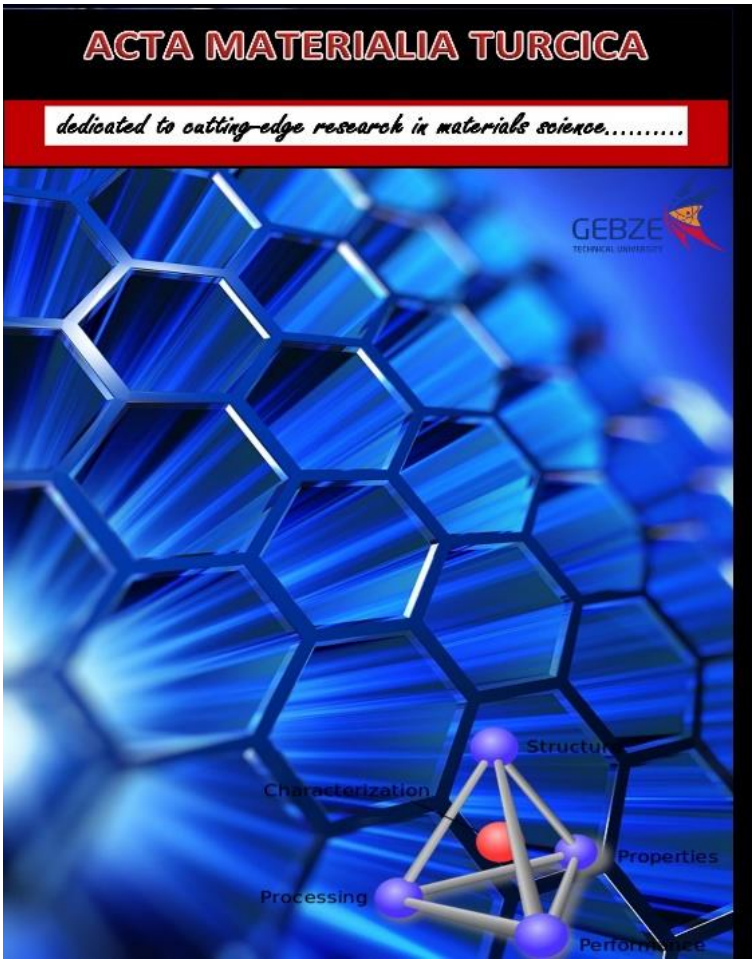
# ACTA MATERIALIA TURCICA

# Book of Abstracts

# NANOMACH 2020




International Conference on Nanomaterials, Nanofabrication and Nanocharacterization

NANOMACH

October 14-20 2020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# International Conference on Nanomaterials, Nanofabrication and Nanocharacterization (NANOMACH 2020)


**Virtual**

**October 14-20, 2020**


**Plenary Speakers**

Guy Le Lay Aix-Marseille University, France


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## PLENARY SPEAKERS

## Id-678

# Silicene, Medicine, and the Lancetgate

G. LE LAY*

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**Abstract:**
Xenes, artifical monoelemental graphene analogues, from borophene to bismuthene, have been a Hot Research Front in Physics since the birth of silicene. The Lancetgate, illustrating the incredible controversy about the hydroxychloroquine molecule to combat the COVID, has dramatically highlighted the failure of the top scientific journals in medicine to identify fake news. Unfortunately, such fake news exist -and persist- also in materials science, especially for silicene, the first synthetically realized two-dimensional elemental material. Recalling the advent of silicene, its prospects in nanotechnology and medicine, comparing with the hydroxychloroquine controversy, we will illustrate how influencing publications in physics still deliberately propagate false -and never reproduced- results.

**Keywords:** Silicene, Xenes, Medicine, COVID, Lancetgate.

## INVITED SPEAKERS

## Id-553

# Nanoencapsulated Aroma Finishing on Fabric by Sol-Gel Process

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**Abstract:**
Sustained-release materials are an important part of the medium which influence the effects and duration of aroma release. Encapsulation of aromas into nanomaterials is an advanced and effective application method. Nanocapsules contain and protect their core materials against reactions with the environment, then release this material deliberately at a defined time. The possibility to determine the performance in such an exact way is the reason for the many industrial applications. Numerous nanocapsule systems, including natural, semisynthetic and synthetic materials, show how developed this field is. A number of techniques have been employed for production of aroma nanocapsules. One of the most common methods is the sol-gel process. In a typical sol-gel process, both of colloid particles and emulsion as templates were coated by controlled surface precipitation of nanoparticles. When the template particles were utilized, they should be removed by selective dissolution in an appropriate solvent or by calcination at elevated temperature in air, leaving behind the desired nanocapsules. The obtained nanocapsules were directly to load aroma by physical adsorption and kept the excellent morphology. Finally, the aroma nanocapsules were used to aromatically finish the fabric. This review paper briefly describes the sol-gel preparation method of aroma nanocapsules and their application in fabric finishing.

**Keywords:** Sol-gel, Encapsulation, Nanomaterials, Fabric Finishing, Aroma.

## INVITED SPEAKERS

## Id-595

# Study on Hybrid Nanofluid Exposed to Radiation and Heat Generation

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**Abstract:**
Electronics equipment produces excessive heat due to an increase in power. This excessive heat needs to dissipate from the devices in order to maintain its working temperature. To solve this problem, the study on the effect of radiation on the flow and heat transfer characteristics of hybrid nanofluid in an internal heat-generating tube has been investigated. The main objectives of this study are to identify the flow characteristic of heat transfer performance of electronic equipment by using selected hybrid nanofluid under the laminar flow region and also to identify heat transfer characteristics of selected hybrid nanofluid on the uniformly heated circular duct. This study is carried out on the long circular tube where the length (1000 mm) and the diameter of the tube (10 mm) with an inlet temperature of distilled water (27°C) and uniform heat flux at 9549.29 W/m$^2$. It is found the type of hybrid nanofluid in the presence of radiation and heat generation significantly influences the heat transfer rate.

**Keywords:** Hybrid Nanofluid, Radiation, Heat Generation, Heat Transfer.

## INVITED SPEAKERS

## Id-598

# Key Factors of Electron Beam Lithography in Research and Manufacturing

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**Abstract:**
In this paper, various factors which influence performance of electron beam lithography (EBL) are presented and discussed. EBL is one of the most widely applied techniques for the production of nanostructures in R&D, for prototyping, production of photomask, imprint mold and small volume production due to its flexibility and mask-less nature, very high (sub-10 nm) resolution and accuracy. The application range is wide, i.e. the development of sensors, nanophotonic devices, high frequency electronics, spintronics, molecular electronics, Bit-patterned media, quantum dots, nanowires, nanomechanical devices, etc. In many cases EBL is the only possible alternative. EBL allows the direct writing of nanostructures with dimensions below 100 nm and in special cases even with sub-10 nm dimensions. Achieving sub-100 nm structures using EBL is a very sensitive process determined by various factors, starting with the choice of polymer resist material and ending with the development process. These factors are affecting the EBL process in a complex, interacting fashion. The objective of manipulating these factors is to achieve a high resolution, high quality, high throughput result with large process windows to maximize yield and reproducibility. Summary of a such key factors are presented in. Various limitation factors of EBL resolution - spot size, electron scattering, resist development, and mechanical stability of the resist are subject of research in the attempt to push further the boundaries of EBL down into the nanometer range.The resolution of electron optical systems can approach 0.1 nm, so the ultimate resolution of electron beam lithography is set not by equipment limitations but by the resolution of the resist and by the subsequent fabrication process. Therefore, resist materials are crucial elements in EBL and their performance determines the final results of the structures patterning. To achieve the minimal resolution of EBL, it requires systematic understanding of the limiting factors involved in both the electron-resist interaction and in the polymer dissolution (development), as well as the corresponding complicated interplay of the numerous process control parameters including the accelerating voltage, exposure dose, and development conditions. This work was supported by the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences under the Contracts VEGA 2/0119/18 and VEGA 1/0563/20, and by the Slovak Academy of Sciences under the contract No. SAS-MOST JRP 2017/1. Nanolithography and SEM facilities at the Institute of Electrical Engineering SAS are gratefully acknowledged.

**Keywords:** Electron Beam Lithograhy, Electron Beam Resist, Electron Scattering, Proximity Effect.

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## REGULAR SESSIONS

## Id-645

# Effectiveness of a New Additive on the Chemical Structure of Aged Bitumen

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**Abstract:**
Bitumen is a substance which is derived from the petroleum industry, it is composed of organic complexes so it is easily oxidized during paving and pavement service life, especially under thermal and/or ultraviolet radiation (UV) conditions. We can consider bitumen as a colloidal system and in particular as a multidisperse micellar system with a rather complicated internal structure based on asphaltene micelles dispersed within a maltene phase. Once removed and processed, bituminous layers become Reclaimed Asphalt Pavement (RAP), which contains valuable asphalt binder and aggregates. In recent years, researchers have conducted many investigations on the use of RAP materials in the production of recycled asphalt. Oxidized bitumen is very hard because at high temperatures, its aromatic components and resins which are responsible for a certain grade of mobility, are oxidized to asphaltenes and reduced to saturates. Hence, asphaltene micelles become larger so that the fluidity of the system is reduced. Currently, additives called "rejuvenators" are used and these rejuvenators act on the chemical structure of aged bitumen to restore its physical properties to a state very similar to virgin bitumen. Alternatively, softening agents can be used and these are capable of restoring only the physical properties. This study aims at evaluating the different performances between a new chemical additive (called TPI) and a softening agent (soy oil) which both function as rejuvenating agents. The effects of the additives on aged bitumen have been investigated through advanced rheological (Dynamic shear rheometer DSR) analysis, Nuclear magnetic resonance (NMR) relaxometry, Powder X-Ray Diffraction (PXRD) measurements, Atomic force microscopy (AFM) and Scanning electron microscope (SEM).

**Keywords**: Bitumen, Rejuvenating Agent, Chemical Structure, Reclaimed Asphalt Pavement (RAP), Rheology.

## REGULAR SESSIONS

## Id-656

# Stability of Bituminous Emulsions Induced by New Bio Surfactants: Physical Chemistry Characterization

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**Abstract:**
Bituminous emulsions play an important role within the road industry. In fact, they are used not only for quick repairs on roads and walkways, but their use can be useful for lowering the workability temperatures of road processing. In general, an emulsion is a colloidal system consisting of a continuous and a dispersed phase. Specifically, in bituminous emulsions the continuous phase is water while the dispersed one is bitumen. Since the two systems are immiscible, it is necessary to add an "agent" which, by lowering the surface tension, between water and bitumen, favours the dispersion of the bitumen inside the aqueous matrix. Normally the agents used for this purpose are surfactants which, thanks to their amphiphilic nature, are able to stabilize the emulsions by orienting the hydrophilic / lipophilic parts on the interface oil/water. The aim of this research was to test for the first time environmentally friendly surfactants (bio surfactants) in order to get a stable emulsion with road bitumens. Generally, these bitumen's are not used for emulsions due to physical chemistry characteristics. In this work three differ bitumens were investigated, two have penetration grade of 70/100 and one with 170/210. Several emulsions with different formulations were prepared by these bitumens and different biosurfactants in order to identify the most effective biosurfactant able to give a stable emulsion. Physical-chemistry characterization of the bitumen was carried out using Nuclear Magnetic Resonance (NMR) to define the chemical composition of the bitumen in order to understand the role of the potential biosurfactant. Thus, the stability and the rheological properties of the obtained emulsions was investigated.

**Keywords:** Bitumen, Colloidal, Emulsion, Bio Surfactants, Nuclear Magnetic Resonance.

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## REGULAR SESSIONS

## Id-676

# Resorc[4]arene-based Site Directed Immobilization of Antibodies for Immunosensors Development

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**Abstract:**
One of the main problems in the development of immunosensors is to overcome the complexity of binding antibody to the surface of the sensor. In fact, antibodies need to be immobilized with a high density and good orientation to allow the easy detection of antigens. The influence of nonspecific bindings should be minimized to improve the detection performance. Most of immobilizing methods lead to randomly oriented antibodies on the surface, which results in a low density of binding sites and alleviation of immunoaffinity of the antibodies. Therefore, oriented immobilization is required for the improvement of the performance enhancement. Calix[4]arene derivatives have been proposed as an alternative tool for the oriented immobilization of antibodies thanks to their unique three-dimensional surface, which can be functionalized at both the upper and lower rims with several functional groups. Within the calixarene family, resorcinol-derived cycloligomers, namely resorcarenes, behave as abiotic artificial receptors having enforced cavities of molecular dimension. To ensure the orientation control of antibodies on the sensor surface, we synthesized several resorc[4]arene derivatives able to self-assemble onto gold surface thanks to the thiol groups present on their structure. After the spectroscopic characterization of resorc[4]arene self-assembled monolayers (SAMs) onto gold films, the surface coverage and the orientation of insulin antibody (Ab-Ins) were assessed by a surface plasmon resonance (SPR) technique and compared with a random immobilization method. Experimental results combined with theoretical studies confirmed the dipole–dipole interaction as an important factor in antibody orientation and demonstrated the importance of the upper rim functionalization of resorcarenes. Accordingly, the bis-crown resorcarene showed a major binding force towards Ab-Ins thanks to the H-bond interactions with the amine protein groups. Based on these findings, the resorcarene-based immunosensor is a powerful system with improved sensitivity providing new insight into sensor development.

**Keywords:** Immunosensor, Macrocycles, Resorc[4]arene, Site Directed Immobilization, Surface Plasmon Resonance.

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## POSTER SESSIONS

## Id-498

# Quantum-chemical Study of CdSe/CdS Core/Shell and CdSe/CdS/ZnS Core/Shell/Shell Quantum Dots with Different Layers Ratio

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**Abstract:**
Theoretical study of the molecular structure and optoelectronic properties of CdSe/CdS core/shell and CdSe/CdS/ZnS core/shell/shell quantum dots (QD) was performed by quantum-chemical and numerical simulation methods. Periodic plane-wave density functional theory (DFT+U) calculations were carried out with the PBE implementation of the generalized gradient approximation (GGA) in conjunction with the projector-augmented wave (PAW) representation of the atomic cores. The cut-off energy of the plane-wave basis set was chosen to be 400 eV. The Brillouin zone was sampled with a Monkhorst Pack mesh with G-centered grid of 8 × 8 × 6 k-points. It has been established that the DFT+U method requires various Hubbard parameters U for accurate representation of different experimental properties of QDs (crystal lattice parameters, band gaps, band diagrams, etc.) with less time and computational costs in comparison with hybrid functionals. Selected simulation technique showed sufficient accuracy with a relative error up to 4%. For accurate representation of the density of states and the band structure additional single-point calculations were performed using the hybrid functional HSE06. The least resource-consuming were the numerical simulations of band diagrams based on the solution of the multiband Schrödinger-Poisson equation in the nextnano program. According to the results of calculations the mechanism of QDs filling with charge carriers and the localization of an electron-hole pair depending on the nature of the core and shell material were studied. Optimization of the (001) geometry of the QD surface showed that the QDs retain the original crystalline structure of the bulk materials in the core. The studied systems included ten monolayers with different layer ratios in the core and shell: 3/7, 5/5, 6/4, 7/3 for core/shell QDs and 3/2/5, 4/1/5, 5/3/2 for core/shell/shell QDs. According to the results of optimization the bond lengths on the surface are 19% shorter than in the bulk material which indicates a deviation of the surface morphology from the internal structure of the QD. Smaller deviations (10%) of the geometric parameters in the surface from the parameters in the QD core were registered in QD clusters. It was found that all surface metal atoms are three-coordinated and have one unsaturated valency which can be used for coordination of surface agents. The influence of the number of monolayers in the QD shell on the band gap was studied. An increase in the number of CdS monolayers in the CdSe/CdS QD shell from 4 to 7 reduces the band gap by 13% from 2.34 eV to 2.03 eV. An increase in the number of ZnS monolayers on the CdSe/CdS/ZnS surface from 2 to 5 leads to a decrease in the band gap by 15%.

**Keywords:** Density Functional Theory, Quantum Dots, Band Gap, Quantum-chemical Simulation.

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## POSTER SESSIONS

## Id-499

# Synthesis of Complex Oxides with Garnet Structure by Supercritical Antisolvent Precipitation $CO_2$ Technique

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**Abstract:**
In this work, the authors were synthesized samples of RIG (rare-earth iron garnet) via supercritical antisolvent precipitation $CO_2$ technique. These oxides are precursors in the manufacture of ceramics for various applications. Iron containing garnets and spinels with non-equivalent and antiferromagnetically coupled spin sublattices represent two of the most important classes of these materials. The ferrimagnetic rare earth iron garnets, $R_3Fe_5O_{12}$, characterize a unique group of materials which have long been studied for their novel magnetic and magnetooptical properties. Ferrimagnets have found the application in passive microwave components such as isolators, circulators, phase shifters, and miniature antennas operating at a wide range of frequencies (1–100 GHz), as magnetic recording media. It has been shown, that nanocrystalline gadolinium iron garnet samples prepared by the microwave hydrothermal method are suitable for circulator, optical isolators and in the fiber communication systems. The dysprosium iron garnets are also used in the manufacture of TV screens and data storage due to large Faraday rotation. The synthesis of powders was carried out on the experimental setup SAS-50 (Waters Corp.). Inorganic salts were chosen as the starting salts – acetates of corresponding elements in stoichiometry ratio and dimethylsulfoxide were used as solvent. The parameters of the experiments were chosen as follow values: pressure 10 MPa, temperature 40 °C, feed rate of carbon dioxide 50 g/min, feed rate of the initial solution 1 ml/min. The obtained samples were investigated by a complex of physicochemical methods: TG-DSC analysis, IR-spectroscopy, X -ray powder diffraction, transmission electron microscopy, X-ray photoelectron spectroscopy. The synthesis in the environment of supercritical fluid $CO_2$ leads to the formation of stable products – nanoparticles of the corresponding metal salts in the X-ray amorphous state. When heated up to 350 °C freshly-prepared acetate salts are destroyed with the formation of a continuous series of X-ray amorphous solid solutions of oxides. The crystallization temperature increases from 630 to 760 °C in $R_3Fe_5O_{12}$ (R=Gd to Y). According to results of thermodynamic calculations, the formation of complex oxides with garnet structure passes through the formation of X-ray amorphous corresponding complex oxide with perovskite structure. This work was supported by the Ministry of science and higher education (project Russian Foundation for Basic Research No 18-29-06013).

**Keywords:** Iron Garnet, Supercritical Antisolvent, Rare Earth.

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## POSTER SESSIONS

## Id-506

# Kinetics of Processes in the Thermoelectric Material of the Sn-Pb-Te System During Heat Treatment

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**Abstract:**
The development of modern technology is linked with the search of new sources of energy. Thermoelectric generation is one of the promising, and in some cases the only available methods of generating electric power. Thermoelectric generators (TEG) have such qualities as autonomy, durability, ease of operation, noiselessness. These devices can be used as power source for actively developed high-tech intelligent systems and sensors, aerospace, military, computer and microwave devices, remote consumers of electricity. However, the relatively low efficiency (not more than 10%) of such devices inhibits their widespread application. Nanostructuring of thermoelectric materials is one of the perspective ways to increase efficiency of TEGs. It leads to the decrease of thermal conductivity with retention of high electrical conductivity. Thermoelectric materials of the Sn-Pb-Te system have been known as suitable materials for TEG application for a long time. But there is very poor information in literature about nanostructuring of such material. In addition, there is practically no information on the study of the kinetics of the effects, which occur in this material with heating. So the aim of this work was to investigate kinetics of processes occurring in the thermoelectric material of the Sn-Pb-Te system during heat treatment. The method of differential scanning calorimetry is well suited to solve this task. Investigated material was synthesized by direct alloying at the temperature of 950 °C in quartz ampoules. Then jaw crusher, knife mill and planetary mill were used. It allows to obtain sizes of the particles about 80-120 nm. Than the hot pressing of the powder was carried out. Differential scanning calorimeter Shimadzu DSC-50 was used for the investigation of thermal properties. Five different heating rates (from 5 to 20 °C/min) were used to investigate kinetics of the processes. Masses of the samples were about 10 mg, Al pans were used. Measurements were carried out in a nitrogen atmosphere (20 ml/min). The technique based on joint application of model-free and model-fitting methods was used. All DSC curves exhibit an exothermal peak at the temperature about 280 °C. The kinetics of this peak was investigated. It was shown that the effective activation energy at the initial stage of the reaction is about 2.3 eV and remains almost unchanged during the reaction, which indicates that one stage dominates in this process. The investigated reaction is most likely described by the second order reaction model. Pre-exponential factor also was determined. It was shown that effective activation energy and pre-exponential factor are related by the compensation equation. The decrease in reaction rate due to increase in activation energy is compensated by the increase of pre-exponential factor. This work was supported by the Russian Science Foundation (project number 18-79-10231).

**Keywords:** TEG, Thermoelectricity, Thermoelectric Generator, Nanostructuring.

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## POSTER SESSIONS

## Id-569

# Synthesis and Magnetic Properties of $CdAs_2$ – MnAs System

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**Abstract:**
The interaction between the $CdAs_2$ semiconductor and the ferromagnet MnAs was investigated in the concentration range up to 60 mol% MnAs. Liquidus lines were created. It was shown that between the semiconductor and the ferromagnet the eutectic is forming with coordinates - 6 mol% MnAs and $T_m$=614 °C. The liquidus lines temperatures, according to the data of melting effects, turned out to be higher than according to crystallization effects. This is due to the tendency for cadmium diarsenide vitrification. MnAs solubility in $CdAs_2$ was ≤ 1 mol%. Magnetic properties measurements show that $CdAs_2$ - MnAs alloys are ferromagnets ($T_c$=315 K). The magnetization in these alloys increased with the MnAs content rise. For quenched samples with sizes of ferromagnetic inclusions ≤ 40 nm, a negative magnetoresistance effect of 2-3 % in the saturation magnetic field is characteristic. This is interesting magnetically granular structures creation based on $CdAs_2$ with MnAs alloys. These data supplemented by the differential scanning calorimetry results. The thermal effect of the conversion from tetragonal (ferromagnetic) to hexagonal (paramagnetic) MnAs modification was observed in the samples. The temperature of the effects correlates with the data for the $T_c$ determination from magnetic measurements.

**Keywords:** Synthesis, $CdAs_2$ – MnAs System, Growth, Magnetic Properties.

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## POSTER SESSIONS

## Id-572

# Anticorrosion Properties of Manganese-containing Complex Oxides, Obtained by Calcination Method

Z. M. RASHIDOVNA, K. D. ISAEVNA, S. S. NIKOLAEVICH, M. V. ALEXANDROVNA*

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**Abstract:**
The steady increase in the number of objects made of carbon steel, highly vulnerable to corrosion combined with the increased aggressive environmental impact caused by the development of industrial plants generating waste that has a damaging effect on various materials, make it obvious that this process should be counteracted. The most common way to protect steel objects from environmental corrosive effects is dyeing. The coatings applied to the surface of various substrates are usually multi-layered and the first pre-coating layer has the main protective load. Anti-corrosive effectiveness of primers is provided by including of inhibiting pigments in their structure. In recent years, in the search for alternatives to toxic anticorrosive chromium pigments, the use of complex metal oxides in this capacity has been actively developed. In this work, the anticorrosive and other physicochemical properties of complex oxides, including manganese in oxidation degrees +4 and +5, obtained by the calcination method were investigated. As a result, it has been shown that the products obtained have good prospects for being used as anti-corrosion pigments. Higher inhibitory properties of pigments containing manganese in oxidation state +5, is probably a consequence of their aqueous extract's alkaline reaction. During the experiments, it was found that the competitiveness of the synthesized pigments can be markedly enhanced by using natural ore, pyrolusite, as manganese source. The complex oxides of manganese in the oxidation state +4 and +5 were synthesized using the method of calcination. Their physicochemical properties allow to use them as anti-corrosion pigments. The calcination product containing Mn (V) and $BaSO_4$, possibly as a stabilizer, has higher anti-corrosion properties, probably due to the alkaline reaction of the aqueous extract. The proven possibility of using natural pyrolusite as a raw material containing manganese can contribute to the significant reduction in the cost and, consequently, increased competitiveness of the synthesized pigments.

**Keywords:** Anticorrosive Pigments, Toxicity, Manganese-containing Complex Oxides, Calcination.

## POSTER SESSIONS

## Id-592

# Anticorrosive Properties of Settled and Coprecipitated Metal Manganates

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**Abstract:**
In the modern industrialized society, anti-corrosive protection of metals is one of the most important scientific, technical and economic problems. Its solution can save huge material and financial resources. In the course of time, the problem of preserving the metal fund, primarily steel objects, becomes more acute due to the increasing use of corrosive environment, high temperatures and pressures in industry. Carbon steel being the most commonly used structural material also belongs to corrosion-sensitive metals. Constantly increasing environmental requirements to paints' and varnishes' components make the development of low toxic anti-corrosive pigments obligatory. The use of complex metal oxides, manganites in particular, as pigments seems to be a fruitful direction for finding this problem solution. The synthesis and study of the calcium and barium manganites' properties showed that, despite the high inhibitory ability of aqueous extracts, it is not possible to use them widely as anti-corrosion pigments because of the high content of water-soluble substances. The co-precipitation of calcium manganite and phosphate made it possible to eliminate this disadvantage, opening up new opportunities in expanding the range of low-toxic anti-corrosion pigments. The analysis showed that coprecipitation with calcium phosphate had a slight effect on the pH of aqueous extract and oil absorption of calcium manganite. Inhibiting properties also remain almost unchanged up to 50% phosphate content, while the content of water-soluble substances decreases by more than 5 times. This confirms the correctness of the chosen modification of manganites and opens up broad opportunities in anticorrosive pigments development, the active principle of which are manganites of various metals. In order to eliminate this drawback, co-precipitated calcium manganite phosphates with different phosphate contents were synthesized. The inclusion of up to 50% of the phosphate component in the pigment practically does not reduce the inhibiting efficiency of aqueous extracts, and that confirms the correct choice of manganites' modification and opens up wide possibilities for expanding the range of anticorrosive pigments.

**Keywords:** Anticorrosive Pigments, Toxicity, Complex Oxides, Precipitated Manganites, Co-precipitated Phosphates.

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## POSTER SESSIONS

## Id-632

# Nano-immunosorbents Based on $SiO_2$ Nanoparticles Functionalized with Antibody for Dicamba Pesticide Dosing

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**Abstract:**
Dicamba (3,6-dichloro-2-methoxybenzoic acid) is a broad-spectrum herbicide used in agriculture and its residues in soil and water require high sensitivity analysis like in order to establish the contamination level of the alimentary products and the environmental factors. Interaction between antigen and antibody in vitro is used to detect either the antigen or antibody by the ELISA technique. Nano-immunosorbents are nanoparticles functionalized with components of immune system (antigens/antibodies). Nano-ELISA (Enzyme Linked Immunosorbent Assay) technique is based on nanoparticles functionalized with antigens/antibodies (nano-immunosorbents) with large total surfaces having an improved efficiency due to their strong adsorption capacity, the high surface-volume ratio and the high diffusion coefficient of the nanoparticles. The immune reaction between the obtained nano-immunosorbents and dicamba analyte, both in suspension, used in nano-ELISA has the advantage of minimizing the diffusion distances between antigen and antibody and time to reach the chemical equilibrium in comparison with heterogeneous ELISA technique. Polyclonal antibodies against residual pesticide 3,6-dichloro-2-methoxybenzoic acid (Dicamba) were obtained by immunization of New Zealand Rabbits experiments undertaken under national and international regulations concerning animal testing, with Dicamba-bovine serum albumin as immunogenic conjugate. The gamma globulins were separated by the chemical method using $(NH_4)_2SO_4$ due to its higher efficiency. Anti-Dicamba antibodies were functionalized using 3-aminopropyl triethoxysilane (APTES) and glutaraldehyde (GA) chemistry. Protein coupling capacity was determined and characterization was made by scanning electron microscopy and atomic force microscopy.

**Keywords:** Antigen, Antibody, Dicamba, Nano-immunosorbent, Nano-ELISA.

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## POSTER SESSIONS

## Id-633

# Separation of Antibodies by Affinity Class Using Nano-Immunosorbents based on $SiO_2$ Nanoparticles Functionalized with Antigen

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**Abstract:**
Using affinity chromatography, performing the selective procedure for the dissociation of the antibodies coupled to the homologous antigen in the affinity chromatographic column can lead to obtaining sets of antibodies with different affinity classes that can be used in the immunochemical dosing techniques. The aim of separating antipesticide antibodies by affinity classes is to select from the polyclonal antiserum the highest affinity antipesticide antibodies. The affinity chromatography separates proteins on the basis of reversible interaction between a protein (or a group of proteins) and a specific ligand coupled to a chromatography matrix. Nano-immunosorbents are nanoparticles functionalized with antigens/antibodies with large total surfaces having an improved efficiency due to their strong adsorption capacity, the high surface-volume ratio and the high diffusion coefficient of the nanoparticles. The need for the purification of specific antibodies is given both by the source from which they are isolated and by their subsequent use. Chromatography is a separation method of where the components to be separated are selectively distributed between two immiscible phases. The functionalization of nanoparticles with antigens combines the properties of the $SiO_2$ nanoparticles themselves with the specific and selective recognition ability of the antibodies-antigens interactions. The non-magnetic nanoparticles are coupled with specific antigen and have the advantages of a large specific surface compared to the classical immunosorbents. Separation by affinity classes was done by eluting solutions of different pH's over the Ag type NIS. Separation of specific anti-Dicamba antibodies with high affinity constant is performed at extreme pH (acidic or basic).

**Keywords:** Antigen, Antibody, Nano-immunosorbent, Affinity Class, Separation.

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## POSTER SESSIONS

## Id-659

# Synthesis and Characterization of Graphene-covered Silver Nanoparticles

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**Abstract:**
Noble metallic nanoparticles are widely exploited for chemical and biological sensing due to their local surface plasmon resonance and surface enhanced Raman scattering properties. In particular, the optical properties of gold (Au) and silver (Ag) nanoparticles are highly investigated due to their enhanced interaction with light. Nanostructured Ag is the best material for plasmonics due to the absence of interband absorptions and low optical loss at optical frequencies. However, silver has poor stability under ambient conditions, forming $Ag_2S$ on its surface. This leads to morphological changes of the Ag nanoparticles, and significant diminishing of the optical properties. Covering Ag nanoparticles with graphene provides not only a unique platform to study the silver–graphene interaction at nanoscale, but also a way for preserving the high surface plasmon resonance intensity of the nanoparticles, which is of key importance in potential applications. Combining Ag nanoparticles with graphene can yield hybrid materials with enhanced light-matter interaction. Here we report a simple method for the synthesis of graphene-silver nanoparticle hybrids on highly oriented pyrolytic graphite and $SiO_2$ substrates. The physical properties of graphene-covered silver nanostructures were investigated by atomic force microscopy, scanning tunneling microscopy and spectroscopy, optical reflectance and Raman spectroscopy. We showed that the graphene overlayer can protect the silver nanostructures from the sulfurization occurring under ambient conditions. The Authors acknowledge financial support from the National Research, Development and Innovation Office (NKFIH) in Hungary, through the Grants K-119532 and KH-129587. Z.O. acknowledges the János Bolyai Research Fellowship from the Hungarian Academy of Sciences.

**Keywords:** Silver Nanoparticles, Graphene, Graphene-based Hybrid Nanostructures.

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## POSTER SESSIONS

## Id-670

# Dynamic Mechanical Characterization of Ternary Polylactide Nanocomposites Reinforced with Hybrid Montmorillonite/Carbon Nanotubes for High-Performance Applications

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**Abstract:**
Incorporation of inorganic rigid nanoparticles remains the most effective means of improving polymer properties; montmorillonite and multi-walled carbon nanotubes are legendary in this field for their individual exceptional physical characteristics. Hybridization of the montmorillonite (MMT) and carbon nanotubes (CNT) is anticipated to create a synergistic role in polymer. At a definite nanofillers concentration, termed percolation threshold, there exists a strong structured-network formation leading to improved bulk polymer properties. This research presents the preparation of polylactic acid (PLA) nanocomposites, reinforced with hybrid of MMT/CNT, through a combined solution and melt mixing methods. A unique investigation on the dynamic mechanical parameters (storage modulus, loss modulus, and damping factor) in relation to incorporation of MMT/CNT hybrid and identification of the percolation threshold through the viscoelastic behaviour is presented. Comparatively, binary nanocomposites reinforced solely with CNT, equivalent to the mass fraction of MMT/CNT hybrid used in ternary nanocomposite, is studied. It was found that the incorporation of MMT enriched the dispersion of CNT in PLA and reduced the percolation threshold of CNT from 1.0 to 0.34 %wt. With 1 %wt MMT/CNT loading in PLA, optimum storage and loss moduli improvement of ~30 and 78% was attained, while binary PLA/CNT requires 1.5 wt% CNT loading to achieve 30 and 37 % of the same viscoelastic properties. Hence, it is thoughtful that the ternary PLA nanocomposite could be efficiently used for advanced applications where biodegradability, high rigidity and thermomechanical properties are basically required.

**Keywords:** Poly(lactic acid), Montmorillonite; Carbon Nanotubes, Nanocomposite, Viscoelastic.

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## POSTER SESSIONS

## Id-674

# The Study on Controlling Inclusions on the Properties of Cast Al SiC Metal Matrix Composit

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**Abstract:** Cast Metal Matrix Composit are widely Manufactured in foundry Industry. Processing of Metal Matrix composit by stir mixing and casting requires special precautions including temperature control and design of pouring and gating systems. The effects of inclusion on the fluidity, viscosity, nucleation, growth etc are a matter of concern. Apart from composit material like SiC, TiB, Flyash the additional wettability improvement material like $K_2TiF_6$ and pre and post working on melt brings great changes in soundness of casting hence additionaly brings improvement in Mechanical and Metallurgical Quality which is required for all automotive, railway, space, computer hardware and recreational equipments. This paper studies the quality of Al SiC cast metal matrix composit with control on these parameters.

**Keywords:** Composit; Processing, Temperature Control, Wettability, Nucleation.

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## POSTER SESSIONS

## Id-675

# Characteristics of Bio-hybrid Hydrogels Modified with the Thermosensitive Nanocarrier - Salicylic Acid System

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**Abstract:**
Hydrogels as a cross-linked polymer network can provide spatial and temporal control over the release of various therapeutic ingredients and consequently are utilized for drug delivery applications. Moreover, recently, due to the unique properties, thermosensitive nanocarriers have become greatly appreciated in the field of controlled drug delivery system. The combination of these components offers features for an ideal wound dressing material. Lately, both sodium alginate - an anionic polymer of natural origin, as well as a poly(vinyl alcohol), which is a synthetic polymer, are successfully used in medicine for wound dressing especially for difficult-healing wounds, including venous ulcers diabetic wounds and bedsores. Even though both polymers meet the requirements of non-toxicity and biocompatibility only their combination can improve their desirable clinical properties, such as adhesiveness, fluid absorption, or gas diffusion which affect their use as wound dressing materials. In this work, the system of thermosensitive nanocarrier – salicylic acid was incorporated into sodium alginate/poly(vinyl alcohol) hydrogel with *Aloe vera* content to achieve a wound dressing material which might effectively accelerate the wound healing process. Briefly, N-isopropylacrylamide based nanocarriers were prepared through a direct one-step emulsion polymerization technique. The synthesis was monitored using UV-Vis spectrophotometry, allowing for the selection of the optimal parameters of the reaction. The chemical structure of obtained system was characterized using FT-IR spectroscopy. Then, the encapsulation of the salicylic acid as a model active substance in a prepared thermosensitive polymer nanocarrier was conducted. The efficiency of encapsulation and the average particle size of the carrier, were evaluated. Moreover, the morphology of proposed polymeric nanocarriers both, before and after encapsulation were carried out using scanning electron microscopy (SEM). In order to prepare the hybrid system, pre-made drug-nanocarrier spheres were initially dispersed into the hydrogel precursor based on aquatic solution of sodium alginate, poly(vinyl alcohol) and *Aloe vera* extract. Finally, obtained cross-linked, flexible and transparent materials were analyzed in terms of their chemical structure, surface morphology and their swelling and degradation properties in different simulated body fluids. We gratefully acknowledge financial support from The National Centre for Research and Development in the frame of 41/0146/L-9/17/NCBR/2018.

**Keywords:** Bio-hybrid Hydrogels, Thermosensitive Nanocarrier.

## POSTER SESSIONS

## Id-679

# Microstructural Properties of Ca doped ZnO Thin Films

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**Abstract:**
Utilization of Zinc oxide (ZnO) thin films have great potential for biosensors due to their biocompatibility, ease of synthesis by diverse methods, and chemical stability. In this study, undoped and Calcium (Ca) doped ZnO thin films were fabricated by sol-gel dip coating method to examine the effects of Ca doping on ZnO thin films. 0.5 M homogeneous solution was prepared via sol–gel method by adding 0%, 1% and 5% (wt%) Ca. Thin films were deposited on glass substrates by dip coating with a withdrawal speed of 100 mm/min. Thermal characterization of the films was examined by thermogravimetric analysis/differential thermal analysis (TGA/DTA). Microstructure characterization and corresponding chemical composition of the films were determined by using X-ray diffraction (XRD), Scanning Electron Microscope (SEM) and Energy-dispersive X-ray spectroscopy (EDS). The results are indicated that the microstructural properties of ZnO thin films were significantly affected by the ratio of Ca doping. It can be concluded that Ca doped films can be strong candidate for biosensing devices.

**Keywords:** Ca Doped ZnO Thin Films, Sol-gel Dip Coating, Microstructure Characterization.


# ALL SUBMISSIONS & TOPICS

| Topics | Submission |
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| **2D Materials Including Graphene** | Id 678 - Silicene, Medicine, and the Lancetgate |
| **Nanobiotechnology** | Id 679 - Microstructural Properties of Ca doped ZnO Thin Films |
| **Nanocomposites** | Id 569 - Synthesis and Magnetic Properties of $CdAs_2$ – MnAs System |
| | Id 670 - Dynamic Mechanical Characterization of Ternary Polylactide nanocomposites Reinforced with Hybrid Montmorillonite/Carbon Nanotubes for High-performance Applications |
| | Id 674 - The Study on Controlling Inclusions on the Properties of Cast Al SiC Metal Matrix Composit |
| **Nanofluids** | Id 595 - Study on Hybrid Nanofluid Exposed to Radiation and Heat Generation |
| **Functional Nanomaterials** | Id 506 - Kinetics of Processes in the Thermoelectric Material of the Sn-Pb-Te System during Heat Treatment |
| | Id 553 - Nanoencapsulated Aroma Finishing on Fabric by Sol-gel Process |
| | Id 632 - Nano-immunosorbents based on $SiO_2$ Nanoparticles Functionalized with Antibody for Dicamba Pesticide Dosing |
| | Id 633 - Separation of Antibodies by Affinity Class using Nano-Immunosorbents based on $SiO_2$ Nanoparticles Functionalized with Antigen |
| | Id 675 - Characteristics of Bio-hybrid Hydrogels Modified with the Thermosensitive Nanocarrier - Salicylic Acid System |
| **Computational Nanotechnology** | Id 498 - Quantum-chemical Study of CdSe/CdS Core/Shell and CdSe/CdS/ZnS Core/Shell/Shell Quantum Dots with Different Layers Ratio |


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| **Electron-beam Lithography** | Id 598 - Key Factors of Electron Beam Lithography in Research and Manufacturing |
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| **Self-Assembly** | Id 645 - Effectiveness of a New Additive on the Chemical Structure of Aged Bitumen |
| | Id 656 - Stability of Bituminous Emulsions Induced by New Bio Surfactants: Physical Chemistry Characterization |
| | Id 676 - Resorc[4]arene-based Site Directed Immobilization of Antibodies for Immunosensors Development |
| **Scanning Probe Microscopy Methods** | Id 659 - Synthesis and Characterization of Graphene-covered Silver Nanoparticles |
| | Id 592 - Anticorrosive Properties of Settled and Coprecipitated Metal Manganates |
| | Id 572 - Anticorrosion Properties of Manganese-containing Complex Oxides, Obtained by Calcination Method |