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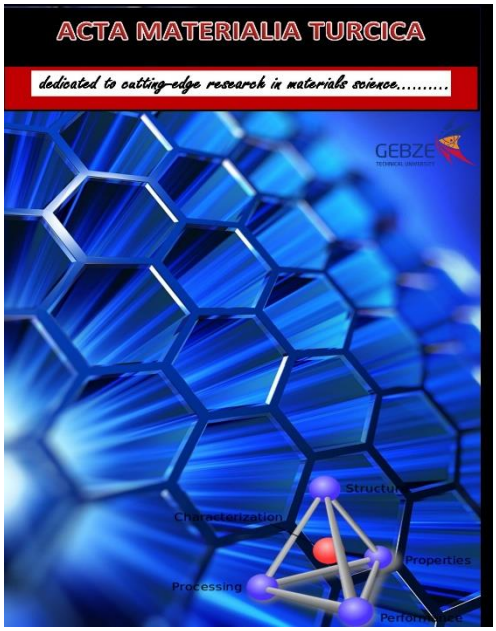
Book of Abstracts

APMAS 2020



10th International Advances in Applied Physics & Materials Science Congress & Exhibition

APMAS

October 14-20 2020

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10th International Advances in Applied Physics & Materials Science Congress & Exhibition (APMAS 2020)

Virtual

October 14-20, 2020

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International Advances in Applied Physics & Materials Science Congress (APMAS) 2020 Abstract Book

INVITED SPEAKERS

Id-1582

Material Characterization in the Microwave Range – Another Look to the Properties of Modern Artificial Dielectrics

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Abstract:
The development of new artificial dielectrics is a key issue of the modern world moving toward the 5G communication standard and Industry 4.0. They have specific mechanical, chemical and physical properties, which have to be characterized by different methods, some of them quite expensive (e.g. spectroscopy, SEM). Their electrodynamic behaviour depends on the complex dielectric constant (permittivity), which can be successfully measured in the microwave range (0.3-300 GHz). Most of the artificial dielectrics could be considered as mixtures between two or more isotropic components. In this case, very important is the homogenization of the resultant material, which can be described by effective (equivalent) dielectric constant. The process of homogenization is possible to a certain extent degree if the characteristic length of the nonresonant inclusions in the mixture is sufficiently smaller than the wavelength. There exist many different technologies to mix two dielectrics: series, parallel, series-parallel; layered, dispersed (uniform or random), pillar, impregnated, foamed, woven, knitted, by additive (3D printing) or subtractive technology, etc. The question is how to calculate the resultant equivalent permittivity of the mixed material. This is an integral characteristic; it gives useful information for the whole sample and we have shown how it can depend on the sample composition, structure, inclusion orientation, fabrication technology, conditions for the sample growth and forming, etc. We present in this invited paper a summary of our concepts, models, measurement methodologies and measurement methods for extraction of the dielectric parameters of different artificial dielectrics in the frequency range 0-40 GHz, as a result of our experience in the material characterization in the Microwave Laboratory of the Faculty of Physics, Sofia University, Bulgaria. A set of useful examples for determination of the equivalent permittivity of different artificial materials: 3D printed dielectrics, reinforced substrates, ceramics, multilayer radomes, foams, absorbers, gradient dielectrics and magneto-dielectrics, textile fabrics, metamaterials, carbon-content materials, fresh plant tissues, plasmas, etc. A special circumstance of these materials is their dielectric anisotropy (different permittivity in different directions), which is a very informative parameter and gives valuable additional information for the samples. We discuss in this paper the origin of the bi-axial and uni-axial anisotropy of different materials, how to measure this parameter, how to use the anisotropy data in the design and simulations of microwave devices and antennas and how the anisotropy influences their main characteristics.

Keywords: Anisotropy, Dielectrics, Microwave Methods, Permittivity.

INVITED SPEAKERS

Id-1606

Drilling Studies of High-Strength CFRP Composites Using Specialized Drills

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Abstract:
High-strength carbon fiber reinforced polymer (CFRP) composites are being extensively used in the modern aerospace industry mainly for the key load-carrying structures of large aircraft because of their extremely superior mechanical properties. However, machining of these CFRPs has faced great challenges in quality control and tool wear management due to their inherent heterogeneity in architecture and highly abrasive nature of reinforcing fibers leading to serious workpiece damage and rapid tool wear. The invited talk aims to address the machinability of one type of high-strength CFRP laminates representative of aircraft components by covering a variety of topics including drilling forces, hole quality, workpiece damage, hole dimensional accuracy and tool wear. Three types of drills involving the brad spur drills, twist drills and dagger drills were used to conduct the drilling tests of the aerospace-grade CFRP composites. Both the in-situ and post-process measuring results were correlated with the input process parameters and the used drill bits. A particular focus was placed on the inspections of the resulting tool morphologies and wear mechanisms governing the drilling of the high-strength CFRPs. The results highlight the importance of using functionally-designed drills and optimum cutting conditions in realizing the damage-free drilling of T800/X850 composites. The work was funded by the National Natural Science Foundation of China (Grant No.51705319) and the Shanghai Pujiang Program (Grant No.17PJ1403800).

Keywords: High-Strength CFRP Composites, Specialized Drills, Drilling-Induced Damage, Hole Quality, Tool Wear.

INVITED SPEAKERS

Id-1658

Nanophosphors for Phosphor Based White Light Generation

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Abstract:
Phosphor materials find various technological and industrial applications such as white-light emitting diodes (WLEDs), lasers, compact fluorescent lights (CFLs), biological label, temperature sensors, solar cells, and display devices with better energy saving, color rendering and high efficiency capacity. Rare earths (RE) doped nano-sized phosphor materials have attracted much attention due to having excellent optical and electrical features because of electronic configurations and energy transfer processes of rare earth ions. Inorganic oxide materials activated by rare earth ions are promising hosts for white light generation studies owing to physical, optical, and chemical properties such as hardness, optical isotropy, high thermal stability and conductivity. Generally, high-luminous white LED sources use a diode that pumps a single or combination of phosphors and called as phosphor converted WLEDs. Phosphor synthesis methods and dopant amounts are known to effect on the control of energy transfer in nanophosphors and tune multicolor emission. In this presentation, recent advances in the synthesis and application of nanophosphors for phosphor based white-light generation studies will be summarized. We will present our latest research on luminescence properties of Rare earth (RE^{3+}) triple doped oxide nano-crystalline phosphors with up-conversion mechanism. The author would like to acknowledge the financial support of the Ege University (14-FEN-027).

Keywords: Nanotechnology, Nanophosphors, White-Light Generation, pc-WLEDs, Rare Earth Ions.

INVITED SPEAKERS

Id-1699

Interlocking and Welding Effect on the Electrical Machines

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Abstract:
The manufacturing process of the electrical machines is a key step that is affecting the performance. One significant part of the manufacturing process is the cutting of the electrical steel. The mechanical cutting and laser cutting are widely used for cutting, which may cause the deformation near the cutting edge. Laser cutting is widely used for prototype design. This deformation may negatively influence the B-H characteristics of the ferromagnetic material. Welding and interlocking are additional parameters that may change performance of the electrical machine. The preliminary modelling is proposed in order to estimate the laser cutting deformation near the edges of the ferromagnetic sample M400-50A. The preliminary research results based on COMSOL simulation software. In this study, the preliminary modelling is improved by combining the effects of the interlocking and welding. In this presentation, we also propose a novel approach to measure the effects of the cutting on the ferromagnetic samples thanks to collaboration between electrical machines lab (University of Ljubljana) and LATARUM (Kocaeli University). The experimental results will be given to show the laser cutting/welding effects on the ferromagnetic samples. The measurement equipment of the LATARUM will be able to demonstrate the parasitic effects coming from technological processes as cutting, welding, interlocking, and surface treatment.

Keywords: Welding, Interlocking, B-H Characteristics, Electrical Machines, Ferromagnetic Materials.

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REGULAR SESSIONS

Id-1613

Plasma Studies in TÜBİTAK National Metrology Institute

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Abstract:
Over the past few decades, low-temperature plasma researches have gained momentum as they lie at the core of numerous applications in industry, environment and medicine. Recently, metrology community has also begun to take advantage of the unusual properties of plasma to develop new advanced measurement techniques and new measuring devices. In accordance with this purpose, in 2019, the Plasma Laboratory is installed in TÜBİTAK National Metrology Institute (UME) within the scope of infrastructure research and development program founded by Industry Ministry of Turkey for contributing to the ongoing worldwide research on plasma studies. In this work, the current advances in Plasma Laboratory of UME and the road map for future studies will be introduced. We present the installed experimental set-up for low-temperature and low-pressure gas discharge plasma. We plan to develop models for understanding the complex nature of plasma and use both invasive and spectroscopic diagnostic methods for determining the chemical, physical and electrical properties of the generated plasma for validation purposes. We summarize our preliminary measurement results. Once the tests and validations are completed, we will extend our studies for determining the physical and chemical structure of liquid and solid substrates sprayed into the plasma which is significant for industrial, environmental and medical applications.

Keywords: Low-Temperature Plasma, Plasma Diagnostics.

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REGULAR SESSIONS

Id-1622

Interfacial Electron Transfer with Azurin at Au/SAM Junctions in Contact with a Protic Ionic Melt: Impact of Glassy Dynamics

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Abstract:
Gold electrodes were coated with alkanethiol SAM/azurin (Az, blue cupredoxin) assemblies and placed in contact with a water-doped and buffered protic ionic melt as the electrolyte, choline dihydrogen phosphate ([ch][dhp]). Fast-scan protein-film voltammetry was applied to explore interfacial biological electron transfer (ET) under conditions approaching the glass-transition border. The ET rate was studied as a function of the water amount, temperature (273–353 K), and pressure (0.1–150 MPa). Exposure of the Az films to the semi-solid electrolyte heavily affected the protein's conformational dynamics, hence the ET rate, via the mechanism occurring in a dinamically-controlled regime, hence compared to the earlier studies on the reference system with a conventional electrolyte (D.E. Khoshtariya et al., 2010, 2015, 2019), allowing for the disclosure of even more uncommon mechanistic motifs. For samples with low water content (ca. 3 or less waters per [ch][dhp]), at moderately low temperatures (below ca. 298 K) and/or high pressure (150 MPa), the voltammetric profiles systematically deviated from standard Marcus current-overvoltage pattern, deemed as attributable to a breakdown of the linear response approximation through the essential steepening of Gibbs energy wells near the glass-forming threshold. Electrolytes with higher water content (6 to 15 waters per [ch][dhp]) display anomalous temperature and pressure performances, suggesting that the system crosses a broad nonergodic zone which arises from the interplay of ET-coupled large-scale conformational (highly cooperative) modes of the Az protein, inherently linked to electrolyte's (water-doped [ch][dhp]) slowest collective relaxation(s). In summary, the sandwich-like assemblies composed of gold-deposited alkanethiol SAMs and on top immobilized films of redox-active protein azurin, in addition were placed in contact with semi-solid electrolytes, the buffered protic ionic melts of variable doping water content. The fast-scan voltammetry studies of biological ET under the conditions of approaching a glassy state (made available below the room temperature or at high-pressure conditions) revealed the need to consider two novel distinctive kinetic motifs that manifest as "irregularities" when the electron transfer is treated in the framework of a "traditional" Marcus-like formalism. From an experimental standpoint, the two anomalies are quite distinct, and hence are interpreted as arising from nonergodic and nonlinear kinetic effects that have been predicted notionally for complex environments. Consequently, this work seems be a first systematic effort in which three modern physical concepts, encompassing: (a) dynamically controlled (adiabatic) interfacial ET; (b) medium's nonergodic response (dynamically arrested ET); and (c) medium's nonlinear response (nonparabolic free energy terms for ET), were invoked to experimentally uncover and elucidate the novel mechanistic peculiarities for a special case of biological ET within the mimetic (potentially realistic) complex environments. Financial support from SRNSFG (Project No FR17_570) is kindly acknowledged.

Keywords: Electron Transfer, Self Assembly, Azuri Protein, Glassy Dynamics, Ionic Liquid.

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REGULAR SESSIONS

Id-1623

The Self-Assembled, Atomically Defined Bilayered Au/L-Cysteine/Cu(II/I) Junctions Capable of Coherent Multiple Electron/Hole Exchange

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Abstract:
Contemporary 2D spintronics is a highly interdisciplinary field with numerous elaborated branches, mostly focusing on atomically thin, layered nano-junctions functionalized within “dry” or “wet” cells/cubicles/circuits. The charge carriers’ spin-implicated aspects emerge throughout, albeit most fascinating (nanotechnologically promising, implying the information and energy transfer/storage aspects) issue among them perhaps is the uniquely complex yet robust and rather universal phenomenon of a hybrid inter- and intra-layer Bose-Einstein-like (BE) condensation. However, this issue is still not sufficiently explored, especially, in the framework of the “wet” spintronic domain. Certainly, search for both, the new or advanced methods for composing new types of bilayer junctions and testing of charge flow therein is a primary task of the current 2D spintronics. In this communication we report on the novel effort towards an extension of the voltage-gated “wet” 2D spintronics enabled through the self-assembling of bilayered Au/L-cysteine/Cu(II/I) junctions, and their preliminary current-voltage testing towards the coherent multiple electron/hole exchange. Our experimental efforts led to a few of rare, uniquely combined observations encompassing the temperature induced directly visible two-state shape-shifting irreversible transformation of a CV signal (the natural signature of a voltage-gated interlayer Faradaic process), the resulting ultra-thin shape of which is explainable by a highly correlated multi-electron/hole flow. Furthermore, cathodic and anodic peaks of the “new” signal are moderately separated from each other and have nearly similar shapes. Additional experiments with a variation of the voltage scan rate demonstrated the unprecedented very regular decaying dependence of a number a simultaneously transferred electrons/holes (extracted from the peak-shape analysis) on the voltage scan rate; although the former parameters shows some fluctuational (random) variability in time and from sample to sample. The cross-analysis of a whole scope of obtained voltammetric data allowed for a preliminary conjecturing of the appearance of a joint quasi-excitonic (BE-like) condensate islands (at room temperature) nesting within the structural clusters (with a variable charge carrier number depending on T or v, e.g.) throughout a whole 2D junction, encompassing the bilayer junction’s both sheets, the specific electron/hole ratio of which is gated by the interlayer potential (voltage) bias. The further multi-theory-based analysis allows conjecturing of a hybrid BE-like dipolar superfluid formation encompassing electron/hole-hosting clusters formed within the bilayer junction. The clusters’ dimensions, charge distribution and dynamic exchange are essentially tunable through the applied potential (voltage-gating). Financial support from SRNSFG (Project No FR17_570) is kindly acknowledged.

Keywords: Bilayered Junction, Multiple Electron Exchange, Interlayer BE Condensation.

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Id-1624

Advances in UME Langmuir Probe

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Abstract:
Plasma, often considered to be the fourth state of matter, is an ionized gas. Very hot plasma is what makes up the most of the visible universe. Confined plasmas at medium and low temperatures can be produced in vacuum systems and in the atmospheric pressures for a variety of industrial purposes. It is essential to understand plasma characteristics by sensitive metrological diagnostics measurements which include electrical probe measurements, emission spectroscopy measurements, magnetic coil measurements, temperature and heat measurements, etc. The newly established plasma laboratory in TÜBİTAK National Metrology Institute (UME) aims in developing advanced measurement techniques and new measuring devices with metrological accuracy for plasma diagnostics. In this study, the DC plasma (with argon, helium, nitrogen and their mixtures) were produced by applying a DC high voltage between the cylindrical planar electrodes to breakdown the gas according to Paschen law. The Langmuir probes were inserted into the plasma to obtain I-V characteristics of the plasma from which plasma properties are obtained. If no voltage is applied to this probe, the voltage measured is the actual plasma potential. If a positive potential is applied, electrons will be attracted to the probe tip and ions will be repelled producing a cloud of negative charge around the tip. This "sheath" will shield the rest of the plasma from the positive charge on the tip within the cloud region whose thickness is called Debye length. As the applied potential is increased, the electron current flowing through probe tip to the earth or vacuum wall for single probe (or flowing between the probes for double probes) increases exponentially and then saturates at higher voltages. By examining the slope of the exponential region, electron temperature can be determined while the electron saturation region allows us to find electron density. When negative potential is applied, the tip attracts ions repelling electrons causing a small amount of diffused current, which gives rise to the measurement of ion density. The main purpose of this study is to construct UME Langmuir probe for plasma characterization. In this work, having described the working principle of such probes, we present the experimental set-up of the homemade Langmuir probe together with its data analysing software. The robustness of the UME Langmuir probe is achieved by comparing our results with those of the reference probes obtained from commercial standard devices. The Langmuir probes described here for his purpose were used to measure plasma electron temperature, floating and plasma potentials as well as ion density at different pressures, at different voltages between electrodes, with different gases and mixtures for the purpose of accurate plasma metrology.

Keywords: Gas Discharge Plasma, Plasma Diagnostic, Plasma Temperature, Langmuir Probe.

REGULAR SESSIONS

Id-1625

Antimicrobial Peptides as a New Combination Agent in Cancer Therapeutics

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Abstract: Antimicrobial peptides are a class of molecules synthetized by a variety of organisms as innate defening means against different pathogens. These natural compounds have been also identified as a promising alternative to widely used molecules against infections and cancer cells. Considering their action mechanism, antimicrobial peptides can be viewed as future chemotherapeutic alternatives, with the advantage of low propensity to drug resistance. In this study, we evaluated the efficiency of an antimicrobial peptide, Gramicidin A (GA) and a classical anticancer drug, Doxorubicin (Doxo) delivered separately and in combination with Gramicidin A, against the spheroids from colorectal cancer cell culture. Spheroids evolution, cell viability, and their ATP levels were monitored at 24 h and 48 h after the applied treatments. The results show a significant drop in cell viability and cellular ATP level, for all the experimental conditions. The simultaneous use of the two compounds (GA and Doxo) has a synergistic effect against the spheroids.

Keywords: Antimicrobial Peptides, Doxorubicin, 3D Tumoral Spheroids, Gramicidin A.

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Id-1696

Preliminary Idea for Bioalarm to Improve the Air Quality

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Abstract:
The indoor air quality has been considered clearer than the outside for a long time, which this is not supposed true anymore. In other words, the indoor air is more polluted than the outside. The inside air pollution comes from biological and non-biological sources. Bioaerosols are the main source of the biological based pollution for the indoors, where it is mainly composed of bacteria, fungi, mold, virus, pollen, and their parts. Inside air contains bacteria, fungi and viruses that may negatively have serious consequences on the human health. In this study, the preliminary idea will be presented to detect the bioaerosols indoor air by using Mie scattering and luminescence. The main objective is to demonstrate the fluorescence spectra of bioaerosols can be measured in real time and prove that the single particle spectra are sufficient to detect the target bioaerosol. The preliminary idea can be converted into a powerful diagnostic tool for bioaerosol classification. The prototype is combined with radiofrequency (RF) electronics to achieve a wireless bioalarm system. Although, the proposed bioalarm system is combined with a proportional–integral–derivative (PID) feedback control loop equipment to stabilize the indoor environment. The authors acknowledge the projects 2019/074 and 2216 HD were financially supported by Kocaeli University (TR), BAP unit.

Keywords: Luminescence, Bioaerosol, Bio-Photonics, Air Quality, Electronics.

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Id-1709

Recycling of Painted and Varnished Acrylonitrile Butadiene Styrene (ABS) Materials with Maleic Anhydrite Additives to Obtain PC/ABS Blends

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Abstract:
Plastic materials are very important for environmental sustainability. Now, it can be recycled many plastic type. But it is not enough level. Sustainability and recovery/recycling of plastic materials must be increased urgently to prevent environmental pollution and protect livings. Especially, it is a difficult problem of recycling and recovery of coated and painted plastics. In this study, it was investigated recycling coated and varnished ABS plastic to obtain polycarbone/ABS blend. PC/ABS blends are commonly used home appliance, automotive and other sectors. The new sector is 3D printing area. Therefore, sustainable production of this blend is very important. Recycling polymers are usually used in same polymer type. If they can be used in different polymer blends, sustainability of the polymers will be increased. Thus, it will be released less waste to nature. However, coated and varnished polymers can not be blended as durable with other blend polymers such as polycarbonate without a agent. In this study, it was examinated effects of ABS-g-MA to durability of blends of coated and varnished ABS with polycarbonate. Impact resistance and tensile strength tests were performed to determine durability. PC/ABS compositions were prepared at 70/30- 50/50-90/10 percentages. It was added ABS-g-MA into the compositions 1-3-5-7-10 %. The test results, show that ABS-g-MA effect possitive to the durability. PC/ABS/ABS-g-MA 90/10/10 composition had highest tensile strenght. PC/ABS/ABS-g-MA 90/10/3 composition had highest impact resistance. In addition, other compositions with ABS-g-Ma were convenient for industrial usage. It was performed SEM for the samples to examine blend stuation. The results are promising for the recycling of coated and varnished ABS in a PC/ABS blend for industrial production.

Keywords: Painted ABS, Polymer Recycling, ABS, ABS/PC, Maleic Anhydrite.

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Id-1710

The Technology for Producing Refractory Products based Metallurgical Production Waste

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Abstract:
Metallurgical processes generate significant amounts of waste that can harm the environment. In modern metallurgical engineering, the formation of solid waste per ton of manufactured products reaches 700 kg, 90% of which is metal-containing waste. Approximately 40% of this waste is represented by scrap steel and cast iron, where scrap and screening of large-tonnage manganese, silicon and chromium ferroalloys also account for a significant proportion, and the remaining 60% is small lumpy or dispersed metal oxide waste. (scale, slag, dust, sludge, cake). Products made from substandard wastes of metallurgical production are a new type of technical materials, which, by their physical and chemical properties, can be classified as refractories. Depending on the purpose - technical conditions, temperature and reaction parameters of metallurgical aggregates, refractories can be presented in the form of non-combustible and calcined products. Non-firing products have many positive properties and can dramatically improve the quality and efficiency of the repair services of metallurgical enterprises. However, in comparison with firing, their purpose is limited due to the inconstancy of their technical properties when exposed to high temperatures, melts and slags. The aim of this work is to obtain the firing refractory materials with properties close to those of foresterite ones in strength, refractoriness, and heat resistance (in the number of heat cycles). Samples of refractory products based on metallurgical production wastes were obtained and studied at various ratios of components in a wide temperature range of 100–1650 °C. The test samples were prepared by sequential mixing formulations set of samples, moistening and compacting in molds of 40 mm diameter at a pressure of 100 MPa (1000 kg/cm^2). The technology for manufacturing samples (products) includes: mixing coarse grains of the charge with a binder, and then rolling the grains with fine powders with a particle size of less than 0.063 mm. Then all this material was placed in a die of a mold between two punches and double-sided pressing was carried out to obtain products. The pressed product was dried at 100 ° C for one day and fired at temperatures of 100-1650 ° C with exposure 2 hour at each predetermined temperature for 3-5 samples. After firing, the products underwent visual control, which consisted in examining their appearance, for the presence of large and small cracks, their integrity and types of destruction during firing, as well as various types of deformations - loss of cylindrical shape or melting. The samples were carefully sorted, and then their properties were determined: ultimate strength in compression (σ), MPa; refractoriness; density (ρ), g/cm^3; shrinkage (Y), %.

Keywords: Dust, Slag, Sludge, Refractory Scrap.

REGULAR SESSIONS

Id-1714

Electrochemical Nucleic Acid Detection Based on PNA Prob

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Abstract: Electrochemical biosensors have been receiving considerable attention since they are capable to analyze a biological sample by means of the direct conversion of a biological event to an electronic signal. In this study, peptide nucleic acids (PNA) organized with alkanethiol self-assembled monolayers (SAMs) was used as a PNA prob for electrochemical nucleic acid detection. Two stage immobilization process on gold electrodes was developed to achieve well-organized PNA prob. The two different molar ratios of 1:1 and 1:20 11-Ferrocenyl-1-Undecane thiol (FcUT): 6-Mercapto-1-hexanol (MCH) and temperature of ~50 °C was applied on gold electrodes as a first stage of the process. After optimized SAMs, 5 µM single strand PNA was immobilized on this gold electrode as a second stage of the process. All measurements (formal potential and surface coverage of SAMs, PNA prob and cDNA (complementary DNA) hybridization) was carried out via AC voltammetry method. PNA prob was successfully detected cDNA by using electrochemical detection method. This study shows that if PNA is organized with alkanethiol SAMs effectively, the highly sensitive and selective electrochemical detection will be accomplished to develop electronic biosensing devices.

Keywords: Self-assembled Monolayers (SAMs), Peptide Nucleic Acid (PNA), Electrochemical Biosensors.

POSTER SESSIONS

Id-1600

Influence of Carbon Nanostructures on the Structural and Thermal Properties of Lipid Membranes

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Abstract:
Studies of carbon nanostuctures, incorporated in phospholipid bilayers show a strong effect of these admixtures on the local structure and dynamic properties of biomembranes, as well as on their toxicity and ability to promote trans-membrane channel formation depending on their size, shape, and surface modification. However, the dominant forces of the influence of these structures on the conformational states and functions of biomembranes remain not clarified. The main goal of our study is the investigation of the thermal and conformational structure characteristics of 1-stearoyl-2-oleoyl-sn-glycero-3-phosphocholine (SOPC) phospholipid at variation of carbon nanostructures in various concentrations. For that purpose, we use the methods differential calorimetric analysis and Fourier transform Infrared (FT-IR) spectroscopy. In the present work we study the influence of incorporated in the membrane carbon nanostructures (pristine or amide functionalized single wall nanotubes and nanoparticles) on the phase transition temperatures and enthalpies of SOPC phospholipid and discuss the possible physical mechanism driving the energetic and structural states of the bio-nano-composites. The authors acknowledge support from the Ministry of Education and Research, Bulgaria (National Science Fund, Grant DN 08-02/2016).

Keywords: Carbon Nanostructures, Structural and Thermal Properties, Lipid Membranes.

POSTER SESSIONS

Id-1626

Direct Graphene Growth on GaN and Au Materials Using the PECVD Method

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Abstract:
Continuous interest in graphene applications in optics and optoelectronics drives to develop alternative methods of obtaining high-quality graphene. Currently used methods of obtaining are based on the transfer of the graphene onto the target substrate. The consequence of such transfer can be lowering structural quality, and thus electrical and optical properties of the isolated graphene. These, in turn, limit the actual use of the defected graphene in optical applications, such as transparent conductive electrode (TCEs) in GaN-based light emitters or as a layers in Au-containing optical fibers. Therefore, the alternative methods of graphene obtain are still in demand. In this work, the plasma-enhanced chemical vapor deposition (PECVD) was used to graphene growth directly on GaN and Au substrates. This method does not require chemical isolation, and then transfer step of graphene, as well as using a metallic catalyst at all. The present work aim to examine the possibility of using PECVD method for obtaining graphene. The structural quality of the obtained graphene was observed using electron microscopy. The presence and overall optical characteristics were investigated by Raman spectroscopy. Raman investigations confirmed the formation of graphene via the presence of 2D mode. Investigations also showed the influence of growth time on graphene formation. These results are important for further development of graphene-based applications. This work was supported by the Research Foundation Flanders (FWO) under Grant no. EOS 30467715.

Keywords: Graphene, Plasma, PECVD.

Acta Materialia Turcica

International Advances in Applied Physics & Materials Science Congress (APMAS) 2020 Abstract Book

POSTER SESSIONS

Id-1659

Heat and Fire Properties of Low Smoke Zero Halogen Materials of Power Cables

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Abstract:
Presently, the need for special insulating and sheathing materials for power cables with zero halogen is in high demand due to safety and environmental issue. The LSZH materials are of either thermoplastic or thermoset materials and they emit low smoke and no halogen while burning. The emission of toxic and corrosive gas is very less in the case of LSZH cable sheathing materials and the environmental impact caused due to burning of LSZH materials is also very less. This kind of materials is gaining popularity and they are being used in the areas where there is poor ventilation and protection of people and equipment from toxic gases is most important. The objective of this study is to compare the three different LSZH materials for its basic fire and heat properties. In this paper three different LSZH materials are chosen for evaluating its fire properties such as Oxygen Index, Temperature Index, Halogen content and smoke density. All the three LSZH materials possess higher flame retardant property which is described by the Oxygen Index and temperature index values of the materials. In terms of smoke release, halogen content and toxic gas release the materials have very less emission and the halogen content of the materials is zero. In order to check the physical properties of the three materials, physical tests such as tensile strength and elongation at break of the materials are determined prior to ageing and after ageing. These results indicate that in all the three cases the tensile value of the materials are in the increasing trend compared to the before ageing samples. However, the elongation values are in the decreasing order compared to the before ageing samples. A higher percentage of elongation at break usually indicates a better flexibility of the materials. It is evident that with ageing the LSZH material tends to lose its flexibility. Further these three materials are evaluated for its heat release using cone calorimeter at two different heat flux inputs i.e. 25 kW/m^2 and 50 kW/m^2. The heat release values of the two LSZH materials are of almost same in terms of the heat release rate, total heat release and Average Rate of Heat Emission (ARHE) at both heat flux input 25 kW/m^2 and 50 kW/m^2. One of the LSZH materials shows higher heat release compared to the other two materials. The tensile strength and elongation values of the same material are on the higher side compared to the other two materials. Further the functional groups of the three LSZH materials are analyzed using FTIR and the resulting peaks are compared.

Keywords: Low Smoke Zero Halogen Materials, Power Cables, Heat Release.

POSTER SESSIONS

Id-1674

Heterogeneous Plastics Mixture Modified Bitumen Characterization and Properties

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Abstract:
Although mechanical recycling is the best option for the recycling of post-consumer plastics, some heterogeneous mixed plastics cannot be recycled to produce secondary material because of their very low properties. In this case, alternative routes must be taken into account for recycling, in order to limit as much as possible their disposal, in agreement with the circular economy's strategies. In this work, a heterogeneous mixed plastics sample coming from the separate collection in Italy is used as a modifier in bitumen for road construction. Polymer modified bitumen, PMBs, have proved, in fact, to be able to improve mechanical performances of the bituminous concrete once in pavement structures, both at high and low service temperature, depending on the type and content of polymer used. Therefore, the paper focused on the characterization of a road bitumen modified at different content of waste plastic, aiming at evaluating the feasibility of the modification itself as well as the characteristics of the modified binder that are of interest once in plant for hot mix production, i.e. stability, viscosity and mixing temperature.

Keywords: Waste Polymers, Recycling, Polymer Modified Bitumen, Road Pavements.

Acta Materialia Turcica

International Advances in Applied Physics & Materials Science Congress (APMAS) 2020 Abstract Book

POSTER SESSIONS

Id-1693

Novel Cobalt(II) and Titanium(IV) Containing Photocatalyst Derived from Phloroglucinol Carboxylic Acid

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Abstract:
A facile approach for the synthesis of nanoporous cobalt oxide, anatase, rutile, and mix of rutile-anatase phase, called as Degussa, through thermal decomposing of organometallic complex compounds of phloroglucinol carboxylic acid were used to treat water from the organic-harmful compounds. The procedure of transformation of the anatase phase of TiO_2 into nanotubes as acid-base treatment together with calcination was proposed, and it was shown that the rutile phase of TiO_2 is stable under the proposed conditions. The modification of the structures based on TiO_2 by Co^{2+} cations was performed by grinding and thermal decomposition of mixtures of titanium and cobalt complexes in the different ratio (10%-to-90%). Nanoparticles of titanium and cobalt mixtures were studied by SEM, EDX, XRD, and photoluminescence methods. The phase analysis of the powders could be detected with the XRD. It was indicated that in the residues of the samples containing small amounts of Ti-complexes some amount of Co_3O_4 nano-sized particles is found which concentration decreases up to the samples containing 50% of TiL_2 (L- phloroglucinol carboxylic acid). Samples with more than 50% of TiL_2 do not contain the Co_3O_4 phase. The $CoTiO_3$ phase was determined in all the samples although its concentration depends on the Ti-to-Co ratio and tends to increase in the mixtures containing from 10 to 60% TiL_2 and then decreases at higher concentrations of the Ti-complex in the initial mixture. The Anatase and Rutile phases were identified in all the samples. Thus, the multi-phase composition of the products of thermal decomposition of the mixtures containing TiL_2 and $CoL_2{\cdot}2H_2O$ in various ratios was proved by FESEM and XRD studies. Influence of cobalt doping titanium oxide nanoparticles was studied by photoluminescence method. and the sample containing Ti80%Co20% ratio was found the most proper ratio to absorb visible light. Finally, this sample was used as a photocatalyst to degrade bromophenol blue (BPB), as a harmful organic target, under visible light. The reduce in concentration of BPB to 82% after 120 min in presence of this sample was determined which showed it as a powerful photocatalyst to treat water under visible light. Funding for this research was provided by the Ministry of Education and Science of the Russian Federation (award no. 075-03-2020-223 (FSSF-2020-0017)).

Keywords: Photocatalyst, Titanium Dioxide, Water Treatment.

POSTER SESSIONS

Id-1697

Development of an Automated NDT System for Ceramic Ballistic Plates

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Abstract:

Ceramic ballistic plates are the key component of anti-projectile protection covers which are required to absorb the extremes of high energy impact. The purpose of this research is to present the results of the development of an inspection system to determine the reliability of these sintered parts. The paper presents some of the research into the non-destructive testing applications implemented in the newly designed in-line automated conveyor system, designed to ensure the reliability of these critical components. The physical size of the ceramic plates (40 x 30 x 5cm) and the plate profile raises numerous challenges, and the system combines the use of a high-resolution laser 3D profiler and a high-resolution 2D x-ray imagining technique, using dedicated image processing algorithms on a fully automated conveyor system. The processed laser and x-ray test data is used to determine important parameters, such as: 3D dimension, thickness, density mapping and defect sizing and positioning to achieve high levels of sensitivity and dimensional resolution (circa 60 microns). When integrated into high speed mass production, the rapid collection of valuable component integrity data adds significantly to maintaining the highest levels of quality control, and the conveyor process will be capable of high-speed high sensitivity production. The system measured plate parameters which are compared with acceptance values, and the rapid sample scanning, data acquisition and total accept/reject process takes around 30 seconds. Studies are underway to closely determine the exact material density, by further processing the correlation of laser thickness values and x-ray data.

Keywords: X-ray; Laser, Non-Destructive Testing, 3D-Image Processing, Automation.

POSTER SESSIONS

Id-1700

Generation of Electromagnetic Rossby-Khantadze Zonal Flow Under the Action of Mean Shear Flow in the Earth's Ionosphere

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Abstract:
Generation of large-scale zonal flows by the small-scale electromagnetic Rossby-Khantadze wave turbulence in the weakly ionized ionospheric E- and F-layers under the action of mean shear wind is considered. Latitudinal inhomogeneity of the Earth's angular velocity, geomagnetic field and mean flow is taken into account. It is shown that such system is unstable to a three wave parametric instability, whereby a coherent monochromatic pumping Rossby-Khantadze waves can drive a band of modes and associated zonal flow and magnetic field generation. The appropriate eigen-value problem is formulated. Influence of existence of charged particles through the Hall's and Pedersen's conductivities on such dynamic equations is studied in detail. Destabilizing role of mean shear flow is shown. The carried out investigation is supported through the grant No. 04/01 of 2017 Joint Call of Shota Rustaveli National Science Foundation of Georgia and the Scientific and Technological Research Council of Turkey (TUBITAK).

Keywords: Rossby Waves, Zonal Flow, Shear Flow, Ionospheric Layers.

POSTER SESSIONS

Id-1706

Catalytic Effect of Cobalt Catalysts in the Reaction of Hydrogenation of Ethylene-Containing Acetylene to Ethylene

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Abstract:
The process of hydrogenation of ethylene-containing acetylene to ethylene in an automated flow-through catalytic unit on cobalt catalysts has been studied. The effect of cobalt catalysts in the hydrogenation of ethylene-containing acetylene to ethylene on the amount of cobalt has been studied. The optimal conditions of the hydrogenation of ethylene-containing acetylene on the 7% Co / SiAl catalyst without ethylene loss have been determined. The effects of temperature, space velocity and the ratio of the initial components in the process of hydrogenation of ethylene-containing acetylene to ethylene have been investigated. The optimum temperature was determined - 140°C in the process of acetylene hydrogenation to ethylene at conversion of 93.0%. The conversion of acetylene increases to 81.2%, when the temperature rises to 200°C, but the conversion of acetylene decreases to 68%, with further increasing in temperature to 220°C. The conversion of acetylene again increases to 92.8% at temperature 140°C on 7% cobalt catalyst in the ratio of ethylene-containing acetylene to hydrogen 1: 2. The selectivity of 7% cobalt catalyst to ethylene was studied depending on the temperature in the acetylene hydrogenation reaction. The selectivity to ethylene decreases with increasing temperature as the temperature rise activates side reactions. The selectivity of the 7%Co/SiAl catalyst to ethylene was studied depending on the temperature in the hydrogenation reaction of ethylene-containing acetylene. The results of the SEM, X-Ray Phase Analysis and IR study are well consistent.

Keywords: Catalytic Unit, Hydrogenation, Acetylene, Ethylene, Catalysts.

POSTER SESSIONS

Id-1707

Application of IF-WS_2 Nanoparticles as Nanofluid Lubricant to Improve Load Carrying Capacity of Plain Bearings

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Abstract:
Hydrodynamic journal bearings have been widely used in heavy industry machinery to support rotating shafts due to their superior durability, low maintenance cost, and excellent load carrying capacity. Nanofluids have extensive applications in hydrodynamic journal bearings. Inorganic fullerene-like tungsten disulfide nanoparticles (IF-WS_2) are the most studied additive for lubrication purpose due to their excellent mechanical characteristics along with their effect on reducing friction and wear. In this work, a CFD simulation approach using realizable $k-\varepsilon$ turbulence flow model along with discrete phase modeling (DPM) of suspended nanoparticles was used to evaluate the application of the IF-WS_2 nanofluid lubricant on load carrying capacity of journal bearings in heavy industry where the normal loads are very high compare to the bearing dimensions. For accurate simulation, nanofluid viscosity was calculated using available empirical models, considering the aggregation effect of NPs. To characterize the aggregations of nanoparticles, scanning electron microscopy (SEM) imaging of the nanofluid samples were employed and then an in-house image processing was used to obtain the size distribution of the aggregates. A benchmark study was first performed to assess the model accuracy. Hydrodynamic lubrication was simulated under different nanofluid weigh fraction. The simulated pressure distribution was then used to calculate the load capacity of the bearing. The results show about 20% improvement of load capacity at 5% weight fraction of IF-WS_2-oil nanofluid.

Keywords: Nanofluid Lubricant, IF-WS_2 Nanoparticles, Journal Bearing, CFD Simulation, Aggregation.

ALL SUBMISSIONS & TOPICS

Topic	Submission
Magnetic materials	Id 1699 - Interlocking and Welding Effect on the Electrical Machines
Nanoscience and Nanomaterials	Id 1658 - Nanophosphors for Phosphor based White Light Generation
	Id 1693 - Novel Cobalt(II) and Titanium(IV) Containing Photocatalyst Derived from Phloroglucinol Carboxylic Acid
Graphene and 2D Materials	Id 1626 - Direct Graphene Growth on GaN and Au Materials Using the PECVD Method
Nanobiotechnology	Id 1622 - Interfacial Electron Transfer with Azurin at Au/SAM Junctions in Contact with a Protic Ionic Melt: Impact of Glassy Dynamics
	Id 1714 - Electrochemical Nucleic Acid Detection based on PNA Prob
Layered and Composite Nanostructures	Id 1623 - The self-assembled, Atomically Defined Bilayered Au/L-cysteine/Cu(II/I) Junctions Capable of Coherent Multiple Electron/Hole Exchange
Materials Science & Engineering	Id 1606 - Drilling Studies of High-Strength CFRP Composites Using Specialized Drills
	Id 1659 - Heat and Fire Properties of Low Smoke Zero Halogen Materials of Power Cables
	Id 1707 - Application of IF-WS_2 Nanoparticles as Nanofluid Lubricant to Improve Load Carrying Capacity of Plain Bearings
	Id 1710 - The technology for Producing Refractory Products based Metallurgical Production Waste

Polymers and Amorphous Materials	Id 1674 - Heterogeneous Plastics Mixture Modified Bitumen Characterization and Properties
	Id 1709 - Recycling of Painted and Varnished Akrilonitril Bütadien Stiren (ABS) Materials with Maleic Anhydrite Additives to Obtain ABS/PC Blend
Biomaterials	Id 1600 - Influence of Carbon Nanostructures on the Structural and Thermal Properties of Lipid Membranes
Nondestructive Evaluation of Materials	Id 1697 - Development of an Automated NDT System for Ceramic Ballistic Plates
Materials Characterization	Id 1582 - Material Characterization in the Microwave Range – Another Look to the Properties of Modern Artificial Dielectrics
Plasma Physics, High-Energy Physics and Particle Physics	Id 1613 - Plasma Studies in TÜBİTAK National Metrology Institute
	Id 1624 - Advances in UME Langmuir Probe
	Id 1700 - Generation of Electromagnetic Rossby-Khantadze Zonal Flow under the Action of Mean Shear Flow
Biotechnology	Id 1625 - Antimicrobial Peptides as a New Combination Agent in Cancer Therapeutics
	Id 1696 - Preliminary Idea for Bioalarm to Improve the Air Quality
Oil, Gas & Geosciences	Id 1706 - Catalytic Effect of Cobalt Catalysts in the Reactoon of Hydrogenation of Ethylene-Containing Acetylene to Ethylene