Conference Proceedings with selected poster abstracts

BEST POSTER CONTEST

1. **P001. SIAM technological platform for surface and nanomaterials characterization,** J. Mejia, J. Colaux, A. Felten, P. Louette, University of Namur, Belgium

Abstract. The SIAM platform (Synthesis, Irradiation & Analysis of Materials) is active in both the synthesis and the characterization of (nano)materials. The equipment available enables applied and fundamental research in materials sciences, surfaces and interfaces and ion/matter interaction. Next to these classical topics of physics and chemistry, we can also perform research in the wide area of life sciences. Our major asset is the ability to link different types of surface spectroscopies with nuclear analysis, thanks to a state-of-the-art equipment and a constant R+D. The research conducted at SIAM has direct applications in various fields such as photovoltaic, intelligent coatings, nanomaterials, public health, biomedical applications. SIAM expertise in (nano)materials characterization relies on its capacity to combine various spectroscopies (XPS, ToF-SIMS & IBA) for offering a global picture of any kind of sample: metals, welds, glass, polymers, powders, liquids, biological material (organs, cells from in vitro or in vivo experiments). In addition, SIAM has several facilities for the functionalization of (nano)materials and/or the synthesis of thin films by plasma treatments. SIAM together with the Namur Nanosafety center, is also active in the characterization, fate of nanomaterials (safety assessment and ecotoxicology).

2. **P002. Combining LCC and LCA for sustainability assessment in nanoenhanced high performance composites**

   A. Gkika, V. Stergiou, F. Petrakli, N. Romanos, E. P. Koumoulos, Corresponding author: E. P. Koumoulos, epk@innovation-res.eu, affiliation: Innovation In Research & Engineering Solutions (IRES), Boulevard Edmond Machtens 79/22 - 1080 Brussels, Belgium

Abstract. Circular economy and industrial symbiosis aim to create a more sustainable and resource-efficient way of supplying products and services to the market. For the development of advanced composite CF-based materials for high value and high performance applications, the assessment of environmental, social, and economic aspects is deemed necessary, in order to ensure their benefits from a sustainability perspective. Life-Cycle Costing (LCC), which has been used in this work, is in-house setup as methodology, while Life-Cycle Assessment (LCA) is performed using commercial software. A detailed analysis was performed to the processing system, regarding material, manufacturing, operation and maintenance cost with the use of a comprehensive methodology that was developed. In both, cost and environmental analyses, were performed throughout the entire life cycle of the process or the final product. The results of the present work showed that

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LCA in combination with LCC analysis, could provide a competitive added value final product by suggesting modifications at the process route. The replacement of the conventional methods/materials with innovative substitutes resulted in a direct reduction to the economic and environmental cost.

3. P003. A new promising technology based on wide band gap semiconductors for a better reliability and cost—effectiveness

Razvan Pascu, National Institute for Research and Development in Microtechnologies - IMT Bucharest), Gheorghe Brezeanu, University "POLITEHNICA" of Bucharest, Romania

Abstract. The silicon technology almost reached its performance limit for the power devices and systems fabrication, a high-growth area being necessary to satisfy the needs of special applications from harsh environments. A new promising technology based on silicon carbide (SiC) is intensively exploited to obtain more efficiently power devices with a better cost-effective for their fabrication through a reduction in overall system size and weight. In this paper, we propose a promising technology for different SiC devices, like Schottky diodes and MOS capacitors, which acts like sensors (temperature and gas) at high temperatures. In order to reduce the fabrication costs for the two SiC devices, we proposed a common technological flow, based on an oxide ramp termination which has the role to assure a better distribution of the current density through the Schottky diode and to avoid an electric field crowding at the electrode corner of the MOS capacitor. The sensors response has been improved by electrochemical growing of Pt nanoparticles as electrode gate. The fabricated sensors demonstrated a stable operating up to 450°C for the temperature sensor and an extremely high sensitivity, as ultra-low detection limit (0.77 ppm H2) and fast response and recovery times (10 s) for gas sensor.

4. P004. Chemical bath deposited Al-doped ZnS thin films: Effect of Al content on their structural and optical properties

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Abstract. ZnS is one of the potential candidates as a window/buffer layer in solar cells and photovoltaic devices. It can substitute the highly toxic CdS buffer layer in heterojunction solar cells and enhance their blue response due to its wide energy band gap of 3.7 eV with a high optical transmittance of >85%. In order to achieve that purpose, its high resistivity (~ 107Ω.cm) must be reduced by several orders of magnitude. Without affecting its optical behavior, doping the ZnS by suitable dopants such as Al, Ga and Cu seems to be an effective way. In the present work, Al-doped ZnS thin films with different Al concentrations (2, 4, 6 and 9 %) were deposited on glass and Si substrates by chemical bath deposition using an aqueous solution containing ZnSO4, thiourea and ammonia. The Structural, Surface morphology and Optical properties were investigated as a function of Al content. The Raman analysis showed a pure cubic ZnS structure. SEM observations showed

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that all films displayed a granular morphology with grain size decreasing by increasing Al content. All films exhibited high transparency (over 70 %) in the visible spectrum. The optical band gap was estimated using optical transmission spectra and the obtained values range around 3.48 and 3.68 eV.

5. P005. Towards novel exposure and risk assessment techniques for nanomaterials

Panagiotis - Theodoros Karagiannis (1,2), Elias P. Koumoulos (1,2), Constantinos A. Charitidis (2). 1)Innovation in Research & Engineering Solutions (IRES), Boulevard Edmond Machtens 79/22 - 1080 Brussels, Belgium, 2) National Technical University of Athens, Greece

Abstract. Nanotechnology exhibits rapid growth in research, manufacturing and commercial aspects, however uncertainties and information gaps that emerge as a byproduct of such an expeditious technological advance present significant barriers to nanomaterial risk assessment. A continuously growing body of research work demonstrates that manufacture, handling, process and use of nanomaterials may present considerable hazards. Therefore, the development of refined risk assessment strategies is crucial. Evaluating the progress achieved in nanomaterial risk assessment in recent years, we initiated development of a dedicated nano-risk assessment tool. Our approach employs a highly targeted analysis in specific aspects of the risk assessment procedure. The system introduces a detailed scheme of scoring hazardous properties and a specialized exposure assessment methodology, utilizing computational modeling and simulation methods that provide exposure scenario details. If judiciously used, process specific simulated exposure assessments can aid in the optimization of the spatial design of nanomaterial workplaces, and inform on the anticipated effectiveness of control measures. Such a system can also provide insight on the establishment of efficient evacuation plans for areas prone to severe contamination. As such, the groundwork for developing Safe-by-Design nanomaterial processes can be provided and the supplied data can serve as a valuable tool in decision making processes.

6. P006. Using a Data Management Plan for Materials Characterisation: the case of Nanoindentation

Elias P. Koumoulos1,2, Nikolaos Romanos1, Maritini Kalogerini1, Costas Charitidis2 1: IRES, oulevard Edmond Machtens 79/22 1080 Brussels, 2: NTUA, 9 Heroon Polytechniou St., Zographos, Athens, Greece GR-15773

Abstract. This work describes a novel methodology of data documentation in materials characterisation, since there is an increasing need of efficient and fast retrieval of necessary information for future needs. While the development and implementation of data-driven materials design protocols are of crucial importance, the initial step was the creation and usage of a Data Management Plan (DMP) document. Its purpose was to facilitate the mining and further processing of large materials data sets, resulting in the extraction and identification of high-value materials knowledge, towards design and manufacturing. The case study is nanoindentation, a widely used method for the experimental assessment of mechanical properties on a small scale. The digital data

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coming from thousands of nanoindentation experiments can be realized over a relevant area and can be kept safe, while reaching worldwide stakeholders at high speeds, thus original and richer information can be gained on the nanomechanical property distributions. Within this complex framework, we have achieved the synergy of data management, materials informatics and digitalization for advanced materials characterization. This effort can be a Key Enabling Technology for introducing groundbreaking innovations in the manufacturing industry and can be harnessed from open innovation environments (OIE), accessible both from industrial and research fields.

7. **P007. Calcium/aluminum co-doped zinc oxide thin films synthesized by RF–magnetron sputtering and diffusion**

Anca-Ionela Istrate, Silviu Vulpe, Florin Nastase, Iuliana Mihalache, Oana Tutunaru, Cosmin Romanitan, National Institute for Research and Development in Microtechnologies -IMT Bucharest, Romania

Abstract. Zinc oxide has attracted interest for use as a gas sensor devices. However, a stable and reproducible co-doping of ZnO thin film is still a main challenging issue. Particularly, Ca atoms has been shown to be able to easily diffuse through the crystal structure of ZnO and resulted in a large increase of the electrical resistance of the ZnO and increase the absorption of CO2. The presence of Al lead to reducing the electrical resistance while maintaining high sensitivity towards CO2. In this context, we report the effect of calcium/aluminum co-doped on zinc oxide (ZnO:(Ca,Al)) thin films, with a fixed loading (2 at.%) of Al and different Ca (1–5 at. %) content, successfully synthesized on SiO2/Si substrates by radio-frequency magnetron sputtering (RF–sputtering) and diffusion. The morphology surface of obtained thin films has been characterized by Scanning electron microscopy (SEM), elemental composition were investigated by Energy dispersive X-ray spectroscopy (EDX) and X-ray diffraction (XRD) has been used for microstructural investigation. Optical and electrical properties were explored to assess the opto-electrical behavior. Our results indicated that the Ca-Al dopants has a great influence on the ZnO thin films, for their possible future such as gas sensors.

8. **P008. Plasmonic Nanopore Slit array fabrication for Single molecule analysis**

Anca Seong Choi, Research Center for Nanobio Science, SunMoon University, Korea South

Abstract. We have fabricated the plasmonic nanopore array for single molecule analysis. Considering the fact that carbon pore membrane consists of slit pore with ~ 5 nm gap, it would be beneficial to fabricate the slit pore array and to characterize the optical effect throught he nanoslit pore array.

9. **P009. Hydrophobicity of nanomaterials measurements for risk assessment**

Loïc BURR, David SCHMID, Stefano CATTANEO, Silvia GENERELLI, CSEM Switzerland

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Abstract. With the frenetic race to miniaturization and performance improvements, industry increased its use of nanomaterials. However, concerns on the potential risks associated to nanomaterials slows the implementation of such technologies due to the lack of industry-friendly risk assessment methods. Among the major risk factors for nanomaterials such as size, concentration, composition or solubility, hydrophobicity has been identified in the nanosafety research community as one of the key properties to be characterized. In the frame of the European ACEnano project, CSEM is developing innovative characterization techniques to describe the hydrophobicity of nanoparticles. Here we present the assessment of hydrophobicity of polystyrene based nanoparticles with various surface functionalizations. We could successfully show that with a new surface-based method, hydrophobicities can be characterized and compared, which in turn can be used to develop a qualitative comparison chart for nanoparticles.

10. P010. Approaches and methodologies accelerating the way from R&D labs to fabrication & market success (TRL9); does it apply to nanotechnologies too?

Nicolae VARACHIU, National Institute for R&D in Microtechnologies -IMT Bucharest, Romania

Abstract. We will consider some tools / methodologies, scientific & statistics based, to design and optimize technological processes and the resulting products, by providing finally a robust design; being implemented in R&D labs, such tools and methodologies could enable a faster skip from lab experiments to real world by catalysing innovation, problem solving and even discovery. Initially such approach came from agriculture, as experiments there usually last for more than one year and sometimes many years are necessary to derive new reliable and efficient species of food plants. Sir Ronald Fisher wrote “Statistical Methods for Research Workers” in 1925 and further he pioneered the principles the “design of experiments” (DoE) while at Rothamsted Experimental Station, the future Institute of Arable Crops Research in UK; his book “The Design of Experiments” (1935) is considered a foundational work in experiential design, further developed and successfully applied in industry too. We will also present some successful examples of application, to open also a larger discussion and debate about the opportunity of intensively using such approach for nano scale organized materials and further products. And why not, to open the way to suitable improvements and adaptation of it, as necessary.

11. P011. GENESIS: High performance MOF and IPOSS enhanced membrane systems as next generation CO_2 capture technologies

Marcel Boringer, Sara Vinklatova, Leitat Technological Center, Spain

Abstract. Atmospheric warming due to greenhouse gases has become a serious global concern. The shifting from fossil fuel to renewable energy has been slow mostly due to technological barriers. Meanwhile, the demand for energy is growing rapidly which makes fossil fuel consumptions inevitable, in spite of their high emission of GHC. Therefore, there is need for an immediate-medium term solutions to address CO_2 emission

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of fossil fuel plants fast and in a cost effective way. CO_2 capture technologies recognized one of the direct answers to this problem. Currently, CO_2 capture technologies have been adopted in different parts of the world but still there is a long way to reach their full potential. Some of the most important barriers are large energy requirements and high cost. Advanced material solutions can play a significant role in price reduction and increase of efficiency and enable industries to use fossil fuel while reduce emission of GHC drastically. GENESIS project aims to develop and upscale some of the most promising material for CO_2 capture and demonstrate their performance, durability and reliability in industrial environments. GENESIS is build upon two previous ambitious EU projects that developed IPOSS and MOF membrane systems with a great performance for CC. GENESIS will take these technologies a step further by scaling up the most promising ones by demonstrating in relevant 0.45 MWe capture process for pre-combustion and 2 post-combustion applications and achieve at least 90% of CO_2 recovery at a cost of 15€/MWh in two carbon intensive industries (Cemex & Arcelormittal). GENESIS is building upon a multidisciplinary team of European technology centers, large enterprises, SMEs in a cross-border project. This will guarantee that the successful implementation of GENESIS and ensure the ambitious objectives will be achieved and impact will be realized in terms of a rapid market penetration of the developed materials and systems by overcoming technological barriers.

12. P012. n-Track: Multimodal nanoparticles for structural and functional tracking of stem cell therapy on muscle regeneration

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Abstract. The prediction of the success or failure of cell therapy is challenged by the current lack of methods to track the biodistribution and fate of the transplanted cells and to detect their viability in real time. Current clinical practice evaluates the success of cell-based treatments by assessing the disease symptoms, which can only be examined after the treatment was initiated. The nTRACK nano-based system will allow the visualization and longitudinal monitoring of the transplanted stem cells in real time. The nTRACK nanoparticles enhances the various strengths of the most prominent clinically-used multimodal imaging systems, overcoming the limitations of each independent imaging system (temporal and spatial resolution, anatomical details, and functional information) and allowing direct clinical translation. The main goal of nTRACK project is to develop a safe, scalable and highly sensitive multimodal nano-imaging agent, gold-shell iron-core, aligned with current regulatory framework. It will enable non-invasive, quantitative and longitudinal stem cell tracking and whole body biodistribution. nTRACK will end up with fully characterized, (nano)safe and functional nano-based contrast agent proved in a clinical imaging framework with a large animal model to resemble human complexity plus a data interpretation and modelling software.

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13. P013. Lase-induced Graphene as Microporous Layer in PEM Fuel Cells

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Abstract. High porosity nanocarbons are established as main materials in the manufacturing of microporous layer (MPL), a main component of PEM fuel cells (FC). MPL has the role of enhance the water/gas management and facilitate electron transfer, thus influencing both FC cost and performance. However, with low quality carbon, the corrosion of the carbon material leads to mass loss and low durability - one of the main causes which hinders large scale implementation of low-temperature fuel cells. Obtaining high quality nanocarbons at competitive yield-to cost ratio constitutes an important objective, with plasma or pyrolytic techniques having shown promise for the bulk production of nanocarbons. We present the first results of using laser-induced graphene (LIG) foam as the MPL in PEM fuel cells. LIG method employs low-cost IR laser engravers for the laser pyrolysis of commercial polyimide substrates into graphene-based foams with distinctive 3D porous networks, enhanced stability, high electrical conductivity and good hydrofobicity. The LIG/Pt catalyst/Membrane assembly is tested on a BT-112 Single Cell Test System, showing power performance comparable to industrial quality membrane assemblies, with elevated working potential and impeccable fuel crossover for a low-cost system resulting from a highly scalable, inexpensive, and rapid manufacturing method.

14. P014. Synthesis of SiO2 nanoparticles via the sonochemical sol-gel process

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Abstract. The interest in the scientific research of SiO_2 nanoparticles has increased because of many and various industrial applications1-3. The size and narrow size distribution of the particles play a very important role in each of in that applications. In this work we present the preparation of SiO_2 nanoparticles with narrow distribution via a sonochemical sol-gel process. In that synthesis, tetraethyl orthosilicate (TEOS) was used as silicon source, ethylenediamine as catalyst and polyvinylpyrolidone (PVP) as surfactant. The prepared SiO2 nanoparticles have been characterized by X-Ray Diffraction (XRD), Energy Dispersive Spectroscopy (EDS), Fourier Transform Infrared (FTIR) spectroscopy, Scanning Electron Microscopy (SEM). The XRD measurement revealed the amorphous nature of SiO_2 nanoparticles. EDS analysis has confirmed only the presence of Si and O elements. FTIR spectroscopy confirmed the presence of Si – O in sample. SEM result showed that SiO_2 nanoparticles with spherical morphology and diameter of approximately 35 nm were obtained.

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15. P015. GUIDEnano as a key risk assessment tool to be integrated into the NanoCommons e-infrastructure Platform

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Abstract. H2020 NanoCommons aims at creating a novel e-infrastructure providing a standardized, reproducible and interoperable way to access available data, knowledge, models and tools for nanomaterials. One of the specific objectives of NanoCommons is to integrate existing knowledge for risk assessment of nanomaterials and novel and emerging materials. Integration of these tools into this platform will allow the tools to reach a wider audience for future benchmarking, as well as assuring robustness and repeatability as a key step towards ensuring industry and regulatory acceptance. One of the tools currently being integrated into the NanoCommons platform is the GUIDEnano Tool, a web-based guidance tool, which was developed to support and guide industry in the evaluation and management of human and environmental health risks of nanomaterials and nano-enabled products. GUIDEnano combines a range of predictive models, multilevel decision trees, and databases to derive critical information along the risk assessment and risk mitigation processes. In this presentation we will provide an overview of the knowledge in the different modules of GUIDEnano tool, the steps towards a user-friendly version of the tool, and an overview of the steps underway to integrate it into NanoCommons. These steps can then be generalized for other tools and models.

16. P016. ALD 3D-nanosensors on CMOS compatible substrates

A Jupe, D. Dietz, H.Kappert, H.Vogt, Fraunhofer Institute for Microelectronic Circuits and Systems, Germany

Abstract. ALD technology (atomic-layer-deposition), in combination with selective sacrificial layer etching, enables the production of free-standing 3D nanosensors. The technology is used for the production of sensitive gas sensors or for the realization of 3D multi-electrode arrays. For a 3D-MOx gas sensor, metal oxide (MOx) nanowires with a width of 350 nm and a length of 150 µm were used. The metal oxide (e.g. ZnO or SnO2) is used as a functional layer. However, the metal oxides have to be heated by a hot plate structure to increase gas sensitivity. In this case Ru, TiN or TiAlCN is used as heating material, which is also deposited by ALD. The novel technology is also used to manufacture nanopellistors on CMOS. The heating elements also consist of free-standing 3D structures to thermally decouple sensor and substrate. All materials are deposited by ALD. The heater consists of Ru. The peripheral insolation layer is Al2O3 and the catalyst layer is made of Ru. Another application for the use of the technology is the production of 3D-MEA. Ru nanostructures can penetrate biological cell membranes to directly measure intracellular electrical signals. The structures have a diameter of 200 nm and a height of a few micrometers.

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17. P017. BayFOR support for European funding

Dr. Panteleimon Panagiotou, Dr. Nico Riemann, Bavarian Research Alliance GmbH, Germany

Abstract. ALD The Bavarian Research Alliance GmbH (BayFOR) is a private company which supports Bavaria as a centre for science and innovation. Its Associates are the Bavarian universities (of applied sciences) and it is funded by the Bavarian State Government. BayFOR assists researchers from academia and the private sector with acquiring European funds for research and innovation projects. The focus is directed at the Framework Programme for Research and Innovation "Horizon 2020". BayFOR is part of a large network: at regional level in the Bavarian Research and Innovation Agency (www.bayfia.de), funded by the State of Bavaria, and at EU level in the world's largest advisory network for SMEs, the Enterprise Europe Network (een.ec.europa.eu).

18. P018. IN-POWER: Advanced Materials technologies to quadruple the Concentrated Solar Thermal current Power Generation

Monica Della, Elena Torralba, Vincent Jamier - LEITAT

Abstract. IN-POWER project develops High efficiency solar harvesting CSP architectures based on holistic materials and innovative manufacturing process to allow an innovation effort mainly focusing on advanced materials such as High Reflectance Tailored Shape light Free glass mirror, High working temperature absorber in Vacuum Free receiver, optimized Reduced Mass support structure allow upgrading current solar field. IN-POWER reduces environmental impact also by reducing THREE times standard thermal storage systems by novel thermal storage materials; and an amazing reduction FOUR TIMES the required land extension in comparison of current mature PTC power generation with the same thermal power output. IN-POWER solution will bring LCOE below 0.10 €/KWh beyond 2020.

19. P019. Plug and play decoration of gold nanoparticles with recombinant proteins

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Abstract. The functionalization of gold nanoparticles with active proteins has been extensively exploited in nanomedicine and beyond, due to the broad availability and easy synthesis of the nanoparticles and their ability to passively adsorb proteins. However, passive adsorption, or physisorption, does not necessarily lead to functional conjugates, as the protein function can be compromised by denaturation or inaccessibility of active sites. On the other hand, chemisorption, which is the conjugation by bespoke chemical modification of the nanoparticles, the protein or both, is unpractical to obtain routinely and universally, due to the vast biochemical diversity of proteins, which forces to undergo tedious optimizations for each individual protein-nanoparticle pair. To facilitate covalent and oriented conjugation of recombinant proteins on standard citrate-capped gold nanoparticles, we designed and synthesised a fusion protein with the function of "universal adaptor". This protein consists of two recombinantly fused polypeptides: 1. glutathione S-transferase (GST), which rapidly

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forms stable gold-sulphur bonds with the gold nanoparticle and 2. SpyCatcher, a well-established synthetic protein that spontaneously forms an iso-peptidic bond with any protein tagged with SpyTag. This highly modular approach provides a convenient method to covalently bind a SpyTag-modified protein to gold nanoparticles by simple mixing.

20. P020. Functional Layered Double Hydroxides (LDHs) thin films obtained by laser techniques

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Abstract. The Nowadays, fabrication of hybrid organic-inorganic thin film of layered double hydroxides (LDHs) in order to obtain functional surfaces with controlled properties has attracted attention of the scientific community.

The main property of LDHs is their ability to intercalate anionic species (metals, organic chromophores, polymers, drugs) into the interlayer space. The lamellar structure of this compound provides good support for different applications: adsorption of heavy metals from aqueous solution or for fabrication of photoluminescent thin films.

Here we report two deposition techniques used to obtain layered double hydroxides thin films: Pulsed Laser Deposition (PLD) and Matrix Assisted Pulsed Laser Evaporation (MAPLE) technique.

In order to obtain functional luminescent material two types of chromophores were used: coumarin-343 and curcumin. Preparation of functional thin films of Mg-Al layered double hydroxide (LDH) with Mg/Al of 2.5, organic coumarin and curcumin intercalated Mg-Al LDH thin films have been investigated. Pulsed laser deposition (PLD) technique using a Nd:YAG laser (266, 532, 1064 nm) and Matrix Assisted Pulsed Laser Evaporation (MAPLE) technique using Nd:YAG laser (266 nm) have been employed. All the films display photoluminescence properties. PLD and MAPLE proves to be suitable techniques for deposition of complex structures.

21. P021. Advanced Materials and Nanotechnologies to boost innovation and shape the future - Examples from Slovenia

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Abstract. Strategic Research and Innovation Partnership Factories of the Future (SRIP FoF) integrates Slovenian research and innovation know-how and experiences from the industrial and academic sector, in order to enable priority breakthroughs of new products, technologies and services. Advanced Materials and Nanotechnology, as two important pillars of this Partnership, can enrich international consortiums with

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interdisciplinary research teams and the support of state-of–the-art research equipment. Our main expertise is based on modern material synthesis, structural and functional characterisation, optimisation of technological processes and nano enabling quantum technologies. The area of our research and development activities includes materials for electronics, energy, medicine and insulation, nano-sensor structures for industrial, biomedical and environmental applications, smart surface coatings for construction, industrial and medical applications, as well as smart nanotech-based systems for sustainable environment.

22. P022. Bilayer Al2O3/ 40Ni-YSZ Thin Films Electrode Materials Prepared by Pulsed Laser Deposition

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Abstract. Thin films Al2O3/ 40Ni-YSZ were prepared by PLD on Si (100) substrate in the following configurations: a (650°C/600°C, 10.000/190.000 pulses, 4 5 (J/cm2)); b (650°C/600°C, 15.000/ 250.000 pulses, 4/ 5 (J/cm2).The development of Al2O3/ 40Ni-YSZ is a technology used to protect on thermal and mechanical stresses anode/ reference electrodes on electrochemical devices like µSOFC and planar potentiometric lambda sensor with influence of reduction the thickness of 8 YSZ electrolyte and the temperature of activation. The XRD studies indicate a cubic structure for bilayer Al2O3/ 40Ni-YSZ; the AFM studies reveal a porous surface with uniform distribution of nano crystallites. The cross section of morphology indicates inter columnar porosities. Anode supported design of electrochemical devices can operate at low temperature because lesser ohmic loss in a thinner electrolyte; Al2O3 acts like a thermal barrier and generated a robust anode. Keywords: Bilayer Al2O3/ 40Ni-YSZ, PLD, Electrode Materials, µSOFC and planar potentiometric lambda sensor.

23. P023. H2020 - ACEnano: Characterization of nanomaterials for risk assessment – sample prep for solubility

David SCHMID, Loïc BURR, Sundas ISMAEEL, Peter CRISTOFOLINI, CSEM SA, Switzerland

Abstract. Engineered nanomaterials are being produced in exponentially increasing quantities, due to their unique physical and chemicals properties and the improved performance of final products, and therefore spur technological and economic progress. However, assessment of potential risks associated with nanomaterials in an industry-friendly manner, is still lagging behind considerably. Solubility of nanomaterials has been identified in the nanosafety research community as a potential key property to be assessed and included in a cost efficient analysis that will facilitate decision-making in choice of techniques and support quality control, labelling and anti-counterfeiting. Here we present the development of a well plate based preparation system for automated nanomaterials mixing and incubation with a range of solvents for 24 assays in parallel. The solutions can be probed consecutively with an autosampler and fed into the analysis system, e.g. an ICP-MS.

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24. P024. Optimization and ISO scale-up of magnetic nanoparticles

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Abstract. Pancreatic ductal adenocarcinoma is an orphan disease with a very bad prognosis, even when diagnosed early1. the objective of the NoCanTher project (H2020) is to optimize the formulation to scale-up those MNPs under ISO conditions to reach clinical trials.

MNPs batches under ISO conditions were successfully synthesized and characterized. In the following months, these batches will be tested for stability and toxicity studies, as previous steps for the clinical trial.

25. P025. Fabrication of dense arrays of GaN nanocolumns by a hybrid top-down–regrowth approach

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Abstract. A detailed description of a fabrication procedure for the preparation of ultradense locally ordered arrays of hexagonal cross-section GaN nanocolumns is presented. Our primary strategy is a hybrid top–down-regrowth approach, using top–down nanofabrication based on cheap, flexible silica nanosphere lithography for the first step. A sequence of dry and wet etches is then used to form nearly cylindrical GaN nanocolumns, with care taken to avoid undesirable array height variation. The NC arrays, of moderately high fill factor, (defined by the closely packed silica nanosphere monolayer being used as hard mask) then undergo an annealing step using optimised conditions to recover their natural crystallographic facets, giving an almost perfect hexagonal section. A regrowth step is demonstrated to increase the array fill factor if necessary. For many applications densely ordered, homogenous NC arrays with size, and particularly height, uniformity are desirable as they provide a large surface area and allow for easy fabrication of resulting devices. Arrays of such GaN nanocolumns may serve as a suitable ingot for various advanced structures, particularly ones with core–shell architecture and thus are a potentially ideal building block for various optoelectronic devices such as light emitting diodes, photovoltaics, photoelectrodes etc.

26. P026. Chemiresistive Humidity Sensors Based On Oxidized Nanocarbon Materials

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Abstract. Single-walled carbon nanohorns (SWCNHs) have been investigated for various applications such as drug delivery system, photovoltaics, gas storage, supercapacitors. Despite their attractive properties, the literature is poor in data related to their use as sensing films in humidity and gas sensors. The poster presents three novel chemiresitive humidity sensors (patents pending) based on oxidized carbon nanonhorns and their nanocomposites with poly (ethylene glycol)-block-poly (propylene glycol)-block-poly (ethyleneglycol) and

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polyvinylpirrolidone nanocomposites as sensing layers. All the sensing films were drop casted on IDT structures based on Si/SiO2 substrates. The humidity sensing measurements were performed at room temperature, in different conditions (humid nitrogen, humid air) by applying a constant current between the two connecting electrodes and recording the voltage at different values of the relative humidity level at which the sensing layers were exposed. The results are discussed from the perspective of different sensing mechanisms: a decrease in holes's concentration and the swelling effect. The most promising results are obtained in the case of using SWCNHs – PVP (1:2, w/w). This nanocomposite combines the excellent properties of the nanocarbonic component (high conductivity, high surface area, good dispersion in water due to carboxylic groups) with those specific to the polymer (hydrophilicity, film- former properties).

27. P027. Fabrication of bioanalytical microfluidic lab-on-chip devices by roll-to-roll (R2R) nanoimprinting

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Abstract. Driven by global trends that are increasingly favoring personalized medicine and Point-of-Care (PoC) testing, a steadily increasing demand exists for miniaturized analytical systems [1]. The EU-projecft R2R Biofluidics [2] established a completely new process chain for large scale production of selected lab-on-a-chip devices suitable for PoC applications, e.g. for detecting antibiotic-resistant pathogens. The novel chips designed for chemiluminescence detection provide improved sensitivity thanks to imprinted optical structures. Secondly, project partners jointly developed cell chips containing imprinted cavities and microscale channels for controlled neuron culturing to be applied in high-throughput drug screening. Within the innovation process, clarity about the safety surrounding these new technologies is one of the most important conditions for acceptance of the technology [3]. Since eliminating hazards at the design stage is often easier and cheaper to achieve than making changes later when hazards become real risks a Safe-by-Design (SbD) [4] approach was chosen to cover materials (i.e., resist formulations, adhesion-promoting molecules, coating materials, biomolecule candidates), processes (i.e., mastering und imprinting) and the products. Biocompatibility testing, workplace monitoring (with special focus on workers safety), and screening of potential safety concerns along the life-cycle (consumer and environmental issues) led to evidence of safety for the products of this project.

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28. P028. Innovative products based on Photonics & Bionanotechnology

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Abstract. Nanotechnology in combination with biophotonics is used for entering the medical device market with novel diagnostic tools. The Nanoengineering Group at CIC nanoGUNE aligns its research and technology according to industrial and clinical needs, considering market-driven needs and real-life applications. Current research includes photonic and plasmonic sensing for biomedical applications, food control, environmental monitoring and material science. In particular, we develop plasmonic detection systems for next generation health care, realized by liquid biopsy for cancer diagnostics. We also build up optical probes for monitoring cardiovascular conditions as well as physiological parameters, that way replacing slow biochemical analysis by continuous and real-time monitoring technology. Moreover, we develop novel non-existing instrumentation for early detection of Alzheimer's disease and food quality control by combining the two different spectroscopy techniques Raman and FTIR, resulting in extended information. According to our philosophy to include end-users needs from the beginning at each R&D stage into our multidisciplinary programs, we accelerate the value chain from lab to market. All this work is realized by means of nanoGUNE's excellent nanotechnology facilities and through close collaborations with different R&D entities of the unique research and technology landscape and network within the Basque Country.

29. P029. Toward oxide electronics by advanced structure design, processing and characterization

Bogdan R. Plugaru, National Institute for R&D in Microtechnologies, Erou Iancu Nicolae Str. 126A, Bucharest 077190, Romania

Abstract. The present and foreseeable developments in critical domains such as energy, transportation and information technology pose challenging requirements on electron devices, including: i) accurate processing routes with in situ control at atomic scale, ii) charge and spin transport, detection and manipulation, iii) use of strains, polarization and magnetization for multiple functionality, and iv) control of interface phenomena. The use of binary and complex oxides compatible with the silicon technology in novel structures that overcome the limitations of the present devices has emerged as a promising research area of oxide electronics. Here, we present results obtained on each of the three directions: 1) Design of heterostructures comprising of arrays of nano objects and ultrathin films for testing charge dynamics and photoresponse functions. We also use computational methods to establish guidelines for tuning the macroscopic properties; 2) Innovative processing routes for the deposition of multilevel structures, substrate patterning and control of dopants and defects; 3) Accurate characterization methods of the optical, transport and electrical properties of the structures.

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We highlight the main phenomenology involved and the appropriate handles for properties control at each stage.

30. P030. Multifunctional coatings based on metallic and metal oxide nanoparticles

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Abstract. Coatings able to combine more than one functionalities on the same material, such as self-healing, superhydrophobic, anti-icing and/or anti-fogging, antibacterial, antireflection, photoactive, have been studied in the last decades for many applications in various fields.

Superhydrophobic or highly hydrophobic modification of surfaces is usually obtained from filmogenic materials with nanostructured fillers, in order to obtain adequate roughness. Nanopowders with different composition are used, encapsulated in organic or organic-inorganic films.

Metallic and metal oxide nanoparticles, such as Ag, Cu, CuO, ZnO, MgO were proved to possess strong antimicrobial activities against many common pathogens and, moreover against multidrug resistant ones. Composite materials based on organic-inorganic silica matrix with various nanoparticles are reported, designed to ensure various combinations of functionalities (self-cleaning and water-repellent properties, UV protection and superhydrobobicity, self-cleaning and antibacterial). The morphology and efficiency of composite coatings are significantly influenced by the nanoparticle content, size and shape of the nanoparticles, hydrophobic nature of the filmogenic material. Composite materials with superhydrophobic and antibacterial properties were successfully fabricated and characterized using SEM, AFM contact angle measurements and antibacterial tests. The multifunctional coatings are cost effective, eco-friendly easy scalable and versatile, since they can be transferred on various substrate (stone, textile, paper).

31. P031. Development of multicellular 3D in vitro models of the gut and their application in the hazard assessment of engineered nanomaterials

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Abstract. The increasing use of engineered nanomaterials (ENM) in products intended for human consumption and food contact materials has raised questions regarding their safety upon oral uptake. As the gastro-intestinal route of exposure has long been neglected, the availability of reliable and practicable in vitro models is a major challenge.

In the project on Physiologically Anchored Tools for Realistic nanOmateriaL hazard aSsessment (PATROLS), an international team of academics, industrial scientists and governmental officials combines efforts to provide innovative laboratory-based and computational approaches to predict the potential human hazards of ENM.

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Within PATROLS, two intestinal in vitro models were advanced to approach complementary endpoints of ENM hazard assessment following repeated long-term, low-dose exposure. Both models are based on transwell-grown co-cultures of human Caco-2 and mucus-producing HT29-MTX epithelial cells. The first model focuses on the induction of microfold (M-)cells by RajiB lymphocytes; the other model includes differentiated THP-1 cells to represent the innate immune system. Whereas the M-cell model is especially suitable to study ENM uptake and translocation, the macrophage model can mimic the intestine in healthy and inflamed-like state. Thereby, it enables the study of the inflammatory potential as well as the impact of pre-existing inflammatory conditions on effects of ENM exposure.

32. P032. The relationship between FAIR data and data driven innovation in nanosafety research. Disruptive or disrupted?

Anastasios G. Papadiamantis[1], Thomas Exner[2], Dieter Maier[3], Egon Willighagen[4], Ivan Stambolic[3], Lucian Farcal[2] and Iseult Lynch[1] ,[1] School of Geography and Environmental Sciences, University of Birmingham, UK [2] Edelweiss Connect, Switzerland [3] Biomax In

Abstract. The Significant part of industrial innovation originates from publicly funded research. Technology advancement and nanoinformatics transform nanosafety into a data intensive field. But publicly funded research outputs remain disparate, poorly accessible, and often of poor quality, due to insufficient semantic metadata disrupting findability, accessibility, interoperability and reusability (FAIR) and inhibiting the potential for data driven innovation. Therefore, the return on public investment is sub-optimal and does not stimulate the expected positive innovative and socioeconomic impact. Hence, the relationship between academic research and data driven innovation becomes disrupted rather than disruptive. H2020 NanoCommons addresses these by implementing data capture into everyday scientific research using Electronic Laboratory Notebooks linked to the NanoCommons KnowledgeBase (findability). Our Research Data Management Plan describes the rolling out of our Commons under CC-BY licensing, allowing partial reuse. Detailed data management workflows, user and application programming interfaces (with H2020 OpenRiskNet) ensure accessibility. Interoperability is provided by standardisation (e.g. collaborating with GO FAIR) and a translational layer able to harvest and combine data from publicly available sources to create bigger, more complete datasets. The resulting reusability will, thus, strengthen big-data analysis and Artificial Intelligence, bringing data driven innovation including nanomaterials safety-by-design to the heart of the EU's growth strategy.

33. P033. Transparent conductive Sn:ZnOx coatings prepared by magnetron sputtering at low temperature

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Abstract. The coatings were deposited from two 2in magnetrons. The targets were made of ZnO and SnO_2 connected to DC pulsed and RF power supplies, respectively. The pure Ar and reactive gas mixture Ar/O_2 were used for the depositions. DC pulsed power applied on ZnO target was kept constant 50W 50kHz, 20% d.c. and the RF power applied on SnO_2 target was set to values from 0W up to 150W and annealed at temperatures 200º C. The amount of Sn in the films is proportional to applied RF power on SnO2 target. The XPS observed Zn/Sn ratio in surface area is reduced by the annealing process. Films deposited in oxygen rich reactive gas mixture does not reduces the resistivity with added Sn in contrary to films deposited in Ar where the resistivity was reduced by 5 orders of magnitudes. Therefore, we observed differences between refractive indexes in the films deposited with low RF powered SnO2 magnetron at RT and post-annealed at 200 ° and no difference between RT and post-annealed film at higher RF power above 50 W. The transparency of the 180 nm thick films was above 80% in visible range and the resistivity decreased down to 90 Ohm/sq.

34. P034. Using SPM as a process diagnosing tool at the IMT- MINAFAB technological facility of IMT Bucharest

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Abstract. The Originally merely a morphological imaging tool, Atomic Force Microscopy (AFM) has evolved into a family of complementary techniques generic known as Scanning Probe Microscopy (SPM) used for complex investigations of surface properties with high resolution. IMT-MINAFAB, the micro- and nanofabrication center of IMT-Bucharest, is a technological platform devoted to multidisciplinary research and small scale fabrication of micro and nanoelectronic devices, sensors and microsystems. Here we report some applications of SPM in diagnosing and characterizing materials and output of various processes involved in the research conducted using IMT-MINAFAB facilities: physico-chemical depositions, thermal processes, chemical synthesis, surface charging, cleaning or functionalization etc. In particular, SPM proved as an invaluable tool for high resolution characterization of soft matter such as polymers and heterogeneous systems at the nanoscale.

35. P035. Impact of Biogenic Nanoparticles on Future Bioeconomy

Steliana RODINO[1], Alina BUTU[1], Adelina POPESCU[4], Marian BUTU[1], [1]National Institute of Research and Development for Biological Sciences, [2]Romanian Farmers Association

Abstract. Any economic activity arising from products made using biological processes and using biological solutions is considered as bioeconomy. Furthermore, bioeconomy not only provides solutions to pressing social and environmental needs, but also delivers real benefits to the community. In this context, nanoparticles are an important component because of both the methods through which they are obtained and their biological activity. With the rapid development of nano techniques, the basic research and application of nanoparticles starting from plant protection, improving the quality of agricultural production industry to delivering drugs, medical imaging, and other areas are also rapidly developing. At present, nanoparticles are increasingly used

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for commercial purposes. The widespread use of nanoparticles can have positive and negative effects on the environment and health. The production and also the applications of nanoparticles strongly impact the development of bio-economy at a regional/national level as well as globally. This paper analyzes both the positive and the negative aspects of the impact nanoparticles production and application have on bioeconomy. Finally, the importance of the research on the assessment of the potential impact nanoparticles have on the environment and on human health in the context of bioeconomy standards and innovative approaches is summarized.

36. P036. Impact Green Synthesis of Silver Nanoparticles and Their Preservation Effect on Fresh Fruits

Marian BUTU[1], Alina BUTU[1], Steliana RODINO[1], [1]National Institute of Research and Development for Biological Sciences

Abstract. The objective of our research was to study the silver nanoparticles by the synthesis mediated with plant extracts and to evaluate their preservation effect on fresh fruits. The vegetal material used for plant extracts was Vaccinium vitis idaea fruits and Petroselinum crispum leaves. The silver nanoparticles were formed by reducing silver nitrate solution with the plant extracts. Various concentrations of silver nanoparticles - plant extracts solutions were investigated for their effect on prolongation of fruits shelf life. The fruit species used were Vaccinium myrtillus (blueberries) and Rubus fruticosus (blackberry). The influence of the mixtures on fruits preservation was evaluated by monitoring the sensorial and microbiological quality during the storage period. The synthesis of nanoparticles was characterized by the color change of mixture. The silver nanoparticles produced by green synthesis with both extracts showed the good results on prolongation of tested fruits shelf life. Our study demonstrated both the potential of green silver nanoparticles and the synergistic effect of plant extract and nanoparticles in preservation of fresh fruits.

37. P037. Application of Nanoparticles in Shelf Life Extension of Vegetables and Fruits

Alina BUTU[1], Steliana RODINO[2], Marian BUTU[1], [1]National Institute of Research and Development for Biological Sciences, [2]The Bucharest University of Economic Studies

Abstract. Despite the numerous potential applications of nanoparticles and the growing trends in scientific publications and patents, applications on vegetables and fruits shelf life extension are not yet available on the market. The growing demand for fresh vegetables and fruits leads to the constant challenge to develop innovative solutions for vegetables and fruits preservation. Nanoparticles such as gold, silver or copper nanoparticles have increasingly attracted the researcher's interest for antimicrobial products due to their biological properties. This study gives an overview of the synthesis steps, variety of plant species and practical applications of biogenic nanoparticles in shelf life extension of vegetables and fruits. The best results of our research have been obtained for silver nanoparticles synthesized by plant extracts-mediated.

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38. P038. Wettability properties of lamellar thin films obtained via laser methods

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Abstract. Lamellar clay materials are promising candidates as low-cost adsorbents. Layered double hydroxides (LDH) are anionic clays consisting in brucitic-like layers of positively charged metal/hydroxides with anions and water molecules in between the layers. Montmorillonite (MMT) is cationic lamellar clay, part of phyllosilicate mineral species, with an interesting lamellar structure allowing guest absorption between the lamellas. The absorption can take place at the surface, or interlayer. In this work, thin films of lamellar materials were obtained by pulsed laser deposition (PLD) and matrix assisted pulsed laser evaporation (MAPLE). A Nd:YAG laser (1064, 532, 355 and 266 nm) was used for PLD experiments, irradiating dry pressed targets of Mg-Al based LDH or MMT clay powder. For MAPLE, the powders were frozen in deionized water or water: ethanol (10% w/w) and used as targets. The laser fluence was in the range 1–3 J/cm2 and silicon was used as substrate. Surface wetting capabilities of the films can be controlled and tailored by using proper deposition parameters, or by intercalating a suitable guest in the interlayer space. Fatty acids can be used for obtaining hydrophobic films and polyethylene glycol for hydrophilic layers. Chemical, structural and morphological analysis were performed in order to corelate films properties with the hydrophilic/ hydrophobic character of the film surface. Contact angles in a large range of values were obtained (between 20° and 160°) due to micro and nano scale roughness and chemistry of surface.

39. P039. A complex 3D tetra-culture alveolar model to study the toxicological effects of gold nanoparticle suspensions

Melissa Saibene[1], Sebastien Cambier[1], Tommaso Serchi[1], Elisa Moschini[1], Patrizia Bonfanti[2], Anita Colombo[2], Wolfgang Parak[3], Paride Mantecca[2], Arno C. Gutleb[1], [1]Environmental Health Group, Environmental Sustainability Assessment and Circularity Unit, ERIN

Abstract. In the last decades nanotechnology advancements lead to a massive increase of the engineered nanoparticles (NPs) in our society and in consumers products increasing human and environmental exposure. For humans, inhalation can be considered the main exposure route, reason why lung toxicity studies should be considered a priority. Inhaled NPs reach the alveoli, the lowest part of the human air-ways, thin barrier between the organism and the atmosphere. NPs are able to cross this barrier, enter the blood stream and reach other organs exerting systemic effects. Generally, inhalation studies are performed in vivo to mimic the human exposure. The use of 3D in vitro models represents a valid and efficient alternative to predict the acute toxicity effects of inhaled substances on human health. We describe the effects of different shaped gold nanoparticles (AuNPs) on a complex 3D in vitro alveolar tetra-culture model in which cells are maintained at Air-Liquid-Interface (ALI) and exposed to nebulized NP suspension by the VitroCell™ Cloud System. 24 hour after exposure, the effects of Pegylated AuNPs with comparable size were evaluated in terms of viability,

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cytotoxicity, inflammatory response and uptake. The set of AuNPs included Gold Nano Spheres (GNPs), Rods (GNRs) and Stars (GNSs).

40. P040. Piezoelectric energy harvester for environmental applications

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Abstract. The current paper focus on the fabrication and testing of a piezoelectric energy harvester which is capable to harvest mechanical energy from ambient environment and convert it into electrical energy. The MEMS device includes 20 piezoelectric harvesting cantilevers which are designed as unimorph cantilevers and working in flexure mode. The piezoelectric material was chosen as a lead-free material (Sc doped AlN). We focused on obtaining a double array of proof mass cantilevers for a resonant frequency in the environment application domain (few hundred Hz [1]) and a chip area of 1cm2. The technological process consists in using SOI wafers, thermal oxidation, sputtering deposition and DRIE etching. We obtained a double array of 10 cantilevers (2500µm x 300µm x 10µm) with a thickness of 400µm for the proof mass. The resonant frequency was around 465Hz (measured with a laser Doppler interferometer) and the cantilevers were connected according with their phases [2]. For this resonant frequency and an acceleration of 2g we obtained, using the integrated circuit LTC3588-1 [3], a stabilized output voltage of 1.8V, which is sufficient to power up a wide range of commercially available microcontrollers, like STM32L series. The estimated output power for the fabricated chip is around 4.8µW.

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41. P041. Piezoelectric Wafer Level Nanoimprint Lithography Enabling Novel Photonic Devices

Anneliese Pönninger, Martin Eibelhuber, EV Group E.Thallner GmbH, Austria

Abstract. Photonic applications are emerging rapidly using the fabrication infrastructure of the semiconductor industry to enable new functionalities, smaller form factors, improved performance and reduced costs. The nanoscale manipulation of light is at the core of developing the full potential of photonic devices, where shape and periodicity of the structures are the key parameters. For that reason, adequate Nano-patterning solutions

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will play an essential role in the photonics market. To this end, direct writing methods have been extensively used for research and development of optical structures but these techniques cannot be easily scaled up for cost-efficient production. Nanoimprint lithography (NIL) though is in many cases key enabling to bridge the gap from R&D to high-volume manufacturing. NIL has the unique capability of adapting to the needs of the fragmented and less standardized photonic market while still providing a low cost volume production solution. In particular, full-field UV-NIL can be used to stitch free patterns over large areas and supports a wide range of structure dimensions and shapes including 3D patterns. Cost efficient replication of such patterns by NIL is essential for many applications like augmented reality devices, optical sensors and biomedical chips.

42. P042. Piezoelectric Thin film- and Nano-technology for future solar-driven energy conversion systems

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Abstract. Thin film (TF)- and nanotechnology (NT) are crucial for any PV-technology, amongst others, in the form of anti-reflection-coatings, transparent conductive materials, back-contact-, buffer-, or absorber layers. In a broader sense, future PV-based energy conversion systems will need to be integrated to an increased extent with related energy conversion- and storage technologies, such as batteries or hydrogen-based systems. Regardless of the type of solar cell or other solar-driven energy conversion system, the current and future requirements for each material and its associated manufacturing technology are the same: low-cost, applicability, reliability and sustainability. The Competence Unit Photovoltaic Systems at AITs Center for Energy develops and commercializes TF and NTs for above given applications, while focusing on low-cost and sustainable material systems that are abundant in the earth's crust and can be processed with easily scalable deposition techniques. This presentation gives an overview on these activities, summarizing AITs recent achievements regarding transparent conductive materials, buffer- and absorber layers processed via physical vapor based- or chemical solution based on deposition routes. In addition, considered future application possibilities of AITs TF- and NT-based competences regarding future photovoltaic- and solar-driven integrated energy conversion- and storage systems are outlined.

43. P043. Piezoelectric Innovative and Smart Printed Electronics based on Multifunctionalized Paper: from Smart Labelling to Point of Care Bioplatforms

Ana Viñuales, Ramón Tena, FUNDACIÓN CIDETEC

Abstract. Being flexible, easily foldable and recyclable, paper as substrate and functional part of portable, wireless, and/or disposable electronic devices is emerging as a promising approach to develop sustainable electronics contributing to reduce the electronic waste. INNPAPER is a use-case driven project aiming at providing a configurable common electronic platform based on multifunctional paper. To develop innovative

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paper manufacturing approaches, including (Nano)cellulose functionalization, to generate paper with tailor-made properties (e.g. (super)hydrophobicity/philicity, conductivity, etc) at surface and bulk level will be the first key challenge of the project. Based on this progress, a configurable common platform comprising a variety of paper-based devices (printed battery, electrochromic display, antenna and hybrid electronic circuit), where the paper will act as substrate and active component, will be developed. The common platform will be the basis for the subsequent manufacturing of a variety of use-cases covering different industrial sectors, in particular packaging and Point of Care (PoC) assays (security, food traceability, medical). The paper-based platforms will be manufactured in existing printing and hybrid manufacturing pilot-lines located at the partners facilities, providing not only a high impact paper-based electronics business case but also an open-access pilot line network to the EU after the project. An eco-design strategy including sustainability and re-use issues will be implemented. Exploitation and Business plan to ensure the profitable use of the pilot-lines in short and long term timescale and the commercialization of the resulting paper-based platforms will be elaborated. The accomplishment of the INNPAPER targets will support the EU industry in the emergence of internet of things, consolidating the paper making and wood-harvesting industries and positioning EU in the environmental management of electronic waste.

44. P044. Photocatalytic metal oxide materials for air purification applications

M. Suchea [1,2], I. V. Tudose [2,3], C. Pachiu[1], P. Pascariu[4], A.Dinescu[1], E. Koudoumas[2]

Abstract. The photocatalytic materials have various functions, such as self-cleaning, antifogging, antibacterial actions, deodorization or decomposition as removal of pollutant. These effects of photocatalyst's functions are the responsible for the development of a broader range of functional smart materials used in various applications. The most widely used semiconductor photocatalysts are TiO_2 and ZnO because of their high photosensitivity, photochemical stability, large band gap, strong oxidizing power and non-toxic nature. The successful exploitation of such photocatalysts requires the development of techniques for controlling their size, morphology, structural and surface characteristics, as well as efforts to enhance their photochemical response to visible/solar illumination. Until now, there are quite few reports in the literature presenting state of art approaches of use of TiO_2 and ZnO materials onto textile substrates for several applications such as antibacterial, deodorizing and UV protection, and none regarding any systematic approach of direct growth and optimization with respect the textile support. Up to our knowledge, there are only a few available studies in the literature about TiO_2 and ZnO coated textiles used as photocatalytic active support for gaseous compounds decomposition. This work will particularly present recent advances on photocatalytic pure and doped TiO_2 onto textile supports for air purification applications.

45. P045. Photocatalytic activity of rare earth (La, Er, Sm) doped ZnO nanostructures under UV irradiation for Congo-Red dye degradation

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Abstract. In recent years, photocatalysts based on ZnO nanostructures has shown a special interest in both fundamental scientific research and use in many applications (sensors and actuators, solar cells, diodes, photocatalysts, piezoelectric devices). ZnO doped with 1% rare earth metals RE (Sm, Er, La) nanostructures were obtained by electrospinning method combined with calcination at 700 °C for 3 h. All materials were characterized using the surface morphology (SEM, TEM), crystalline structure (XRD) and band gap energies. SEM micrographs of the e electrospun products showed the formation of uniform, long and continuous fibers with average diameters ranging from 0.39 to 1.19 μm. TEM images of ZnO doped with RE disclosed a morphology of interconnected nanoparticles of 25 – 134 nm in size. The XRD patterns of the inorganic products confirmed the hexagonal wurtzite structure. Photocatalytic activity of RE doped ZnO nanostructures was investigated by the degradation of Congo Red dye under UV-light irradiation. Optimal conditions of experiments were determined empirically by employing the gradient method. Thus, a maximal value of color removal efficiency (95.8%) was observed experimentally for the initial dye concentration of 10.7mg/L and 0.236 g/L catalyst dosage (ZnO:Sm). Furthermore, a successful recovery of the spent catalyst was accomplished by thermal activation.

46. P046. Investigation of Crystalline and Magnetic Properties of Nanostructured Ferrites, Hardened by Exchange Interactions

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Abstract. The magnetic nanostructured systems, constituted from magnetically hard and soft phases that interact by magnetic exchange coupling, are potential candidates to replace the conventional single-phase materials. Here we report the synthesis by chemical route of the exchange coupled ferrites nanocomposites, using the BaO•6Fe2O3 and CoO•Fe2O3 as hard magnetic, respectively soft magnetic phases. The subsequent calcination converts the assembly into BaO•6Fe2O3/CoO•Fe2O3 nanocomposites, which exhibit hard magnetic characteristics, due to the effect of exchange interaction occurred between the two phases. The prepared nanocomposites were morpho-structural, through X-ray diffraction a scanning electronic microscopy and magnetic, through vibrating sample magnetometry, characterised. The values reached for saturation magnetisation are 40 – 50 emu/g and for coercivities 1000 – 2000 Oe. The obtained value of ratio between remanent magnetisation and saturation magnetisation are greater than 0.5 (Mr/MS = 0.53) that means that the two phases are exchange coupled.

47. P047. Electro-analytical application of nano-crystalline graphite

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Abstract. A nano-crystalline graphite film (NCG, ~350 nm, ~340 Ω/sq.) wqas used as sensor for caffeic acid detection and quantification in real samples. It worked at an applied potential of + 0.4 V vs. Hg/Hg2Cl2 reference electrode showing a linear working range comprised between 5.0 × 10-5 and 1.0 × 10-3 M.

48. P048. Assessment of Antitumor Activity of Liposomes With Cafeic Acid and Caffeic Acid Phenethyl Ester

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Abstract. Although many vegetal compounds have been shown to have significant antitumor activity, their production and use as therapeutic agents is limited by their disadvantages: poor solubility, poor permeability, low bioavailability, instability in biological fluids, and extensive first pass metabolism. These limitations of vegetal compounds can be overcome by using nanotechnology for their formulation. The purpose of this paper is to formulate liposomes with caffeic acid and caffeic acid phenethyl ester to provide antitumor activities at least equal to the substances in free form. In the experiments performed, various caffeic acid and caffeic acid phenethyl ester liposomes formulation were prepared and their antitumor activity was compared with the substances in free form. The cell viability for all formulations was determined by MTS method through CellTiter 96 AQueous Non-Radioactive Cell Proliferation Assay Kit (MTS), Promega. The results have shown that by incorporation of caffeic acid and caffeic acid phenethyl ester into liposomes was obtained an increase of the antitumor activity of the vegetal compounds.

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49. P049. A common camera as ultrasensitive power-meter in the investigation of the third-order optical nonlinearity

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Abstract. The generation of the third harmonic in nonlinear optical materials is a powerful method in the investigation of their ultrafast third-order optical nonlinearity of electronic origin. When the third-order nonlinearity is excited in non-phase-matching conditions, the conversion efficiency is very low and the third harmonic beam can be very weak (pW¸fW power). We present a method, recently introduced by us, in which the very low optical powers are measured using a commercial inexpensive camera as an ultrasensitive optical power-meter. Each pixel of the camera's photosensitive array is a micrometric sensor, which converts the light into an electrical signal. The incident optical power is determined by image processing, converting the average

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pixel gray level to optical power according to a procedure developed by us. Adjusting the exposure time and the spot size on the camera, and collecting the signal only from the pixels inside a software generated window that surrounds the measured beam spot, we measured optical powers down to fW level. We used this method in the measurement of the optical third harmonic generated in nonlinear materials by high-repetition-rate infrared femtosecond laser pulses.

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50. P050. New advanced materials based on SiGeSn nanocrystals in oxides for SWIR phototodetectors and non-volatile memory devices

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Abstract. We deal with new solutions for fabricating new advanced materials based on SiGeSn nanocrystals (NCs) in oxides with targeted photoconductive (PHC) and non-volatile memory (NVM) properties, using environmentally friendly and cost-effective technologies and raw materials with impact on wide range domains of applications as environment, biomedicine, food, nuclear, space and optosecurity. For fabrication we use magnetron sputtering deposition followed rapid thermal annealing for films nanostructuring. The oxide (TiO2, SiO2) films with embedded SiGeSn NCs that we obtain by engineering NCs sizes, composition and concentration have controlled photosensitivity in SWIR. The photodetectors based on these materials discriminate between different road conditions as dry, wet and icy asphalt, contributing to reducing traffic accidents [https://m-era.net/success-stories/high-photoconductive-oxide-films-functionalized-with-gesi-nanoparticles-for-environmental-applications-photonanop]. Our materials are versatile as PHC properties can be tuned for other dedicated applications (specified above). We have the know-how to fabricate MNV devices of gate HfO2/Ge-HfO2 floating gate/tunnel HfO2/Si wafer with floating gate of Ge QDs positioned in a single layer in HfO2 that determines the high NVM performance (4–6 V memory window; very good retention time with 50% capacitance decrease after 10 years). Also, we have the know-how to fabricate MNV devices targeted to be used in radiation dosimetry applications (medical, space, nuclear, military).

51. P051. New Release kinetics of lipid-polymer nanoparticles loaded with perindropril for cardiovascular applications

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Abstract. Lipid-polymer nanoparticles (LPHNPs) are structures conceptually derived from liposome and polymeric nanoparticles that possess advantages of both systems like: excellent biocompatibility, nano-size, high carrier capacity, high stability. The objective of this paper was the release behavior evaluation of lipid-

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polymer nanoparticles for cardiovascular applications. As cardiovascular model drug was used an angiotensin-converting enzime inhibitor, perindropril. LPHNPs loaded with perindropril were prepared via modified nanoprecipitation and characterized in terms of entrapment efficiency, size and polydispersity. In vitro drug release from LPHNPs was performed in 0.1M PBS, pH = 6.8 by using dialysis bag method under sink conditions. Various models such as: Zero-order, First order, Korsmeyer-Peppas, Higuchi and Hixson-Crowell were applied to evaluate the release mechanism. The prepared LPHNPs loaded with perindopril showed good entrapment efficiency, small sizes and narrow distribution. The in vitro release study showed a slow release of perindopril compared with free perindopril. The results suggested that LPHNPs could be exploited as drug carriers for cardiovascular drugs. Acknowledgement: This work was financially supported by Ministery of Research and Innovation CNCS-UEFISCDI through Contract 74/2018 - PNIII (PN-III-P1-1.1-PD-2016-1756).

52. P052. DPN techniques and its future for micro-nanoelectronics

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Abstract. Dip pen nanolithography (DPN) is a scanning probe nanolithography technique where an atomic force microscope (AFM) tip is used to transfer molecules or nanoparticles to the surface of a substrate in a controlled manner. In DPN technique, the ink material to be patterned is transferred from the coated tip / meniscus to the substrate surface / meniscus. Comparing with micro printing (μCP or Inkjet printing), DPN printing method provides a greater flexibility because it allows control over the size of the pattern by adjusting the tip speed dwell time and environmental control. We present here new research and development efforts that demonstrate the potential of DPN as a technique to the direct deposition of metallic materials or to improve micro-nanoelectronic devices.

53. P053. Phonon Fluctuation Spectroscopy in Nanostructures and Nanomaterials

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Abstract. Thermal vibrations of the atoms around their equilibrium position scatter the electrons flowing in a solid-state matrix. Since this mechanism/interaction is fundamental for the material properties, it is of paramount importance to know what are the most important atomic vibration modes(phonons) the electrons interact with. In individual nanostructures, such as a single nanowire, etc., these mechanisms of interaction are difficult to investigate by conventional methods of spectroscopy. A new electrical method which is capable to extract the phonon spectrum from electronic noise data at room temperature, called phonon fluctuation spectroscopy, has been proposed and developed in the last decade. It is especially useful for small dimensional systems, because it offers a detailed map of how electrons couple to different phonon modes in a conducting nanostructure or nanomaterial. This method and some of its applications will be briefly presented in this work. For pure solid-state matrix, the method gives the energies of extended phonon modes, while both extended and impurity-induced local phonon modes are observed in intentionally doped or impure nanomaterials. These

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statements will be exemplified by results obtained on individual nanowires and detection of pure carbon molecules (fullerenes) in carbon dust.

54. P054. Influence of alternating magnetic fields on the differentiation of stem cells loaded with magnetic nanoparticle

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Abstract. Magnetic nanoparticles (MNPs) are versatile tools for various applications in biotechnology and nanomedicine. MNPs-mediated cell tracking, targeting and imaging are increasingly studied for regenerative medicine applications in cell therapy and tissue engineering. Mechanical stimulation influences mesenchymal stem cell differentiation. Here we show that MNPs-mediated magneto-mechanical stimulation of human primary adipose derived stem cells (ADSCs) exposed to variable magnetic field (MF) influences their adipogenic and osteogenic differentiation. ADSCs loaded with biocompatible magnetite nanoparticles of 6.6 nm, and with an average load of 21 picograms iron/cell were exposed to alternating low intensity (0.5 mT - LMF) and higher intensity magnetic fields (14.7 and 21.6 mT - HMF). Type, duration, intensity and frequency of MF differently affect differentiation. Short time (2 days) intermittent exposure to LMF increases adipogenesis while longer (7 days) intermittent as well as continuous exposure favours osteogenesis. HMF (21.6 mT) short time intermittent exposure favours osteogenesis. Magnetic remotely-actuated MNPs up-taken by ADSCs promotes the shift towards osteoblastic lineage. ADSCs-MNPs under MF exposure could be used for enabling osteoblastic conversion during cell therapy for systemic osteoporosis. Current results enable further in vivo studies investigating the role of remotely-controlled magnetically actuated ADSCs-MNPs for specific biomedical applications.

55. P055. Influence High saturation magnetization Co35Fe65 nanowires for biomedical applications

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Abstract. Recently it has been demonstrated that high saturation magnetization CoFe nanowires with various lengths and diameters are highly efficient hyperthermia materials, showing a high specific absorption rate (SAR). Also, theoretical studies suggested that the acceleration of spin-spin relaxation has a square dependence on the magnetic moments of nanoparticles contrast agents. Therefore, magnetic nanostructures with high BS could be used as new T2 MRI contrast and magnetic hyperthermia agents.

Here we report on electrodeposition of high saturation magnetization Co35Fe65 nanowires with diameters of 35 and 200 nm and lengths up to 20 micrometers. Electrodeposition was carried out from a sulfate/chloride

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solution using a pulsed potential deposition with Ton = 2.5 s at the potential of 1.15 V/SCE and Toff = 1.0 s at - 0.70 V/SCE. Uniform nanowires arrays with constant composition have been obtained. CoFe nanowires were analyzed by SEM, EDS, and VSM measurements (results will be shown on poster). As deposited CoFe nanowires were released from AAO template, were functionalized and were used to measure longitudinal (T1) and transversal (T2) relaxation times and their corresponding relaxivities r1 and r2, respectively. Our results showed r2/r1 values much higher compared to Fe2O3 nanoparticles and high SAR values.

56. P056. Influence New broadband electromagnetic shielding composite material based on Co-Fe-B amorphous nanoparticles embedded in textile-structure

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Abstract. The presence of electromagnetic fields in the environment has a negative effect on the human body. To reduce this effect is necessary to use electromagnetic shields with high shielding efficiencies. Composite materials based on metallic nanoparticles embedded in textile fiber structures are now days intensively studied as possible new candidates for electromagnetic shielding domain.In this paper, a new broadband electromagnetic shielding composite material containing chemically synthesized polymer coated Co-Fe-B amorphous nanoparticles embedded in textile-structure for 1 GHz - 18 GHz microwave frequency domain is presented. Co-Fe-B amorphous nanoparticles have a high potential for applications in microwave domain due to their special soft magnetic properties like high saturation magnetization, low coercivity, large anisotropy and high magnetic permeability. Chemical synthesis method gives the possibility to obtain polymer coated Co-Fe-B amorphous nanoparticles with diameters from few nanometers to tens of nanometers by varying the parameters of the chemical synthesis. The shielding properties of the broadband electromagnetic shielding composite material are controlled through the thickness of the polymer layer, the concentration of the nanoparticles and the thickness of the composite material. Electromagnetic shielding efficiencies above 30 dB (> 99% attenuation) is obtained by using a multi-layered composite structure.

57. P057. Nanostructured thin films used to improve the fundamental characteristics of the mechatronic components

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Abstract. Considering the importance of mechatronic applications realized in INCDMTM, researches have been carried out on the possibility to increase the lifetime of the mechatronic components, subjected to friction, by using nanostructured thin films. Nanostructured metallic thin films (Ti, Cr, Al and Ti/Al multilayer) were deposited by the electron beam evaporation method on different types of steel substrates (OLC45, Rul1, C120,

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OSC). These have been selected because nanomaterials have superior properties in relation to macrostructured materials and these steel types are frequently used in mechatronics. After scratch tests, mechanical and topographic characterization of the thin films, Ti and Cr proved to be the materials with the highest wear resistance. Ti layer presented the best adhesion on all types of substrates. Behaviour of Ti and Cr layers deposited on mechatronic components has been analyzed comparatively for obtaining information about their wear resistance in real medium. Functional tests were performed in dynamic and real-time conditions, evaluating the tribological behaviour of the components belonging to a guiding-precentration device made of Rul1 steel. Taking into account the behaviour of these layers, the main conclusion was that Ti and Cr thin films should be integrated into real mechatronic systems in order to increase their lifetime.

58. P058. DaNa2.0 Knowledge Base - Quality-approved information on Safety of Nanomaterials for all

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Abstract. Nanomaterials have found their way in our everyday lives via numerous market applications ranging from electronics to the health care system. They offer great innovative potential and are assumed to be beneficial to mankind and the environment. However, consumers, journalists, or regulators often miss reliable and understandable information on nanomaterials and their applications. Communication of scientific facts with the public is an ambitious task as complex issues need to be simplified whilst ensuring scientific correctness. Due to the multidisciplinary nature of nanotechnology, communication on safety aspects is particularly challenging. The DaNa2.0 project (data and knowledge on nanomaterials) is addressing these challenges by collecting and evaluating scientific results. Alongside, a criteria checklist for quality evaluation and management of scientific publications with mandatory and desirable criteria has been developed to ensure a thorough and comprehensive assessment. These evaluated research findings are presented in a worldwide unique knowledge base, correlating material properties and applications, tailored to interested citizens, stakeholders and scientists. The DaNa2.0 platform www.nanoobjects.info offers easy-to-understand, up-to-date and quality-approved information on the 26 most widely used nanomaterials together with FAQs and cross-cutting topics like Nanomedicine. DaNa2.0 is a national project funded by the German Federal Ministry of Education and Research (FKZ 03X0131).

59. P059. Nano-structured GeSn coatings for detection and emission of short-wave infrared light

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Abstract. GeSn is a new advanced coating material for detection and emission of short-wave infrared (SWIR) light. The new GeSn semiconductor material offers an alternative solution to the current III-V IR technology, being less expensive, environmentally friendly and compatible with Si technology. GeSn is a direct-bandgap semiconductor, opening a new path for silicon photonics. The performances of the GeSn based devices can be further enhanced by nano-structuring. This is the topic of the GESNAPHOTO project* in the frame of the M-ERA.NET EU program. The project is a synergistic partnership of research institutes and manufacturing companies from Romania and Germany. Two methods of fabrication of GeSn layers are addressed: cost effective magnetron sputtering (MS) and industrial standard chemical vapor (CVD) depositions. Multiple structural and topological characterization methods available in consortium are used as well and electronic band structure modeling. SWIR detection up to wavelength of 2.4 mm was demonstrated for GeSn nanocrystals (NCs) embedded in SiO2 obtained by annealing of MS deposited layers and light emission at about 2.5 µm on multiple quantum well structures. Electroluminescence diodes and SWIR detectors were fabricated by using both homojunction and nanostructured multilayers of epitaxially grown (Si)GeSn on Ge-virtual substrates. *More on: http://www.infim.ro/projects/nano-structured-gesn-coatings-photonics-gesnaphoto

60. P060. Sensitive platform with surface acoustic wave sensor for hydrogen detection

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Abstract. Fabrication and experimental characterization using a sensitive platform with surface acoustic wave (SAW) sensors for hydrogen detection are presented in this paper. The development and implementation of this platform using chemical microsensors are required for answering to actual market needs: short response time, low manufacturing costs and highly reproducible sensitivity to low hydrogen concentrations. The SAlW microsensors were fabricated using aluminum for the interdigital transducers (IDTs) and a thin absorptive platinum film as sensing area. All these metallic layers were deposited over a quartz substrate using a delay line configuration. Central frequencies between 96 MHz to 97.5 MHz range were measured after the first fabrication run of the SAW devices. The experimental characterization was performed by measuring the phase characteristics of the transmission coefficient S21 with a laboratory grade Vector Network Analyzer (VNA) from Anritsu. The hydrogen concentration into the hermetic measurement enclosure was gradually increased by injecting a “diluted” gas mixture of 7 % H_2 and 93 % N_2.

61. P061. ZnO nanostructures obtained by chemical methods with special applications

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Abstract. ZnO is a n-type semiconductor with a large band gap of 3.37 eV at room temperature and it can be used in a large variety of applications like: solar cells, light emitting devices, gas sensors, piezoelectric devices or photocatalysis. In our previous works we have established that the conduction, transparency and charge carriers concentration of ZnO can be controlled by using different dopants (Al, Sn, Li, Ni, In-N). In the most recent research sol-gel (SG) and hydrothermal (HT) methods were used separately or in combination in order to obtain ZnO nanostructures doped with Mn or V (1, 2 and 5%) for possible application in transparent optoelectronics or as piezoelectric materials. Sol-gel films exhibit equiaxed nanoparticles and thikness of about 60 nm, while the films prepared by hidrothermal method show a homogeneous morphology consisting of uniform 1D nanorods and thikness of 200 nm. From the piezoelectric tests, it was found that the d33 coefficient is much larger for the HT samples in comparison with the SG samples, especially for 2 and 5 at% Mn. The optical and piezoelectric results could be of interest for applications in optoelectronic or piezoelectric devices.

62. P062. Thermodynamic parameters controlling the interaction at the bio/nano interface: novel criteria for nanomaterials grouping

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Abstract. The evaluation of the thermodynamic parameters driving the interactions at the bio-nano interface is a key issue for the nanosafety research. Based on the approach of the intelligent testing strategy (ITS), within the Nanoreg2 EU funded project, the identification of energetic parameters describing the interactions between manufactured nanomaterials (MNMs) and several selected relevant proteins has been performed with special focus on an alternative, novel concept for MNM grouping. Thermodynamic signature associated with the interaction of three commonly used metal oxide NMs, i.e. zinc oxide (ZnO), titanium dioxide (TiO2) and silica (SiO2) with three proteins, namely the bovine serum albumin (BSA), bovine plasma fibrinogen (BPF type I-S) and bovine immunoglobulin G (IgG) has been investigated.

The following issues have been addressed: (i) Analysis of binding characteristics for protein-NMs systems represented by the binding constant, stoichiometry, binding enthalpy, Gibbs energy and entropy changes obtained by means Isothermal Titration Calorimetry; (ii) Assessing the effect of the NM on the protein stability by measuring the thermodynamic parameters for the proteins denaturation (denaturation temperature, heat capacity; enthalpy, entropy and free energy changes). The information generated by the calorimetric investigation provides a platform allowing MNM classification by different energetic profiles. Acknowledgements: The support of the project NanoReg2, Nr. 646221/2015, Horizon 2020 Framework Program of the European Union is acknowledged.

63. P063. Thermodynamic Nanotechnology in the context of additive manufacturing - Results obtained at IMT Bucharest

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 847673.

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Abstract. We present an overview of research activities at IMT that are made at the junction between nanotechnology and additive manufacturing – two key enabling technologies. Results regarding novel nanofabrication technologies, ways of reaching industrial scale productivity for these technologies, use of nano- and subnanoscale phenomena for achieving 3D Printing of different types of materials previously not accessible (or hardly accessible) for additive manufacturing are among the results that are shown. These results were obtained in national and EU H2020 projects devoted to nanoelectronics.

64. P064. Development of enzymatic electrochemical sensors based on minimal-invasive microneedle probes for continuous monitoring of molecular biomarkers in the dermal interstitial fluid

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Abstract. Wearable technologies that continuously monitor physiological parameters for personal health and well-being applications have rapidly entered the consumer mass market. However, a more in-depth analysis requires quantification of molecular biomarkers, which naturally entails direct contact with the user's biofluids. While a number of systems are currently in development that make use of non-invasive biofluids such as sweat, saliva or ocular fluid, these systems generally struggle with specific challenges linked to the nature of the sample. Alternatively, the dermal interstitial fluid has been demonstrated to be highly similar in biomarker composition to blood, and it can be accessed in a painless minimal-invasive manner by microneedle-based probes.

We demonstrate our approach to develop microneedle-based biosensors that are designed to detect glucose levels in the dermal interstitial fluid via electrochemical reactions catalysed by direct electron transfer enzymes. The enzymes are embedded into a hydrogel-based biofunctional layer that is deposited onto the microneedles by inkjet printing. Furthermore, we also give an outlook towards integration of such microneedle-based sensors into a fully self-sustained electronic smart patch.

65. P065. One-pot synthesis of tunable photoluminescent interconnected graphene network and its application in SiNWs solar cells

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Abstract. An interconnected graphene network (IGN) displayed excitation dependent photoluminescence in the 300-450 nm domain owing to the presence of trap states energy levels associated with surface functional

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groups. The IGN architecture was synthetized using low temperature hydrothermal carbonization of sucrose/2-amino-2-(hydroxymethyl)-1,3-propanediol. The presence of locally ordered stacks of 2-6 graphene-like layers with enlarged fringe separation ranging between 0.34 and 0.40 nm along (002) was revealed. Remarkably, spontaneous curving of the layers led to the formation of carbon nano-onions containing 3-5 fullerene-like shells with ~4 nm outer diameter, randomly distributed inside the carbon framework. The high degree of π states delocalization in this type of nanostructures also enhanced the electronic conductivity of the sample.

Further, we fabricated a hybrid Si nanowire photovoltaic device based on IGN/p-SiNWs heterojunction, where the IGN multiple trap energy levels could foster more effectively charge injection into nanowires. The photocurrent showed a 3-fold increase upon the heterojunction formation whereas Voc was found to increase by 9 %. Moreover, IMVS/IMPS spectroscopy revealed the significant increase of the recombination time from 2.82 μs and 7.72 μs demonstrating IGN successful passivation of Si surface. These findings are promising for further exploitation of IGN in the future energy conversion applications.

66. P066. Laser-induced gratings in thin films of chalcogenide glasses

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Abstract. Chalcogenide glasses are promising materials for nonlinear photonics (holography, recording and storage, phase conjugation, image processing, switching, integrated optics etc.). Many of these applications are based on diffraction gratings induced by the laser light in thin film or bulk forms of these nonlinear optical materials. We report the results obtained in the holographic recording of gratings in thin films of As2S3 chalcogenide glass and in the analysis of light diffraction in these gratings. Mixed phase and amplitude gratings (due to the light-induced structural changes) are recorded by the illumination of the film with a laser interference pattern of green light at the band-gap energy of the material. Moreover, there are two components of the light-induced phase grating, a refractive index grating and a surface relief grating.

The diffraction of a probe laser beam at a wavelength (red) below the band-gap energy occurs only on the phase components of the mixed grating. It is analysed by us in the frame of the Raman-Nath diffraction theory. Important parameters of the laser-induced gratings as the refractive index modulation and surface relief amplitude are determined. Acknowledgment: The support of the Ministry of Research and Innovation (Nucleus Programme LAPLAS VI 16N/08.02.2019) is acknowledged.

67. P067. Sustainable autonomous system for nitrites/nitrates and heavy metals monitoring of natural water sources (WaterSafe)

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Abstract. The purpose of our research was to obtain new electrochemical sensors based on sensitive materials incorporated into a portable device that can provide real-time monitoring of the concentration of water harmful species: nitrites/nitrates and heavy metals. The work was focused on three directions: (i) high efficiency energy harvesting and power stabilized device, able to supply the needed voltage for the sensors and electronic module; (ii) new microsensors for detection of nitrites/nitrates (Romanian Consortium) and heavy metals (Hungarian partners) in water; (iii) low cost autonomous energy system integration and fabrication. The materials optimized for the nitrites/nitrates sensors are SnO2, polymeric membranes and copper nanocomposites while bacterial flagellar filaments were engineered as sensitive biolayer for heavy metal detection. Two photovoltaic panels, based on thin DSSC, were optimised and provided about 10V to the potentiostat.

The main factors in performing an efficient and accurate analysis are the portability of the measuring apparatus, the miniaturization of the electrochemical cell and the sensitivity of the sensors. The WaterSafe portable device allows the determination of contaminants in water samples and the tests can be done with easily not only in the laboratory but also on the field.

68. P068. Study of the structural and morphological properties of NixSix thin films

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Abstract. Nickel silicide (NixSix) is used for both ohmic and Schottky contacts in micro- and nano-devices, due to their remarkable properties, like high temperature stability, low stress and good mechanical strength making them suitable for the micro/nano-systems industry. They also have numerous advantages, such as: low/high formation temperature, low contact resistance, low silicon consummation, etc. In this study, we report microstructural analysis of NixSix thin films formed by rapid thermal processing of nickel thin film deposited on n-type silicon (100) substrates. The Ni thin films were deposited by sputtering on the Si wafer, afterwards was supposed to a post-metallization annealing in an inert atmosphere (N_2) for 5 minutes in the range of 300 – 400°C and 850 - 950°C in order to obtain Ni silicide. The obtained thin films of NixSix were microstructural analyzed using techniques like micro-Raman spectroscopy, Grazing Incidence X-ray diffraction (GI-XRD) and scanning electron microscopy (SEM). We observed that the thermal range used to obtain NixSix thin films plays an important role in the obtained crystalline phases, leading to a decreased of Ni concentration with temperature increasing (Ni¬2¬Si à $NiSi_2$).

69. P069. A road-mapping process to improve innovation governance of nanotechnologies: practical experiences in nanotech companies

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847673.

Abstract. Enabling and transformative technologies such as nanotechnologies could change society, pervasively impacting on almost all industrial sectors and daily life. The complexity of the innovation eco-system and the normative context for these ground breaking technologies increases the need of companies to develop long-term, socially attentive governance strategies for the development of innovative products. The EU H2020 PRISMA project (GA nr. 710059, 2016-2019) developed a road-mapping methodology, to integrate values and social impacts in technological innovation promoting safe, trustworthy and sustainable progress. The methodology is the outcome of eight industrial pilots, including companies developing theranostic approaches to treat cancer diseases, and nano-capsules systems for dermo-cosmetics applications, that allowed these companies to: deal with risks and uncertainties related to nanomaterials, inform product development by dialogue with stakeholders, and address public needs and concerns, toward an open innovation approach all along their R&I value chain. The PRISMA approach follows the structure and definitions considered in existing standards on social responsibility, risk management, quality and innovation management (e.g. ISO 26000, ISO 31000). The PRISMA case studies and the socio-technological roadmaps developed for the nano-medicine and nano-related products for the health-care and cosmetics sectors are illustrated.

70. P070 Predictive 3D lung models to assess the long-term hazard of nanomaterial aerosols

Hana Barosova1*, Kirsty Meldrum2*, Hedwig Braakhuis3*, Rob Vandebriel3, Arti Ahluwalia4

Abstract. Many cell culture models mimicking the human epithelial tissue barrier are described in the literature and the choice of the model, the mode of exposure to nanomaterials and finally the endpoints investigated depends on the relevant scenario to be studied. There has been a clear trend over the past few years to design reliable advanced, multicellular tissue models that allow the investigation of effects of aerosols under more realistic conditions. Furthermore, since air-liquid exposure scenarios are more realistic towards mimicking in vivo nanomaterial exposure in the lung than the commonly used suspension exposure method, a dose-controlled deposition of various aerosols at the air-liquid interface of cultured lung cells has been developed. Limitations still remain with such systems in terms of their realism regarding extended culture durations considering the long-term, repeated, low-dose exposure of humans to inhaled nanomaterials. The aim for WP3 within PATROLS (Physiologically Anchored Tools for hazaRd assessment of nanOmateriaLS; EU Grant Agreement #:760813) is to improve existing in vitro lung models by increasing their complexity through heightening their physiological relevance in order to valid in vitro alternatives to study ENM hazard towards human health.

71. P071. Development of bio- functionalized gold/poly (3,4-etilenedioxythiophene) electrodes for amperometric detection of organophosphate pesticides

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847673.

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Abstract. The conducting polymers which are highly conductive and easily synthesized are suitable for sensors electrochemical reactions and have been used for enzyme immobilization. Some of these sensors are based on the inhibition by the cholinesterase enzymes (AChE). We reported here the synthesis of hybrid film by electro polymerizing 3, 4-ethylenedioxythiophene on a gold working electrode of a sensor for applications in detection of pesticides. After formation of the poly (3, 4-ethylenedioxythiophene) film on the gold electrode, the enzyme, AChE is entrapped into poly (3, 4-ethylenedioxythiophene) matrix and the thickness of sensing film can be controlled by the number of cycles applied or deposition time during electro polymerization. The modified electrodes have been investigated by cyclic voltammetry and by potential step chronoamperometry. The configuration of the sensors was: Au/Ti as working electrode, Pt/Ti as the counter electrode and Ag/Ti as reference electrode. The resulting biosensor, with entrapped AChE, was characterized in term of: the influence of the thickness of the polymer, substrates enzymatic concentration, the optimum pH and range of linear response. The linear range for substrate concentrations was between 2-10 mM and 3 cycles of electro polymerization were optimal parameters for sensor functionality.

Acknowledgements: The results were obtained within the contract C77.6D (TGE-PLAT), SMIS code 105623.

72. P072. Detection of ammonia using surface acoustic wave microsensors with different nano - ZnO based coatings

Violeta Dediu, Ileana Cernica, Ionescu Octavian, Vulpe Silviu and Florian Pistritu, National Institute for Research and Development in Microtenologies

Abstract. In this work, different nanostructures based on ZnO and SiO2 combination prepared through chemical and physical methods, were investigated for ammonia surface acoustic wave microsensors. ZnO, consisting on nanorods (NR) or nanoparticles (NP), were obtained through solvothermal method. ZnO nanorods, having diameters under 50 nm, were decorated with gold nanoparticles, obtained through chemical reduction. Nanocomposites consisting of ZnO (NR or NP) and SiO2 (obtained by RF sputtering and chemical methods) were deposited on langasite or quartz SAW structures and used as sensitive layer materials. Scanning electron microscopy coupled with energy dispersive X-ray spectroscopy (SEM -EDS) and X-ray diffraction (XRD) were used to investigate the morphology and structure of the obtained nanostuctures. The sensing behaviour of nanostructures towards ammonia was investigated. The gas response of these complex nanostructures was superior compared with those of single ZnO layer reported in the literature. The tested materials prove good sensitivity and stability, reversibility at room temperature. Also, the mechanism of ammonia sensing is discussed.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847673.

73. P073. Raman spectroscopy investigation of structural changes and defects in CVD graphene transferred on oxidized silicon and quartz substrates

Munizer PURICA, IMT-Bucharest, National Institute for Research and Development in Microtechnologies, Bucharest, Romania

Abstract. Raman spectroscopy is considered one of the powerful noninvasive method which has successfully applied to investigation and characterization of carbon nanomaterials such as graphene, graphene oxide, carbon nanodots and nanotubes and to study other two-dimensional materials beyond graphene. Current research and development of graphene and graphene based next generation electronic and optoelectronic devices is driven due to its distinct properties (high conductivity and electron mobility 200 000 cm2V-1s-1 at room temperature, high optical transmittance ~ 97 %) and to advancement of its synthesis and transfer technologies on the target substrate. We present the results of micro-Raman studies of CVD graphene grown on copper foil surface and transferred on SiO2/Si and quartz substrates by means of electrochemical delamination. Raman spectra were collected at room temperature using LabRAM HR 800 spectrometer with confocal optical microscope in backscattering configuration using He-Ne laser (l=633 nm) and tunable Ar laser (l=514 nm). Analysis of the characteristics of the main Raman bands G(~ 1580 cm-1), 2D (~ 2700 cm-1), D (~1350 cm-1), DI (~1625 cm-1) and D+Dl (~2950 cm-1) and also the intensities ratio ID / IG , I2D / IG, ID/IDl, were highlighted the quality and defects densities of the CVD grown graphene.

74. P074. ALD CoCampus Jyväskylä, Finland. Four ALDs and extensive characterization facility

Sajavara, T. University of Jyväskylä. Alakoski, E., Harju, M., Kallberg, E. and Laine, T. JAMK University of Applide Sciences Finland

Abstract. ALD CoCampus, Jyväskylä, Finland. Four ALDs and extensive characterization facility Roll-to-roll ALD and helium ion microscope (HIM) are the main attractions of ALD CoCampus, Jyväskylä, Finland, co-operated by University of Jyväskylä and JAMK University of Applied Sciences. Altogether, there are four ALD equipment at JYU and JAMK.

Beneq TFS 200 https://beneq.com/en/thin-films/products/ald-research-equipment/beneq-tfs-200

Beneq TFS 500 https://beneq.com/en/thin-films/products/batch-production-ald/beneq-tfs-500

Beneq TFS 200 R https://beneq.com/en/thin-films/products/custom-ald-equipment/tfs-200r

Beneq WCS 500 roll-to-roll https://www.youtube.com/watch?v=xOr8UOmSvo4

The helium ion microscope (HIM) is located next to the accelerator based materials physics laboratory, Nanoscience Canter and other top laboratories in the two universities.

https://www.jyu.fi/science/en/physics/research/nuclear-and-accelerator-based-physics/abasedmat

https://www.jyu.fi/science/en/nanoscience-center

Materials research facilities makes it possible to characterize the functionalize ALD coated materials; for example wetting, contact angle, water vapor transmission rate, gas transmission rate, tearing resistance tests.

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The universities are eager to acquire and develop more testing methods to fulfill the needs of the companies. At JAMK the ALD CoCampus is a part of The Center for Applied Materials Research www.jamk.fi/cams ALD CoCampus, Jyväskylä, Finland, is a unique environment to develop and manufacture atomic layer deposition thin films, characterize surfaces and design equipment. Competent personnel will help the companies to reach their goals and will assist the companies own specialists to operate in the facilities. ALD CoCampus, Jyväskylä, is a platform operated by University of Jyväskylä and JAMK University of Applied Sciences. It offers any company access to top equipped ALD laboratory and other facilities. Contact Dr. Mauno Harju, mauno.harju@jamk.fi, tel. +358 40 768 1931. www.jamk.fi/cams

75. P075. ALD Properties of Thermoelectricit Oxide and Silicide Thin Films

Liviu P. Zarbo, INCDTIM Cluj

Abstract. Starting from theoretical predictions, we select a few more promising oxide and silicide materials and obtain their thin films by pulsed laser deposition. We characterize these thin films in order to determine if their properties are suitable for their use in thermoelements.

76. P076. Processing and Characterization of ultrananocrystalline diamond films for MEMS applications

T. Sandu, C. Pachiu, C.Tibeica, L. M. Veca, R. C. Popa, A. Avram, National Institute for Research and Development in Microtechnologies - IMT Bucharest, 126A Erou Iancu Nicolae, Bucharest, Romania; C. Popov, Institute of Nanostructure Technologies and Analytics

Abstract. Fabrication and characterization of suspended microstructures out of ultrananocrystalline diamond film was carried out. Various arrays of bridges and cantilevers were successfully fabricated by a well-controlled process. We were also able to estimate the Young's modulus as well as the residual stress existing in the diamond film by mechanical indentation and finite element simulations.

77. P077. Expertise of National R&D Institute for Nonferrous and Rare Metals in European Projects in the NMPB Area

Roxana M. Piticescu-IMNR; Adrian Mihail Motoc-IMNR; Radu R.Piticescu-IMNR

Abstract. The poster presents some major achievements obtained by National R&D Institute for Nonferrous and Rare Metals - IMNR - in the key enabling technologies domain Advanced Nanomaterials in the frame of some cooperative projects financed by European Commission in different H2020 calls. Such results include: innovative nanobiomaterials for cancer diagnosis and treatment, hybrid nanocoatings for detection of rare diseases using non-invasive sensors, design of new coatings and solid oxide fuel cells based on collective rare earths, modelling new high entropy alloys with controlled microstructure and properties. The heart of IMNR research is the integration of soft chemical processes for metals extraction and processing, efficient pilot scale EB-PVD coating technologies and additive manufacturing of hybrid nanomaterials in a life cycle concept

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enabling implementation in high added value applications and replacement of critical raw materials. Acknowledgements: H2020 SUPERMAT, H2020 TROPESENSE, Euronanomed NANOVIBER: ERAMIN II MONAMIX, H2020 INTMET, H2020 NEMO, COST Action 15102 CRM Extreme.

78. P078. Polylactic acid /silver nanoparticles nanobiocomposites non-thermal processed with potential use as antifungal materials

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Abstract. Microbial adherence to a polymeric substrate, followed by colonization and biofilm formation, can have a negative impact both in industry and medical fields. Microbial adhesion is the start of a possible infectious process in medical field or food industry. So, for this reason the scope purpose in the present study was to obtain biocompatible, hydrophilic and anti-adhesion/antimicrobial polymeric materials. Novel nanobiocomposites films based on polylactic acid (PLA) and silver nanoparticles (AgNPs) were prepared by the evaporation method of the solvent. They were coded: PLA/ATBC/AgNP 0.004, PLA/ATBC/AgNP 0.007, PLA/ATBC/AgNP 0.009, PLA/ATBC/AgNP 0.015 and PLA/ATBC/AgNP 0.017. Tributyl o-acetyl citrate (ATBC) was used in all formulations as bioplasticizer. The nanobiocomposites were investigated in terms of biocompatibility by using a fibroblast cell line (NCTC clone L929), antifungal activity against Candida albicans ATCC 10231 and water contact angle measurements. Also, it was investigated the morphology of materials by SEM measurements, plasmonic effect of silver nanoparticles by UV-Vis spectroscopy and structural composition by ATR-FTIR analysis. From polymeric variants studied, only PLA/ATBC/AgNP 0.015 and PLA/ATBC/AgNP 0.017 have presented antifungal activity. Also, the experimental results have suggested that these variants have cytotoxic properties, which means that they can not be used as biomaterials but could be approached in the field of food packaging.
Keywords: nanobiocomposites, antifungal activity, biocompatibility, microbial-adhesion.
Acknowledgements. This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI-UEFISCDI, project number PCCDI-2017-0214 (Project No. 3PCCDI/2018).

79. P079. Silver and gold nanoparticles from aqueous fruit extracts with potential application in environmental protection

Alexandrina Nuta, Ana-Alexandra Sorescu, Rodica-Mariana Ion, Lorena Iancu, Ramona Grigorescu; The National Research&Development Institute for Chemistry and Petrochemistry – ICECHIM, Bucharest, Romania

Abstract. Silver and gold nanoparticles have numerous applications in different scientific fields (e.g.: medicine, pharmacy, diagnosis etc.) especially because they exhibit antimicrobial and antioxidant activity. Both metallic nanoparticles can be obtained using conventional or unconventional methods and, in recent years

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especially, the methods that use aqueous plant extracts are intensively studied because they are eco-friendly, they do not require toxic chemicals and no hazardous by-products result. The present paper describes researches carried out in the field of biosynthesized metallic nanoparticles from different fruits rich in nutrients and vitamins: Sea buckthorn (Hippophae rhamnoides), Jujube (Ziziphus jujube), Gooseberry (Ribes grossularia) and European cornel (Cornus mas). Silver and gold nanoparticles are obtained using two different methods: (a) at room temperature, no stirring, overnight; (b) at 500 C, 600 rpm, 30 minutes. The formation of both silver and gold nanoparticles was studied by different physical-chemical techniques: UV-Vis, FTIR, microscopy, etc.

80. P080. Binding of ferrihydrite nanoparticles to lactate dehydrogenase and their influence on thermal denaturation process

Claudia G. Chilom 1, Silviu Vulpe 2, Vasilica Tucureanu 2, Maria Bălăşoiu 3,4,5, Sergey V. Stolyar 6,7, Sergey Tyutyunnikov 8. 1 Faculty of Physics, University of Bucharest, Romania, 2 National Institute for Research and Development in Microtechnologies

Abstract. In this work, the conformational changes of LDH in the presence of Fh-NPs simple and doped with Cu and Co were highlighted by FT-IR spectroscopy, using the Attenuated Total Reflection (ATR) technique. The mechanism of interaction between the three types of Fh-NPs and lactate dehydrogenase (LDH) and the effect on thermal denaturation of LDH were investigated by means of fluorimetry. The experimental results show that the amide I and amide II bands change in the presence of all NPs, thus the tertiary structure of LDH is modified, suggesting that all Fh-NPs interact with the enzyme. The fluorescent quenching of LDH induced by the three types of Fh-NPs is static and the binding occurs with moderate affinity and is driven by electrostatic forces mainly. Thermal denaturation of LDH in the presence of simple Fh-NPs and Fh-NPs doped with Cu and Co shows that the thermodynamic parameters of protein unfolding are significant changing with temperature. The denaturation temperature of LDH shifts to higher values in the presence of all types of Fh-NPs, than in the case of simple LDH. These results have direct implication on the uses of the complex of LDH enzyme with Fh-NPs in various biochimical, biological or clinical applications.

81. P081. Binding Mesoporous carbon thin films synthesized by Matrix-Assisted Pulsed Laser Evaporation

Cristina Nita a,b,c, Mihai Sopronyi d, Aissam Airoudj c, Gautier Schrodj b, Felix Sima a, Camélia Matei Ghimbeu b,c, Emanuel Axente a; Center for Advanced Laser Technologies (CETAL), National Institute for Laser, Plasma and Radiation Physics (INFLPR)

Abstract. A fast method to synthesize porous carbon films on solid substrate by using Matrix-Assisted Pulsed Laser Evaporation technique is presented in this work for the first time. The procedure consists of UV (KrF*, λ=248 nm, τ=25 ns, frep=5 Hz) pulsed laser irradiation of a cryogenic target composed of phloroglucinol/glyoxylic acid organic precursors dissolved in different mixtures of solvents. By modifying

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laser energy or target solvents (chloroform, water and dimethyl sulfoxide mixed with ethanol), thin polymeric coatings of hundreds of nanometers with various cross-linking degrees, different morphologies and textural properties were obtained at room temperature, in 10 min only. The physico-chemical characterization of the phenolic resin and carbon materials involved structural (Raman, UV-VIS), morphological (SEM, TEM), topographical (AFM) and textural analysis (Kr adsorption/desorption). Carbon materials with high specific surface areas between 530 m2 g-1 and 702 m2 g-1 were obtained very fast by using the proposed precursors and irradiation conditions, without the need for a drying or thermo-polymerization step.

82. P082. Binding Vertical and Lateral Thermoelectric Nanodevice Structures for Real 3D Integrated Circuit

P.L. Neumann, M. Németh, L. Pohl, B. Plesz, and J. Mizsei, aff. Budapest University of Technology and Economics, Electron Devices Dep.Hungary

Abstract. Nowadays, CMOS technology is approaching its scale-down limits, thus researchers are investigating alternative technologies to keep up with the constant evolution in computing capacity needs and preferred compatibility to current CMOS technologies. The signals of electronic devices are transmitted based on electron transport, where thermal effects appear as unwanted side-effects. In special devices in nanometer range it is possible to use also the thermal energy as a signal for carrying information, in addition to the electron transport. At the nanoscale the propagation speed of a thermal signal is comparable with electron velocity. The thermal electric device is able to utilize both ways of information propagation independently. This device is based on metal-insulator transition (MIT) material (VO2) and is called phonon transistor or phonsistor. The phonsistor's resistance depends on the device temperature and the self-heating by current, and the temperature induced resistance change aggregates to 3 or 4 orders of magnitude. The aim of this research is to fabricate and characterize phonsistor based thermoelectric nanodevice structures. The fabricated samples were lateral and vertical device structures processed by CMOS compatible technology and allow to build up real 3D integrated devices. The device concept and structure, as well as characterization and theoretical results of vertical and lateral devices will be presented. The possible application of the phonsistor based thermoelectric nanodevices is expected to range from simple Boolean functions to complex artificial neuron systems.

83. P083. Binding Design and Fabrication of the Bidirectional Micro-Optic Concentrator for Optical Radiation

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Abstract. This paper presents the design and fabrication of bidirectional micro-optic concentrator for optical radiation based on micro-lenses and micro-prism arrays coupled with a planar slab multimode waveguide. Micro-lenses array, mounted on the top of waveguide, collect and focused incident optical radiation onto to

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waveguide and the micro-prisme array mounted on the back of the waveguide leads to an increased efficiency of the microconcentrator due to a further concentration of the radiation and to obtaining bidirectionality in this type of micro-system. Numerical simulations were performed using the COMSOL Multiphysics program and the Ray Optics geometric optics module. Analysis and design were performed for the 0.4-1.6um spectral range. Simulations for ray-tracing has been modeled in order to optimize the geometries of micro-optics elements taking into account the optical parameters of the materials to be used (polymers and glass) in the process of micro-concentrator fabrication. To increase the efficiency of the micro-concentrator the simulations are considered the loss due to alignment between the top lensses array and back micro-prism array relative to the optical waveguide. Finally, simulations data for optimization of the individual micro-optic elements and them assembling and the fabrication process allowed to achieve an micro-optic concentrator with 87.4% efficiency.

84. P084. Precise 3D micro-fabrication of photosensitive glass materials by high repetition rate picosecond laser-assisted etching

Authors: Florin Jipa, Stefana Iosub, Bogdan Calin, Cristian Butnaru, Emanuel Axente, Felix Sima. Affiliation: Center for Advanced Laser Technologies (CETAL), National Institute for Laser, Plasma and Radiation Physics (INFLPR)

Abstract. In this study, we address the possibility to get precise 3D micro-fabrication of photosensitive glass materials by high repetition rate picosecond laser-assisted etching (PLAE) (ref Nanomaterials) for creating biomimetic environments. The biomimetic characteristics will refer to the flow aspects, 3D characteristics and possibility of producing shape-structure function. In particular, distinct examples are referring to the fabrication of biomimetic micro- to nanoscale materials by: i) generation of 3D structures in glass volume or on surface to be further exploited as microfluidic channels; ii) subtractive 3D surface patterning to create controlled patterned molds for casting polydimethylsiloxane (PDMS) and structuring single cell micro-chambers and iii) designing glass photo-masks to be used for sequel additive 2D patterning of biomimetic nanomaterials with controlled shapes, sizes and periodicity. The goal is to generate biomimetic cell-instructive environments, able to modulate specific responses for tissue engineering, regenerative medicine, and cancer therapy. Possible applications such as microfluidic devices for cell cultures, micro-chambers for single cell immobilization and customized micro-patterns are herein evaluated.

85. P085. Findings on the synthesis and properties of perovskite-type materials

Mirela Dragan[1], Stanica Enache[1], Mihai Varlam[1], Konstantin Petrov[1,2], [1] National R&D Institute for Cryogenic & Isotope Technologies, Ramnicu Valcea, Romania 2 Academician Evgeni Budevski Institute of Electrochemistry and Energy Systems; Sofia; Bulgaria

Abstract. Synthesis of a single phase ionic material is a challenge and the cost, durability, and scalability represent significant hurdles to large scale implementation of laboratory developments. Solid state ionic materials have received considerable attention due to their potential applications in energy

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storage applications, which is considered to be promising nonpolluting technology for the substitution of fossil fuels. In this presentation, we aimed at exploring the solid-state reaction process for Lanthanum cobaltite $LaCoO_3$. Characterization of prepared lanthanum cobalt oxide material have been studied by X-ray diffractometry (XRD), scanning electron microscopy (SEM), thermogravimetry - differential scanning calorimetry (TG-DSC) and conduction properties. Physical and chemical properties of the final lanthanum cobalt oxide powder material obtained are strongly dependent on the method of preparation.

86. P086. Cell mechanotransdution with piconewton forces applied by optical tweezers

Fabio Falleroni, Vincent Torre (SISSA, Trieste IT), Dan Cojoc (CNR-IOM, Trieste IT))

Abstract. Mechanical stresses are always present in the cellular environment and mechanotransduction occurs in all cells. Although many experimental approaches have been developed to investigate mechanotransduction, the physical properties of the mechanical stimulus have yet to be accurately characterized. Here, we proposea mechanical stimulation method employing an oscillatory optical trap to apply piconewton forces perpendicularly to the cell membrane, for short instants. We show that this stimulation produces membrane indentation and induces cellular calcium transients in mouse neuroblastoma NG108-15 cells dependent of the stimulus strength and the number of force pulses.

87. P087. Cell Nanostructured Carbon Materials Obtained from the Pyrolysis of Pelletized Biomass for Applications in Fuel Cells and Ultracapacitors

Eden MAMUT, Gabriel PRODAN, Laurentiu OANCEA, Institute for Nanotechnologies and Alternative Energy Sources, Iuliean HORNET, Ecohornet Ltd.

Abstract. The proposed paper is synthesizing the research activities and results that have been obtained in the implementation of a scientific research project dedicated to the integration of nanostructured materials in advanced materials for energy systems with multiscale and multiphysics optimization – project MULTISCALE. It has been conceived a special installation of pyrolysis of pelletized biomass integrating a module for synthesis of nanostructured carbon materials. There were carried out several tests with various compositions of biomass, different values of operation parameters and different precursors. The nanostructured carbon materials have been investigated using electronic microscopy and spectrometric analyses. The results were evaluated in respect to the composition of the biomass, the operation parameters and the types of precursors that have been used in the experiments. Selected samples of nanostructured carbon materials have been tested for the possibility of being used as catalyst supports in electrochemical applications and porous electrodes for ultracapacitors. There were prepared catalyst layers that have been integrated in Membrane Electrode Assemblies – MEAs and layers for porous nanostructured carbon materials that have been tested for their performances. In the presentation there will be included results obtained on the testing of sample MEAs and porous nanostructured carbon films.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847673.

88. P088. Label-free impedance-based nanotoxicity testing: Static vs. dynamic exposure to nanomaterials

Ivan-Rios Mondragon1, Melanie Ostermann1, Emil Cimpan[2], Alexander Sauter[3], Mihaela Roxana Cimpan[1], [1]University of Bergen, Bergen, Norway;2Western Norway University of Applied Sciences Bergen, Norway; [3]Royal Norwegian Naval Academy, Bergen, Norway;

Abstract. Reliable, robust and cost-efficient methods, which are less prone to interferences from nanomaterials (NMs), are urgently needed in order to ensure a correct hazard assessment and risk/ benefit analyses for the benefit of manufacturers, workers, policymakers, healthcare providers, and patients. NM interferences with traditional in vitro toxicity assays have been reported. Moreover, these assays are usually performed under static, non-physiological conditions and therefore do not reflect the in-vivo exposure situation. Label-free methods can provide a reliable alternative since they are less prone to NM interferences. To assess the impact of the exposure conditions on the putative toxic effects of NMs, we monitored in real time adherent cells exposed to NMs under static conditions (xCELLigence, ACEA) and under dynamic exposure conditions. For the latter we employed a multi-channel microfluidic device with integrated microelectrode arrays, which allows a well-controlled perfusion of NM dispersions under physiologically relevant flow conditions. To evaluate the response of cells in suspension to NMs, impedance- microfluidic chip-based flow cytometry (IFC) (AmphaZ30, Ampahsys) was used. The cellular responses were influenced by the exposure conditions both in the short and longer-term exposure to NMs. This work was supported by the EC FP7 NANoREG (Grant Agreement NMP4-LA-2013-310584), the Research Council of Norway project NanoBioReal (288768), UH-Nett vest, and the EuroNanoMed II “INNOCENT” project (271075).

89. P089. Label Optical vortices for communications

Authors: Cristian Kusko, Rebeca Tudor, Mihai Kusko, Affiliation: National Institute for R&D in Microtechnologies IMT-Bucharest, Voluntari, Romania

Abstract. We present different methods to generate optical vortices (OVs) both with diffractive optical elements working in reflection and in integrated photonic circuit in order to exploit a new degree of freedom for encoding the information – Orbital Angular Momentum (OAM). OAM provides high capacity and security for information channels in optical communications systems.

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Student poster contest

90. S001. Label Unraveling the strain state of the silicon nanowires arrays using High Resolution X-ray diffraction

C.Romanitan (IMT-Bucharest), M.Kusko (IMT-Bucharest), M.Popescu (IMT-Bucharest), P.Varasteanu (IMT-Bucharest), A.Radoi (IMT-Bucharest), C.Pachiu (IMT-Bucharest)

Abstract. Semiconductor nanowires (NWs) gained an increased attention in the last years due to their improved physical properties, favourable for opto- and upwards bio-electronic applications. In this paper, we investigated the bending and torsion evolution and emerged strain relaxation processes in highly dense arrays of silicon nanowires obtained through metal assisted chemical etching. To circumvent the issues related to the anisotropic distribution of the strain and structural defects along the z-direction, we proposed a non-destructive High Resolution X-ray method that exploits the finite penetration depth nature of X-rays and their ability to imagine the arrays morphology in terms of tilt and twist. Our method enables us to build unambiguously the bending and torsion profiles and to gain a quantitative description of the relaxation processes in connection with their morphological features using laboratory X-ray diffraction experiments. It is important to remark that, in most cases, the X-rays diffraction studies concerning the strain and relaxation processes in nanowires systems employ synchrotron X-ray sources.

91. S002. Towards an integrated chip for quantum sensing using color centers in diamond for biological applications

A.R Ortiz Moreno, C.G Mignon, R. Schirhagl (University Medical Center Groningen, University of Groningen, 9713 AW Groningen, The Netherlands) // A. S. Goossens (Zernike Institute for Advanced Materials, University of Groningen, 9747 AG Groningen, The Netherlands

Abstract. Nitrogen vacancy (NV) centers in diamond are promising candidates for quantum sensing in biological media, due to their optical readout capabilities at room temperature. In this project we present an integrated circular resonator in a microscope slide that is capable of generate microwave excitations that manipulate NV center spins in diamond.

92. S003. Towards H2020 - CUPIDO

Degli Esposti Lorenzo (a), Catalucci Daniele(a), Iafisco Michele(a), Miragoli Michele(a), Post Heiner(b), Carullo Pierluigi(a), Modica Jessica(a), Alogna Alessio(b), Tampieri Anna(a), CUPIDO Consortium(a); (a) Italian National Research Council, Piazzale A

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847673.

Abstract. CUPIDO is an EU-funded project that aims to develop an innovative and patient-friendly drug delivery system for diseased heart treatment: inhalable nanoparticles that can carry and release therapeutic molecules directly to the myocardial cells.

Peptides or small RNAs represent efficacious tools for cardiovascular diseases treatment. However, their heart-targeting is unspecific and currently possible via invasive methods. We demonstrate that inhalation of small (<50 nm), biocompatible and biodegradable calcium phosphate nanoparticles (CaPs) allows for rapid translocation of CaPs from the pulmonary tree to the bloodstream and to the myocardium, where their cargo is released. We tested the CaPs delivery capabilities with two biomolecules:

1) An MP mimetic peptide able to improve myocardial contraction through restoration of altered cardiac channel protein. Inhalation of MP-loaded CaPs restores cardiac function in a rodent model of diabetic cardiomyopathy.

2) The cardiac-enriched microRNA-133, which level is inversely related to failing heart conditions. A therapy via inhalable miRNA-133-loaded-CaPs prevents the cardiac remodeling in a mouse models of left ventricular pressure overload. The rapid accumulation of inhaled CaPs in the heart of healthy pigs encourages the application of CUPIDO approach in large animals. Results demonstrate that inhalation of drug-loaded nanocarriers represents a pioneering approach for heart failure treatment.

93. S004. The influence of molecular weight of ssDNA-SRY and BSA on SPR signal amplification

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Abstract. The discovery of cell-free fetal DNA (cffDNA) in maternal plasma led to a new noninvasive prenatal testing that allows determining the fetal sex from 9th week of pregnancy, in order to detect diseases with recessive X-linked inheritance. SPR is a sensitive biosensor technique monitoring in real-time very small changes in refractive index induced by analytes bonding on Au. To set up the technical parameters for SRY-DNA identification, we perform two experiments. Our first study was focused on determining the detection limit in relation with the molecular weight. To accomplish this study, we have attached bovine serum albumin (BSA) and ssDNA-SRY on a Au chip and then studied the changes in SPR signal response for the two probes of ssDNA-SRY having 6,668 kDa, 41,553 kDa and BSA having 68 kDa. The second experiment aimed for obtaining a decrease of detection limits by signal amplification and for that we used BSA and BSA modified with gold nanoparticles. The experiment was performed using BSA concentrations from 1 uM to 10 pM. All the experiments indicate a strong dependence of detection limit in relationship with the molecular weight and the necessity of a signal amplification.

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94. S005. "H2020 - Smart multifunctional GLA-nanoformulation for Fabry Disease"

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Abstract. Lysosomal storage disorders (LSDs), such as Fabry, Gaucher, Hunter, and Sanfilippo diseases are a group of rare diseases that currently lack a definitive cure. LSDs individually occur with incidences of less than 1:100,000; representing a serious global health problem. Therefore, development of new treatments for this type of rare diseases has become a key priority for European Research policy. In Fabry Disease (FD), the lack of α-galactosidase A (GLA) activity in FD patients causes the accumulation of glycosphingolipids (such as Gb3) in the vasculature leading to multiple organ pathology, and the death of patients before 45 years old. Enzyme replacement therapy (ERT), the most common treatment of LSDs, exhibits several drawbacks: short plasma half-life, poor biodistribution, high immunogenicity, and low capability to cross biological barriers such as the blood brain barrier (BBB). In the frame of the Smart-4-Fabry EU project (#720942), a new GLA nanoformulation (nano-GLA) more effective than current treatments for FD patients will be obtained. Such gain in the efficacy would further allow lowering the clinical dose and spacing the administration schedule for FD patients, being the final benefit a reduction on the FD treatment cost and improvement in the quality of life for FD patients.

95. S006. H2020 - Development, characterization and evaluation of 3D liver models for in vitro Engineered Nanomaterial toxicology testing.

Samantha Llewellyn, Ume-Kulsoom Shah, Stephen J. Evans, Jana Rupp, Wolfgang Moritz, Ali Kermanizadeh, Vicki Stone, Gareth J. S. Jenkins, Martin J.D Clift and Shareen H. Doak. In Vitro Toxicology Group, Swansea University Medical School, Swansea, UK. InSph

Abstract. Hepatic toxicology is key when considering engineered nanomaterial (ENM) exposure, as it widely known that the liver is a major site of ENM accumulation post exposure. The liver serves a vital role in metabolic homeostasis and detoxification, thus it is imperative that robust and physiologically representative models for ENM liver hazard assessment in vitro are established. The PATROLS (Physiologically Anchored Tools for hazaRd assessment of nanOmateriaLS; EU Grant Agreement #:760813) project is aimed at building upon existing 3D in vitro liver models to better understand hazard associated with long-term exposure to ENM, while further advancing the technology to include multiple cell types and fluid flow. The in vitro 3D liver models developed are based on immortalised cell line and primary human hepatocyte (PHH) based spheroids, which are viable for long-term culture, able to support both extended and repeated ENM exposures. Their ability to predict a range of toxicity and genotoxicity endpoints has been characterised using a range of ENMs (e.g. TiO2, ZnO and MWCNT). The ability of each model system for evaluating more realistic ENM exposures has been established, thereby providing a future approach based on alternative in vitro liver models to better support ENM hazard assessment.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847673.

96. S007. Novel [ZnLn] luminiscent coordination compounds deposited of graphene

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Abstract. Attempts were made to functionalize the graphene surface with different complex compounds, in order to enhance its properties. In order to perform this, the most studied methods are covalent bond formation, encapsulation or non-bonding interactions, including hydrogen bonds and π- π stacking [1]. Heterometallic [ZnLn] complexes containing as ligand a Schiff-base derived from o-vanillin have been studied in the past for their luminescent properties [2]. By using the appropriate lanthanide precursor, it is possible to create a carboxylate bridge between the two metallic ions. For instance, the 1-pyrenebutirate was added in the structure, resulting [ZnLn] complexes containing a pyrene fragment (Ln = Nd, Eu, Gd, Tb, Sm, Dy). Having this moiety, the complexes were attached to the graphene surface, where they kept their luminescent properties. All the compounds have been characterized in solid state using FTIR, UV-Vis spectroscopy, luminescence measurements, powder and single crystal X-ray diffraction. In order to prove that the selected complex has been attached to the graphene, the composite material has been characterized via SEM/EDX, Raman and luminescence measurements.

[1] K.Karami, A.Ramezanpour, M.Zakariazadeh, C.Silvestru, Appl. Organometal. Chem., 2019, 33, e4907.
[2] T.D.Pasatoiu, C.Tiseanu, A.M.Madalan, B.Jurca, C.Duhayon, J.P.Sutter, M.Andruh, Inorg. Chem., 2011, 50, 5879.

97. S008. Composite materials circular economy. The case of green fibres and nanoenhanced fibrous polymer composites

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Abstract. Science and Technology are pushing the boundaries, aiming to design composites structures by carbon fibers (CFs) through environmental friendly processes, with reduced cost and improved mechanical properties. After long research, a growing industry with a multitude of applications has been established and the need of new precursors has been revealed. New approaches are necessary to be developed based on chemical modification and functionalization of CFs. This requires novel techniques that introduce the challenge of CFs production from green precursors and manufacturing of fibre-reinforced composites via ecofriendly-production methodologies. In this context, CFs production, matrices modification, hybrid materials, smart structures, surface/interface functionalization, manufacturing and processing, pilot and upscaling, as well as green and low cost materials, together with recycling topics, are considered. In addition, development of innovative reclamation and repurposing routes for the end-of-life of fibre-based composites in on the scene. Practices of interest for electronics, aviation and automotive industry have been addressed during

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the last four years, proving that EC provided a consistent strategic plan with NMBP Programs, offering regularity, stability and continuity in composites research. This work has been partially supported by the EU Horizon 2020 Programmes MODCOMP (GA No 685844), SMARTFAN (GA No 760779) and REPAIR3D (GA No 814588).

98. S009. Numerical investigation of SPR (bio)sensors modified with 2D materials

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Abstract. Surface Plasmon Resonance (SPR) based sensors are well known for their high sensitivity, real-time monitoring of surface interactions and label-free detection for a broad range of molecules. However, the detection capabilities become significantly lower for small sized molecules. This drawback can be overcome by coating the sensor's metallic surface with thin layers of materials with high refractive index in order to increase the refractive index contrast and consequently enhance the electromagnetic field confinement at the interface between the metal and detection medium. In this study, we investigated the influence of modification of a standard SPR sensor metallic surface with monolayers of 2D materials, such as MoS2, WS2, MoSe2, WSe2. Firstly, the plasmon properties at the interface were analyzed using COMSOL Multiphysics by calculating the SPP dispersion relations as a function of the number of 2D monolayers. In addition to the dispersion relations, reflectivity maps were also calculated using Transfer Matrix Method, because they provide information about the angles at which the resonance arise. Finally reflectivity response and phase response for the modified structures were compared showing that coating the metallic layer with 2D materials monolayers improves the sensing performances.

99. S010. Metasurfaces for controlling absorption in infrared

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Abstract. Nanophotonic metamaterials are a special type of artificial materials with engineered subwavelength structures. They have evolved rapidly into a functional platform for engineering of nanoscale photonic "meta-devices" and were conceived as a means of achieving specific optical properties [R.F.Waters et al, Appl.Phys. Lett.107, 081102(2015)]. This type of structures has the role of tailoring the shape of the optical fields by nano-structuring the substrates with structures smaller than the wavelength of the field [N.Yu, FCapasso, Nature Materials, 13, 139–150(2014)- XLiu, et al, Phys.Rev.Lett.107, 045901(2011)]. We propose a metasurface with a configuration consisting of a circular-shaped metallic resonator of diameter in the order of nanometers used for improved absorption in narrow wavelengths intervals of the IR domain. Our metamaterial is obtained by nano-patterning an array of gold pillars of 100 nm height on a 200 nm thick amorphous silicon substrate. The

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diameter of the metallic pillars is selected in order to achieve an almost total absorption at a specific wavelength. For example, a rectangular array of gold disks with 230 nm diameter with the lattice constant of 400 nm offers perfect absorption at 2.3μm wavelength. The designed structures can be employed in developing IR selective emission sources or perfect absorbant metamaterials.

100. S011. Microfluidic glass biochip fabricated by picosecond laser assisted etching for controlled release of biomolecules

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Abstract. Various material processing techniques have been proposed for the fabrication of smart interfaces to modulate cellular behaviour and address specific clinical issues. Particularly, laser-based technologies have attracted growing interest due to processing versatility. Latest development of ultrashort pulse lasers with pulse widths of several tens of femtosecond (fs) to several picoseconds (ps) allows fast and clean micro-fabrication of a variety of materials at micro- and nano-scale both at surface and inside volume. High quality micro-channels embedded in photosensitive glass can be successfully generated by ultrafast laser-assisted etching. We propose here a novel microfluidic glass biochip fabricated by picosecond laser assisted etching (PLAE). This has a splitter configuration consisting of a distributor reservoir connected to three collecting reservoirs via channels of various dimensions distributing different flow rates. The potential of fibroblast growth factor (FGF2) to prevent or treat bone degeneration was assessed using an "in vitro" model of osteogenesis. Using the microfluidic biochip, we tested the effect of perfusing different controlled doses of FGF2, thereby creating a miniature platform for therapeutic testing allowing identification of optimal dosages and development of temporal administration protocols. These findings could guide the design of novel therapeutic strategies for treating spaceflight osteopenia or osteoporosis.

101. S012. Graphitized Porous Silicon Electrodes for High Performance Quasi-Solid Supercapacitor

Irina-Nicoleta Bratosin, Cosmin Romanitan, Antonio Radoi,Mihaela Kusko

Abstract. Porous silicon offers a very high inherent surface area to volume ratio, while also being compatible to the prevalent Si based technology, which makes it a suitable candidate for supercapacitor electrodes. The device presented is based on two symmetric porous p-doped Si electrodes on which 7-hydroxy-1,2,3,4-tetrahydronaphtalene-2-carboxylic acid was deposited electrochemically before being treated thermally at 800o C for graphitization. The cyclic voltammetry (CV) performed on it between the potential range of -1 V to 1.5 V revealed two charge storage concurrent mechanisms, double layer and Faradaic charge storage, as well capacitance values from 3.26 mF at 50 mV/s to 0.46 mF at 12 V/s. The device's capacity retention was tested through galvanostatic charge discharge (GCD) carried out at six different current values, from 50 μA to

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1mA, presenting an ohmic drop between 10.07 mV to 107.12 mV. Furthermore, the supercapacitor was charged and discharged 3000 times at 0.1 mA, which led to a decrease of 45 % from its initial capacitance. In summary, the porous p-Si based device presented showed promising results, with a potential window of 2.5 V, low ohmic drop and a high capacitance which has maintained more than half of its initial value after 3000 charge-discharge cycles.

102. S013. SCATTERING MATRIX MAPLE APPLICATION FOR PROPAGATION OF ELECTROMAGNETIC RADIATION IN STRATIFIED MEDIA

Adrian MURARIU, Gabriel MURARIU; Imperial College London, South Kensington, London SW7 2AZ UK; Dunarea de Jos University of Galati

Abstract. A recurrent scattering matrix formalism for electromagnetic wave propagation modeling in stratified media structures. The python procedure is computationally efficient and stable. For a case study, it is applied successfully to the modeling of total attenuated reflection in nematic liquid crystals. The modes of a planar multilayer waveguide can readily be determined by using an algorithm that exploits the analyticity of the waveguide dispersion relation. No prior knowledge of the number of solutions or their approximate locations is required; the algorithms finds all the solutions within the region of interest. The application could be used for structures of transparent and lossy materials.

103. S014. Prototyping a Miniaturized Microfluidic Sensor for Real-Time Detection of Airborne Formaldehyde

Daniel Măriuța - Institute of Microstructure Technology (IMT), 76344 Eggenstein-Leopoldshafen, Karlsruhe Institute of Technology (KIT); Lucien Baldas - Clement Ader Institute CNRS, INSA, ISAE-SUPAERO, Mines Albi, UPS, Université de Toulouse, 31400 Toulouse

Abstract. Formaldehyde is a carcinogenic volatile organic compound that is largely used in the fabrication process of a variety of household products, being sometimes released indoor in concentrations that are beyond the limits recommended by the World Health Organization. The current commercially available formaldehyde sensors are far from simultaneously being ultra-portable, highly sensitive (< 1 ppb), real-time, and especially cost-efficient. This work aims to study the feasibility to miniaturize the formaldehyde sensing system down to a palm hand device, based on the microfluidic Hantzsch reaction method and fluorescence detection. A Gas-Liquid Micro-Reactor based on integration of a hydrophobic membrane inside a polymer flat chip is proposed and its formaldehyde trapping yield is planned to be further tested. By combining contact sensing with time-resolved CMOS sensors, the dimensions of the fluorescence detection component could go down to millimeters using commercial-available components and therefore, enabling continuous and fast-response measurements in small volumes and low concentration samples.Keywords—Contact sensing, Micro-fabrication, On-chip membrane-based gas-liquid contacting, Time-Resolved CMOS Sensing.

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H2020/NMBP Project contest (posters and exhibition)

104. H01. H2020 - INNOVIP

Daniel Mărițța - Institute of Microstructure Technology (IMT), 76344 Eggenstein-Leopoldshafen, Karlsruhe Institute of Technology (KIT); Lucien Baldas - Clement Ader Institute CNRS, INSA, ISAE-SUPAERO, Mines Albi, UPS, Université de Toulouse, 31400 Toulouse Dr. Panagiotou - Bavarian Research Alliance Germany

Abstract. INNOVIP - EEB-01-2016 - Highly efficient insulation materials with improved properties: INNOVIP Consortium will reinvent the top-of-the-line insulating material vacuum-insulation-panels (VIP) by improving their thermal performance over the entire lifetime by at least 25 % and making VIPs adjustable, mountable and machineable. By reducing the density of the core material and/or using an alternative core material together with less expensive VIP-envelopes as gas barrier, it will be possible to sell the new product INNOVIP by more than 20 % lower price. Besides, the new product has a reduced embodied energy by at least 25 % and, attaching different cover layers, the panels can fulfill different functions. These additional functions can be adjusted according to the application they address, for example photocatalytic VOC removal from indoor- and outdoor air, anti mould coating, moisture buffering by Aluminium Compounds or summer heat cut-off by latent heat activated in phase change materials (PCMs).

105. H02. H2020 - LISA

Jeromy Snel - LEITAT Technological Center, Spain

Abstract. Li-ion batteries are still the limiting factor for mass scale adoption of electrified vehicles and there is a need for new batteries that enable EVs with higher driving range, higher safety and faster charging at lower cost. LiS is a promising alternative free of critical raw material (CRM) and non-limited in capacity and energy by material of intercalation. LISA aims to develop high energy and safe LiS battery cells with hybrid solid state electrolytes validated at 20Ah cell level according to EUCAR industrial standards for automotive integration. LISA will solve specific bottlenecks of lithium sulphur technology on metallic lithium protection, power rate, and volumetric energy density. Today, LiS is twice lighter than Li-ion and has reached only 10% of the sulphur theoretical energy density (2600Wh/kg) at cell prototype level (250-300Wh/kg), with potentially 800Wh/l (600Wh/kg) achievable by improving materials, components and manufacturing. LISA will have a large impact on existing and next-generation EV batteries, delivering technology with higher energy density beyond the theoretical capacities of chemistries using CRM – i.e. natural graphite and cobalt - or silicon-based chemistries.

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106. H03. H2020 - NEXTOWER Project (GA 721045) : Advanced materials solutions for high temperature heat storage block in concentrated solar power (CSP) tower systems

A. Rinaldi - ENEA, Italy; C. Testani - CALEF, Italy; P. Szakalos - KUNGLIGA TEKNISKA HOEGSKOLAN, Sweden; M. Pedemonte - IIS, Italy; E. Melotti - BEWARRANT SL, Belgium; J. Ejenstam - SANDVIK MATERIALS TECHNOLOGY AB, Sweden; J. Fernández-Reche - CENTRO D…

Abstract. NEXTOWER H2020 funded project proposes a set of innovative materials to boost the performance of atmospheric air-based concentrated solar power (CSP) systems through a comprehensive conceptual and manufacturing approach. Bulk and joining materials optimized for durability at the component level and for maximum thermodynamic efficiency at the system level have been developed, lab-tested and will be then full-scale validated in the new SOLEAD demo (in Spain) made within the project. One of the innovations introduced consists in the use of liquid lead instead of molten salts as heat transfer and storage fluid, which allows to achieve high temperature heat storage at unprecedented working temperature (about 750°C and above). The high temperature liquid metal corrosion that prevents use of standard Ni-based alloys is effectively addressed by adopting a superalloy structural shell coated with innovative FeCrAl-based alloys to fabricate especially designed storage vessels and heat exchangers in NEXTOWER. Other advances in the solar receiver compartment spur a new generation of CSP materials that allow both an increased working temperature of the receiver and a new storage concept based on liquid metal, so contributing to the next-generation of CSP towers, capable of competing with other industrially-relevant CSP alternatives and sustainable power supply options.

107. H04. "H2020-DEVELOPING AND IMPLEMENTATION OF A NEW GENERATION OF NANOSAFETY ASSESSMENT TOOLS "

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Abstract. NanoMaterials safety is of great societal concern and raises many questions for the general public, governments, industry, scientists and regulators. Identifying and controlling the hazards associated with NMs is required to ensure the safety in parallel to exploiting the technological benefits. NANOGENTOOLS answers this challenge by creating a collaborative excellence-based knowledge exchange network that will: i) push forward knowledge via method development and pre-validation, ii) train scientists in new methodologies to assess long term nanosafety, and iii) support their inclusion in standardization and EU regulations. NANOGENTOOLS combines toxicogenomics, proteomics, biophysics, molecular modeling, chemistry, bio/chemoinformatics to develop fast in vitro high throughput (HTS) assays, with molecular based computational models for nanotoxicity.NANOGENTOOLS brings together cutting edge research, innovative knowledge-transfer and co-development, and cross-sectoral and cross-disciplinary secondments linking EU academic institutes/networks with industry and policy makers across 8 countries. Expected impacts include pre-validated tools for efficient cost-effective nanosafety assessment applicable to SMEs for incorporation into

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regulatory frameworks, and translation of knowledge via development of a CNT-based nanosensor based on safe-by-design SoF principles.

108. H05. "H2020 - M3DLoC - Additive Manufacturing of 3D Microfluidic MEMS for Lab-on-a-Chip applications"

Jelena Aleksic, Monica Spreadbury, Bojan Boskovic, Costas A. Charitidis

Abstract. MEDLOC aims at the employment of multi-material 3D printing technologies for the large-scale fabrication of microfluidic MEMS for lab-on-a-chip and sensing applications. The concept is based on the combination of multimaterial direct-ink-writing method and an extrusion-based 3D printing pilot line, in order to fabricate microstructured detection devices with the ability to perform all steps of chemical analysis in an automated fashion. The functionality of these devices will be evaluated based on their ability to streamline all steps needed to obtain mobility and binding-based identity information in one continuous biochemical detection system. Optimum in-line control systems will be incorporated in various stages of the fabrication process, to achieve precise control and repeatability. Microfluidic MEMS are increasingly recognized as a unique technology field for the development of biomedical devices (BioMEMS), due to their functional performance on the microscale, at the dimensions of which most physiological processes are operative. Applications near micro- and nanoscale are promising in the field of intelligent biosensors, where it enables the monolithic integration of sensing devices with intelligent functions like molecular detection, signal analysis, electrical stimulation, data transmission, etc., in a single microchip.

109. H06. H2020-GIOTTO: Active aGeIng and Osteoporosis, the next challenge for smarT nanobiOmaterials and 3D technologies

Isella Vicini – Warrant Hub S.p.A., Italy

Abstract. Osteoporosis (“porous bone”) is a very common bone disease. It occurs when the body loses too much bone, as a result bones become so weak and brittle that a fall or even mild stresses can cause a fracture. The GIOTTO project is funded by the European Union under the Horizon 2020 research and innovation programme (grant agreement n 814410), call H2020-NMBP-TR-IND-2018-2020 (TRANSFORMING EUROPEAN INDUSTRY), and it will exploit the most recent materials and manufacturing technological advancements to help healthcare systems fight the consequences of bone fractures caused by osteoporosis. Medical doctors will work together with scientists and medical device producers to develop and test new solutions based on cutting edge technologies such as 3D printing and smart nano-biomaterials. Ad hoc devices will be designed for the different types of osteoporotic fractures stimulating bone regeneration while reducing bone loss. In addition to 3D-printing and the most updated technologies for bone scaffold manufacturing, also the most advanced technologies will be put in place such as the nano-functionalisation for the smart release of active molecules.

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110. H07. Smart by Design and Intelligent by Architecture Nanocomposites Materials (SMARTFAN Project)

Isella Vicini - Warrant Hub S.p.A., Italy

Abstract. SMARTFAN project aims at the development of smart (bulk), through micro and nano components, for final application on intelligent structures with integrated functionalities that are able to communicate and interact with their environment (upon IoT and in line with Industry 4.0), store data about their condition and, based on external stimuli, react accordingly; at the same time, real-time monitoring of processes and materials performance are foreseen. The cases include carbon fibers (CFs) for reinforcement and conductivity variance, carbon nanotubes (CNTs) and carbon nanofibers (CNFs) for sensing, micro-containers for self-healing, nanoparticles for electromagnetic fields detection and shielding, colouring agents for marking cracks and defects, and piezoelectric materials. In order to develop lightweight composite materials and transfer the properties of smart components into bulk materials, polymer based matrices (such as epoxy resins, polypropylene, polylactic acid, etc.) are used, due to their compatibility with the above mentioned components, their low cost and in case of thermoplastics their recyclability/reusability. The composite material (layers and grids) architectures will be the crucial parameter for dealing with Smart-by-Design intelligent structures that leads to reduction of environmental impact (reuse/recycling of materials at their End-of-Life).
Acknowledgements
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111. H08. H2020 - OYSTER

Bojan Boskovic, Monica Spreadbury, Jelena Aleksic Cambridge Nanomaterials Technology Ltd United Kingdom

Abstract. A failure to quantitatively control adhesion costs billions of euros each year in failed components, suboptimal product performance and life-threatening infections. Nano-enabled and bio-inspired products offer practical solutions to overcome adhesion and friction problems in these application areas. Current tools and methodologies, however, have so far failed to produce any standardised interpretation of adhesion data linking nanoscale adhesion to the macroscopic data. OYSTER uses contact mechanics to bridge adhesion data at multiple length scales and link interfacial adhesion to physicochemical properties. OYSTER brings Europe's first-class laboratories and SMEs to take existing nanoscale characterisation technologies towards widespread utilisation in process optimisation and model validation. OYSTER achieves this by sharing metadata and by creating Open Innovation Environment (OIE), where new paradigms of multi-scale contact mechanics are validated on selected application oriented reference materials through continuous interaction with the European Materials Characterisation Council (EMCC). This way, OYSTER generates wider agreement over adhesion measurement protocols by multimodal Atomic Force Microscopy and high-speed nanoindentation.

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Nano-patterned wear resistant surfaces and chemically/topologically functionalised soft contact lenses will show case nano-enabled and bioinspired products for significant market impact.

112. H09. H2020-NEMOSINE-Innovative packaging solutions for storage and conservation of 20th century cultural heritage of artefacts based on cellulose derivative.

Ferran Marti and Serafin Garcia, AIMPLAS, Spain

Abstract. A huge percentage of the recent European cultural heritage (CH) can be found in movies, photographies, posters and slides produced between 1895 and 1970 were made using cellulose derivates. More than 75 years of visual and audio memories are in serious danger to be lost due to the natural instability cellulose acetate (CA) and Cellulose nitrate (CN) materials. In case of cellulose derivates and other components of the movie or photos, once initiated, degradation cannot be prevented, reversed or stopped, but only inhibited or slowed. Inhibitive conservation of cellulose derivates can either involve the removal or reduction of factors causing degradation including light, oxygen, acids, fungus and relative humidity among others, as well as costsensitive processes such as freeze. NEMOSINE improves the traditional storage solutions, such as freeze storage, by developing an innovative package with the main goal of energy saving and extent conservation time. NEMOSINE will develop: i) Active packaging using non-odour additives, ii) Active acid adsorbers based on functionalized Metal Organic Framework integrated in innovative structures, iii) Gas detection sensors to monitoring, iv) Multi-scale modelling to correlate degradation & sensors signals, v)Packaging with modular design.

113. H10. H2020 – NANORIGO: a Risk Governance Framework and Council for Nanomaterials and Nano-enabled Products NANORIGO

Mark Morrison, Optimat Ltd., United Kingdom

Abstract. The main objective of NANORIGO (NANOtechnology RIsk GOvernance) is to develop and implement a transparent, transdisciplinary and science-based Risk Governance Framework (RGF) for managing possible nanotechnology risks regarding social, environmental and economic benefits. A new risk management approach is formed based on available high-quality data and advanced scientific tools developed for industry and regulators' decision-making, and on communication with all stakeholders (regulators, industries, politicians, the civil society). The RGF will use a life-cycle perspective and integrate available knowledge on ethical, social, environmental and economic concerns into a user-friendly format that can be easily adapted and transferred into regulation for hazard, exposure and risk assessment and management of nanomaterials. It will consist of: (i) risk management strategies based on reinforced tools for guidance and decision-making developed for risk assessment, (ii) validated methodologies to identify potential hazard and exposure, and (iii) a web-based information and communication platform to facilitate access to good quality data and a clear risk understanding of stakeholders, and their valuable feedback. The NANORIGO work plan consists of 7 work packages covering all major risk governance aspects. Finally, a self-sustained European

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Risk Governance Council (ERGC) will be installed and implemented by NANORIGO and all relevant stakeholders, and embedded in relevant international structures, in close cooperation with the International Risk Governance Center (IRGC). Case studies will demonstrate the sustainability of solutions and their consistent integration into regulatory applications under real conditions. For the first time, all stakeholders will be brought together under a common "umbrella" to share and integrate the most appropriate governance tools, frameworks and plans for future scientific and regulatory research and to foster consistency of management approaches in the EU and synergies internationally.

114. H11. H2020- ACEnano knowledge infrastructure to support data collection, methods optimisation and knowledge sharing in the area of physicochemical characterisation of nanomaterials

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Abstract. ACEnano knowledge infrastructure (KI) supports the activities related to data collection and method optimisation in the area of physicochemical characterisation of nanomaterials. The KI provides a central place to access harmonised and standardised methods and data, supporting the implementation of Findable, Accessible, Interoperable and Reusable (FAIR) data principles, the reproducibility and documentation process towards the goal of generating reference resources for nanomaterials risk assessment. The KI includes instances to accommodate data and protocols. The protocols database facilitates adding, sharing and comparing methods in a questionnaire-like format guiding users through the documentation process from starting material identification to sample preparation, measurement and data processing. The data warehouse offers long-term storage of the results in a reusable format that are directly linked to the methods applied. A public version of the data warehouse is being integrated in the NanoCommons data ecosystem. By semantic annotation and linking, this guarantees harmonisation and interoperability with other data sources of the EU NanoSafety Cluster like the eNanoMapper and NanoFASE. The development of the KI is supported by ACEnano (EU Horizon 2020 NMBP project no. 720952), while its availability to a wider community is assured by the activities in NanoCommons (Horizon 2020 INFRAIA project no. 731032).

115. H12. H2020-BIORIMA - Biomaterial Risk Management

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Abstract. BIORIMA is a EU H2020 project (contract 760928) and stands for Biomaterial Risk Management. BIORIMA aims to develop an integrated risk management (IRM) framework for nano-biomaterials (NBM) used in Advanced Therapeutic Medicinal Products (ATMP) and Medical Devices (MD). The BIORIMA IRM

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framework is an operational structure designed to implement validated tools and methods developed for materials, exposure, hazard and risk identification/assessment and management, plus a decision-support system for selecting and using the most appropriate tools to manage and reduce possible risks associated with production, use and final disposal of NBM in ATMP and MD. The IRM framework will consist of (1) risk management strategies based on validated methods, (2) guidance documents for monitoring, evaluating and reducing risks; (3) validated tools to identify potential exposure and hazard of NBM to humans and the environment; (4) a strategy for Intelligent Testing (ITS), (5) a tiered risk assessment system for NBM in ATMP and MD; (6) risk reduction measures and the safer-by-design approach. The BIORIMA IRM framework will be a web-based Decision Support System to help end-users, such as regulators, industries and in particular SMEs, to evaluate the risk/benefit profile of their NBM products and to shorten their time from design to market.

116. H13. H2020- PATROLS: Physiologically Anchored Tools for Realistic nanOmateriaL hazard aSsessment

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Abstract. Classical hazard testing strategies for the human and environmental health impact of engineered nanomaterials (ENM) commonly apply unrealistic acute, high-dose exposures to models that poorly reflect the in vivo environment. Furthermore, existing in vitro and in silico hazard detection methods are not accurately predictive, hence, there is an urgent need for improved tools. The Horizon2020 PATROLS project is aimed at addressing these issues by establishing a battery of next generation hazard assessment tools that more accurately predict adverse human health and environmental effects caused by long-term, low dose ENM exposure. PATROLS will develop: 1) more realistic in vitro 3D lung, gastrointestinal tract (GIT) and liver models for mechanism-based hazard assessment; 2) Novel methods to evaluate hazard associated with long-term exposure in ecologically relevant test systems and organisms; 3) in silico methods for exposure and dosimetry modelling, in vitro-to-in vivo extrapolation (IVIVE) and hazard prediction. ENM characterisation under physiologically relevant experimental conditions will be integral to this approach, coupled to iterative training and testing phases to establish fit-for-purpose hazard bioassays. The battery of risk prioritisation methods generated will provide an effective mechanism-based weight of evidence approach to establish the long-term (eco)toxicological effects of ENM to support regulatory risk decision making.

117. H14. H2020- Online training tools for nanosafety assessment – NanoCommons for researchers and safety assessors in industry, academia and regulatory authorities

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Abstract. NanoCommons is a research e-infrastructure project offering access to high quality nanoinformatics tools and services for nanotechnology and nanosafety stakeholders (academia, industry, regulators). It is user-led, offering and developing the services needed by the user community of nanotechnology, nanosafety and related fields. NanoCommons is built on 3 main pillars: joint research activities, networking activities and transnational access services, covering four categories relevant for nanosafety assessment:

• experimental workflows design and implementation; • data processing and analysis; • data visualisation and predictive toxicity; • data storage and online accessibility.

These services are designed to promote data FAIRness (Findable, Accessible, Interoperable, and Reusable), a key NanoCommons goal, that can be made Open through the NanoCommons Knowledgebase. Thus, NanoCommons provides innovative solutions for data mining, harmonisation, utilisation and re-utilisation, including incorporation of a range of modelling and decision support tools that require and/or can produce organised, high-quality datasets. A number of online training tools have been developed for each of the offered services to help users chose and use the services relevant to their needs. The NanoCommons help-desk and training library shall bridge academic research with industry and regulators, as recommended by the EU NanoSafety Cluster‘s “Closer to the Market” Research Roadmap serving the Safe-by-Design concept in nanotechnology.

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118. H14. H2020- Online The GRACIOUS draft Framework for the Grouping of Nanomaterials in order to streamline risk assessment and decision making

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Abstract. Nanomaterials exist in a variety of nanoforms characterised by properties such as size, shape or coating. In order to streamline the assessment of risk, the GRACIOUS project has developed a framework that groups nanoforms together. The initial steps require basic information relating to the purpose of grouping (e.g. regulatory risk assessment or product innovation), the physicochemical properties, the intended uses and the potential releases of the nanoform(s). The GRACIOUS framework uses this basic information to formulate hypotheses to explain why certain nanoforms can be grouped. These hypotheses may be well defined hypotheses, for which the scientific evidence is (being) gathered and risk implications are clear. Tailored Integrated Approaches to Testing and Assessment (IATA), which combine in silico and testing methods, then guide the user through identification or acquisition of information in order to assess whether the grouping

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hypothesis is justified. Alternatively, when information is lacking, the framework guides generation of a user defined hypothesis. The group can then be used to support inclusion of multiple forms within a regulatory document, to establish read-across of risk information from one nanoform to another, and to support decision making during design of nanoforms.

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