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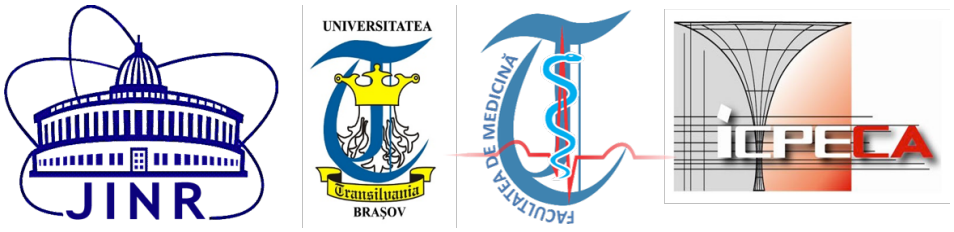

Book of Abstracts

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FRESH FUEL INVESTIGATION USING THE DRY NEUTRON RADIOGRAPHY FACILITY

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The non-destructive imaging examination by thermal neutrons and gamma radiations is a testing method for nuclear fuel, used in INR, useful for the improvement of the CANDU nuclear fuel fabrication.
For the investigation of fresh nuclear fuel, the dry neutron radiography facility placed at the tangential channel of the Annular Core Pulsing Reactor (ACPR), can be used. INUS uses a modern digital detector with scintillators for neutrons and gamma radiations and CCD cameras for the presented experiments with experimental CANDU nuclear fuel. Some of the images obtained are shown and discussed from the point of relevance for geometrical resolution, internal structure, contrast etc.
The tomography reconstruction for a nuclear fuel element will be presented. The paper will outcome some conclusions on the possibility to offer meaningful information about the internal structure of the fuel, grains in the structure of the pellets, dishes between pellets, eventual defects etc..

1

METAL BIOSORPTION BY SPIRULINA PLATENSIS BIOMASS

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The cyanobacteria Arthrospira platensis, previously called spirulina, is a well-studied biological entity with a wide range of possible physiological, biochemical, genetical, biotechnological, and ecological uses.. This study assessed the efficiency of spirulina biomass uptake of zinc, iron, copper, cobalt and chromium ions in single and multi-component systems through the use of epithermal neutron activation analysis. In single metal solutions, the efficiency of studied metal uptake changes was found in the following order: Cu(II) > Zn(II) > Co(II) > Fe(III) > Cr(IV), while in the multi-metal solution the order observed was: Cu(II) > Co(II) > Zn(II) > Fe(III) > Cr(IV). Additionally, alterations in the elemental content of spirulina biomass under metal loading was observed. Spirulina platensis biomass can be efficiently applied to obtain metal-enriched biomass and to remove metal from complex industrial effluents.

2

THE COOLING, THE REGULATION AND THE TEMPERATURE STABILIZATION SYSTEM FOR MPD DETECTOR AT JINR ACCELERATOPR COMPLEX NICA.

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The cooling, the regulation and the temperature stabilisation system is very important for every kind of electronics. Devices, which are not cooled, can be destroyed and burned. This poster consists simulation of different cooling systems for MPD detector as an example of TOF detector.

3

POSSIBLE EXPERIMENT FOR THE DEMONSTRATION OF NEUTRON WAVES INTERACTION WITH SPATIALLY OSCILLATING POTENTIAL

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A wide range of problems in neutron optics is well described by a theory based on application of the effective potential model. It is important to note that theory of dispersion involves a very substantial assumption of sphericity of interfering scattered waves. In a non-inertial reference frame associated with accelerated matter, the concept of spherical waves is invalid. It was supposed that the concept of the effective potential in neutron optics has a limited region of validity and ceases to be correct in the case of the giant acceleration of a matter [1]. To test this hypothesis a new Ultra Cold neutron experiment for the observation of neutron interaction with potential structure oscillating in space was proposed [2]. The report is focused on the model calculations of the topography of sample surface that oscillates in space. These calculations are necessary to find optimal parameters and geometry of the planned experiment.
References:
[1] Frank A.I., JETP Lett. 100 (2014) 613
[2] A.I. Frank, D.V. Kustov, G.V. Kulin el al., J. Phys.: Conf. Ser. 746 (2016) 012054

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THE DESIGN BRIEF OF THE SLOW CONTROL SYSTEM FOR TOF-MPD.

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The MPD (Multi Purpose Detector At NICA) experiment being under construction at Laboratory of High Energy Physics at Joint Institute for Nuclear Research will be studying relativistic heavy ion collisions. Such experiments produce not only experimental data but also a lot of operation parameters which should be under monitoring and controling during regural working. For this purpose Slow Control System is needed. This presentation will show you the design brief of the Slow Control System which is preparing for TOF-MPD detector but because of modular structure can be duplicated for every subdetector in MPD experiment.

6

MANIFESTATION OF COLLECTIVE BEHAVIOR IN COUPLED SYSTEMS OF INTRINSIC JOSEPHSON JUNCTIONS

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We study a system of Josephson junctions, quantum mechanical devices, each junction being composed of two superconducting electrodes and a separating barrier. They can be influenced by coupling and dissipation parameters.
In our work we solve numerically the system of nonlinear equations and theoretically investigate the influence of coupling and dissipation parameters upon the systems. The study of the c-axis charge traveling wave for coupling parameter of α=1 and dissipation parameter of β=0.2 in a coupled system of Josephson junctions is presented in Ref. [1]. In our work we extended the studies from Ref. [1] for systems with larger dissipation (β=0.9) parameter and strong coupling.
Was observed the appearance of a second hysteresis zone on IV-characteristic for strong enough coupling between the junctions and large dissipation parameter. Also is observed the reduction in McCumber hysteresis zone with the increase of dissipation parameter. We find correlation between the manifestation of the second hysteresis zone with the traveling longitudinal plasma wave. We present and analize results of time dependences of charge oscillations and corresponding fast Fourier transformation.

7

SIMULATING NEUTRINO INTERACTIONS FOR THE BAIKAL-GVD EXPERIMENT

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A simulation of the neutrino interaction in a vicinity of the detection volume of the BAIKAL-GVD experiment is presented. Numerical calculations are accomplished by a c++ program ANIS (All Neutrino Interaction Simulations). The routine reads the data files with full cross-sections for the neutrino(antineutrino) interactions, propagates the neutrino through the Earth, and eventuaLly simulates the interaction within the sensitive volume of the detector. We will compare the results of the program with simulations obtained by a fortran code that has been used by the collaboration in the past years.

8

SUPERCONDUCTING COMPONENTS IN DEVICES FOR HIGH ENERGY PHYSICS

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Superconductors are widely applied in the devices for high energy physics. They are mostly used as materials for high-field magnets used to bend particle beams in the accelerators and to confine plasma in fusion reactors. There are also minor auxiliary superconducting devices.
Two types of such minor devices are presented. The first are superconducting magnetic shields used to modify magnetic field by attenuating or homogenising it. The other are superconducting bus-bars used to carry large electric currents to the magnets and RF cavities.
Examples of applications are presented along with the results of numerical of the devices. Both high- and low-temperature superconductors are analysed.

9

NEW METHODS FOR THE STUDY OF NANOPARTICLES PHYSICAL PROPERSTIES USING THEIR DISPERSION IN NEMATIC LIQUID CRYSTALS

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Nanoparticles synthesis is one of the most attractive research field due to the increased interest in their application in various fields from electronic device and medicine to environmental science or food industry. It is already known that nanoparticles exhibit a completely different behaviour compared to the same substance in bulk form but, their use in some devices is still impeded by the lack of information about their physical properties. In order to gather more and accurate information about these properties, we used dispersions of carbon nanotubes, ferromagnetic nanoparticles or quantum dots in an organised, flexible and controllable environment such as liquid crystal. By placing the samples in different field (magnetic, electric or laser) we were able to study some of their properties such as electric conductivity, magnetic anisotropy, orientation preferences, or to observe their influence on nonlinear optical properties of the liquid crystal host.

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APPLIED PHYSICS-NANOTECHNOLOGY ON DEPARTMENT OF PHYSICS IN NOVI SAD

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Following the latest trends in science, approximately 10 years ago, scientists from Department of Physics teamed up with scientists from Faculty of Technology (University of Novi Sad) forming a group for experimental research in field of nanotechnology. Now our group has grown and includes researcher from Faculty of Technology, Faculty of Technical Sciences, BIOSENCE Institute (all University of Novi Sad) and Institute for Multidisciplinary Research, University of Belgrade.
Our group chose to do research in specific field of magnetic nanoparticles and multiferroic thin films. Laboratory for structure analysis at Department of Physics is equipped with 3 x-ray diffractometers

for powder samples, 1 for single crystal, dielectrometer and a Raman spectrometer. Our recent published papers show our results of structural characterization of NiFe2O4 and BaTiO nanoparticles as well as multiferroic thin films. For structural characterization we are using X-ray diffraction and Raman spectroscopy. Some of our results for NiFe2O4 nanoparticles are shown on Figure 1. and Figure 2. As these techniques are compatible, reliable, fast and non-invasive, other groups found it interesting for their research, so we started with characterization of carbon based materials- nanotubes and graphene, as well as some biomaterials and tissues. Some of our papers are:

1. Manjakkal Libu, Elvira Djurdjic, Cvejin K., Jan Kulawik, Krzysztof Zaraska, Dorota Szwagierczak, Electrochemical Impedance Spectroscopic Analysis of RuO2 Based Thick Film pH Sensors, Electrochimica Acta (ISSN: 0013-4686), Vol 168, 2015, pp. 246-255.
2. Cvejić Željka, Elvira Djurdjic, Goran Ivkovic Ivandekic, Bajac Branimir, Postolache Petronel, Mitoseriu Liliana, Srdic Vladimir, Rakic Srdjan, The effect of annealing on microstructure and cation distribution of NiFe2O4, Journal of Alloys and Compounds (ISSN: 0925-8388), Vol 649, 2015, pp. 1231-1238.
3. Tripković Đorđije, Vukmirović Jelena, Bajac Branimir, Samardžić Nataša, Elvira Djurdjic, Stojanovic Goran, Srdić Vladimir, Inkjet pattering of in-situ sol-gel derived barium titanate thin films, Ceramics International (ISSN: 0272-8842), Vol 42, 2016, pp. 1840-1846.
4. Bajac Branimir, Vukmirović Jelena, Tripković Đorđije, Elvira Djurdjic, Stanojev Jovana, Cvejic Zeljka, Skoric Branko, Srdic Vladimir, Structural characterization and dielectric properties of BaTiO3 thin films obtained by spin coating, Processing and application of ceramics (ISSN: 1820-6131), Vol 8, No 4, 2014, pp. 219-224.

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GREEN SYNTHESIS OF EUROPIUM OXIDE NANOPARTICLES BY HIBISCUS SABDARIFFA EXTRACT: STRUCTURAL AND OPTICAL PROPERTIES

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This contribution reports on the synthesis and the main physical properties of Europium (III) oxide (Eu2O3) nanocrystals synthesized for the first time by a completely green physical-chemistry process using Hibiscus sabdariffa flower natural extract as an effective chelating agent. The structural and optical properties of such biosynthesis nanocrystals were analyzed by High Resolution Transmission Electron Microscopy (HRTEM), Scanning Electron Microscopy (SEM), Electron Dispersive X-rays Spectroscopy (EDS), X-Rays Diffraction (XRD), Infrared (ATR-FTIR), Raman as well as room temperature photoluminescence. The luminescence properties of such cubic were characterized by an intense red emission centered at 614.8 nm (5D0-7F3).

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NEUTRONS IN TWO-BAND MAZE: SUGGESTION FOR SOME CHANGES IN EXISTING PROTOCOL FOR ESTIMATION OF NEUTRON DOSE EQUIVALENT

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Therapy accelerators operating at energies higher than a threshold for (γ, n) nuclear reaction produces measurable number of neutrons. In this study we investigate the neutron dose equivalent in the 15 MeV linear therapy accelerator vault having two band maze. The neutron dose equivalent was measured at 32 points in both maze corridors. Results show that neutron equivalent dose at the entrance of the two-band maze was reduced almost three orders of magnitude. One of objectives of this study was to compare measured and calculated values of neutron dose equivalent. However there is only one IAEA protocol which proposes a model for estimation of neutron dose equivalent at the entrance door in the two band maze geometry. According to our measurements, TVD in the first bend (closer to the inner maze entrance) is approximately 5 m, which is in relative good agreement with values obtained by proposed one band maze protocols. However TVD measured in second maze corridor differ significantly from TVD proposed by IAEA protocol as well as measured neutron dose equivalent at entrance doors. New method for estimation of neutron dose equivalent at the entrance doors is proposed.

13

LASER-INDUCED BREAKDOWN SPECTROSCOPY (LIBS) ON GEOLOGICAL SAMPLES: COMPOSITIONAL DIFFERENTIATION

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1. Project objective
2. Methodology 3.Findings and conclusion or Intended Results

Summary:

This contribution reports on the LIBS device applied on some selected geological samples for compositional differentiation. LIBS is a developing analytical tool, which can be used to peform elemental analysis of any material (solid, liquid and gas). For generation of laser induced plasma, a Q-switched neodymium-yttrium aluminium garnet (Nd: YAG) laser operated at 10 Hz and wavelength of 1064 nm was employed on the surface of the samples. A spectrometer fitted with an intensified charge-coupled device (ICCD) was used to record the diffracted spectrum. The spectrometer was attached to a computer for rapid processing and interpretation of the data acquired. A Variety of samples was measured, the sample set was compiled from the samples collected directly from: (1) the Gold, Copper, and Iron mines in South Africa; (2) the Karoo (Prince Albert Formation (Fm) in South Africa; and (3) the Karas region in Namibia. The results from the LIBS technique were correlated with subsequent analysis of the same samples by X-ray computed tomography (XCT); Particle-induced X-ray emission (PIXE) and X-ray fluorescence (XRF). Based on theory and results, an analytical tool for compositional differentiation of geological samples is proposed. The whole study should contribute to improve analytical methods for geochemical analysis of samples (Mining, exploration, filed analysis, etc.), real time analysis of samples, thus saving money and time spent in labs. Nevertheless, LIBS can fulfil its potential as a versatile and irreplaceable technique for in-situ differentiation when utilized with chemometric algorithms.

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CONTINUOUS RADON MONITORING WITH TWO FILTER DETECTION SYSTEM

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In this paper we used two filter detection system to measure radon activity concentrations in outdoor atmosphere. By modification of the Thomas method we were able to operate our monitoring system in continuous mode. To calibrate the measuring system, the Ward-Borak method based on determination of inverting coefficients was used. The activity concentration of radon was determined within a series of short-time integral measurements during which the outdoor air has been sucked into 200 l storage tank trough filter on the input. Radon progeny from storage tank was filtered and measured on the output. The results indicate that our system is capable to measure low radon activity concentrations and our results are in a good match with results from other continuous monitoring systems.

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LASER-INDUCED BREAKDOWN SPECTROSCOPY (LIBS) ON GEOLOGICAL SAMPLES: QUANTIFICATION OF RELETIVE HARDNESS PROPERTIES

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1. Project's objective
2. Methodology
3. findings and Conclusion or Intended results

Summary:

This paper reports on the effects of LIBS experiment for quantification of relative hardness properties. The technique depends on the correlation between the intensity ratio of ionic to atomic spectral lines and the hardness of the target material. Based on theory and results, an analytical tool for estimation of relative hardness of geological samples is proposed.

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INVESTIGATION OF GAMMA RADIATION EFFECTS ON FLUORESCENT PEPTIDES

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Gamma radiation is a well-known technique applied to medical devices and food products to reduce microbial contamination [1]. However, irradiation also induces chemical changes in biological molecules, such as proteins, lipids, DNA, etc. Aside from the direct effect of the radiation (breaking the covalent bonds of the proteins), the free radicals generated by the radiolysis of water can also lead to modification of the primary structure of proteins by fragmentation, cross-linking, aggregation, etc [2]. The radiation-induced changes of the protein structure were previously studied by measuring the changes in the molecular properties of the proteins [3-5]. Fluorescence spectroscopy is a powerful tool used to investigate the changes in the local environment around tryptophan and tyrosine residues. Although this technique was employed to study the effects of radiation against larger proteins, no studies were reported regarding the effects on smaller molecules (amino-acids or peptide).
The aim of this study is to evaluate the radiolysis effect on the fluorescence properties of small molecules (indole, tryptophan and gramicidin A). The molecules in aqueous solutions were irradiated with a 60Co source with radiation doses of 0, 0.5, 1, 2 and 2.5 kGy. UV-Vis and fluorescence spectroscopy techniques (intensity and time resolved) were used to observe the changes suffered by the molecules. Contrary to fluorescence intensity measurements, the fluorescence lifetime is independent of fluorophore concentration, but is sensitive to a variety of factors, like: the fluorophore structure, temperature, polarity, etc.
Fluorescence intensity of indole and tryptophan molecules were quenched by the radiation, but no changes were recorded for their fluorescence lifetime. For Gramicidin A, both the fluorescence intensity and lifetime were affected indicating a change in the local environment around tryptophan residues.
These preliminary data suggest the degradation of indole ring in both indole and tryptophan samples by radiation exposure (number of active molecules is lowered). In the case of indole ring included in a peptide structure (Gramicidin A) the local environment is modified affecting the lifetime values too.
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2. Filali-Mouhim, et al., International Journal of Radiation Biology, 1997;
3. Cho and Song, Journal of Biochemistry and Molecular Biology, 2000;
4. Lee and Song, Journal of Biochemistry and Molecular Biology, 2002;
5. Gaber, Journal of bioscience and bioengineering, 2005;

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SPIDER SILK COATED WITH EUROPIUM DOPED CERIA NANOPARTICLES SYNTHESIS, CHARACTERIZATION AND POTENTIAL APPLICATIONS

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Spider dragline silk was coated with pure as well as Eu doped ceria nanopowders at the room temperature. The treatment was done by immersion of the spider silk mesh into aqueous solutions of

cerium nitrate (CeNO3)3) and ammonium hydroxide (NH4OH). Depending on the relationship between Ce3+ ion and ammonium hydroxide concentration, coated fibers exhibited a different thickness. Obtained materials were studied by means of FESEM. It was found that ceria nanoparticles of average size of 3 nm were coated along spider thread. X-ray diffraction (XRD) and selected-area electron diffraction (SAED) confirmed crystal nature of nanoparticle coating of spider silk. By using Williamson-Hall plots, crystallite size and strain were estimated. EDS measurement confirmed the presence of Eu in spider-Eu doped ceria composite, and according to FTIR analysis, the interaction between CeO2 and spider silk was proposed. The morphology of obtained composite was observed by TEM. The photoluminescence emission spectra of spider silk coated with Eu doped ceria were measured with two different excitations of 385 nm and 466 nm. The two-photon excited auto-fluorescence of spider silk coated with Eu doped ceria was detected using nonlinear laser scanning microscope. Obtained composite has a potential as a fluorescent labeling material in diverse applications.

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THE COMPARATIVE STUDY ON THE DEGRADATION OF EPDM BY γ IRRADIATION AND WEATHERING

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This paper reports the stability behavior of ethylene-propylene elastomer (EPDM) modified by the addition of two efficient antioxidants namely rosemary and gallic acid powders.
By the exposure of the samples to γ rays and weathering aging, the polymeric material is slowly degraded due to the formation of free radicals.
In the presence of protective compounds, the oxidation is slowed down. The emphasizing of the oxidation development was revealed by FT-IR and UV spectroscopies, chemiluminescence and DSC.
The kinetic approach applied to the polymer degradation is based on the changes happened in the rate of oxidation, onset oxidation temperature, carbonyl/hydroxyl indices and thermogravimetry.
There is a main difference between the two degradation procedures because of the different variation of radical concentrations.
The assessment of EPDM stability under accelerated oxidation can be used for the qualification of EPDM for long term applications.

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ACCRETION DISK RADIATION IN KERR METRIC

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We perturb the circular, equatorial orbit of a test particle around a compact object in Kerr-like metric. Mathematically, we solve the stochastic differential equations which govern the particle's motion, in order to obtain the radiation in the particle's frame of reference and at infinity.

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RADIATION INDUCED BYSTANDER SIGNLING REQUIRE PINK1, A KEY MITOCHONDRIAL KINASE

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Irradiation represents now a tool in many technological and medical applications. Besides the important benefits, exposure induces a series of molecular damages in directly hit but also in neighbouring, bystander cells. Understanding the mechanisms involved in induction of detrimental effects will contribute to decide the optimal risk-benefits ratio and will allow limiting the side effects of radiation exposure.
We investigated here the role of a mitochondrial kinase, PINK1, in radiation sensibility and bystander signaling following X-ray exposure. PINK1 is a key molecule involved in several essential cellular processes. While loss-of-function mutations are known as a cause of Parkinson's disease, its increased expression was associated with some cancers.
PINK1 role was addressed in two cell types: mouse embrionary fibroblasts (MEFs) and human neuroblastoma (SH-SY5Y), using genetically modified cells, deficient for the kinase expression. Bystander effects were induced by medium transfer. We proved decreased ATP levels and shortage of cellular cycle for PINK1 defficient cells, correlated with increased radiosensibility. Bystander effects were highlighted in both MEFs and SH-SY5Y cells as increase DNA damage. Interestingly, the effects were only observed when both donor and acceptor cells have a normal phenotype. PINK1 deficient cells were not able to induce or respond to bystander signals.
PINK1 deficiency, associated with lower ATP level and faster cell cycle, lead to increased radiosensibility, and impaired bystander signaling independently of cell type.

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ENHANCEMENT OF ENTRAPMENT AND TOXICITY OF DOXORUBICIN-FUNCTIONALIZED IRON OXIDE NANOPARTICLES' FOR MG-63 CELLS USING LOW DOSE RADIOTHERAPY

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The goal of cancer therapy involving radiotherapy aims to deliver a high radiation dose to the tumor, so that the growth of the tumor cells is maximally inhibited, while at the same time trying to spare the healthy normal tissue cells. Nanotechnology has offered solutions in this regards, not only by using nanoparticles as carriers for active substances, but also by exploiting their physical properties to enhance the cytotoxic effects of ionizing radiation on cancer cells. For this, we have designed and synthesized iron oxide nanoparticles (IONPs), directly functionalized with doxorubicin (DOX) chemotherapeutic substance, using a modified chemical co-precipitation method. The nanoparticles were characterized using relevant physico- chemical methods, in order to evaluate the morphology, composition and crystallinity of the samples. The biological cytotoxic effects and mechanisms were

proved for MG-63 osteosarcoma cell cultures using both qualitative and quantitative methods. The efficiency of the IONPs cellular entrapment was determined through particle induced X-ray emission. The tests were done in comparison for both unexposed and exposed cells to 1 Gy X-Rays. The in vivo biologic evaluation was done for Balb/c mice and chick embryo animal models. DOX- functionalized nanoparticles proved to have genotoxic effects on MG-63 cells, which were linked to an increased production of reactive oxygen species. The exposure of the tumor cells to 1 Gy radiation, followed by DOX-IONPs treatment, led to higher cytotoxic effects due to an increased internalizing of the nanoparticles into the cells. These effects were correlated with a delayed cell division, due to both X-Ray exposure and DOX-IONPs treatment. The systems showed no in vivo systemic toxicity for the exposed animals, proving to be safe and promising for cancer therapy applications.

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NUCLEAR AND ATOMIC METHODS USED FOR CULTURAL HERITAGE ANALYSIS

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The aim of this paper is to present the methods for analysing pigments and ceramic of the Middle and Late Bronze Age encrusted pottery. Particle Induced X-Ray Emission (PIXE) measurements were carried out at the external beam setup of the 3 MV Tandetron accelerator at IFIN-HH, Măgurele-Bucharest, in order to determine the elemental composition of pigments (and fabric). A 2.7 MeV proton beam was focused to approximately 2 x 2 mm2, the electric current has been kept under 5 nA, for a data acquisition time of 300 s per spectrum. A 500 μm thick Amptek Si-PIN detector, positioned at 45° with respect to the beam direction was used to measure the characteristic X-rays. The quantitative data analysis was performed using GUPIX software. The pigment was then analyzed using a Bruker Vertex 70 FTIR spectrometer equipped with a RAM II Raman module (with N2 cooled detector and Nd:YAG laser excitation source of 1064 nm). The results of the two methods were strikingly similar and allow for deductions concerning transmission of local tradition in pottery manufacturing and possible interregional contacts.

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NUCLEAR AND ATOMIC METHODS USED FOR CULTURAL HERITAGE ANALYSIS

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The aim of this paper is to present the methods for analysing pigments and ceramic of the Middle and Late Bronze Age encrusted pottery. Particle Induced X-Ray Emission (PIXE) measurements were carried out at the external beam setup of the 3 MV Tandetron accelerator at IFIN-HH, Măgurele-Bucharest, in order to determine the elemental composition of pigments (and fabric). A 2.7 MeV proton beam was focused to approximately 2 x 2 mm2, the electric current has been kept under 5 nA, for a data acquisition time of 300 s per spectrum. A 500 μm thick Amptek Si-PIN detector, positioned at 45° with respect to the beam direction was used to measure the characteristic X-rays. The quantitative data analysis was performed using GUPIX software. The pigment was then analyzed using a Bruker Vertex 70 FTIR spectrometer equipped with a RAM II Raman module (with N2 cooled detector and Nd:YAG laser excitation source of 1064 nm). The results of the two methods were strikingly similar and allow for deductions concerning transmission of local tradition in pottery manufacturing and possible interregional contacts.

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STRUCTURE DETERMINATION OF CDO(001)

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Cadmium oxide is transparent semiconductor with a lot of potential applications in technology. I-V Low-energy electron diffraction (LEED), and density functional theory (DFT) calculations have been used to investigate the geometric structure of CdO (Cadmium Oxide) within area of a few layers below interface along [001] direction. The analysis of I-V LEED curves has been done using CLEED package and MatLab. Basing on DFT calculations theoretical I-V curves have been computed using CLEED non-symmetrized version. The geometric structure of CdO has been determined as a comparison between theoretical and experimental curves. In order to compare curves CLEED RFAC was used and R-factor is given. Debye temperature of CdO(001) surface was computed in Matlab taking into account LEED pattern intensity changes.

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INITIAL ANALYSIS OF TECHNOLOGY- CRITICAL ELEMENTS IN THE SEDIMENTS OF THE DANUBE RIVER

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Technology-critical elements (TCE), which includes Nb, Ta, Ga, In, Ge, Tl, Te, the platinum group elements (PGE: Pt, Os, Ru, Rh, Pd and Ir), and most of the rare earth elements (REE: Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Yb, Lu) are of the great relevance in the development of modern technologies [1, 2]. For most of these elements, the present understanding of their concentrations, transformation and transport in the different environmental compartments is scarce and/or contradictory. Determination of many of TCEs cannot be treated as routine due to their typical ultratrace concentrations, which are making their analytical determination extremely difficult and/or time consuming [3-5].
The Danbe is Europe's second longest river (2860 km) that flows through 10 countries with more than 30 tributaries. Sediments from Danube River and its tributaries (Sava, Vellika Morava and Pek) were collected on 11 localities in Serbia . The aim of this research is to analyze TCEs in sediment samples and to use obtained results as the base for further development of analytical methods for determination TCEs. After sample preparation TCE concentrations were determined by Instrumental Neutron Activation Analysis at Frank Laboratory of Neutron Physics of the Joint Institute of Nuclear Research, Dubna, at the pulsed reactor IBR 2 using epithermal neutrons.
Obtained results shows slightly increased level of Nd, Eu and Dy in comparison with standard rock composition and that further investigations are necessary in order to gain representative data of TCEs in environmental samples.
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MUON CAPTURE USING PLASTIC TRACK DETECTORS

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A problem that is poorly investigated concerning the background in neutrino experiments or other rare processes is the contribution of muon capture in the target material or in other components of the detector. The first discussion of these processes was done by Fermi and Teller [1]; Huston et. al. [2] have done measurements of capture processes in mixed noble gases, but a systematic investigation does not yet exist. An important step in this investigation is to correct the measurements of the low and very low energy component of the muon spectra from cosmic rays.
In the present contribution, after an estimation of the cosmic rays spectra and their variability in time and geographical position using PARMA/EXPACS analytical model with numeric excel interface [3], we discuss some aspects of the physics of muons capture and present preliminary results of the cosmic muon capture rate using plastic track detectors and possible consequences for the next generation of great neutrino LAr detectors. Details of the experimental procedure and the chemical etching are also discussed in the contribution.

- Supervisor: Professor Ionel Lazanu, University of Bucharest [1] E. Fermi and E. Teller, Phys. Rev. 72(1947) 399. [2] R. L.Hutson et. al., Phys. Lett. 76A (1980) 226. [3] Sato T (2016), PLoS ONE 11(8): e0160390. doi:10.1371/journal.pone.0160390

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SIMUALTION OF NUCLEON SPALLATION USING COSMO CODE AND PRELIMINARY RESULTS FOR RADIOACTIVITY INDUCED BY MUON ACTIVATION –IMPACTS ON DEEP UNDERGROUND LAr NEUTRINO EXPERIMENTS

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Low-background experiments, such as those related to neutrino interactions, are placed in deep underground locations to diminish the background events created by cosmic-ray muons passing through the detector volumes or the radioactivity induced in different environmental materials. An accurate knowledge of the production of the latter source is of paramount importance to be able to interpret the results of low-background experiments. Cosmic-ray primaries interacting with the atmosphere create showers, including a broad spectrum of neutrons, protons and muons. The objective of this work is to evaluate different sources and contributions to the radioactivity using simulations in various materials and activation due to muon fluxes. We evaluated the cosmogenic production rates [1], [2] in some materials that are used as targets (argon) and shielding/supporting components for detection ensemble.

- Supervisor: Professor Ionel Lazanu, University of Bucharest [1] C. J. Martoff, P. D.Lewin, Computer Physics Communications 72(1992) 96-103; new version from the author of the code [2] T. Luu, C. Hagmann, UCRL-TR-226323, 2006

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ANTIMATTER EXPERIMENTS: FACILITIES AND RESULTS

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In 1928 Paul Dirac creates an equation that combined quantum theory and special relativity to describe the behavior of an electron moving at a relativistic speed. Dirac's equation posed a problem – it had a two possible solutions, one for an electron with positive energy and one for an electron with negative energy. Classical physics impose that the energy of a particle must always be a positive number.
As an explanation of the problem Dirac suggested that for every particle there exist a corresponding antiparticle, exactly matching the particle but with opposite charge. This has been confirmed in 1932 by Carl Anderson who observed positron (antielectron) for the first time. Since that time many scientists have dealt with subject of antimatter, asking more and more questions about its nature, properties and possible applications.
To make an answers possible it is necessary to have an appropriate research apparatus and conduct proper and reliable tests. The first big-scale installation allowing deepening knowledge in antimatter was "Bevatron"- with its use the existence of the antiproton was confirmed. In the later years, many studies were carried out, building larger and more complex installations like SPEAR, SPS, LEP, LEAR etc.
Presently the most advanced research are carried out at CERN, with the present or future use of the Antiproton Decelerator, ACE, AEGIS, ATRAP, ALPHA, ASACUSA and ELENA facilities.
Presentation includes principles of antimatter studies, description of historical, present and planned research facilities with the results obtained so far. It will also be shown how these research results can be used in various fields of science, technology and medicine.

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APPLIED PHYSICS-NANOTECHNOLOGY ON DEPARTMENT OF PHYSICS IN NOVI SAD

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Following the latest trends in science, approximately 10 years ago, scientists from Department of Physics teamed up with scientists from Faculty of Technology (University of Novi Sad) forming a group for experimental research in field of nanotechnology. Now our group has grown and includes researcher from Faculty of Technology, Faculty of Technical Sciences, BIOSENCE Institute (all University of Novi Sad) and Institute for Multidisciplinary Research, University of Belgrade.
On the poster will be presented the facilities that Laboratory for structure analysis at Department

of Physics owns. Also, there will be presented the part of the research group as well as some of the papers published in recent years.

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QUINTA SETUP IRRADIATION BY HIGH-ENERGY PROTON AND DEUTERON BEAMS

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Use of Accelerator Driven Systems (ADS) is supposed to be a convenient solution for nuclear waste reduction. The ADS research in the Joint Institute for Nuclear Research (JINR) has a long history. The first experiments were realized in 1990s and continue until now.
Our group in JINR is a member of the international Energy & Transmutation of Radioactive Waste collaboration, which consists of members from 15 states, and is involved in study of simple subcritical setups. The setups are usually made from a spallation target (lead, uranium) and a subcritical blanket (natural or depleted uranium). High-energy proton or deuteron beams coming from Phasotron or Nuclotron accelerator are impinging on the setups and massive neutron fields are created by spallation and fission reactions. These fields are measured by activation detectors and evaluated by activation techniques.
Currently, the uranium subcritical assembly QUINTA has been studied. In the presented experiments, activation samples of 27Al, 59Co and natPb were used and neutron fields along the primary beam passage were investigated. Experimental results were compared with Monte Carlo simulations.

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RAMAN AND X-RAY PHOTOELECTRON SPECTROSCOPY STUDY OF ION-IRRADIATED SINGLE-WALLED CARBON NANOTUBES

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The main goal of this contribution is to present studied effects of high-energy ion irradiation on the single-walled carbon nanotubes (SWCNTs). A variety of SWCNTs samples were prepared and irradiated with 167 MeV Xe ions at the IC-100 cyclotron (FLNR JINR, Dubna). To disclose the structural changes occurring upon irradiation the samples were thoroughly analyzed by Raman spectroscopy (EL = 488 nm) and X-ray Photoelectron Spectroscopy. Based on the measured data the dependence between radiation dose and the extent of the damage induced in the material is derived. The future perspectives, including conductance measurements, are drawn.

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STUDY OF CHEMICAL WET ETCHING TECHNIQUE ON ALUMINUM DOPED ZINC OXIDE THIN FILMS

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The paper proposed to study the structural, optical, morphological and electrical properties of AZO films deposited by magnetron sputtering and textured using the chemical wet etching technique. Because the surface morphology of primary magnetron sputtered AZO film is quite smooth (surface roughness is around 4.9 nm) and does not have apparent light scattering effect, it is imposed the realization of the subsequent surface treatment of primary magnetron sputtered AZO layer. The textured surface of the AZO prepared films achieves light trapping effect, and this fact leads to the improvement of the conversion efficiency for the solar cells. The films were deposited by magnetron sputtering method using ceramic targets (ZnO : Al2O3) with thickness of 500 nm and etched in acetic acid (CH3COOH) to achieve rough surface textures for better light scattering. Through the etching texturing, the AZO thin films maintain their structural characteristics, have a 80% transmittance in the visible domain, and the surface roughness is increased up to 30 nm, with the resistivity maintained in the range of 10-3 - 10-4 Ω•cm.

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RECYCLING OF ND-FE-B SCRAP PERMANENT MAGNETS VIA HYDROGEN PROCESSING

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Nd-Fe-B permanent magnets are a strategic material for a number of emerging technologies. They are a key component in the most energy efficient electric motors and generators, thus, they are vital for energy technologies, industrial applications and automation, and future forms of mobility. Rare earth elements such as neodymium, dysprosium and praseodymium are also found in WEEE in volumes that grow with the technological evolution, and are marked as critical elements by the European Commission due to their high economic importance combined with significant supply risks [1, 2]. Appliances containing Nd-Fe-B comprise a significant environmental footprint, which comes with the use of rare earth metals, most importantly Nd, Pr, Dy and Tb. However, recycling of these "metals"is not yet commercially conducted. In fact, less than 1 % of the rare earths are currently being recycled mainly due to low collection rates and lack of mature and economically feasible technologies [3].

In our work, a combination of low and high temperature hydrogen treatments - hydrogen decrepitation and dynamic hydrogenation disproportionation desorption recombination (d-HDDR) - was used to produce new anisotropic magnet powders from scrap sintered Nd-Fe-B magnets for resin-bonded magnets [4]. This study covers 4 different types of permanent magnets from different electrical motors and 2 mixtures of scrap PM, one made of permanent magnets from electrical motors and one of Nd-Fe-B magnets from waste electrical and electronic equipment's. The main elements of these types of scrap magnets are (Nd,Dy,Pr)-(Fe,Co)-B, with small additions of Cu, Al and Ga. Due to the sensitivity of the d-HDDR process to additives such as Co and Dy, the process parameters were optimized for each type of alloy. Anisotropic or isotropic powder is obtained by applying different H2 pressures and/or H2 desorption rates. The variations of the process parameters also have a strong impact on the magnetic properties of the final powder. All the changes and the behavior of these scrap Nd-Fe-B magnets regarding their exposure to carefully controlled H2 pressure, temperature and H2 desorption rate will be discussed.

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ESTIMATIONS OF THE TERRESTRIAL COSMIC RAYS INTENSITIES AS A BACKGROUND FOR THE NEUTRINO EXPERIMENTS

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In order to search for rare nuclear processes in particular experiments, it is necessary to know the local cosmic ray flux.
The present contribution discusses the major sources of primary cosmic rays and also reviews the main processes associated with the penetration of cosmic rays through the Earth's atmosphere. The final particle flux depends on the geomagnetic coordinates, on the altitude and temporal moment of measurement or calculation.
In the estimation of cosmic-ray fluxes using the EXPACS code [1], the contributions of neutrons, protons, ions, muons, electrons, positrons and photons, which are potentially essential issues in various experiments, are considered. These results are compared with the calculations of Ziegler [2]. The following locations are considered for flux estimation at Earth's surface: the Mediterranean Sea (35°N 18°E), Antartica (81030'S, 1750 W), Lake Baikal (53°30′N 108°0′E), Gran Sasso (42°28′N 13°33′E), Daya Bay (22.5953°N 114.5431°E), Chooz (50°06′15″N 4°48′28″E), Kaiping (22°22′N 112°41′E), Hida (36°14′N 137°11′E), South Dakota (44° 21′ N, 103° 45′ W), Pyhasalmi (63°39′N 26°02′E), Slanic (45°14′N 25°56′E). The time variation of the local cosmic ray fluxes is also considered.

- Supervisor: Professor Ionel Lazanu [1] Tatsuhiko Sato, (2015) Analytical Model for Estimating Terrestrial Cosmic Ray Fluxes Nearly Anytime and Anywhere in the World: Extension of PARMA/EXPACS. PLoS ONE 10(12): e0144679., doi:10.1371/journal.pone.0144679 [2] J. F. Ziegler, Terrestrial cosmic ray intensities, IBM J., Develop., vol. 42, (1998) 117

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CONTROLLING SYSTEM FOR EXPERIMENTAL SETUPS OF MASHA AT CYCLOTRON DC280.

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Modernization of control system of the experiment MASHA will be discussed. The controlling system based on CompactRIO, FlexRIO and PXI/PXIe standards will be developed, tested and integrated with new experimental setups at cyclotron DC280. MASHA Experiment is designed to study properties of super heavy elements synthesized in reactions 242,244Pu and other neutron rich actinides + 48Ca. Setup of MASHA is a combination of ISOL (Isotope Separator On-Line) methods and the classical mass spectroscopy. There is a requirement for high reliability and stability of the measurement and control. Therefore, we are gradually building distributed control network consist of up-to-date devices. Controllers based on RIO architecture was applied for control (several actuators) and connecting to whole experiment for study cross sections of reactions 40Ar + 144Sm and 166Er. And there is plan to use RIO standard (consist of microprocessor working on real-time operating system and Field Programmable Gate Array) in new setup of MASHA with gas catcher and beam line from new accelerator DC280.

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A SURFACE ENHANCED RAMAN SCATTERING-BASED METHOD FOR DETECTION OF MICROALBUMINURIA

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Introduction

Microalbuminuria, which is defined as the excretion of 30–300 mg of albumin per 24 hours, represents an independent risk factor for chronic renal failure and for cardiovascular morbidity and mortality. However, point of care tests used for screening in diabetic and hypertensive patients do not meet recommended sensitivity criteria for accurate identification of microalbuminuria. Therefore, the present study proposes a surface enhanced Raman spectroscopy (SERS)-based method for detecting trace amounts of urine albumine and proteins using iodine modified silver nanoparticles.

Materials and Methods

Iodine modified silver nanoparticles synthetized using the hydroxylamine reduction method were mixed with human urine aliquots that contained bovine serum albumin in the 30-300 microg/l range. SERS spectra were collected with a He-Ne laser emitting at 633 nm, which delivered approximately 40 mW of power at the sample. For data acquisition, the laser was focused on the sample via a 10X microscope objective (N.A. 0.25) with an exposure time of 30 s. All data processing and analysis was performed using the MATLAB software environment.

Results

SERS spectra of urine samples presented two Raman bands at 860 cm-1 and 1003 cm-1, that were tentativelly attributed to the tyrozine and phenylalanin breathing mode, respectively. The intensity of the Raman bands was proportional to the concentration of the albumine and the detection limin was aproximatelly 30 mg/l. As oposed to enzymatic or immunological assays, the SERS-based detection method is insensitive to chemical modifications and could be used with other types of urine proteins as well, including degraded albumin or Bence-Jones proteins.

Conclusion

The SERS based method can detect trace amounts of urine albumine using the Raman bands at 860 cm-1 and 1003 cm-1. Therefore, SERS is a promissing method for detecting proteins in urine samples, which could be implemented in a future point of care instrumentation.

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THE RTD CALLIBRATION PROCESS FOR NUCLOTRON APPLICATION

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For proper operating, particle accelerators based on superconductive magnets require precise temperature monitoring. A calibration system for resistance temperature detectors (RTD) designed for this purpose, together with the details on the calibration process which it implies is presented.
The calibration routine, originally prepared for the nuclotron monitoring system only, was optimized for high accuracy of sensors in cryogenic temperatures. The system was rebuilt and is currently based on an 18-bit ADC with an internal MUX and 35 input channels for calibrated resistors and referential sources. The reconstruction was long overdue, since the NICA project, currently underway, clearly demands a higher efficiency.

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EVALUATION OF MOSS BIOMONITORING DATA USING GIS TECHNOLOGIES

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The state of the environment and the health of the population depend on the state of the Earth's atmosphere. Moravian-Silesian region in the Czech Republic is one of the most polluted areas in the Europe. The state of air from this region is result of metallurgical and associated industries. Air quality is also determined by a region's topography. Industry and population is concentrated in lowlands which are surrounded by mountain ranges. This causes more common occurrence of thermal inversions and smog episodes.
Bioindicators are organisms or their parts that contain informations about quality of the environment. The main criteria for choosing bioindicator which are suitable for characterization of atmospheric aerosols are ability to respond to variation in concentrations of elements, natural occurrence in the study region, possibility of sampling in a particular season, tolerance to elevated levels of pollution and their assimilation must be independent of local conditions.
In this research were used mosses. A developed surface of their above ground parts is in good contact with the atmospheric air, and thus deposition and capture of aerosols is quite probable. Surface properties of moss cuticles facilitate penetration of metal ions into cells and onto the places in which they are bound.
Since mosses have an underdeveloped root system, their contact with soil and, thus, intake of metal with substrates can be considered negligibly small.
The samples are analyzed by neutron activation analysis. The results are imported to GIS in order to find statistical and spatial dependence. Research heavily depends on using the GIS tools for data collection, analyses and visualization.
GIS analysis were used for comparison of concentrations in different moss species which were collected in the same sample sites. Aim was point out to importance of collecting the same moss species. Another important analysis was identification of air pollution sources by using concentration from moss samples and spatial analysis in ArcGIS software.

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STUDIES REGARDING SOME ANCIENT PIGMENTS DISCOVERED ON SPUR-THIGHED TORTOISE SHELL (TESTUDO GRAECA)

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Testudo graeca is a Eurasian reptile, widespread especially in the steppe climate areas. In some archaeological site was found shell remains and other anatomic elements among the household waste. This confirms that the spur-thighed tortoise was consumed as food in Prehistory. Due to the shape of Testudo graeca shell, prehistoric humans used it as a container for various products and not only. In this paper was studied five shell samples collected from 3 sites: Icoana (Mesolithic site, dated probably to the 8th millennium BC, Romania), Cheia (Eneolitihic site, dated probably to the 5th millennium BC, Romania) and Masis Blur (Neolithic site, dated probably 6th millennium BC, Armenia). The present study aims to determine the morphology and chemical content of pigments, so to do this, the shell samples were pre-investigated by optical microscopy. Areas covered by pigments were highlighted by this method and afterwards were the subject of Scanning Electron Microscopy coupled with Energy Dispersive Spectrometer (SEM-EDS) analysis. The purpose was to determine the morphology of those areas, as well as the elemental composition of each investigated sample. Since samples were not covered by any metallic depositions, the recorded SEM images required further computer processing for noise removal. Attenuated Total Reflection –Fourier Transform Infrared Spectroscopy (ATR-FTIR) was also used to identify the chemical functional groups of inorganic and organic compounds.

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AGING STUDY OF INSULATORS USED IN ELECTRIC MACHINES BY DIFFERENT ANALYTICAL TECHNIQUES

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This study investigates the aging process of polyethylene terephthalate (PET) layers impregnated with resin and used as insulator for electric machines. Five of such machines were turned on and let to function under the same environmental conditions for 80 to 400 hours. In all this time, the structure of PET layers was affected by the aging process. For this reason it was necessary to have precise information regarding the structure of the insulators after a set period of time. Therefore, representative samples were extracted from each machine and investigated by different analytical techniques.

The thermo oxidative effect was studied using ATR-FTIR and Raman Spectrometry and the obtained data were correlated with morphological and chemical structure information acquired from Scanning Electron Microscopy coupled with Energy Dispersive Spectrometry SEM-EDS. Since samples were not covered by any metallic depositions, the recorded SEM images required further computer processing for noise removal.
The analysis was carry out before and after insulators being used in electric machines so the results shown interesting chemical and structural modifications.

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COMPARISON OF MATHEMATICAL MODELLING RESULTS WITH RESULTS OF SPECIAL AIR POLLUTION MONITORING

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Moravian-Silesian region in the Czech Republic is one of the most polluted areas in the Europe. In this region is concentrated heavy industry which is mainly focused on metallurgy processes and associated industries.The research is based on the comparsion of several methods for air pollution characterization such as modelling, moss biomonitoring and air pollution monitoring.
The main aims of research is verification of the air pollution mathematical modelling results using special monitoring and analytical methods. This model is capable to modeling relationships between emission sources and air polution concentration in arbitrary point using the parallel clusters computing, geographic information systems and air pollution monitoring stations. Verification is realized by analysis of data from survey of ground layer of the atmosphere by unmanned aerial vehicles (UAV) and results from air pollution moss biomonitoring. For analysis are using GIS technology and statistical analysis.
Various spatial data analysis are used for data from UAV measurement. Data recorded airships are compared with the results of modeling specific meteorological situation and emitted emissions. Moss biomonitoring was realized in the mesh of monitoring sites. Mesh covering polluted area include two large industrial complexes. Results of moss biomonitoring show that some heavy metal pollution approximately correlate with influence of large pollution sources.

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ION BEAM IRRADIATION OF POLYETHYLENE TEREPHTHALATE FILM AS A METHOD OF PRODUCTION OF NANOPORES FOR SENSOR TECHNOLOGY

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In this work the method of fabrication of PET-membrane-based sensors was presented. The polyester foils were irradiated with Xe ion beam at the IC-100 cyclotron of the Flerov Laboratory of Nuclear

Reactions in Dubna (Russia). Tracks in films were transformed into the nanometer-sized pores by subjecting to one-sided UV exposure and etching in sodium hydroxide solution. The shape and size of pores depend on etching process conditions and were determined using scanning electron microscopy.
Symmetric, cylindrical pores in membranes with pore density of 1x105 pores/cm2 were prepared by exposure of ion-irradiated films to ultraviolet radiation for 4 h and etching in surfactant-doped 1 M sodium hydroxide solution at 60 °C for 35 min. After that samples were covered from one side with a gold layer by the sputtering method.
Single asymmetric pores were produced using a special method of irradiation. During the process the metal mask with apertures of appropriate size was placed in front of the foil [1]. The tracks were UV treated for 24 h and etched in surfactant-doped 5 M sodium hydroxide solution at 60 °C for 6.5 min. The physicochemical treatment of membranes allowed us to obtain nanopores with bullet-like shape [2].
The registration of current-voltage characteristics of investigated nanopores showed that samples rectify the ion current. The electrical asymmetry is observed not only for geometrically asymmetric channels but also for symmetric ones provided one side of the membrane is metal-coated. The comparison of ion transport properties of single- and many-pore membranes prepared in identical conditions made it possible to observe that individual nanopores show higher rectification effect. Because of this the studies of single-pore membranes as sensors is of particular importance today and were discussed in this work.

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EFFECTS OF NEUTRON AND GAMMA IRRADIATIONS ON TRIPHENYLEMI XYLENE MIXTURES

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Some mixtures of triphenylmethane and meta-xylene, possible candidates for cold moderators, were subjected to neutron irradiation, under real exploitation conditions, at cryogenic temperature (~30 K) at IBR-2M reactor, Dubna. A color change of the liquid (from clear to yellow) and an increased mass of the evaporation residue with irradiation time were observed. The physic-chemical characterization shows small differences between the irradiated and unirradiated samples. However, increased absorption (from ATR-FTIR spectra) due to the presence of some oxidation compounds (bands at 3400 cm-1, 1750 cm-1, 1100-1250 cm-1 and changes observed in relative intensity of other bands in the range of 600 - 900 cm-1 proves the existence of some radiation-induced degradation processes affecting the aliphatic substituents of these molecules. Partial alteration of aromatic hydrocarbon is also noticed. Irradiation with gamma irradiation proved less degradation effects, in concordance with our earlier observations on polystyrene system. Preliminary chromatographic analysis evidenced the presence of toluene as radiolytic degradation product, in both gas and liquid phases (liquid phase required the removal of high molecular weight products). Further GC measurements on the gaseous Helium for determination of contaminants are intended.

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MnBi DILUTED ALLOYS USED MICRO- ELECTRICAL ENGINEERING

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The paper aims to prepare diluted MnBi alloys used in spintronics and micro-electrical engineering. In spintronics can be exploited the good transport properties verified in such materials as thin films, and micro-electrical engineering for properties in magnetostrictive actuators, sensors and micromotors.
Development of micro technology open a vast field of research, supported by new features increasing motivation of microsystems. In the field of electrical and electronics magnetostriction applications so far have been limited to transducers for sonar, currently there are developing new microtechnologys where this material plays an important role. New types of magnetostrictive micro actuators, micro sensors, micro motors which are currently designs based on interdependence between the mechanical and magnetostrictive properties of these materials

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STRUCTURAL AND MAGNETIC PROPERTIES TRANSFORMATIONS BY RAPID THERMAL TREATMENTS IN ALNICO-TYPE THIN FILMS

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Thin films of nominal composition Fe44.7Al17.2Co22.3Ni12.7Cu3.1 (at%) have been prepared by DC magnetron sputtering from the same composition target alloy, close to Alnico5 permanent magnets. Their structure has been studied by means of scanning electron microscopy and X-ray diffraction and reveals a partly amorphous state in the as prepared samples. Their magnetic properties are weaker than those of a classic Alnico permanent magnet or those previously reported [5]. The films were rapid annealed at 10000C, following two different ways of rapid cooling, similar to classic Alnico permanent magnets annealing procedure, and structural and magnetic properties changes were investigated