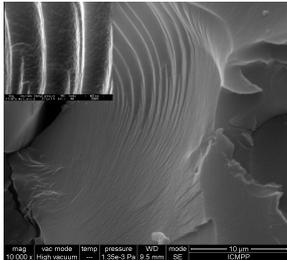
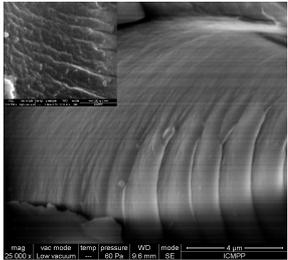
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Considerable interest has been lately focused on the designing of novel porous hydrogels with controlled morphology and increased levels of spatial organization and functionalities [1,2]. Porous hydrogels have been found more benefits than conventional hydrogels when they are used as chromatographic materials, controlled delivery devices for drugs and proteins, and matrices for repairing and regenerating a wide variety of tissues and organs [3,4]. In the present paper, the design of two types of chitosan (CS) cryogels with tailored porous morphology by the synthesis conditions is developed. One type presented a heterogeneous morphology with two generation of pores produced by a strategy which combines ice-templating process and porogen leaching. Poly(methylmethacrylate) (PMMA), as fractionated particles, has been used as porogen. The other type exhibited an oriented structure, which has porous walls arranged along the freezing direction and a honey-comb structure in cross-section, with sizes ranging from 30 μm to 50 μm , obtained by a strategy which combines unidirectional freezing in liquid nitrogen, ice-templating process and porogen leaching. The effects of the speed of the crystallization, the weight ratio between CS and fractionated PMMA particles, and mesh of the fractionated PMMA particles on the pore structure of CS cryogels were investigated. It was found that by conducting the synthesis of CS cryogels using different weight ratios between CS and PMMA the pores diameter could be controlled in a range from 10 μm to 84 μm . A comparative study of the internal morphology of the CS cryogels and of the poly(hydroxyethyl methacrylate) (PHEMA) cryogels has been also developed. The results showed that by increasing the mesh of PMMA, the microstructure of PHEMA cryogels gradually changed from networks having regular assembly of polyhedral pores of about 10 μm to those exhibiting relatively small pores of about 4 μm and 1 μm .

Acknowledgments: This work was supported by CNCSIS-UEFISCSU by the project PN-II-ID-PCE-2011-3-0300 and Grant Agency of the Czech Republic, projects No. 108/12/1538.

1. Mattiasson B et al. Langmuir 26, 16129, 2010
2. Dragan ES et al. Carbohydr. Polym. 88, 270, 2012
3. Lozinsky VL et al. Bioseparation 10, 163, 2001
4. Bajpai AK et al. Prog. Polym. Sci. 33, 1088, 2008

<p>O2</p>	<p align="center">Studies on the structure, electrical and magnetic properties of iron oxide/polysiloxane composites</p> <p align="center">Yildiz¹, R. Bosanceanu², M. Cazacu³, D. Tampu³, F. Iacomi²</p> <p align="center">¹ Department of Energy Systems Engineering, Faculty of Engineering and Natural Sciences, Yildirim Beyazıt University, Ankara, Turkey</p> <p align="center">² Faculty of Physics, Alexandru Ioan Cuza University, of Iasi, Romania</p> <p align="center">³ Institute of Macromolecular Chemistry „Petru Poni”, Iasi, Romania</p> <p>Poly[dimethyl(methylvinyl)siloxane]α-ωdiol was prepared through the copolymerization of octamethylcyclotetrasiloxane, with heptamethylvinilcyclotetrasiloxane, in the presence of H₂SO₄ as a catalyst, at room temperature. Siloxane polymer was mixed with hydrophobe silica in a Yanke - Kunkel mixer. Iron oxide was added in small quantities. Composites with different quantities of silica and iron oxide were pressed between two glass plates and annealed at 423 K for 2h. XRD, SEM, AFM and magnetic investigations evidenced that the nature of oxide phase is influenced by the silica concentration: high silica favors hematite and low silica favors lepidocrocite. The study of the temperature dependence of the electrical conductivity of composites clearly evidenced a variable range hopping (VRH) conduction mechanism at low temperatures.</p>
<p>O-3</p>	<p align="center">Details concerning the use of epoxy soybean oil to obtain magnetic nanofluids</p> <p align="center">Elena Alina Tăculescu^{1,2}, Ladislau Vékás², Faniță Mustăță³, Oana Maria Marinică^{4,5}, Maria Camelia Daia², Nicolae Crainic⁴</p> <p align="center">¹“Politehnica” University of Timisoara, Faculty of Industrial Chemistry and Environmental Engineering, Victoriei Square no. 2, RO-300006, Timisoara, Romania</p> <p align="center">²Romanian Academy-Timisoara Branch, Center for Fundamental and Advanced Technical Research, Bv. Mihai Viteazu no. 24, RO-300223, Timisoara, Romania</p> <p align="center">³Institute of Macromolecular Chemistry „Petru Poni”, Aleea Grigore Ghica Voda no. 41A, RO-700487, Iasi, Romania</p> <p align="center">⁴“Politehnica” University of Timisoara, Research Center for Engineering of Systems with Complex Fluids, Bv. Mihai Viteazu no. 1, RO-300222, Timisoara, Romania</p> <p align="center">⁵West University of Timisoara, Faculty of Physics, Bv. Vasile Parvan no. 4, RO-300223, Timisoara, Romania</p> <p>This article describe the magnetic and rheological properties, as well the size distribution of the particles in the magnetic nanofluids obtained with epoxy soybean oil. The magnetic nanofluids is characterized by the magnetic nanoparticles stabled dispersed in the epoxidised soybean oil carrier. We prepared three types of magnetic nanofluids; two types of nanofluids dispersed in simple epoxidised soybean oil (IN) and another one dispersed in double epoxidised soybean oil (DR). These nanofluids will be used to obtain the magnetic nanocomposites materials with polymeric and epoxy resins used in the RTM processes. The magnetic nanofluids were tested to determinate the magnetic properties (magnetization curve and hysteresis curve) and the rheological properties. The particle size distribution was also analyzed.</p> <p>Keywords: Magnetic Nanofluids, Nanomagnetic particles, Resins, Nanocomposites</p> <p>N. Crainic et al. <i>Magnetic nanocomposite materials obtained using magnetic fluids and resins</i>, <i>International Journal of Nanomanufacturing</i> , 2010, vol. 6, No. 1/2/3/4 pp. 350-361</p>

<p>O-4</p>	<p>Silsesquioxane-based hybrid nanocomposites with hierarchical structures for monumental stone conservation</p> <p>Bogdana Simionescu^{1,2}, <u>Magdalena Aflori</u>¹, Irina Bordianu¹, Liviu Sacarescu¹, Florica Doroftei¹, Mihaela Olaru¹</p> <p>¹<i>Physical Characterization of Polymers, Petru Poni Institute of Macromolecular Chemistry, Iasi, Romania</i></p> <p>²<i>Synthesis Laboratory, "Costin D. Nenitescu" Centre of Organic Chemistry, Bucharest, Romania</i></p> <p>The paper reports on the evaluation of two silsesquioxane-based hybrid nanocomposites containing titanium and/or silver units with hierarchical structures. The silsesquioxane-based hybrid nanocomposite with silver nanoparticles (POSS-Ag) was obtained through hydrolysis and polycondensation of (trimethoxysilyl)propyl methacrylate (TMSPMA) in the presence of silver nitrate, while the one containing titanium and silver nanoparticles (POSS-AgTi) was obtained through hydrolysis and polycondensation of TMSPMA with titanium isopropoxide in the presence of silver nitrate. The formation of hierarchical structures was evidenced through TEM, SEM, XRD, SAXS and fluorescence measurements.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>SEM images of POSS-Ag</p> </div> <div style="text-align: center;">  <p>SEM images of POSS-AgTi</p> </div> </div> <p>The polymers behaviour as regarding one monumental stone originating from Romania was evidenced through FTIR and PRXD techniques.</p> <p>Acknowledgements One of the authors (B.S.) acknowledges the financial support of European Social Fund – „Cristofor I. Simionescu” Postdoctoral Fellowship Programme (ID POSDRU/89/1.5/S/55216), Sectoral Operational Programme Human Resources Development 2007 – 2013. The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement n°264115 - STREAM.</p>
<p>O-5</p>	<p>Thin film polymer photonics: Spin cast distributed Bragg reflectors</p> <p><u>James Bailey</u>¹, James S. Sharp¹</p> <p>¹<i>Physics and Astronomy, The University of Nottingham, Nottingham, United Kingdom</i></p> <p>Polymer photonic structures were made by spin-casting alternating layers of polyvinylpyrrolidone (PVP) and polystyrene (PS) onto glass substrates from mutually exclusive solvents. Narrow reflection bandwidths of 10-20nm were observed in the UV/Visible region and bands with widths of 40-60nm in were observed in the infrared. The reflection properties of the multilayer samples were measured using a purpose built visible/UV spectrometer [1] and an infrared Fourier transform spectrometer [2] respectively. The positions of the reflection bands were controlled by varying the film thickness of the individual layers within the multilayer structure. These were controlled by varying the rotation speed of the spin-coater. Chirped structures with broader reflection bands were also made by periodically changing the spin-speed using a home-built automated spin-coater. Reflection intensities were controlled by varying the</p>

	<p>number of layers deposited and reflectances of over 90% have been measured for these samples. A similar system which uses alternating layers which have larger refractive index contrast was used to investigate the effects of corrugating polymer DBR films. This was done in an attempt to improve the angular dependence of the reflection properties of these samples. All results were modelled using a modified optical transfer matrix method which includes the effects of diffuse polymer/polymer interfaces.</p> <p>[1] J. Bailey & J. S. Sharp, Eur. Phys. J. E. 33, 41-49 (2010) [2] James Bailey and James S. Sharp, Journal of polymer science part B: Polymer physics 2011, 49, 732–739.</p>
<p>O-6</p>	<p>Use of Differential Scanning Calorimetry (DSC) as thermoanalytical technique to investigate degradation of insulation used in electrical cables Păun Costel¹, Monica Bostacă¹, Iosif Lingvay², Doina Elena Gavrilă¹ ¹Dept. of Physics, University Politehnica Bucharest, Bucharest, Romania ²ICPE-CA, ICPE-CA, Bucharest, Romania</p> <p>Differential Scanning Calorimetry (DSC) was analyzed and introduced by E.S. Watson and MJ O'Neill in 1960 and in 1963 at the Pittsburgh Conference of Analytical Chemistry and Applied Spectroscopy. Recently the interest for this technique has increased considerably due to the appearance of commercial DSC equipments. The paper focuses on recent applications for investigation of degradation of polymers used as insulation of electrical cables. The following properties and parameters can be measured or calculated using DSC: Glass Transitions Temperature; Melting and Boiling Points; Crystallization time and temperature and Percent Crystallinity; Heats of Fusion and Reactions; Enthalpy, Specific Heat and Heat Capacity (Cp); Oxidative and Thermal Stability; Rate and Degree of Cure; Reaction Kinetics and Percent Purity; L-length; m-mass. Is presented the way of determining the crystallinity by using the latent heat of melting. The heat given off by that part of the polymer sample which was already in the crystalline state before we heated the polymer above the temperature of Crystallization is involved in this account. In article are presented thermal analysis curves for crosslinked PE which is in important polymer insulation of electrical cables. The results for reference sample and for the samples subject to accelerated aging tests are presented. It is noted that in the progressive heating of PE the following processes occur: melting, thermo-oxidation with the formation of peroxides and variation of the mass.</p>
<p>O-7</p>	<p>Prediction of mechanical properties of polymer concrete with tyre rubber using neural networks Rodica-Mariana Diaconescu¹, Marinela Barbuta², Maria Harja¹ ¹Faculty of Chemical Engineering and Environmental Protection, Gheorghe Asachi Technical University of Iasi, Iasi, Romania ²Faculty of Civil Engineering and Services, Gheorghe Asachi Technical University of Iasi, Iasi, Romania</p> <p>The influence of filler and resin content on the mechanical properties of polymer composite with powdered tyre waste was investigated by using the neural network method. The mechanical strengths of ten experimentally determined combinations of epoxy resin, aggregates and tyre powder as filler were optimised using direct neural modelling and inverse neural modelling, by imposing a minimum cost (content in resin). Direct neural modelling gave the optimum composition for obtaining maximum values for compressive strength, flexural strength and split tensile strength. Inverse neural modelling analysed the possibility of obtaining maximum values of mechanical properties by variations in the dosages of the epoxy resin and tyre powder. Neural network modelling generated the mixes with the lowest cost and maximum strength. The objective of the study was to maximise the use of the tyre powder content</p>

	<p>with the minimum resin content for the minimum cost. From direct modelling, the maximum compressive strength was obtained for a composition with 0.215 epoxy resin and 0.3 tyre powder. Maximum flexural strength was obtained for experimental values of 0.23 epoxy resin and 0.17 tyre powder with a severe reduction noted for smaller resin dosages. The maximum split tensile strength was obtained for a resin dosage of 0.24 and tyre powder dosage of 0.17. The neural network modelling has shown that the mechanical properties cannot be simultaneously optimised in the investigation domain. It is necessary to establish a priority of mechanical characteristics (only one from compressive strength, flexural strength or split tensile strength) with the smallest resin content and highest tyre powder dosage.</p>
<p>O-8</p>	<p>Study of polyamideimides-hydrosilicates nanocomposites by using AFM combined with other investigation methods <u>Daniel Timpu</u>¹, Galina Gubanova², S.V. Kononova², ¹<i>Polymer Physics and Polimeric Materials, "Petru Poni" Institute of Macromolecular Chemistry, Romanian Academy, Iasi, Romania</i> ²<i>Laboratory of polymeric morphology, Institute of Macromolecular Compounds, Russian Academy of Science, St. Petersburg, Russia</i></p> <p>The development of nanocomposites based on polyamide-imides and nanotubes (NT) of different morphology and size is the perspective direction for obtaining new materials for the membrane application. The introduction of inorganic tubular nanoparticles in to the matrix of poly(diphenyloxideamino-N-phenylphthalimide) leads to the formation of nanocomposite with improved mechanical properties permeable to a greater extent than the pure polymer in the process of pervaporation of polar liquids, in particular of water and alcohol. In this work the nonporous composite films based on aromatic polyamidoimides differing by the structure of diamine component, containing equal amount of silicate nanotubes Mg₃Si₂O₅(OH)₄ were obtained and their structure, morphology, thermal, transport properties were investigated. The presentation highlights the AFM techniques importance in find out an explanation or to solve a problem.</p>
<p>P-1</p>	<p>Hydrogel of double porosity based on 2-hydroxyethyl methacrylate for tissue engineering <u>Martin Pradny</u>¹, Miroslava Duskova¹, Karel Dusek¹, Miroslav Slouf¹, Jiri Michalek¹ ¹<i>Department of synthetic hydrogels, Institute of Macromolecular Chemistry, AV ČR, v.v.i., Prague 6, 162 06, Czech Republic</i></p> <p>Porous hydrogels are important materials in tissue engineering techniques. In our previous work [1], we observed that cell growth on gel scaffold was reduced, or even stopped after some time, which we explained by the increasingly limited nutrient supply as the large pores became blocked with cells. Therefore, we designed a double-porous hydrogel (pore size on the order of tens to hundreds of μm), with finely porous walls (units of μm) between the large pores. The pores in walls do not allow the ingrowth of cells while supply of low-molecular substances remains unaffected, although larger pores are filled by cells. Synthetic hydrogels by polymerizing 2-hydroxyethyl methacrylate were prepared and characterized focusing on the control of porosity architecture. Primary larger pores were achieved by crosslinking polymerization of monomer in presence of inert solid template (fractionated particles of poly(methyl methacrylate)) that was washed out with acetone after polymerization. Secondary smaller pores were obtained by reaction-induced phase separation when using dodecanol as poor solvent (precipitant). The sizes of larger templated pores in equilibrium water swollen hydrogels spanned over broad range (20 – 200 μm). These pores are separated by gel walls with smaller pores from microsineresis induced by polymerization. The volume fractions of primary templated pores and secondary pores</p>

were calculated using equilibrium swelling data. The total pore volume fraction in swollen samples with double porosity is typically 85 %. Also, the specific number of larger pores (i.e. number of pores in 1 cm³ hydrogel), volume and diameter of larger pores, specific surface of larger pores and hydrogel permeation properties are discussed.

Supported by GA CR No. 108/12/1538, AV CR-KAN 200520804

[1] Lesný, P., Přádný, M., Jendelová, P., Michálek, J., Vacík, J., Syková, E.: J.Mater. Sci. Mater.Med., 17 (2006), 829.

P-2

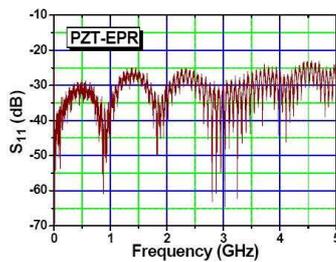
Microwave Measurements of the dielectric properties of PZT – EPR composite

Vasilica Pascariu^{1,2}, Ovidiu Avadanei², Paolo Nanni¹, Liliana Mitoseriu²

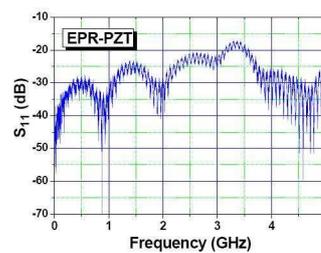
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In this work, we report a simple method of preparation epoxy resin-ferroelectric Pb(Zr,Ti)O₃ composite (EPR-PZT) with compositional gradient along its thickness. The aim of present study is to check the influence of the Pb(Zr,Ti)O₃ ferroelectric filler on the electrical properties of the entire composite. Composite Pb(Zr,Ti)O₃ - epoxy resin (PZT-EPR) with different compositions from 2.5% to 15 vol% were prepared by gravitational casting at room temperature. Further, the composites were tested as adaptive impedance in GHz range. To put in evidence the influence of the concentration gradient on the dielectric properties in GHz range, the return loss from the graded samples placed with each one of the two surfaces with small/high permittivity was measured, using a vectorial network analyzer (VNA) with a 7/3 mm coaxial wave guide measurement cell terminated with a 50 Ω load. The samples were manufactured to completely fill the space in the coaxial wave guide. The compositional PZT gradient generated a permittivity gradient along the sample thickness: a higher permittivity ϵ_1 is characteristic at the interface 1 (where PZT concentration is higher) and a smaller permittivity ϵ_2 at the opposite side (interface 2): $\epsilon_1 > \epsilon_2$.



(a) interface 2 (smaller PZT concentration, ϵ_2 permittivity)

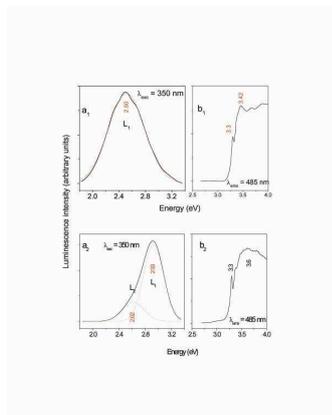


(b) interface 1 (higher PZT concentration, ϵ_1 permittivity).

If the losses are neglected due to the relative low thickness, mainly the reflections of the electromagnetic field on the two interfaces air-dielectric ϵ_1 and dielectric ϵ_2 - air should be considered. If the reflection coefficients at these interfaces are Γ_1 and Γ_2 , the total reflection is characterized by the S_{11} parameter. It results that different return losses should be obtained when the sample is placed with the two different interfaces towards the analyzer. The Figure 1 shows comparatively return loss measured: (a) interface 2 (smaller PZT concentration, ϵ_2 permittivity); (b) interface 1 (higher PZT concentration, ϵ_1 permittivity).

	<p>Acknowledgements: The financial support from the Grant POSDRU/89/1.5/S/ 63663 is highly acknowledged.</p>
<p>P-3</p>	<p>DC-conductivity and dielectric permittivity of chitosan-based membranes Ana Cazacu^{1,2}, <u>Alexandra Maria Neagu</u>¹, Lavinia Curecheriu¹, Liliana Mitoseriu¹, Viorel Melnig¹ ¹<i>Department of Physics, Alexandru Ioan Cuza University, Iasi, Romania</i> ²<i>Department of Physics, University of Genoa, Genoa, Italy</i></p> <p>In the field of organic electronics, biopolymers have started to be used due to the fact that they are biodegradable, biocompatible, typically environmentally friendly, and do not require chemical synthesis. Being a natural polymer, chitosan does not present a unique chemical structure. Its chemical and physical properties depend not only on the origin of the samples but also on the method of preparation. Therefore, it is important to characterize the solidstate physical and physicochemical properties of chitosan, including the molecular mobility that occurs within the polymeric structure with the variation of temperature. Since chitosan has an interesting collection of dipolar groups, dielectric relaxation spectroscopy can be an adequate technique to probe molecular motions. Among the recent approaches towards material development for flexible electronics, the combination of flexible polymers with conductive nanoparticles to reach giant capacitance for energy storage and non-linear dielectric properties for tunability seems to be very promising. In the present paper, the temperature dependence of electrical properties of chitosan membranes with different gold concentration prepared by dry phase inversion were investigated. By addition of gold particles with controlled size an increased of dielectric constant was obtained together with low dielectric losses at room temperature. By increasing temperature, the extrinsic contributions increased and the samples had a semiconductive behaviour. A strong nonlinear behaviour was obtained for all the samples. By gold addition, an increase of hysteretic behaviour was obtained together with an asymmetric behaviour for negative/positive field. These properties make the membranes based on chitosan as a suitable composite for flexible electronics applications.</p> <p>Acknowledgements: This study was financially supported by the POSDRU/89/1.5/S/63663 and POSDRU 89/1.5/S/49944 grants.</p>
<p>P-4</p>	<p>Spectroelectrochemical properties of the single-walled carbon nanotubes functionalized with the copolymer poly(3,4-ethylenedioxythiophene-copolyrene) Mihaela Baibarac¹, Ioan Baltog¹, Timucin Velula¹, <u>Malvina Scocioreanu (Stroe)</u>¹, Jean Yves Mevellec², Serge Lefrant² ¹<i>Optical Processes in Nanostructured Materials, National Institute of Materials Physics, Bucharest, Romania</i> ²<i>Physics of materials and nanostructures, Institut des Matériaux “Jean Rouxel”, Nantes, France</i></p> <p>Electrochemical polymerization of the 3,4-ethylenedioxythiophene (EDOT) and pyrene (Py) monomers mixture in the presence of single-walled carbon nanotubes (SWNTs) leads to SWNTs functionalized with the poly(3,4-ethylenedioxythiophene-copolyrene) (PEDOT-Py) copolymer. To evaluate the chemical interactions between SWNTs and PEDOT-Py copolymer, the anti-Stokes/Stokes Raman scattering and IR spectroscopy studies were carried out. Raman spectrum of the PEDOT-Py copolymer synthesized onto the blank Au electrode, at a potential of +1.6 V vs. Ag/Ag⁺ has been taken as reference, it being dominated of the lines with maximum at 1222, 1377, 1442-1465, 1500, 1590 and 1610 cm⁻¹. Contrary, to the Boltzmann law which establishes the</p>

ratio value between the intensities of Stokes and anti-Stokes Raman lines, an abnormal intense anti-Stokes Raman spectrum is reported for the lines situated in the range (1300-1700) cm^{-1} when the electropolymerization of EDOT and Py takes place on Au electrode coated with a SWNT film. In the anti-Stokes branch an increase in intensity of the Raman lines that belongs both to the PEDOT-Py copolymer and SWNTs is observed.



Emission spectra and photoluminescence excitation spectra of the PEDOT-Py copolymer (a1, b1) and SWNTs functionalized with the PEDOT-Py copolymer (a2, b2).

This together with a down-shift of the Raman line from 1465-1442 to 1433-1401 cm^{-1} is interpreted as originating in the functionalization of SWNTs with copolymer molecules. The increase in the relative intensity of the FTIR bands situated in the spectral range 1300-1600 cm^{-1} , the down-shift of the FTIR band from 1107 to 1083 cm^{-1} and the up-shift of the FTIR band from 704 to 709 cm^{-1} are facts which indicate that a covalent functionalization of SWNTs with the PEDOP-Py copolymer took place. Other evidences concerning the interactions between the two constituents are reported by photoluminescence (PL) studies. At exciting light of 350 nm, PL spectra of the PEDOT-Py copolymer deposited onto blank Au electrode and Au support coated with a SWNTs film, show a broad band at 2.5 and 2.93 eV, respectively. In the last case, the PL band discloses two Lorentzian components at 2.62 and 2.93 eV which indicate two recombination processes that involve different trapping centers for the carriers produced by light excitation.

M. Baibarac, I. Baltog, S. Lefrant, *Current Organic Chemistry* 15, 1160-1196, 2011

P-5

Polymer fibres by spin-coating machine

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The attention of making polymer fibres is increasing rapidly, in view of the fact that its usage in a various applications, for example, polymer fibers in batteries, filtration, sensors and protective clothes. In addition aforementioned applications, their high surface to volume ratio provide them act as a catalyst supports also in tissue engineering and drug delivery. There are a number of methods by which one can make polymer fibers but the most commonly employed methods, to create polymer nano fibres, is electrospinning. The aim of this work is making polymer fibres by the using of the spin-coating machine in order to avoid using any voltage source. Different conditions for spinning process (spin speed, dynamic or static spinning) and different polymers/concentrations have been used. The polymer fibres with diameter (0.4-2) μm and variable length have been obtained. The investigation of the uniformity in diameter and the fibres length can be obtained by the using of Scanning Electron Microscopic (SEM).

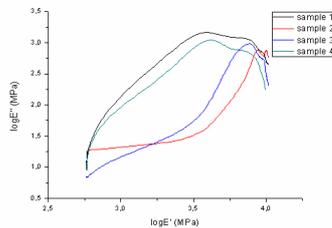
[1] M. Hunley, T.Long, Polymer International, 57 , 385, (2008)
 [2] S. Zhong, WE Teo,X. Zhu, RW Beuerman, S. Ramakrishna, LY Yung, J. Biomed. Mater. Res., 79A: 456, (2006)

P-6 Hybridization effects on effective mechanical, dynamical and thermal properties of carbon & glass fiber reinforced polymeric composites

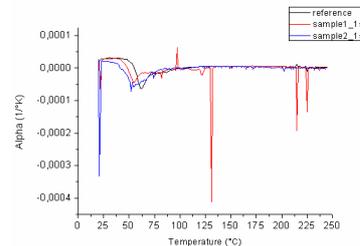
Dana Motoc Luca^{1,1}

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Hybrid polymeric composites were given an increasingly attention due to the advantages offered by their constitutive mixing effects in terms of obtaining not only predictable but certain material properties, ranging from improved mechanical to outstanding thermal or electrical characteristics. Special attention will be paid on the advantages/disadvantages offered by embedding carbon fibers within hybrid polymer structures designed as potential candidates for sensors or substrates for energy harvesting applications and a debate around the herein class of self-manufactured composites will be addressed taking into account their properties. In such circumstances, the paper aims to approach, individually and interdependently, the effective mechanical and thermal properties of different hybrid architectures of carbon and glass fibers embedded into a commercial polymer matrix. The overall mechanical properties were retrieved using a LS100 and LR5K Plus from Lloyd Instruments thus allowing recording of stress – strain curves evolution to provide elastic moduli, yield stress, ultimate strength, as well as a preliminary assessment of toughness whereas from the flexural tests identification of bending stiffness and strength, shear stiffness and strength. Furthermore, the relaxation phenomenon within the polymer matrix and thereby the behavior under various condition of loadings and temperature were monitored using a dynamic mechanical analyzer DMA 242 from Netzsch working in the 3-point bending mode under a controlled atmosphere, from -5 C to 220 C.



Cole-Cole diagram of the hybrid composite structures



Instantaneous overall CTE variation over the imposed temperature range

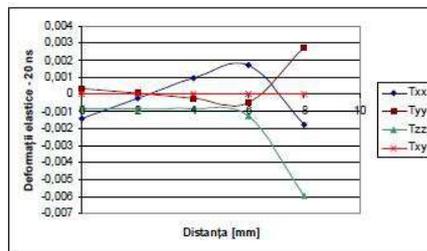
Storage and loss modulus, loss tangent were recorded as function of temperature both on longitudinal and transverse direction of samples. Instantaneous coefficient of thermal expansion and thermal strains fields have been retrieved using a DIL 42PC dilatometer from the same manufacturer by imposing several heating cycles with a linear temperature variation from 20 C to 250 C. The effective values retrieved will be further subjected to statistical analysis with the aim to identify and asses the influencing factors and particular the hybridization effects upon the specific property to be able to set up a general approaching procedure in further advanced materials design.

1. Motoc Luca, D., Curtu, I., 2009, "Dynamic mechanical analysis of multiphase polymeric composite materials", Mat. Plast., 46, p. 462.

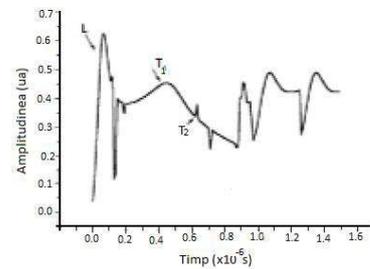
P-7 Nondestructive assessment of polymeric composite's dynamical properties by laser ultrasonics

Dana Luca Motoc¹, Gheorghe Bejinaru Mihoc²

Laser ultrasonics became nowadays a reliable and relatively widely used nondestructive testing facility owing to the experimental configuration and devices implied and used as well as to the way that enables to set-up and run measurements in aggressive environments. As the developments of new materials, including polymer composite based ones, are continuously emerging there were just a matter of time until many experimental facilities were adapted to aid their characterization and properties assessment. In such circumstances, the herein work aims to present, both theoretically and experimentally, a protocol of assessing dynamical properties of polymer based particle reinforced composite materials based on noncontact and nondestructive set-up by aid of laser generated ultrasound. The elastic coefficients of several particles (ex. carbon, wolfram, etc.) reinforced epoxy composites were retrieved using a Nd:YAG laser source with a 20 ns pulse duration and emission at 532 nm, focused on the samples' surface both as a point and a line source with a power density of 20 MW/cm² running in the ablation mode.



FEM simulation of the elastic strain field developed after 20 ns in the loading direction



Experimental displacement field recorded for W particle reinforced polymer composite

A computer algorithm was particularly written to retrieve these elastic coefficients using the overall displacement field measured experimentally [1]. Supplementary, finite element based simulations (e.g. ANSYS 12) were implemented and run for all the composite materials involved as well as for the two different loading conditions to retrieve the overall displacement field, the elastic and thermal stress and strain fields developed within the samples and to aid the data correlation with the material's behavior under real circumstances [2]. Finally, a debate in favor of nondestructive experimental facilities such is the herein laser based ultrasonics will be made despite the relatively high costs of the components.

1. Castagnede, et.al., Laser impact generation of ultrasound in composite materials, Acta Acustica, 1994.
2. Motoc Luca D., Materiale compozite cu pulberi, Ed. Universitatii Transilvania, 2005.

TOPIC 10

Self-assembly and Patterning

<p>PI-1</p>	<p style="text-align: center;">Low temperature growth of silicon nano-structures for electronic applications <u>Shashi Paul</u>¹, ¹<i>Emerging Technologies Research Centre, De Montfort University, The Gateway Leicester LE1 9BH, United Kingdom</i></p> <p>We have developed a novel methodology, which involves an initial substrate preparatory ritual, of growing high-quality silicon nano-structures less than 400 C. This method by-passes the long hours of annealing necessary for the solid-phase crystallisation of amorphous silicon. We have previously demonstrated the suitability of this growth technique for future 3-D flash memory technology. The applications of these nano-structures into photovoltaic solar cells, diodes and two terminal memory devices will also be discussed. An in-depth study of the structural, optical and electrical properties of thin-film silicon structures grown by this novel technique will also be presented.</p>
<p>P-1</p>	<p style="text-align: center;">Electronic structure of cysteine dimmers adsorbed on gold: a DFT study <u>Luiza Buimaga-Iarinca</u>¹, Adrian Calborean^{1,2}, Cristian Morari¹ ¹<i>Department of Molecular and Biomolecular Physics, INCDTIM, Cluj-Napoca, Romania</i> ²<i>Department of Biomedical Physics, Faculty of Physics, Babes-Bolyai University, Cluj-Napoca, Romania</i></p> <p>The self-assembly of organic molecules on solid surfaces has attracted much interest in recent years. Special attention has been devoted to metal/organic interfaces [1], which are of particular interest for the development of functional molecular architectures in the emerging area of nanotechnology. The adsorption mechanisms of cysteine on both Au(111) and Au(110) surface was investigated by means of periodic density functional theory calculations using the SIESTA code [2,3], which uses norm-conserving pseudopotentials in their fully non-local form and expands the wave functions of valence electrons by flexible linear combinations of atomic orbitals. The interaction between valence electrons is treated within generalized gradient approximation (GGA) to the exchange and correlation functional, i.e. the improved Perdew–Burke–Ernzerhof (PBE) functional of Hammer et al (revised PBE (RPBE)) [4]. The computed binding energies suggest that cysteine dimer is stabilized by the interaction occurring between the COOH groups. For all the investigated adsorption geometries the molecules are physisorbed at a relatively high position with respect to the gold surface. We found out that the role of the surface in the self-assembly process is to provide geometric patterns (the two-dimensional confinement or the potential presence of defects) rather than to influence the intermolecular interactions.</p> <p>Acknowledgments Thanks are due to INCDTIM Cluj-Napoca Data Center for providing computer facilities. AC acknowledges financial support from the Sectorial Operational Program for Human Resources Development 2007-2013, co-financed by the European Social Fund, within the project POSDRU 89/1.5/S/60189 titled Postdoctoral Programs for Sustainable Development in a Knowledge Based Society. The authors also acknowledge financial support from the project PN-II-ID-PCCE-2011-2-0027.</p> <p>[1] Kuhnle A et al, 2002 Nature 415, 891 [2] Ordejon P et al, 1996 Phys. Rev. B 53, R10441 [3] Soler J M et al, 2002 J. Phys.: Condens. Matter 14 2745 [4] Hammer B et al, 1999 Phys. Rev. B 59, 7413</p>

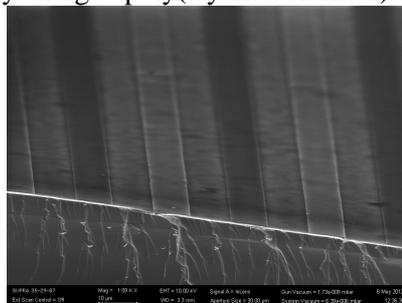
P-2

Growth characteristics of the LbL deposited multilayer nanostructures

Adina Bragaru¹, Mihaela Kusko¹, Monica Simion¹, Teodora Ignat¹, Mihai Danila¹

¹Laboratory of Nanobiotechnology, National Institute for Research and Development in Microtechnologies, Bucharest, Romania

In the last years, layer-by-layer (LbL) self-assembly technique has received much attention in the field of electrochemistry as a very promising tool for the fabrication of nanostructured films with high organisation at the nanoscale level fabricated films through specific interactions of organic functional groups for multilayer growth, and the films deposited onto a solid substrate were obtained with high stability [1]. Regarding biosensing, it is the main idea to improve the biosensor response by finding a good signal transducer material, and a communication between the biomolecules and electrode surface in order to intensify signal processing on the electrode surface. The aim of this work is to obtain multilayer nanocomposite structures starting from gold interdigitated electrodes array, using this LbL technique, as simple and versatile method for surface modification. First of all, the gold electrodes arrays patterned on silicon substrate are functionalized by immersion in Nafion ethanol 5% solution and then, the multilayers were grown by alternately dipping the Nafion modified electrode into positively charged poly (diallyldimethylammonium chloride)-PDADMAC and negatively charged poly(styrenesulfonate)-PSS.



cross section SEM image of modified gold interdigitated electrodes with 8 bilayers of polyelectrolytes

The growth of deposited multilayer film was evidenced by FT-IR spectroscopy and SEM. The presence of self-assembled polyelectrolyte layers at the solid / liquid interface significantly affects the surface conductivity obtained by electrochemical impedance spectroscopy (EIS). Deposition of just one bilayer of PE notably modify the impedance module decreasing its value and since the bulk electrolyte conductivity was maintained constant, all the changes may be attributed to the effect of PE charges. Furthermore, this growth method LBL is giving us the possibility of developing miniaturised devices capable of more sensitive and selective analysis and of detecting small quantities of molecules.

R. M. Iost, F. N. Cresilho, Biosensors and Bioelectronics 31 (2012), 1-10.

TOPIC 11

Thin Films and Nanostructures for Modern Electronics

<p>I-2</p>	<p align="center">Studies on the influence of doping and deposition conditions on the electrical transport mechanism of ZnO thin films</p> <p align="center">A. Yildiz^{1*}, F. Iacomi²</p> <p>¹ Department of Energy Systems Engineering, Faculty of Engineering and Natural Sciences, Yıldırım Beyazıt University, Ankara, Turkey</p> <p>² Faculty of Physics, Alexandru Ioan Cuza University, 11 Carol I Blvd., 700506-Iasi, Romania</p> <p>Studies on doping effect and substrate nature on physical properties of ZnO with transitional metals (Ni, Co) or Ga have huge research interests. To date, there have only been a few attempts to explain electrical conduction mechanism in Ni, Co or Ga-doped ZnO [1-3]. We established that, as a function of Ni or Co concentration, the electrical conduction mechanism could be explained on the basis of the multiphonon assisted hopping model (MPH) with a weak electron-phonon coupling, or on the basis of grain boundary conduction model. For Ga-ZnO thin films, there was an experimental evidence for a transition from the grain boundary (GB) conduction at high temperatures to the nearest-neighbor hopping (NNH) conduction at low temperatures. In the light of the employed conduction models, characteristic parameters describing the electrical transport are determined and correlated with the structural results.</p> <p>[1] A. Yildiz, B. Kayhan, B. Yurduguzel, A. P. Rambur, F. Iacomi, S. Simon, <i>J Mater Sci: Mater Electron</i> 22 (2011) 1473</p> <p>[2] A. Yildiz, B. Yurduguzel, B. Kayhan, G. Calin, M. Dobromir, F. Iacomi, <i>J Mater Sci: Mater Electron</i>, 23 (2012) 425</p> <p>[3] A. Yildiz, F. Iacomi, <i>J. Phys. Soc. Jpn.</i> 81 (2012) 054602.</p>
<p>O-1</p>	<p align="center">In situ X-ray photoelectron spectroscopy analysis of Au growth on PZT(001) surfaces</p> <p align="center">Nicoleta Georgiana Apostol¹, Laura Elena Stoflea¹, George Adrian Lungu¹, Cristina Dragoi¹, Lucian Trupina¹, Lucian Pintilie¹, Cristian-Mihail Teodorescu¹</p> <p align="center">¹<i>Nanoscale Condensed Matter Physics, National Institute of Materials Physics, Magurele, Romania</i></p> <p>The aim of this study is to elucidate the formation of Schottky barriers or, eventually, of ohmic contacts onto ferroelectric substrates. Gold layers are grown on Pb(Zr_{0.2},Ti_{0.8})O₃ (PZT) and in situ investigated by X-ray photoelectron spectroscopy (XPS) in the thickness range 2-100 Å (Figs. 1,2). For the clean surface, the resulted composition is close to nominal PZT resulted from the target's composition. This is a first difference between the actual results and some previous XPS studies on PZT(111) [1]. However, in the actual case, all core level binding energies suggest the formation of two kind of surfaces. The 'standard' surface is represented by all binding energies (Pb 4f7, Ti 2p3, Zr 3d5, O 1s) identical to the nominal values for PZT [1], whereas the 'charged' phase exhibits all core levels are shifted by ~ 1 eV towards higher binding energies.</p>

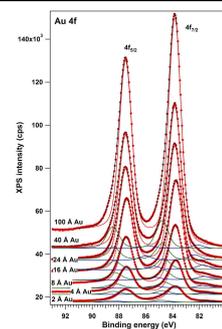
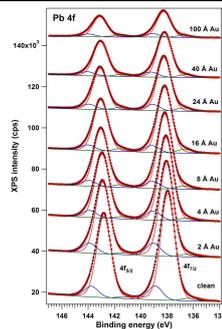


Fig. 1. Pb 4f7 core levels evolution with Au deposition. Fig. 2. Au 4f7 core levels evolution with Au deposition.

This 'charged' phase presents inwards permanent electrical polarization. The gold deposition proceeds in the formation of an ohmic contact with a band bending of $\Phi_{PZT} - \Phi_{Au} \sim 0.4-0.5$ eV for both phases, identified as similar shifts towards higher binding energies of all Pb, Ti, Zr, O core levels. The Au contact on the 'charged' phase manifests in a shift of Au 4f7 core level by about 1 eV towards lower binding energies with respect to the Au 4f7 binding energy position in metal Au. This suggests the occurrence of electron transfer from PZT to Au, driven by the polarization field. The free PZT phase is occupied by \sim one quarter monolayer of Pb; this Pb forms a surface alloy with Au, producing a Au 4f7 component shifted by ~ 0.7 eV towards higher binding energies with respect to metal Au.

[1] C. Dragoi, N.G. Gheorghe, G.A. Lungu, L. Trupina, A.G. Ibanescu, C.M. Teodorescu, Phys. Stat. Solidi A 209, 1049 (2012).

[2] NIST X-ray photoelectron spectroscopy database, <http://srdata.nist.gov/xps>.

O-2 Optically transparent n-channel thin film transistor based on wide band gap oxide semiconductors

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Transparent thin-film transistor (TTFT) is an essential electronic device to develop fully transparent flat panel displays and integrated circuits. We report a top-gate field effect transistor structure achieved using wide bandgap semiconducting oxides ($E_g > 3\text{eV}$) as n-ZnO, ZITO ($\text{In}_{2-(x+y)}\text{Sn}_x\text{Zn}_y\text{O}_{3-\delta}$), ITO. Two types of TTFT structures have been experimented using as channel materials n-ZnO or n-ZITO and SiO as gate isolator and ITO as source (S) and drain (D) electrodes and as gate contacts. n-ZITO layers have been obtained by vacuum thermal evaporation using as solid source a mixture of 0.0004 g Zn (99.99%), 0.0014 g Sn (99.99%), 0.0107 g In (99.99%) and followed by oxidation at 300 °C. Transmittance of the deposited layers on quartz wafers was over 80 % and the electrical conductivity about 55 S/cm. n-ZnO layers of ~ 100 nm thickness were deposited by Radio Frequency assisted Pulsed Laser Deposition (RF-

	<p>PLD) using a AZO ceramic source (ZnO with 1 % Al) in reactive oxygen atmosphere and 300 OC substrate temperature. n-ZnO films presented a polycrystalline structure, (222) oriented and below to 2 nm roughness over entire surface of quartz wafer. Optical transmission was approximately 85% in the visible spectral range. After the patterning of the active channel (150x70 μm²) by means of conventional photolithography the gate isolator of 250-300 nm SiO was deposited by vacuum thermal evaporation using a SiO source at chamber pressure of 3 10⁻⁶ torr with the deposition rate of 0,5 nm/s. The source, drain (90x90 μm²) and gate (100x90 μm²) contacts were obtained by lift-off of indium thin oxide (ITO) deposited by DC sputtering. Electrical characterization of fully-transparent transistor was performed using a Keithley 4200 station. Current–voltage measurements directly on wafer indicate n-channel, depletion-mode transistor operation and insensitive operation to visible light irradiation. Drain current - voltage ID (VDS) curves were taken in dark environment for various gate source voltages and also in the case of no potential applied on gate. As expected when we have no potential applied on the gate the drain current – voltage ID (VDS) curve is linear. For low values of gate source applied voltage VGS.</p>
<p>P-1</p>	<p>Newly synthesized stable disubstituted 4-(4-pyridyl)pyridinium ylides in thin films with semiconductor properties</p> <p>Liviu Leontie¹, Ramona Danac², Mihaela Girtan³, Marius Prelipceanu⁴, Adrian Graur⁴, <u>Aurelian Carlescu</u>¹, Gheorghe I. Rusu¹</p> <p>¹<i>Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i> ²<i>Faculty of Chemistry, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i> ³<i>Laboratoire LPhiA, Angers University, Angers, France</i> ⁴<i>Faculty of Electrical Engineering and Computer Science, Stefan cel Mare University of Suceava, Suceava, Romania</i></p> <p>Temperature-dependent d.c. electric conductivity of some recently synthesized organic compounds, stable disubstituted 4-(4-pyridyl)pyridinium ylides, is studied. Thin-film samples ($d=0.10-0.80 \mu\text{m}$) spin-coated from dimethylformamide solutions onto glass substrates have been used. Organic films with reproducible electron transport properties can be obtained if, after deposition, they are submitted to a heat treatment within temperature range 297-527 K. The studied polycrystalline compounds show typical n-type semiconductor behavior. The activation energy of the electric conduction ranges between 0.59 and 0.94 eV. Some correlations between semiconducting parameters and molecular structure of the organic compounds have been discussed. In the higher temperature range ($T>400 \text{ K}$), the electron transport in examined compounds can be interpreted in terms of the band gap representation model, while in the lower temperature range, the Mott's variable-range hopping conduction model was found to be appropriate. Some of the investigated compounds hold promise for thermistor applications.</p> <p>[1] Thorsten U. Kampen, Low Molecular Weight Organic Semiconductors, Wiley, Weinheim, 2010. [2] A. V. Rotaru, R. P. Danac, I. D. Druta, J. Heterocycl. Chem. 41 (2004) 893.</p>
<p>P-2</p>	<p>Effect of substrate temperature on the structural and optical properties of tin oxide thin films</p> <p><u>Nicolae Tigau</u>¹, Constantin Gheorghies¹, Denys Cristina Vladu Radu¹, Simona Condurache-Bota¹</p> <p>¹<i>Faculty of Sciences and Environment, Dunarea de Jos University of Galati, Galati, Romania</i></p> <p>The tin oxide thin films were deposited onto glass substrates by a vacuum</p>

	<p>thermal evaporation technique. The substrate temperature (T_s) was varied from 300 K to 583 K. Structural investigations have been carried out by X-ray diffraction. The tin oxide thin films deposited at $T_s < 583$ K are amorphous and the films deposited at $T_s = 583$ K are polycrystalline with tetragonal structure. The optical properties of tin oxide thin films were investigated using spectrophotometric measurements of transmittance and reflectance in the wavelength range 300-1100 nm. The transmission and reflection spectra were used to extract the absorption coefficient (α), refractive index (n), extinction coefficient (k) and optical band gap energy (E_g).</p>
<p>P-3</p>	<p>FINEMET-type thin films deposited by HiPIMS: influence of growth and annealing conditions on the magnetic behaviour</p> <p><u>Ioana-Laura Velicu</u>¹, Maciej Kowalczyk², Maria Neagu¹, Vasile Tiron¹, Horia Chiriac³, Jarosław Ferenc²</p> <p>¹<i>Faculty of Physics, Alexandru Ioan Cuza University, Iasi, Romania</i> ²<i>Faculty of Materials Science and Engineering, Warsaw University of Technology, Warszawa, Poland</i> ³<i>Physics, National Institute of Research & Development for Technical Physics, Iasi, Romania</i></p> <p>High power impulse magnetron sputtering (HiPIMS) is a relatively new technique, which can be successfully used to grow high-quality thin films [1, 2]. Using HiPIMS, FeCuNbSiB amorphous thin films have been deposited on glass and silicon substrates, from ribbons with the nominal composition Fe_{73.5}Cu₁Nb₃Si_{15.5}B₇. The depositions were performed in pure argon atmosphere, maintaining the gas flow at 20 sccm and the target-substrate distance at 6 cm [2]. The influence of argon pressure (from 8 mtorr to 60 mtorr), effective power (from 30 W to 90 W) and pulse length (from 4 μs to 20 μs) on the magnetic behaviour of thin films has been investigated. FeCuNbSiB thin films, with thicknesses in the range of 160 nm and 740 nm were analyzed. The obtained results showed that the deposition rate increases when the effective power increases and decreases when the pulse length or working gas pressure increase. X-ray diffraction (Bragg-Brentano configuration, Cu-Kα radiation) results show that, in as-deposited state, the films are amorphous and exhibit a halo typical of amorphous phase ($2\theta = 45^\circ$). The X-ray photoelectron spectroscopy investigations demonstrate that the stoichiometry of the target has been achieved in the deposited films. The atomic force microscopy scans revealed a surface with a root-mean-square roughness no more than 5 nm. The magnetic behaviour investigations were performed using vibrating sample magnetometer (Lakeshore 7410)/differential inductive techniques. The coercive magnetic field (H_c) of the as-deposited films with the same thickness presents a strong dependence on argon pressure. For the same effective power, the value of coercive magnetic field increases when the pulse length increases. The heat treatment conditions used for obtaining nanocrystalline FeCuNbSiB alloys were determined by recording the temperature dependence of the magnetization/differential scanning calorimetry (Perkin Elmer 8000). The obtained results for the as-deposited films prepared in different conditions showed small variations in first crystallization temperature value. In nanocrystalline state (obtained after furnace annealing between 400°C and 550°C), H_c value is up to about 3 times smaller than in the amorphous state.</p> <p>[1] Daniel Lundin and Kostas Sarakinos, Journal of Materials Research 27 (2012) 780-792; [2] I.L. Velicu, M. Neagu, H. Chiriac, V. Tiron, M. Dobromir, IEEE Transactions on Magnetics 48 (2012) 1336-1339.</p>

<p>P-4</p>	<p style="text-align: center;">Bistable Memory Devices using Silicon Nanostructures Konstantina Saranti¹, <u>Shashi Paul</u>¹ ¹<i>Emerging Technologies Research Centre, De Montfort University, Leicester, UK</i></p> <p>Silicon nanostructures have attracted attention due to their small size, interesting properties and their potential integration into devices. Research is underway to study their use as the floating gate in flash memories since there is a need in the field of electronic memory devices of a memory which combines low cost, high performance and long retention times. In this paper, an investigation on the quality and suitability of silicon nanostructures as the charge storage medium in bistable non-volatile memory devices was conducted. The device has the simple structure of silicon nanostructures sandwiched between dielectric layers on glass substrate with thermal evaporated aluminium bottom and top contacts. Si₃N₄ was used for the dielectric layer and was deposited by Plasma Enhanced Chemical Vapour Deposition (PECVD) technique. Silicon nanostructures have been grown by PECVD after the substrate underwent an initial preparation step (IPS). The electrical behaviour of the memory cell was examined by Current-Voltage (I-V) and data retention time (Current-Time) measurements. The morphology of the silicon structures was investigated by Scanning Electron Microscopy (SEM).</p> <p>References: [1] Salaoru, I. and S. Paul., "Small organic molecules for electrically re-writable non-volatile polymer memory devices," Materials Research Society Symposium Proceedings, vol. 1250 pp. 159-164, 2010. [2] Mih, T.A., S. Paul, and R.B.M. Cross, "Low temperature growth of silicon structures for application in flash memory devices," Materials Research Society Symposium Proceedings, vol. 1250, pp. 9-14, 2010. [3] Koliopoulou, S., et al., "Metal nano-floating gate memory devices fabricated at low temperature," Microelectronic Engineering, 83 (4-9 SPEC. ISS.), vol. 83, pp. 1563-1566, 2006. [4] Salaoru, I. and S. Paul., "Bistability in electrically writable non-volatile polymer memory devices," Materials Research Society Symposium Proceedings, vol. 1114, pp. 100-105, 2008. [5] Mih, T.A., R.B. Cross, and S. Paul., "A novel method for the growth of low temperature silicon structures for 3-D flash memory devices," Materials Research Society Symposium Proceedings, vol. 1112, pp. 265-269, 2009.</p>
<p>P-5</p>	<p style="text-align: center;">Graphene growth by a pulsed laser deposition system Vasile Tiron¹, Petru-Edward Nica², <u>Cristian Ursu</u>³ ¹<i>Faculty of Physics, "Al. I. Cuza" University, Iasi, Romania</i> ²<i>Technical "Gh. Asachi" University, Technical "Gh. Asachi" University, Iasi, Romania</i> ³<i>Petru Poni Institute of Macromolecular Chemistry, Petru Poni Institute of Macromolecular Chemistry, Iasi, Romania</i></p> <p>Since its discovery in 2004 made by Nobel Prize laureates Novoselov and Geim [1], graphene (one atom thick two dimensional sp²-bonded carbon material) has attracted considerable interest in materials science and solid-state physics research. Because of its large applications potential much attention is devoted to its study than to synthesis methods for high quality and large surface graphene production. Graphene based applications require a method of forming uniform single-layer film and the precise control of the number of layers. We propose to use for graphene synthesis Pulsed Laser Deposition (PLD) technique. There is only few articles that have been reported the deposition of graphene using PLD method [2]. Few layers graphene are obtained by using the catalytic growth of carbon laser produced plasma species on a predeposited nickel thin film. Nickel films are deposited in a High-Power Impulse Magnetron Sputtering (HIPIMS) system in order to avoid some supplementary problems related to</p>

	<p>the experimental parameters in PLD required for a low roughness and uniform nickel film. The influences of the cooling rate and nickel film characteristics on the graphene properties are presented. Moreover, it is investigated the possibility of decreasing the necessary temperature for heating the substrate (for lowering the fabrication costs) by using the in situ laser annealing of the carbon deposited layer with the second harmonic Nd:YAG laser.</p> <p>Acknowledgements: the financial support was assured by POSDRU/89/1.5/S/55216.</p> <p>[1] K. S. Novoselov, A. K. Geim, S. V. Morozov, D. Jiang, Y. Zhang, S. V. Dubonos, I. V. Grigorieva, and A. A. Firsov, <i>Science</i> 306, 666 (2004). [2] K. Wang, G. Tai, K. H. Wong, S. P. Lau, and W. Guo, <i>AIP Advances</i> 1, 022141 (2011).</p>
<p>P-6</p>	<p>Temperature dependence of the optical properties of Bi₂O₃ based on the Kramers-Kronig transformation for polynomial segregated terms models Gabriel Murariu¹, SIMONA CONDURACHE-BOTA¹, Corneliu Doroftei^{2,3} ¹<i>Physics, Chemistry and Environment Department, Science Faculty, "Dunărea de Jos" University, Galati, Romania</i> ²<i>Faculty of Physics, "Al. I. Cuza" University, Iasi, Romania</i> ³<i>Physics, National Institute of Research and Development for Technical Physics, Iasi, Romania</i></p> <p>Recently, several articles present interesting results obtained using Kramers-Kronig transformation (KK). This computation method constitutes a powerful tool to validate experimental data and is often used in the literature. The present study is implemented for Bi₂O₃ thin films deposited by thermal vacuum evaporation at different temperatures of the glass substrates. While the extraordinary properties of this fabric allow us to consider particular analytical approach, as it was previously shown, it could be proposed an innovative computational method in order to succeed in studying the reflectance properties of Bi₂O₃ as a function of temperature. The novelty of this article is due to the to study an global effective analytical representation, based on polynomial functions, in order to obtain a general model that includes temperature dependence of the optical properties, with better results that the previous. In the mathematical expressions, was included separated terms in order to avoid the effects of Runge phenomenon, aiming a better fitting function representation. As a case study, was chosen Bi₂O₃ - a substance fewer studied in literature.</p> <p>[1] M.A. Calin, R.M. Iona, N. Herascu, <i>Journal of Optoelectronics and Advanced Materials</i>, 7(6) (2005) 3155 – 3160. [2] F.M. Segal-Rosenheimer, R. Linker, <i>Journal of Quantitative Spectroscopy and Radiative Transfer</i>, 110 (2009) 11471161. [3] Gabriel Murariu, Simona Condurache-Bota, Nicolae Tigau, <i>International Journal of Modern Physics B</i> 26, No. 07 (2012) 1250049. [4] L. Leontie, <i>Journal of Optoelectronics and Advanced Materials</i> 8 (3), (2006) 1221 – 1224.</p>
<p>P-7</p>	<p>Optical and morphological proprieties of PVA foils containing Congo red dye: effect of concentration and degree of stretching Carmen Beatrice Zelinschi¹, Iuliana Stoica², Dana Ortansa Dorohoi¹ ¹<i>Optic and Spectroscopy, "Al.I.Cuza" University, Faculty of Pshysics, Iasi, Romania</i> ²<i>Polymer, "Petru Poni", Institute of Macromolecular Chemistry, Iasi, Romania</i></p> <p>The aim of this study is to establish connections between the optical and morphological properties of the anisotropic foils containing dichroic molecules of dies. Pure and colored with Congo red poly (vinyl-alcohol) (PVA) foils were stretched under</p>

	<p>gentile heating. The development of the surface morphology and roughness parameters was investigated by means of atomic force microscopy (AFM), in tapping mode. The 5x5 μm^2 images reveal that the topography of the un-stretched foils varies with dye concentration, ranging from 2% to 6%. The determined roughness of the colored PVA foils was lower than that of the pure PVA foil. Instead, the surfaces area ratio has increased with the spatial intricacy of the texture induced by the increasing Congo red concentration. In addition, an increase in roughness and morphological anisotropy with the degree of stretching has been evidenced for uncolored and colored PVA foils, facilitated by the presence of the dye. The previous results are sustained by the optical measurements of birefringence and dichroism of the un-stretched and stretched pure and colored PVA foils. Keywords: Congo red, APV foils, AFM, dichroism, birefringence.</p> <p>Acknowledgment: This work was partially supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/88/1.5/S/47646</p> <p>[1] Pop, V., Dorohoi, D. O., Cringeanu, E., A New Method For Determining Birefringence Dispersion, J. Macromol. Sci. - Phys., B, 33 (3&4), 1994.</p>
<p>P-8</p>	<p>The influence of different substrates on the physical properties of ITO and SnO₂ thin films prepared by rf magnetron sputtering <u>Petronela Prepelita (married Garoi)¹</u> ¹<i>Lasers, National Institute for Laser, Plasma and Radiation Physics, Magurele, Romania</i></p> <p>Indium tin oxide (ITO) and tin oxide (SnO₂) thin films deposited on different substrates (e.g. glass and polyimide) were deposited by rf magnetron sputtering in oxygen atmosphere. The X-ray diffraction analyses showed that all the thin films are polycrystalline. Obviously, the structural properties depend on the different substrates used and have a preferential orientation of the microcrystallites, with their (002) (for SnO₂ film), and (222) (for ITO film) plane respectively, perpendicular to the substrate. Roughness of the samples deposited on polyimide substrate is slightly higher than that of the samples deposited on glass substrate. Morphology analysis and surface topography of the films were realized by atomic force microscopy and scanning electron microscopy. The optical band gap was calculated from absorption spectra and a comparative discussion of the results is presented. The polycrystalline structure of the films strongly influences the mechanism of electrical conduction. Typically, all samples are conductive and transparent. After deposition, these films were subjected to many heating/cooling cycles up to 450 K in air, allowing us to calculate the activation energies of the samples. Such properties are suitable for transparent conductive electrodes in various modern electronics applications.</p> <p>1. M. Hwang et al. Materials Science and Engineering: B 176 (2011) 1128–1131 2. P. Prepelita et al. Thin Solid Films 520 (2012) 4689–4693 3. O. Lupan et al. Materials Science and Engineering B 157 (2009) 101–104</p>

<p>P-9</p>	<p align="center">Influence of the substrate on the structure, morphology and optical properties of antimony trioxide thin films</p> <p align="center">SIMONA CONDURACHE-BOTA¹, NICOLAE TIGAU¹, RALUCA GAVRILA², ROMANA DRASOVEAN¹</p> <p>¹<i>Chemistry, Physics and Environment Department, Dunarea de Jos University, Galati, Romania</i> ²<i>Microphysical Characterization Group, National Institute for Research and Development in Microtechnologies, Bucharest, Romania</i></p> <p>Optoelectronics has found since some time ago various uses for antimony trioxide (Sb₂O₃) thin films. The deposition method and the deposition conditions play an essential role in determining the properties of any thin film. This paper proves that the nature of the substrate and its temperature during the deposition process strongly influence the structure, the morphology and the optical properties of Sb₂O₃ thin films. The substrates which are compared are high-quality microscope glass slides and bismuth trioxide, Bi₂O₃, the latter being chosen because bismuth and antimony belong to the same column of the periodical table of elements, thus similar properties are expected for Sb₂O₃ and Bi₂O₃.</p>
<p>P-10</p>	<p align="center">Oxidized bismuth films analyzed by Transmission Electron Microscopy</p> <p align="center">Simona Condurache-Bota¹, Nicolae Tigau¹, Constantin Gheorghies¹, Gabriel Prodan², Denys Cristina Vladu Radu¹</p> <p>¹<i>Chemistry, Physics and Environment Department, Dunarea de Jos University, Galati, Romania</i> ²<i>Physics, Chemistry, Electronics and Petroleum Technology Faculty, Ovidius University, Constanta, Romania</i></p> <p>Thermal oxidation of bismuth thin films leads to samples with different structural, optical and electrical properties in function of the deposition conditions and those of the oxidation process. Especially the structural analysis may be very tricky because of the various types of intermediate bismuth oxides and various polymorphs of bismuth trioxide that may form during the oxidation process. The coexistence of several of these bismuth oxides within a sample makes it difficult to assign the X-ray diffraction peaks (XRD) or the Selected-Area Electron Diffraction (SAED) rings to one or other of these oxides. This is why, a combined structural analysis by XRD and SAED is welcome for oxidized bismuth films. This paper presents such an analysis, proving the complementarity of the XRD and SAED, along with some other morphological analysis that Transmission Electron Microscopy techniques are offering.</p>
<p>P-11</p>	<p align="center">Sol aging and substrate dipping time dependence of the optical properties of sol-gel deposited cobalt oxide films</p> <p align="center">ROMANA DRASOVEAN¹, NICOLAE TIGAU¹, SIMONA CONDURACHE-BOTA¹</p> <p>¹<i>Chemistry, Physics and Environment Department, Dunarea de Jos University, Galati, Romania</i></p> <p>Cobalt oxide films have unique optical properties. In many articles it was demonstrated that sol-gel deposited cobalt oxide thin films possess suitable optical properties as selective coatings. In this work, cobalt oxide thin films were prepared by dipping sol-gel technique and their optical properties were analyzed as a function of the aging time of the sol and the dipping time of the substrate in the sol. The optical properties of the films were investigated by using the UV-VIS spectroscopy. The optical constants for these films, in the 200–800 nm range, are reported as a function of the two</p>

	<p>studied parameters. Film thickness was determined to be dependent on the aging and immersion time. The structural characterization of the films was made by the X-ray diffraction technique.</p>
P-12	<p>Electronic transport properties of thermally evaporated CdS films <u>Lucian Petcu</u>¹, Adina Petcu¹, Petronela Rambu², Cristian Baban² ¹Physics, Ovidius University, Constanta, Romania ²Physics, Alexandru Ioan Cuza University, Iasi, Romania</p> <p>Cadmium sulfide (CdS) thin films have been intensively studied due to their interesting characteristics (wide band gap, direct band-to-band optical transition, high transmittance in visible domain, etc), which make this compound suitable for different applications. CdS thin films, with different thickness, have been deposited onto glass substrates by thermal evaporation under vacuum of high purity (99.99%) of CdS polycrystalline powders. X-ray diffraction and electron diffraction analysis show that the films under study possess a polycrystalline wurtzite (hexagonal) structure. In order to perform the temperature dependences of electrical conductivity measurements the analyzed films were equipped with two parallel thin-film silver electrodes. These dependences were investigated during a heat treatment consisting of two heating and cooling cycles in a temperature range $\Delta T=(300-520)K$. It was observed that the temperature dependences of electrical conductivity curves become reversible. It is supposed that the heat treatment performed stabilizes the structure of the studied samples and consequently $\ln\sigma=f(10^3/T)$ dependences become reversible.</p>
P-13	<p>Annealing effect on the structural and optical properties of CdSe films Adina Petcu¹, <u>Lucian Petcu</u>¹, Petronela Rambu², George Rusu², Cristian Baban² ¹Physics, Ovidius University, Constanta, Romania ²Physics, Alexandru Ioan Cuza University, Iasi, Romania</p> <p>CdSe is an important material which can be used for the development of various modern technologies of solid-state devices such as solar cells, high-efficiency thin-film transistors, light-emitting diodes, etc. Major attention must be given to the investigation of physical properties of CdSe thin films in order to improve the performances of the devices and also for finding new applications. In present paper the influence of the heat treatment conditions on the structural and optical properties of CdSe thin films are investigated. Studied thin films were deposited on glass substrates, by thermal evaporation under vacuum, using the quasi-closed volume technique. Transmission electron microscopy and electronic diffraction investigations revealed that some structural modifications appear after performing a heat-treated at different temperatures (200°C, 300°C and 400°C respectively.) The optical transmission spectra were recorded within the range of 300-1700 nm. The optical band gap of the films was estimated using the optical transmittance measurements. It was observed that optical properties of investigated films depend on the structural characteristics of respective samples.</p>
P-14	<p>Pulsed laser deposition of ZnO and Al:ZnO thin films and characterization Cristian Ursu¹, <u>Tudor Bogdan Coman</u>², Ovidiu Florin Caltun² ¹Polymer Materials Physics, "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania ²Faculty of Physics, "Al. I. Cuza" University, Iasi, Romania</p> <p>Thin films of ZnO and Al doped ZnO (Al:ZnO) were obtained from metallic and ceramic targets by pulsed laser deposition (PLD) technique in various experimental</p>

	<p>conditions. We have investigated the possibility of growing high quality transparent conductive oxide (TCO) films from the ablation in reactive atmosphere of metallic target instead of the conventional way of using sintered materials. For comparison thin films of Al:ZnO were obtained from Al:ZnO ceramic targets with different Al concentration (1, 2 and 4 wt.% of Al). In both cases the films are obtained for different oxygen partial pressures and substrate temperatures (from 750°C to room temperature). The obtained samples are investigated in terms of their structural, optical and electrical properties by using the following investigation methods: X-ray diffraction (XRD) and photoelectron spectroscopy (XPS), Raman spectroscopy, atomic force microscopy (AFM), UV-VIS and four point probe technique.</p> <p>Acknowledgements: the financial support was assured by European Social Fund – „Cristofor I. Simionescu” Postdoctoral Fellowship Programme (ID POSDRU/89/1.5/S/55216), Sectoral Operational Programme Human Resources Development 2007 – 2013 and partially supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 (grant POSDRU/107/1.5/S/78342).</p>
<p>P-15</p>	<p>Pixe and edxrf techniques applied in the study of Bi-Te-Se thermoelements <u>Ion Popescu V.</u>^{1,3}, Iulian Bancuta², Claudia Stihl¹, Cristiana Radulescu¹, Calin Oros¹, Roxana Bancuta², Dan Gabriel Ghita³</p> <p>¹Science, Valahia University of Targoviste, Targoviste, Romania ²Multidisciplinary Institute for Science and Technology, Valahia University of Targoviste, Targoviste, Romania ³Nuclear Physics, National Institute for Physics and Nuclear Engineering, Bucharest, Romania</p> <p>A good thermoelectric material should have high electrical conductivity and thermal power, and low thermal conductivity. For making the thermoelements with the appropriate characteristics is required to choose the material according on the application followed and temperature range. This requires different methods to study the structure of these materials, the amount of impurities contained in the material or alloy used. The quality and content of these materials are key factors in achieving high performance in thermoelectric conversion. This paper presents original contributions in the study of Bi-Te-Se thermoelements, using Particle Induced X-ray Emission - PIXE and Energy Dispersive X-ray Fluorescence – EDXRF techniques. The studied thermoelements are used in micro and optoelectronic systems, as well as in energy recovery applications.</p> <p>Keywords: PIXE, EDXRF, thermoelement</p> <p>[1] V. Cimpoca, I. Bancuta, Fizica și Tehnologia Materialelor Termoelectrice, Editura Bibliotheca, Târgoviște, (2007); [2] I. Bancuta, V. Cimpoca, I. V. Popescu, A. Gheboianu, M. Cimpoca, C. Stihl, Ghe. Brezeanu, Journal of Science and Arts, 9(2), 354-359 (2008); [3] C. Stihl, I.V. Popescu, A. Gheboianu, I. Bancuta, A. Pantelica, G. Vlaicu, Proceeding of 1st International Conference: Environment- Natural Sciences-Food Industry, 16-17 November, Baia Mare, Romania, 228-231, ISBN:978-973-1729-39-8(2007); [4] L. D. Hicks, M. S. Dresselhaus, Phys. Rev. B 47, 16631–16634 (1993); [5] I. Bancuta, V. Cimpoca, I. V. Popescu, A. Gheboianu, M. Cimpoca, C. Stihl, Ghe. Brezeanu, Journal of Science and Arts, 9(2), 354-359 (2008); [6] R. Setnescu, I. Bancuta, T. Setnescu, V. Cimpoca, S. Jipa, I. V. Popescu, Journal of Science and Arts, 12(1), 95-102 (2010);</p>

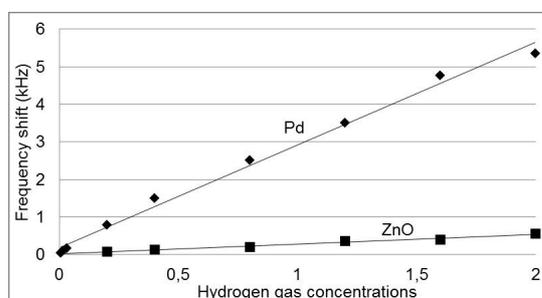
<p>P-16</p>	<p style="text-align: center;">Defect layers in one dimensional phononic material Cristina Pachi¹, Bruno Morvan^{2,2}, Jean Louis Izbicki^{2,2} ¹<i>L9, National Institute for R&D in Microtechnologies, Bucharest, Romania</i> ²<i>Acoustic, Laboratoire d'Acoustique Ultrasonore et d'Electronique, Le Havre, France</i></p> <p>The analysis in one dimensional (1D) phononic crystal was developed by the Transfer Matrix Method (TMM) thus giving the phononic band-gap structures. Phononic band-gap materials are composite media which exhibit stop bands in the spectrum of acoustic wave transmission. The analytical solution of 1D wave propagation problems in periodic acoustical systems has been studied in numerous reports where several theoretical methods have been developed, such as: the TMM method, the Plane-Wave Expansion Method, the Finite Difference Time Domain Method and Finite Element Method. In the TMM method, the up and down plane waves in each layer is matched individual to adjacent layers in compliance with the continuity of the total acoustic field and its derivative. The resulting equations are written one second order matrix form with each layer having its own reference of position in structure. In this work, the analytical method is developed for calculation of the scalar wave function in 1D phononic crystal with defect layers. Our formalism can be used for tracking the reflection and transmission coefficients of the system, positioning band-gap frequency in relation with the characteristics of phonon crystal and defect layer, as well for pursuing integrity of bound structure. We compute the band of a finite and compare it with the experimental results. We present a simple way to fabricate 1D periodic structures: Si multilayers and SU8 defect layers at the micrometer scale using the lithography tools. A significant effect in generating defect peaks within the PBG has been experimentally shown by using a set-up with one high power laser as an emitter by photoelastic effect and one laser vibrometer as a receiver for the detection of ultrasonic acoustic waves. The experimental study is made in the ultrasonic regime explored mechanical wave propagation 1D structures focusing on high amplitude stress wave propagation. At much higher frequencies, greater than 1 GHz, at the micrometres scale and the propagation of high amplitude picosecond pulse, the propagation of thermal phonons are most important. The ability to couple multi-physical effects in new periodic materials can also lead to the creation novel opto-mechanical systems.</p>
<p>P-17</p>	<p style="text-align: center;">Studies On The Influence Of Cobalt Content On Gas-Sensitive Electrical Conduction Of Ni_{1-x}Co_xFe₂O₄ Ferrite Thin Films Florin Tudorache¹, Paul Dorin Popa², Felicia Iacomi¹ ¹<i>Department of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania</i> ²<i>Department of Physics, National Institute of R&D for Technical Physics-IFT Iasi, Iasi, Romania</i></p> <p>In this work, we have studied the influence of Co³⁺ ions content in Ni_{1-x}Co_xFe₂O₄ (x = 0.25, 0.5, 0.75) ferrite thin films. The thin film structural characterization (XRD, XPS) evidenced that Co entered into the ferrite structure by substitution. No other crystalline phases were evidenced. The sensitivity to some reducing gases vapors (acetone, ethyl alcohol, methyl alcohol and liquefied petroleum gas—LPG) was investigated. We found that the gas sensitivity largely depends on the composition, temperature and the test gas species.</p> <p>Acknowledgments: Authors are grateful to "Research Center on Advanced Materials and Technologies - RAMTECH" created within the framework 162/15.06.2010 of POS CCE – A2-O2.1.2, where these measurements have been done.</p>

P-18 Surface Acoustic Wave Sensors Based On Nanoporous Films For Hydrogen Detection

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Surface Acoustic Wave Sensor (SAWS) are one of the most promising detection systems due to smaller size, lower weight, power requirements and great sensitivity. A nanoporous Pd and ZnO based layered SAW sensors have been develop and investigated for hydrogen, at room temperature. The sensors were of a “delay line” type (quartz substrate, ~ 70 MHz central frequency). The nanoporous sensitive layer was directly deposited onto a quartz substrate using the picosecond laser ablation method. The influence of different experimental conditions such as laser power density and inert gas pressure on the morpho-structural proprieties of thin films was investigated by X ray diffraction and Scanning Electron Microscopy.



Dynamic response of the Pd and ZnO nanoporous films based SAW sensor towards H₂ gas at room temperature

The sensor performances (sensitivity, limit of detection and response time), for a hydrogen concentration in synthetic air of 0.015– 2 % were studied. I was observed that the frequency shift was proportional to the concentration for all the sensors. The response times of 15 - 44 s and 6 - 27 s were obtained using as sensitive layers Pd and ZnO respectively, for a concentration between 0.2 - 0.8 hydrogen/synthetic air. The results presented show that high sensitivities can be achieved utilizing a nanoporous layer structure for gas sensing applications. Also the limit of detection was by 6.3 times better at Pd sensors (50 ppm) than ZnO sensors (315 ppm).

TOPIC 12

Trends in Condensed Matter and Field Theory

<p>O-1</p>	<p>Theory of stimulated Raman atomic-molecular conversion in Bose condensate Ann Zingan^{1,1} ¹<i>Physics and Mathematics, Dniester State University, Tiraspol, Moldova</i></p> <p>The study of the properties of cold and ultracold molecular gases at temperatures of a few micro- or nanokelvin is one of the most promising scientific directions in atomic and molecular physics and physical chemistry. Because of their unique properties, ultracold molecules offer broad possibilities for practical applications. At present much progress has been achieved in theoretical and experimental investigations of the dynamics of coupled atomic and molecular condensates under conditions of Feshbach resonance and atomic–molecular conversion involving one or two resonance laser pulses. Strongly bound ultracold molecules can be efficiently produced at the lowest levels by the method of stimulated Raman adiabatic passage (STIRAP). This approach was successfully employed to produce ultracold RbCs molecules by photoassociation of ultracold atoms followed by their transfer to the lowest state induced by coherent laser radiation. Resonance interaction between molecules can lead to the synthesis of more complex objects. Authors of [1] observed collision resonances tuned by a magnetic field in the ultracold gas of Cs₂ molecules produced from an atomic Bose condensate and interpreted them as Feshbach resonances for ultracold Cs₂ molecules with the formation of Cs₄. The results obtained above show that the time evolution of the densities of atoms, molecules, and photons during the stimulated Raman conversion of two Bose atoms to a Bose heteromolecule is considerably determined by the initial density of particles and the initial phase difference. The process is stimulated due to the macroscopic occupation not only of the initial atomic system but also of the final state. Note that the atomic–molecular conversion at T≠0 in a thermodynamically equilibrium atomic system cannot produce such collective oscillations because the phases of all particles involved in the process are random. In this sense, the process studied in the paper is an example of new chemistry, the so called ultracold coherent superchemistry, in which the coherent stimulation of chemical reactions is performed.</p> <p>1. C. Chin at al., Phys. Rev. Lett. 94, 123201 (2005).</p>
<p>O-2</p>	<p>Tailoring dc-tunability properties by local field engineering in ferroelectric structures <u>Leontin Padurariu</u>¹, Lavinia-Petronela Curecheriu¹, Liliana Mitoseriu¹ ¹<i>Physics, Alexandru Ioan Cuza University, Iasi, Romania</i></p> <p>The nonlinear dielectric characteristics of ferroelectrics drive them as possible candidates for voltage tunable microwave devices (tunable oscillators, phase shifters, varactors), in which permittivity of hundreds is desired. For preserving high tunability combined with moderate permittivity of ≈1000 and losses below 3%, different approaches were proposed: (i) doping with different ions, (ii) forming composites with low-permittivity non-ferroelectrics. Unfortunately, for such systems, both a “dilution” of permittivity and diminished tunability were obtained. Under these circumstances, the exploration of other solutions and design of structures are still desirable for tunable devices, together with fundamental studies related to the origin of the dielectric nonlinearity in different materials. In the present work a method to control the nonlinear dielectric properties in different ferroelectric structures is proposed. A ferroelectric ceramic can be described as a composite material formed by ferroelectric grains and low-permittivity inclusion (grain boundary or pores). In order to analyze the role and the contribution of these non-ferroelectric parts on non-linear properties, realistic 2D virtual ceramic microstructures were numerically generated by Potts model [1]. For this kind of polycrystalline structures, the local field potential was consequently determined by using</p>

	<p>finite element method (FEM). The effective permittivity-field responses $\epsilon_{\text{eff}}(\mathbf{E})$ have been computed by taking into consideration the specific local field distribution. A remarkable agreement between the experimental tunability features and the model calculations was obtained in nanostructure BaTiO₃ ceramics with grain size between 5000 to 90 nm [2] and porous PZT materials with different porosity levels [3].</p> <p>Acknowledgments: The financial support of CNCSIS-UEFISCSU projects PN II-RU TE code 187/2010 and PN-II-ID-PCE-2011-3-0745 are highly acknowledged.</p> <p>[1] R.B. Potts, Proc. Camb. Phil. Soc. 48, 106 (1952). [2] L. Padurariu, L. Curecheriu, V. Buscaglia, L. Mitoseriu, Phys.Rev.B 85, 224111 (2012) [3] L. Padurariu, L. Curecheriu, C. Galassi, L. Mitoseriu, Appl.Phys.Lett. 100, 2529</p>
<p>O-3</p>	<p>The Schrödinger-Poisson heuristic limit of the Klein-Gordon-Maxwell-System and its S-Eigenmode solution for a spherically trapped particle Ciprian Dariescu¹, Marina-Aura Dariescu¹, <u>Ciprian Cretu</u>¹ ¹<i>Faculty of Physics, Alexandru Ioan Cuza University, Iasi, Romania</i></p> <p>The paper deals with a functional-numerical approach to the spherically symmetric eigenstates of a charged massive scalar particle, trapped in a ball, interacting with its own electrostatic field. The second-order nonlinearly coupled differential equations, governing the structure of such a physical system, is termed as the Schrödinger- Poisson(Gauss)-system. Using Mathematica, we derive, by numerical integration, the first-order ground state and the first excited energy levels.</p> <p>[1]S.Datta(Cambridge,2003) [2]J.Luscombe,A.Bouchard,M.Luban,Phys.R.B46(1992) [3]L.Ram-Mohan,K.Yoo,J.Moussa,J.A.P.95(2004) [4]A.Trellakis,A.Galick,A.Pacelli,U.Ravaioli,J.A.P.81(1997) [5]C.Cheng,Q.Liu,J.Lee,H.Massoud,J.C.E.3(2004)</p>
<p>O-4</p>	<p>Solvatochromic effects in electronic absorption spectra of N-Ylids Dana-Ortansa Dorohoi¹, Mihaela Maria Oprea¹, Valentina Closca¹ ¹<i>Alexandru Ioan Cuza University, Faculty of Physics, 11 Carol I Blv., RO-700506, Romania</i></p> <p>N-Ylids are zwitterionic compounds with electronic absorption spectra in UV Vis range. The UV bands of N-ylids are of $\pi \rightarrow \pi^*$ nature, while the visible band is due to an intramolecular charge transfer (ICT) from the carbanion towards the heterocycle. This band is very sensitive to the solvent nature. The study of the solvent influence on the ICT visible band permits estimation of the dipole moment in the excited state of N-ylids. From our determinations it results that the dipole moment of N-ylids decreases by excitation. The solvatochromic studies allow to separate the supply of the universal and specific interactions from the total spectral shift recorded in each solvent and to determine the average statistic weights of the active solvent in the first solvation shell of N-ylids in ternary solutions achieved from one protic and one aprotic solvent. The results are important for Organic Chemistry due to the fact that N-ylids are precursors for new heterocyclic compounds with different applications, such as acid-basic indicators, for pharmaceutical purposes or in obtaining dichroic foils with polarizing action.</p>
<p>P-1</p>	<p>The limits of known universe and critical aspects of the Drake equation <u>Octavian Gurlui</u>¹ ¹<i>National, College „Costache Negruzzi“, Str. Toma Cozma nr. 4, Iasi, Romania</i></p> <p>This paper contains some critical data concerning the limits of our Universe, and proposes a complementary theory regarding the existence of extraterrestrial intelligence (ETI). Based on the observation data and suppositions, the formalism of Drake equation</p>

	<p>may be reviewed as indicated in the paper above. Therefore, in our Galaxy, a limited number ($GO = 2 \div 20$) of ETI have been obtained. Unfortunately, using the actual technologies we aren't able to send people further than on Mars and the wormholes may be the future solution. For now, we know that wormholes are everywhere. There are wormholes in the quantum foam, but they are too small to us. They are smaller than an atom. So if we can grow up a wormhole like this and stabilize it with Dark Matter (this kind of wormholes appears and disappears in a very, very short time) we can travel where we want. Moreover, we cannot use wormholes (the big ones) because they are situated on the center of Rotating Black Holes but also because they're far, far away. A critical discussions regarding of the questions like « when and why things are happening in the big Cosmos » but also the importance of the Dark Matter in the Universe are discussed here. It must be underlined also those Universes (parallels Universes), with their own Big Bang, "other laws of physics", but also the very big space between them.</p> <p>[1]. Gurlui Octavian, INFINITUL, Casa Editoriala Demiurg Plus, Iasi, 2010 [2]. Gurlui Octavian, PRIMA EXPLOZIE, Editura Stef, Iasi, 2012</p>
<p>P-2</p>	<p style="text-align: center;">3D-modelling of temperature in a 3-body Domen-type calorimeter for absorbed dose measurements</p> <p style="text-align: center;">Cristina Elena Ionita(Mironescu)¹, Daniel Radu¹, Iordana Astefanoaei¹, <i>¹Alexandru Ioan Cuza University, Faculty of Physics, 11 Carol I Blv., RO-700506, Romania</i></p> <p>The effect of thermal gradients that appear in the core of a Domen-type absorbed-dose calorimeter during an electrical calibration run is revised using the finite element 3D-numerical analysis. The local thermal modelling that is the method allowing for spatio-temporal distribution of temperature within the three bodies of the graphite calorimeter combined with both a careful analysis on what really happens when a certain amount of electrical power is dissipated in a NTC heating thermistor and the consideration of heat loss through radiation from the surface of the calorimeter bodies have led to results which are in agreement with those obtained from experimental measurements and reported in the literature.</p>

