Book of Abstracts

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(APMAS 2018)

Oludeniz, Turkey

April 24-30, 2018

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INVITED SPEAKERS

Id-491

Free-standing Undoped Acceptor-rich ZnO Single-crystal Microtubes as Ultrathin-Walled Optical Microcavites

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Abstract:
Fabrication of large-sized *p*-ZnO is a major challenge to achieve ZnO-based homojunction electronic devices. Here we report a novel technique to fabricate high-quality free-standing undoped acceptor-rich ZnO (A-ZnO) microtubes with dimensions of 50-100 μm in diameter and >5 mm in length by optical vapour supersaturated precipitation (OVSP). The A-ZnO exhibits stable shallow acceptors related to Zn vacancies with binding energy of ~127 meV. It provides a possibility for a mimetic *p*-*n* homojunction diode with n^+-ZnO:Sn, where the diode threshold voltage, turn-on voltage, reverse saturated current and reverse breakdown voltage are 0.72 V, 1.90 V, <10 uA and > 15V, respectively. In addition, the wave-guided whispering-gallery modes (WG-WGMs) supported in the ultrathin-walled ZnO (UTW-ZnO) microtube is proposed. The excitation threshold for exciton-exciton collision is reduced to 0.28 mW in the microtube cavity, whereas the intensities of near-band edge (UV light) and *X*-band (blue light) emission increase at least one order of magnitude in a wide temperature range of 0-500^{o}C. As a result, the temperature-dependent visible luminescence from near white to bluish-violet is realized. The low-threshold UV lasing down to 5.50 μW is also achieved by WG-WGMs. Furthermore, the UTW-ZnO microtube enhances the catalytic performance for photodegradation owing to light harvesting via WG-WGMs as well as sufficient holes and electrons for extra oxidation-reduction reactions. The ZnO microtube catalyst is compatible to microfluidic channels for recyclable on-chip-degradation. The present work opens new opportunities to design novel tubular wide band-gap semiconductor devices for a variety of optoelectronic applications in micro/nano-photonics.

Keywords: ZnO Microtube, Optical Vapour Supersaturated Precipitation, Acceptor-rich, Optical Microcavity, UV Lasing.

INVITED SPEAKERS

Id-498

Controlling Ferroic Thin Films by Strain Doping

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Abstract:
Morphotropic ferroics have been of great interest for many years since the competition of their different crystal phases at so called morphotropic phase boundaries often leads to outstanding physical properties. Tuning external parameters such as the materials composition or mechanical pressure is the standard approach to functionalize these ferroic oxides. However, in thin films these external parameters are typically not accessible. Here, we demonstrate that strain doping via low-energy He implantation is an alternative, controllable, and highly flexible way to induce morphotropic phase transition in ferroelectric oxide thin films. Strain doping of multiferroic $BiFeO_3$ films leads to a gradual transition from a rhombohedral to a tetragonal-like phase that is not accessible by standard strain-engineering approaches. The changes in structure dramatically affect physical properties. We argue that our approach to tailor phase coexistence by strain doping is of general applicability and should be useful for a wide range of oxides with competing morphotropic phases. This effort was wholly supported by the US Department of Energy (DOE), Office of Basic Energy Sciences (BES), Materials Sciences and Engineering Division, with user projects supported at ORNLs Center for Nanophase Materials Research (CNMS).

Keywords: Strain doping, Multiferroics, Morphotropic

INVITED SPEAKERS

Id-508

Advanced Designed $La_{2-x}Pr_xNiO_{4+\delta}$ Oxygen Electrodes for SOFCs

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Abstract:
Solid oxide fuel cells (SOFCs) operating at ~ 600 °C are efficient energy-conversion systems for electrical power generation. In order to design novel optimized cathodes with improved mixed ionic-electronic properties, it is of high importance to control (i) the electrode microstructure and composition to obtain large surface areas, increasing the number of active sites for the oxygen reduction reaction, (ii) the electrode/electrolyte interface to enhance the charge transfer. The present work is focused on designing Pr doped lanthanum nickelates, $La_{2-x}Pr_xNiO_{4+\delta}$ (LPNO) with $0 \leq x \leq 2$ with the aim of finding the best compromise between chemical stability and optimized electrochemical performance. The double layer design consists of a stacking of two layers starting with a 3D tree-like microstructure (~20 μm thick) over a thin dense base layer (~100 nm) fabricated in one step by electrostatic spray deposition and then topped by a screen-printed current collecting layer of the same composition. This talk will end with our latest results incorporating a composite sub-layer to the double layer LPNO electrode, to investigate the role of the electrode/electrolyte interface. The correlation between microstructure, composition, interfaces and electrical properties is discussed in detail.

Keywords: SOFC, Electrostatic Spray Deposition, Impedance Spectroscopy, Nickelate, Microstructure

INVITED SPEAKERS

Id-515

Engineering of Magnetic Properties of Magnetic Microwires

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Abstract:

Studies of amorphous magnetic wires have attracted great attention owing to excellent magnetic properties such as magnetic bistability, excellent magnetic, mechanical and corrosion properties, Giant Magnetoimpedance (GMI) effect. Recent tendency in devices miniaturization stimulated development of thin (few micrometers diameters) soft magnetic microwires prepared using Taylor-Ulitovsky method. Excellent soft magnetic properties and GMI effect have been reported for properly prepared and processed Co-rich microwires. Less expensive Fe-rich microwires are preferable for the applications. But amorphous Fe-rich materials exhibit rather high magnetostriction coefficient and consequently present quite low GMI effect. The most common method for magnetic softness optimization is the annealing. From previous studies of Co-rich amorphous materials it is known that stress annealing can considerably affect the magnetic properties of amorphous materials. Consequently, the purpose of this paper is to present our recent experimental results on influence of stress- annealing on magnetic properties and GMI effect of Fe- and Fe-Co based glass-coated microwires. We observed that Fe-rich microwires annealed under stress at appropriate annealing conditions (time and temperature) can present low coercivity, considerable magnetic softening and enhanced GMI effect. For interpretation of observed changes of hysteresis loops after stress annealing we considered internal stresses relaxation and different mechanisms of stress-induced anisotropy. Observed versatile properties of stress annealed glass-coated microwires with enhanced and tunable soft magnetic properties make them suitable for technological sensing applications

Keywords: Magnetic Materials

INVITED SPEAKERS

Id-530

Annealing-stimulated Structural Transformations and Magnetic Phenomena in Metastable Perovskite Phases

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Abstract:

Formation of certain structural type in mixed ABO_3 oxides with a framework of BO_6 octahedra is determined by the relative size and the electronic configuration of the involved atoms, which dictates the type of chemical bonding. It happens that, in spite of the fact that the atoms formally fulfil the tolerance criteria, the desired perovskite composition does not form at ambient pressure and exists as a mixture of other phases or as a less compact (non-perovskite) phase. In many cases, the perovskite composition forms as a result of high-pressure synthesis and can be obtained as metastable phase by means of quenching under pressure. In such a way, new compounds and solid solutions including Bi-containing perovskites with ferroelectric and magnetic properties have been obtained. It was found that an annealing of metastable phases at temperatures below their decomposition limits often induces polymorphic transformations to other metastable phases. Thus, the same compound can obtained in different polymorphs, providing a unique opportunity to explore structure-properties relationship. We demonstrate such a conversion polymorphism, Pnma→R3c, Pnma→Ima2 and C2/c→Pnma, in solid solutions based on $BiFeO_3$. Peculiarities of crystal structure and magnetic behaviour of the respected polymorphs are compared and analysed.

This work was supported by project TUMOCS. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 645660.

Keywords: Metastable Phase, High-pressure Synthesis, Polymorphism

INVITED SPEAKERS

Id-534

Electronic and Superconducting Properties of Boron Based Nanostructures

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Abstract:

As the nearest-row neighbor of carbon, boron have similar structural features and rich electronic properties when forming nanostructures. In this talk, I will show that boron and boron-carbon nanostructures exhibit rich variety of electronic properties. We show that BCS superconductivity in the stable 2D boron structures is ubiquitous with the critical temperature above the liquid hydrogen temperature for certain configurations. Our results support that 2D boron structure may be a pure single-element material with the highest Tc on conditions without high pressure and external strain. Our results show that the adsorption energy of alkaline and alkaline earth atoms on BC_3 sheet is larger than the cohesive energy of the metal atoms themselves. Under a suitable external electric field, a considerable magnetism can be induced, accompanying with the emergence of magnetism the electric dipole moment of the systems change suddenly. Our results show that the system is in the vicinity of magnetic ordering which derives competing SDW, ferromagnetic orders and topological superconductivity. We show that the helical p+ip superconductor is the leading instability when weak repulsive interactions is introduced.

Keywords: Electronic properties; Magnetic states; Superconducting properties; Boron.

INVITED SPEAKERS

Id-535

Solidification of Monotectic Alloys and Effects of Electric and Magnetic Fields

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Abstract:
Monotectic alloys are a broad kind of materials. They are characterized by the appearance of a miscibility gap in the liquid state. When a homogeneous single-phase liquid is cooled into the miscibility gap, it transforms into two liquids. Generally, the liquid-liquid decomposition begins with the nucleation of the minority phase droplets (MPDs). These droplets then grow by the diffusion of solute in the matrix. They may also settle or float due to gravity (Stokes motion) and migrate due to a temperature or concentration gradient (Marangoni migration). These alloys have are good candidates for the development of the in-situ composites if one can control the liquid-liquid decomposition process efficiently. We worked on the solidification behaviors of monotectic alloys both experimentally and numerically in recent years. The results demonstrated that the continuous solidification technique have great future in the manufacturing of monotectic alloy composites; A static magnetic field can suppress the convection in the melt during the solidification and promote the formation of a homogenously dispersed microstructure; Applications of the electric current pulses (ECPs) cause an increase in the nucleation rate of the MPDs and promote the formation of a well dispersed microstructure for the alloys whose MPDs have a higher electric conductivity compared to the matrix liquid; A direct current (DC) may be used to control the spatial motions of the MPDs during the liquid-liquid decomposition. The solidifications under the effect of a properly selected DC may cause the formation of the monotectic alloy wires with a core/shell composite structure.

Keywords: Monotectic Alloy, Solidification, Modelling, External field

INVITED SPEAKERS

Id-543

Colossal Magnetoresistance in Phase-separated Manganites

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Abstract:
In this communication, we will investigate the colossal magnetoresistance (CMR) exhibited by half-doped polycrystalline manganites. These systems are characterized by several physical phenomena like charge ordering, training effect and phase separation. CMR materials can be used for spintronics, data storage, temperature and magnetic field sensing. Around the electrical transition temperature, half-doped manganites demonstrate negative CMR values above 70% for only 1T applied magnetic field, which indicates the possibility of using these samples for several technological applications. The importance of CMR effect for such field values can be ascribed to the magnetic phase separation phenomenon characterizing these samples.

Keywords: Manganite, Magnetoresistance, Charge Ordering, Phase Separation

INVITED SPEAKERS

Id-553

The Analysis of Device Degradation While Being Driven in the Oxide Semiconductor

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Abstract:

Oxide semiconductors as the active layer have attracted much attention for various applications including display due to their high electrical and optical characteristics available. Indeed, InGaZnO, as a representative, has been adopted as an active material in the backplane of high-resolution display in mass production since 2012. Here we report the device instability under the AC bias stress on the drain of thin-film transistors (TFT) which may be one of the main origins of the failure of integrated circuits (providing the control signal for the gate in the active matrix). The effects of the driving frequency, pulse shape and the strength of lateral electric field as well as the channel current are investigated. This investigation reports that the device degradation is accelerated drastically by transient current such as the pulse shape and frequency as well as the the strength of the lateral electric field. The variation of the current profiles based on test conditions is related to the generation of local defect states in the oxide material; this generation could be caused by the structural change of the material. We believe that these findings should be considered for the reliable design of integrated circuits which consist of oxide semiconductor TFTs, such as gate driver circuits in the active-matrix display device.

Keywords: Oxide Semiconductor, Degradation, Hot Electron, IGZO

INVITED SPEAKERS

Id-566

Topological Transition Points of a Magnetic-semiconductor Periodic Structure in an External Magnetic Field

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Abstract:
In general, the propagation of electromagnetic waves inside a material is defined by both the dielectric permittivity and magnetic permeability tensors. The ability to control both the electric permittivity and magnetic permeability gives a full flexibility for the dispersion engineering for any arbitrary polarization. This opportunity can be realized by properly combining together of gyroelectric (e.g. semiconductors) and gyromagnetic (e.g. ferrites) materials within the single structure. Such coexistence within the same metamaterial brings a number of interesting physical phenomena. The characteristic resonance frequencies of gyroelectric permittivity and gyromagnetic permeability usually occur in the THz and microwave frequency ranges, respectively. These resonances cause a topology transitions in the corresponding constituent materials, while differently affecting the topological properties of the entire structure, which depend on a number of parameters. The characteristic frequencies of gyroelectric and gyromagnetic materials can be closely spaced within the same frequency band, which may results in a number of optical topology transition phenomena. Therefore, in the current report we study the topological properties of the superlattice, which consist of ferrite and semiconductor layers. We assume that the whole structure is placed into an external magnetic field, which causes a change in the anisotropy of the constituent materials. In anisotropic metamaterials the isofrequency surface of the dispersion relation may become hyperboloid under the certain conditions, forming the structures called hyperbolic metamaterials (HMM). Despite the fact that hyperbolic topology can be found in natural anisotropic media, there is a considerable interest in creating artificial structures (metamaterials) possessing desired functionality.

Keywords: Magnetic Materials.

INVITED SPEAKERS

Id-579

Study of Kesterite Phase Evolution in Chemical Bath Deposited Cu_2ZnSnS_4 Thin Films for Photovoltaic Applications

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Abstract:

In recent years Cu_2ZnSnS_4 (CZTS) based thin films have emerged as a top candidate for thin film solar cell applications, the reason being their tunable bandgap and high absorption coefficient in the visible spectrum in addition to the cost competitive, earth abundant and non-toxic constituents. Unlike the more matured absorber layer $Cu(InGa)S_2$ in thin films solar cells, however, CZTS single phase exists within a much smaller stoichiometry range, implying complicated reaction pathways for the formation of the single phase. The tendency to form binary phases, selective re-evaporation of elements from the film, reaction at contacts, etc. further make it difficult to control the intended composition and the formation of single phase. Therefore, designing deposition processes those are simple and cost-competent, and yet, yield films of intended properties is quite challenging. While solution based techniques have been accepted as the industrially viable ones for large scale production, use of hydrazine, which has yielded the highest efficiency for the CZTS based solar cells, has limited its acceptability. Here, we demonstrate facile growth of the CZTS films from simple non-toxic metal salts (copper chloride, zinc chloride, and tin chloride) in ethanol and monoethanol amine (MEA) and thioacetamide in ethanol as sulfur source from a chemical bath followed by post-sulfurization of the as-grown films at temperatures ranging from 300 to 550 °C. Differently with the available literature, we have explored the role of the chelating agent (MEA, in this case) and the reaction pathways leading to the formation of phase pure stable kesterite CZTS. Detailed XRD and Raman measurements reveal that the as-grown films consists primarily of crystalline Cu_2S phase and the subsequent sulfurization results in the formation of CZTS phase via an intermediate Cu_2SnS_3 phase. Phase pure CZTS films could be obtained at a sulfurization temperature of 500 °C.

Keywords: Thin Film Solar Cell, Semiconductor Thin Films, Kesterite

INVITED SPEAKERS

Id-587

Microwave Spectroscopy of Ferroelectrics and Related Materials

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Abstract:
The dielectric response of materials provides information about the orientational adjustment of dipoles and the translational adjustment of mobile charges present in a dielectric medium in response to an applied electric field. Microwave and terahertz dielectric spectroscopy of ferroelectrics and related materials enables the independent determination of the dielectric permittivity and loss in the dispersion region, as well as the parameters of the soft modes related to phase transitions. Besides scientific purposes, microwave dielectric measurements are of increasing importance in telecommunications related applications and the design of microwave circuit components. The magnetic properties are also of crucial importance. Dielectric and magnetic parameters fully characterize the manner in which electromagnetic waves propagate within the medium. The difficulties of making measurements on a wide range of materials over a wide frequency (and temperature) range have led to the development of various direct and indirect methods. Computers allow the computation of electromagnetic fields in entirely new measurement geometries and the use of numerical analysis in the direct measurement process. Each investigator employs the method adequate for the size and shape of a sample. The most important problem now is the rigorous mathematical solution of the microwave interaction with the samples in various geometries. Although there is now complete overlap and coverage of the radio frequency to the infrared band, the different experimental methods based on coaxial, waveguide, resonator and free – space technique is still divided and will be presented. Examples of different ferroelectric materials broad band dielectric spectroscopy results will be presented.

Keywords: Dielectric Spectroscopy, Microwaves, Phase Transitions, Multiferoics

INVITED SPEAKERS

Id-600

Boosting of Thermoelectric Parameters of VO_2 Nanofilms

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Abstract:

Bulk pristine vanadium dioxide (VO_2), a strongly correlated system, undergoes extremely useful reversible first-order semiconductor to metal phase transition (SMT) at 341 K temperature which stands nearest to the room temperature in comparison to any other thermochromic material discovered so far. This has made VO_2 a promising material not only for basic understanding of correlated electron systems but also for a large gamut of modern-day technological applications such as infrared optical systems, light modulators, optical switches, smart windows and smart radiators for spacecrafts and photonic crystals. One of the immensely important parameters in thermoelectronics is power factor, $P = S^2/\rho$, where S is the Seebeck coefficient and ρ is the electrical resistivity. Thus, to achieve a better thermoelectrical performance, a large value of S and small values of ρ are desired and both are interdependent through carrier concentration (n). Although, in the semiconducting phase, VO_2 shows practically good value of S; however, high value of ρ results in overall low value of P. For practical thermoelectrical applications, it is needed that ρ of VO_2 should be depressed without affecting S. The goal of this presentation is to examine the impact of quadruple effects viz. quantum size effect, doping effect, radiation effect, and a joint response of the doping and quantum size effects on thermoelectrical and electrical transport properties of 15 nm nanofilms and 290 nm microfilms across SMT of VO_2. The presentation has been showcased with a focus on these effects by comparing results on resistivity, Hall Effect, and Seebeck coefficient and related discussions and conclusions.

Keywords: Nanofilms, Thermoelectric Properties, Vanadium Dioxide, Semiconductor To Metal Phase Transition

INVITED SPEAKERS

Id-604

The Nanofabrication and Unique Properties of Graphene/Diamond Nanocone Arrays

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Abstract:
Three-dimensional (3D) nanostructures and nanodevices such as optoelectronic devices, nanosensors, biological information detectors, plasmonics and quantum devices, have attracted tremendous interest in the past few years due to their unique properties, which generally present excellent functional properties than those of planar nanodevices. In this work, we also designed and fabricated a 3D hierarchical structure of flower-like few-layer graphene nanosheets (GNSs) grown on diamond nanocone arrays (DNAs). The flower-like GNSs is synthesized by hot filament chemical vapor deposition, and DNAs are fabricated by maskless ion bean etching. The results indicated that the 3D hierarchical structure enhanced obviously the surface's wettability into a large contact angle state with ultrahigh adhesion, which provide a strategy to understand the ultra-adhesive mechanism of the "rose effect" and enhance the wettability of graphene for many practical applications.
Keywords: Nanofabrication, Diamond, Graphene, Nanocone

INVITED SPEAKERS

Id-609

Electronic Properties of Two-dimensional Materials Studied by Mixed-basis Density Functional Approach

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Abstract:
A mixed basis approach based on density functional theory (DFT) is employed for studying one- and two-dimensional systems such as carbon-dimer chain, carbon nanotube, graphene, graphene nanoribbon, semiconductor surfaces, and MoS_2 sheets. The basis functions are taken to be plane waves for the periodic direction multiplied by B-spline functions in the non-periodic direction. B-splines are localized real-space functions, which are low-order polynomials, possessing easy treatment for derivatives. They are flexible, making the geometry optimization easy to implement. With this mixed basis set we can calculate the total energy of a finite-width slab or finite cross-section wire directly without resorting to the supercell as in the conventional plane-wave based DFT code. All the resulting electronic structures were found to be in good agreement with those obtained by the VASP code, but with a reduced number of basis functions. Another advantage of the mixed-basis code is the easy treatment of charged systems such as positively charged carbon-dimer chain. The spurious Coulomb interaction between the charged defect and its repeated images which appear in the supercell approach can thus be avoided. The resulting electronic structures and optical properties are presented and discussed. The van der Waals (vdW) density functional was implemented in the mixed basis approach, and the binding energy between two layers graphene sheets calculated are consistent with data reported earlier. It is found that, due to the relatively weak vdW interaction, the charge density obtained self-consistently for the whole bi-layer graphene system is not significantly different from the simple addition of those for the two individual one-layer systems. Thus, we expect that the rigid-density approximation can be suitably applied to study the moire pattern of transition-metal dichalcogenides (TMDs) stacked on graphene.

Keywords: Graphene, Graphene Nanoribbon, MoS_2, DFT, Van der Waals

INVITED SPEAKERS

Id-622

Functional Fe-based Ferromagnetic Composite Materials with Novel High-frequency Behavior

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Abstract:

In recent years, high frequency magnetic material has been widely investigated, as it wipes a wide field of application, such as communication system, local area network, and so on. Traditional ferromagnetic materials had a major challenge of improving complex permeability while suppressing complex permittivity at high frequencies due to the Snoek limit of magnetic inclusions and impedance matching requirement. Great efforts have been made to reset-up the relationship and expand the potential. The main concern roots in the morphological control of magnetic inclusions and their composites. The highly alignment of elements, balance between μ and ε, and active control are the ever-lasting targets. In our high-frequency composite study, flexible paper-like composites with high permeability at microwave were successfully fabricated by FeSiAl flaky particles (FFP) and cellulose nanofibers (CNF) through a filtration-assisted self-assembly method. This kind of magnetic composite can be compressed to under 30 μm thick and folded over 3 times. Filtration process realizes the high packing ratio of flaky particles with ideal alignment by the assistance of hydrostatic forces. As a result, the complex permeability increases vastly to over 13-8j with a decreasing complex permittivity. An absorption over -6 dB is obtained in L-band with 1 mm thickness. Due to the favourable electromagnetic properties, flexibility and easy-fabrication, this kinds of magnetic composite may be used for flexible electronics. On the other hand, 2-2 multi-iron heterostructures were prepared on the piezoelectric substrate by magnetron sputtering for active control of high-frequency permeability. The composite structure is composed of FeCoB/SiO2/FeGaB multilayer films or FeCoB-SiO_2 nano granular films. In order to overcome the mismatching between the dielectric constant and the magnetic permeability, the stress transfer mode of heterostructures was proposed by the strain response of piezoelectric strain under the electric field. These kinds of framework realize the tuning of ferromagnetic resonance frequency and amplitude value of μ by E-fields in a certain frequency range and provided a new effective method for balancing the dielectric constant and the magnetic permeability.

Keywords: Magnetic Composites, High-frequency Permeability, Flexible, Multi-iron Heterostructure

INVITED SPEAKERS

Id-632

Hybrid Non-Isocyanate Polyurethanes (HNIPU)

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Abstract:

Mechanical and physical-chemical characteristics of NIPU are inferior to conventional PU, so almost immediately after the first reports of NIPU started developing of hybrid compositions (HNIPU), namely: subsequent cross-linking the resin by reacting with a poly-functional reactant (P4); combining NIPU with epoxy resins and amine hardeners (P5, P6). HNIPU is a modified polyurethane with lower permeability, increased chemical resistance properties and material synthesis that does not use the toxic isocyanate at any stage of production. An intermolecular hydrogen bond is formed during HNIPU synthesis that improves hydrolic stability well above that of conventional polyurethanes. Materials that contain intermolecular hydrogen bonds display chemical resistance 1.5 to 2 times greater than materials of similar structure without such bonds. Synthesis of HNIPU is safe and easy and hardens at ambient temperature without using toxic components in the process. Due to its superior structure and excellent resistance to degradation. HNIPUs are ideal for numerous application including crack-resistant composite materials, chemically resistant coatings, industrial flooring sealants, glues etc. Its outstanding properties are beneficial to many different industries. Practical application of HNIPU on the basis of the epoxy-amine compositions and five-membered CC (1,3- dioxolan-2-ones) in coatings, sealants, adhesives, etc. were largely developed by O. Figovsky, V. Mikheev, V. Stroganov et al. in the 1970-1990's. Recently Polymate Ltd. developed a new hybrid epoxy-amine hydroxyurethane network polymers with lengthy epoxy-amine chains and pendulous hydroxyurethane units. The cured linear hybrid epoxy-amine hydroxyurethane-grafted polymers by novel structure have a controlled number of cross links and combine increased flexibility with well- balanced physical-mechanical and physical-chemical properties of conventional epoxy-amine systems. In particular, new materials have tensile strength up to 12 MPa and elongation at break 70-275%. They may be used for various applications, for example, for manufacturing of synthetic/ artificial leather, soft monolithic floorings and flexible foam.

Keywords: Non-isocyanate Polyuretanes Epox-amine Composition Coatigs, Flooring

INVITED SPEAKERS

Id-636

Dual-*k* Spacer Engineered FinFETs for High Performance (HP) Memory

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Abstract:

FinFET technology has emerged as a major milestone in the field of nano-electronics after the announcement by leading semiconductor industry to use the tri-gate transistors commercially in the 22 nm technology node. In order to keep pace with Intel and TSMC, 10 nm and 14 nm FinFET process nodes are rapidly emerging as preferred choice. In this paper, we focus on the novel device architecture abbreviated as dual-*k* spacer FinFET that intelligently uses the high permittivity spacer targeting for high-performance device-circuit co-design and its immunity to random statistical and structural variations. The dual-permittivity spacer concept and the optimization strategy are presented for the tri-gate FinFET device under study. We also describe the proposed symmetric and asymmetric dual-*k* architectures, their fabrication methodology and superior on- and off-state electrostatics over the conventional (single/low-*k* spacer) as well as the purely high-*k* spacer underlap FinFET structure. We also present the role of fringe capacitances associated with proposed dual-*k* architectures that demonstrates the suitability of high-*k* spacer materials for improving noise-margin and delay performances, simultaneously. Motivated by the superior device/circuit electrostatics, we further explore the possibility of the proposed symmetric and asymmetric dual-*k* architectures for augmenting the SRAM design metrics such as SNM, read/write access time, and the total leakage power. Furthermore, we investigate the tolerance of symmetric and asymmetric dual-*k* spacer architectures and its SRAM performance by random statistical and structural parametric variations.

Keywords: Semiconductors Physics and Devices

INVITED SPEAKERS

Id-648

The Nature of the Magneto-Electric Coupling in Artificial Multiferroic Oxide Layered Ferrite/$BaTiO_3$ Systems As Revealed By Synchrotron Radiation Techniques

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Abstract:
Multiferroic materials are of high technological interest because they are expected to become key components of genuine devices in fields as important as spintronics, sensors, multiple state memory cells, energy harvesting etc. Within the technological context magneto-electric multiferroics having simultaneous magnetic and electric long range orderings are particularly relevant. Artificial multiferroics obtained by combining a ferroelectric and a ferromagnetic material are a promising route to overcome the lack of intrinsic single phase multiferroics. We considered a combination of epitaxial thin films of $BaTiO_3$, which is the prototypical ferroelectric material, and ferrites over-layers ($NiFe_2O_4$ and $CoFe_2O_4$), which are respectively moderately and highly magnetostrictive. These combinations are of practical interest since all ordering temperatures are above room temperature and the compounds are fully oxidized and highly stable. Structural cross coupling could be evidenced by surface X-ray diffraction measurements and electrical polarization revealed a spectroscopic response. Moreover, the layers were electrically polarized by using local pattern writing with Piezo-Force Microscopy (PFM) and we studied the ferroelectric and magnetic response of the individual layers by spectromicroscopy. Our observations show that the chemical, ferroelectric and ferromagnetic contributions are highly entangled leading to coupling mechanisms that have not yet been taken into account in the description of the magneto-electric coupling.

Keywords: Multiferroics, Oxide, Synchrotron, Magnetoelectric Coupling

INVITED SPEAKERS

Id-650

FinFET Technologies and Trends in Evolution

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Abstract:
As the technology egress the design of the circuits becomes more complex. These circuit designs are engraved over the wafer using several technologies like CMOS technology, SOI technology and FinFET technology. CMOS technology is most advent and used for circuit design. As per the Moore's law the numbers of integrated circuits per unit area are shooting up every year which in turn leads to scaling of the transistors. In CMOS technology the transistors are operated based on the control voltage over the channel. Channel plays a crucial role in the transistor operation as the control voltage changes the potential difference along the channel makes it to work. As we discussed earlier the channel of the transistor is scaled down drastically in order to decrease transistor dimension, reduction of channel to a degree has not affected the desired performance of transistors in CMOS technology. But further reduction of channel lead to the short channel effects like channel length modulation, body effect, sub threshold conduction and drain induced barrier lowering. This in turn leads to the deviation of ideal characteristics of the transistors in CMOS technology for this adverse deviation of characteristics we need to have more control over channel even if the length of channel gets reduced. In order to have more control over channel length we step towards FinFET technology. In FinFET technology the channel of transistor is controlled by wrapping the gate around the channel having more control over the channel even if the transistor gets scaled down. FinFet's initially designed as double gate structures and as the technology advanced trigate FET came into existence with the 3D structuring of FinFET. Here a thin Silicon Fin acts as a channel covered by gate on three sides over the substrate. Source and drain regions in the vertical Fin are not covered by gate. The source and drain region over the substrate in FinFET consists of Silicon Fin, extension implant and polyoxide, since the gate is surrounded the channel from three sides the width of transistor consist of three components they are Fin height on both sides and the Fin width. There are two processes to etch Fin into silicon, subtractive Fin and replacement Fin. In Subtractive Fin process FinFET are fabricated on the silicon substrate. The Si substrate is capped with a layer of SiN and over which a Si hard mask is placed. Generally the process used for patterning is Self Aligned double Patterning (SADP) using this we place the mandrel and spacers on the Si hard mask and etch the spacers into the Si hard mask.

Keywords: CMOS technology, FinFETs, Low Voltage Leakage, Short Channel Device, Low Gate Delay

INVITED SPEAKERS

Id-659

Nanoscopic Investigation of Multiferroic Composite Ceramics

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Abstract:

Materials showing the magnetoelectric (ME) effect, have attracted significant attention due to a number of potential applications. The large ME effect at room temperature has been observed in composite multiferroic materials that consist of piezoelectric and magnetostrictive phases. The ME effect in such case is mechanically mediated at interfaces between the phases. As a result the macroscopic ME response depends strongly on the coupling at the local scale in vicinity of the interfaces. Here we present an approach towards studying the magnetoelectric coupling at the nanoscale using scanning probe microscopy (SPM) methods. We addressed both the direct and converse ME effect in multiferroic composites consisting on magnetostrictive hexaferrite ($BaFe_{12}O_{19}$) or spinel ferrite ($CoFe_2O_4$, $NiFe_2O_4$) phase and ferroelectric ($BaTiO_3$) phase. We studied the effect of a magnetic field on the local polarization and ferroelectric domain structure using piezoresponse force microscopy (PFM). We also looked on variation of the magnetic structure in an electric field by using magnetic force microscopy (MFM). PFM reveal that the local piezoelectric coefficient is modulated by the magnetic field, which may be considered as the intrinsic ME effect. To map regularities of the local coupling the principal component analysis method is applied. Furthermore, we find that the magnetic field affects the polarization switching kinetics. Strength of the local ME effect is maximal in the vicinity of the interfaces between piezoelectric and magnetostrictive phases, which agrees well with the strain–stress mediated mechanism of the ME coupling for these composites. For the converse ME effect we observe irreversible changes of magnetic domain configurations under the electric poling. The effect depends on the grain size distribution, homogeneity of the phase distributions, and relative grain orientations. Analysis of the magnetic domain wall displacement revealed a hysteretic change in the magnetization, which could be rationalized by existence of localized concentration of defects.

Keywords: Multiferroic, Piezoresponse Force Microscopy, Magnetoelectric Effect

INVITED SPEAKERS

Id-685

Properties of MOCVD-grown InGaN/GaN MQW LEDs without Using Hydrogen Carrier Gas

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Abstract:
By metal-organic chemical vapor deposition (MOCVD) technique, 3-period $In_{14}Ga_{86}N/GaN$ multiple quantum well (MQW) light-emitting diode (LEDs) were grown on special templates. Only N_2 as a carrier gas was used to grow the entire LED structure including the n-GaN, InGaN MQW active region, and p-GaN epitaxial layers. Due to the thermal properties of chosen carrier gas, the growth temperature was accordingly optimized. Subsequently the growth, fabrication and characterization of the LEDs were methodologically investigated. According to the analysis based on SEM and XRD, with an In composition of x=14%, the thicknesses of the well and barrier in the $In_xGa_{1-x}N/GaN$ MQW active region were estimated to be 2.5 nm and 8.5 nm, respectively. Optical properties of the LED were investigated using the depth-resolved cathodoluminescence technique at room temperature. Furthermore, electroluminescence output of the LED was evaluated. Finally, the only-N_2 carrier gas-grown LED structure was compared with a reference LED which was grown with a typical recipe using a mixed carrier gas of N_2 and H_2. It was observed that the LED structure grown with nitrogen-only carrier gas had superior electroluminescence.

Keywords: Optoelectronics, Quantum Electronics

INVITED SPEAKERS

Id-700

Spintronics Based on Antiferromagnetic Materials

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Abstract:

The spin-transfer torque (STT) influences not only the magnetization in ferromagnetic materials (FM), but also acts on magnetic order parameter in antiferromagnets (AFM), which open a way to control/excite spin dynamics in AFM by electrical current through spin-orbital related phenomena, such as spin-Hall effect. In contrast to the FM-based devices, which properties are controlled by the external magnetic field, the spin dynamics in AFMs is predominantly determined by the exchange interaction and the magneto-crystalline anisotropy. These interactions define ultra-high frequencies of the spin waves and mutual transduction of the angular momentum between the magnetic subsystem and a lattice of the AFM. We demonstrate, that the above features of the AFMs can be utilized in the fundamentally new spintronic devices, such as spin-current invertors and high-efficiency spin-current rectifiers. We also propose a design of a THz-frequency signal generator based on a layered structure consisting of an electrically driven heavy metal (Pt) and a layer of an AFM with biaxial anisotropy. A spin-current flowing from a DC-driven Pt layer and polarized along the hard AFM anisotropy axis excites a non-uniform in time precession of magnetizations sublattices in the AFM, due to the presence of in-plane AFM anisotropy. The frequency of the AFM oscillations is controlled by the applied electric DC and varies in the range of 0.1–2.0 THz for usual AFM materials. The THz-frequency signal from the AFM is picked up by the inverse spin-Hall effect in Pt.

Keywords: Antiferromangnetic, Spin Current, THz Spintronics

INVITED SPEAKERS

Id-711

Electrical Resistivity and Thermodynamic Properties of the Ferromagnet Nd_2Pt_2In

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Abstract:

The Nd_2Pt_2In compound was investigated by means of electrical resistivity $\rho(T)$, heat capacity $C_p(T)$, magnetic susceptibility $\chi(T)$, magnetization $M(\mu_0H)$ and magnetocaloric effect (MCE). The compound orders ferromagnetically at T_C = 16 K with a second - order phase transition. In the ordered state, $\rho(T)$ can be represented in terms of ferromagnetic (FM) spin - wave dispersion with an energy gap Δ_R = 13(1) K in zero field. In concert, the $C_p(T)$ data in this region can be well described by the same model getting Δ_C = 7.6(3) k in zero field. Above T_C, the $\rho(T)$ variation is characteristic of electron - phonon interaction in the presence of *s-d* scattering, while $C_p(T)$ follow the standard Debye formula with the Debye temperature θ_D = 152.44(2) K. The 4*f* - electron specific heat shows a Schottky - type anomaly around 60 K associated with crystalline - electric - field (CEF) with energy splitting Δ_1 = 145(7) K and Δ_2 = 195(13) K of the Nd^{3+} (J = 9/2) multiplet, that we associated with the first and second excited state of Nd^{3+} -ion. At high temperatures $\chi(T)$ data follow the Curie - Weiss relation giving an effective magnetic moment μ_{eff} = 3.61(2) μ_B and a Weiss temperature θ_p = 17(1) K. The magnitude of MCE was estimated from the isothermal magnetization data to be 6.25 J/(K.kg) for a field change of 7 T. The characteristic behaviour of the isothermal magnetic entropy change points to a second - order character of the FM phase transition.

Keywords: Ferromagnetism, Magnetocaloric Effect, Heat Capacity, Spin-wave, Electrical Resistivity, Magnetic Susceptibility

INVITED SPEAKERS

Id-725

Space Charge Lenses and Their Application

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Abstract:
The space charge lenses intended for focusing of ion beams, for the first time have been offered by D.Gabor in 1947. Their optical force on 2 orders of magnitude exceeds optical force of electrostatic and on 4 orders of magnetic lenses with other things being equal. The basic advantage of Gabor lens, besides high optical force, consists in ability to focus intensive ion beams as an ion space charge does not deform initial distribution of potential in a lens, created by a space charge of compensating electrons. Theoretical and the experimental research of Gabor lenses have led to creation of the plasma optics - new section of plasma physics (A.I.Morozov, Russia). These lenses are successfully applied to focusing of high current and high energy ion beams, and also beam of heavy ions. Use of space charge lenses is of interest for additional heating of thermonuclear plasma in installations TOKAMAK at injection of intensive ion beams with their subsequent neutralization. Gabor lenses, owing to accumulation of slow ions at ionization of residual gas, not optimum distribution of a magnetic field and other reasons possess enough a high spherical aberration. This reduces quality of focusing and in the certain cases limits current passing of beams through channels. In the present report opportunities of reduction in a spherical aberration of space charge lenses are considered at extraction of gas ions from duoplasmatron and metal ions from liquid metal ion source. In the first case the lens is filled by electrons as a result an ion-electron emission from walls of the metal compensator, in the second - as a result of thermoelectron emission of a heated spiral (that is the electric field in a lens is formed irrespective of an ion beam and this is of interest for focusing of pulse ion beams).

Keywords: Ion Beam, Gabor Lens, Plasma Optics

INVITED SPEAKERS

Id-731

Properties Prescribing and Control of Direct and Inverse Opal Metamaterials Doped with Spinels, for MEMS Applications

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Abstract:

We have focused on MEMS based on metamaterials with artificial opals (synthetic opals self-organized into a cubic lattice), direct and inverse (complementary structures), with applications like optical modulators; optical sensing, miniature antennae, novel waveguides, subwavelength imaging, nanoscale photolithography, photonic circuits, etc. Adaptive nanostructured metamaterial structures are difficult to be realized and our study is performed for design optimization, using and describing of the new phenomena, and synthesis of metadevices. The analyzed structures represent magnetic-dielectric photonic crystals, structured of SiO_2 nanospheres (opal matrices) with inserted nanoparticles of ferrite spinels (clusters of crystalline phase) in the inter-sphere voids (5 ÷ 60 nm inclusions, 3–7 vol%). Electrically active nanoparticles have been also considered. They are magnetic/electric field-driven devices, of centimeter and millimeter wavebands (at microwave frequencies). Different methods of introducing inclusions in opal have been considered, described in literature (impregnation, nanoparticle melts or solutions, etc.). A structural simulation analysis was performed (HFSS program), using a test configuration with metamaterial sample inside a rectangular waveguide, propagation mode TE_{10}, at working frequencies of 20 ÷ 40 GHz, with a DC pre-polarization field of 0 ÷ 20 kOe. Frequency dependent electromagnetic parameters have been determined, computed with their real and imaginary components. Frequency dispersion of inductivity, conductivity, effective permeability and permittivity have been represented on parametrical curves (with parameters like: inclusions concentration, substrate viscosity, applied field, etc.) and controlled function of the nanometric structure. For specific structures, ferromagnetic antiresonance was obtained, controllable by the pre-polarizing field value. Phenomenon is used for microwave devices controlled by a magnetic field, working on the basis of resonant and antiresonant phenomena, like attenuators, filters, etc. We have selected the frequency domains above the antiresonant frequency, starting from its vicinity, in which the effective permittivity, respectively permeability are negative.

Keywords: Photonic Metamaterials, Opal Matrix, Ferrite Inclusions, Ferromagnetic Antiresonance, Modulated Structure

INVITED SPEAKERS

Id-732

Photovoltaic Properties of Some Lead Free (KNN) and Led Based (PFN and PFW) Multiferroics

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Abstract:
Single phase multiferroic semiconductor materials, that present typical ferroelectric ordering coexisting with magnetic ordering, are being intensively investigated, viewing to the coupling between spontaneous polarization and magnetization (magnetoelectric effect - ME) and photovoltaic properties. Multiferroic and photovoltaic materials have traditionally been investigated separately, although the coupling between light absorption and ferroelectricity has been known for years. Multiferroics semiconductors may present a bandgap that is significantly lower than that of classical ferroelectrics, due to the pronounced electron-electron coupling, allowing combining ferroelectric properties with a low bandgap semiconductor material offering excellent options to tune photovoltaic properties. The efficiency of light conversion to electric energy (photovoltaic effect) in these materials can be modified by new techniques of synthesis, by suitable doping and sample conformation. In this presentation will be presented and discussed semiconductor e photovoltaic properties of some lead free (KNN) and led based (PFN and PFW) multiferroics bulk and thin films. High density bulk ceramics samples were obtained through conventional or Spark Plasma Sintering technique (SPS). Thin films were grown by RF sputtering. The influence in electric, dielectric and photovoltaic properties of oxygen vacancies, generated during the sintering, have been investigated. Different oxidation treatments were used to change the amount oxygen vacancies. Transport properties of domains and domain walls were investigated macroscopically, with conventional I-V techniques, and microscopically, using conductive atomic force microscopy (c-AFM). UV-Vis spectra of surface reflection revealed a remarkable dependence of the light absorption and, consequently, in the optical bandgap on the processing procedure.

Keywords: Ferroics, Ferroelectrics, Multiferroics, Photovoltaics

INVITED SPEAKERS

Id-741

Design and Development of Zirconium Tungstate Based Nanocomposite as IR Window Material

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Abstract:
Cyclic heating and cooling of components during service results in differential change in dimension due the differential coefficient of thermal expansion (CTE) of the materials used for different components and geometric constrains. This results in development of stresses which causes the materials to degrade and eventually fail due to fatigue. One viable way to avoid this kind of failure is to tailor the CTE of the materials. Compounds having negative coefficient of thermal expansion (NTE) can be utilized for the synthesis of composites having tailored coefficient of thermal expansion (CTE). Cubic ZrW_2O_8 is known for its isotropic NTE stable 1105<T<1257°C and is metastable up to 777°C. Metastable ZrW_2O_8 undergoes an order−disorder transformation at around 155 °C accompanied by a discontinuity in NTE. This discontinuity is undesirable for the structural stability of CTE tailored composites. Partial substitution of Mo in place of W is shown to progressively suppress the order−disorder transformation to below room temperature at the same time shifting the decomposition to higher temperatures. To determine relevant physical and mechanical properties of ZrW_2O_8 single crystals with several mm in size were synthesized by self-fluxing technique. Hydrothermal synthesis has been shown to be a viable approach for synthesis of phase pure ZrW_2O_8 with varying levels of Mo substitution for W. In addition, ZrW_2O_8-ZrO_2 composite nanopowders were also synthesized by hydrothermal processing route which were subsequently consolidated by uniaxial pressing and sintered. The structure and several mechanical and physical properties of sintered pellets were characterized.

Keywords: Ceramic Powders, Negative Thermal Expansion, Nanopowders, Ir Materials

INVITED SPEAKERS

Id-751

Rare-earth Doped Sesquioxide Transparent Ceramics: Fabrication and Laser Emission

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Abstract:
Sesquioxide transparent ceramics, such as Y_2O_3, Lu_2O_3, and Sc_2O_3, have excellent thermal conductivity, thermal expansion coefficient, and relatively small phonon energy. They are desired host materials for high power lasers. In this talk, we will present our recent works on the fabrication of various rare-earth doped sesquioxide laser ceramics, such as Yb^{3+}:Y_2O_3, Yb^{3+}:Lu_2O_3, Nd^{3+}:Y_2O_3, Ho^{3+}:Y_2O_3, and Er^{3+}:Y_2O_3. Sesquioxide nano-powders with high purity, excellent dispersibility, narrow particle size distribution were synthesized by using the chemical co-precipitation method. Using the synthesized powders excellent optical quality sesquioxide laser ceramics were further fabricated with the high temperature vacuum sintering technique plus hot isostatic pressing under optimized conditions. Optical quality and optical homogeneity of the ceramics were characterized. High efficient laser operation of the fabricated laser ceramics at 1.0µm, 2.0µm, 3.0µm were also experimentally demonstrated.

Keywords: Transparent Ceramics, Laser Ceramics, Rare-Earth Ions, Nano-Powders

INVITED SPEAKERS

Id-753

The Utilisation of the Sol-gel Process in the Preparation of Advanced Multi-layered Multifunctional Coating

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Abstract:
Exposure to environment yields corrosion of metals, while to corrodent will increase the rate. Thereof, the development of protective coatings has been continuous industrial demand. With plethora of various mono-functional coatings, the concerns have been raised regarding their environmental acceptability, and stability. With recently developed smart coatings that bring about concepts like self-healing, and selective/multi-activity, concerns repose on difficulties to achieve complex architectures or functional groups in simple, cheap and easy-to-scale-up manner. Yet, recent activities show it is possible to exhibit multi-functionality without abovementioned discrepancies. Thereof, this investigation utilises cheap-wet-chemistry to from simple nano-architectures by "smart assembly" with functionalities comparable to those of "smart materials". First of all, we withhold from one-pot synthesis and thereof, with the help of hydrolysis-rate-control-agents, sol-stabilisers, drying-control-agents and post-processing, the distinction of properties was maximised in each layer. Sol-gel method was utilised to tailor different (porosity or high specific surface control) but homogeneous and compatible layers that can be assembled into multifunctional composites. First, metal-contacted protection-layer was dense, crystalline, thin, i.e. barrier from both from environment and chemicals, with low porosity and SS surface, closed pores and excellent mechanical properties. Second layer was thicker, amorphous, container-type with additives, open mezzo-pores and reasonable mechanical properties. Various agents can be infiltrated. Third layer was based on core-shell particles partially penetrating/closing the pores of the 2nd layer thus blocking the infiltrated additives and partially forming additional top layer. Overall, the submicron multi-layer-coating was processed below 350°C to show crack-free, anti-corrosive and tribo-efficiency with good mechanical properties. The financial support of the University of Zagreb is gratefully acknowledged.

Keywords: Sol-gel, Ceramic thin-films, Composite, Anticorrosive, Tribological

INVITED SPEAKERS

Id-760

Optical Studies of Degradation and Resilience in High Temperature Solid Oxide Fuel Cells

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Abstract:

Recent reports have shown that small amounts of different metal oxide dopants that include aluminum and titanium reduce Ni coarsening and improve mechanical strength in Ni-YSZ cermets. Specifically, aluminum titanium oxide (Al_2TiO_5 or ALT) added to Ni-YSZ cermet electrodes has been shown to improve SOFC performance, longevity, and strength. Fabricating anodes from ALT enhanced Ni-YSZ cermets creates 2˚ phases including a nickel aluminate spinel ($NiAl_2O_4$) and a zirconium titanate ($Zr_5Ti_7O_{24}$). Following anode reduction (to generate electrocatalytic Ni), the $NiAl_2O_4$ reduces to form elemental Ni and Al_2O_3. The Zr_5 Ti_7O_{24} remains stable at SOFC operational temperatures (700-800˚C) under reducing conditions. Of the 2˚ phases that form, $NiAl_2O_4$ is believed to suppress Ni coarsening, while the $Zr_5Ti_7O_{24}$ appears to have mixed ion-electron conducting properties. Studies described in this talk use electrochemical methods and *operando* Raman spectroscopy to quantify and compare the effects of repeated electrochemical redox cycling on ALT-enhanced and ALT-free Ni-YSZ anodes. Benchmark voltammetry and EIS measurements are used to evaluate the resilience of ALT enhanced cells relative to those cells operating without ALT. Results show that anodes containing ~5% ALT have improved resilience by approximately a factor of two.

Keywords: Raman Spectroscopy, Metal Oxide, Electrochemistry, Impedance, High Temperature, SOFC

INVITED SPEAKERS

Id-788

Advanced SiC-graphene and SiC-CNT Composites with Enhanced Electrical Conductivity

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Abstract:

New silicon carbide based nanocomposites with carbon nanofillers were developed with the aim of increasing their electrical conductivity, to enable their use in wider functional ways and to explore the possibility to machine them using electrical discharge machining, all of this without lowering their other properties such as hardness, wear resistance, chemical and thermal stability. The materials included SiC-graphene and SiC-CNT (carbon nanotubes) prepared in novel ways. Methods of their preparation were optimized, mainly to achieve a good distribution of the carbon nanophases. The prepared materials were compacted using spark plasma sintering (SPS) and rapid hot pressing (RHP). Their microstructure and composition were studied in detail, the results showed successful microstructure design. In SiC-graphene (graphene nanoplatelets and reduced graphene oxide - up to 5 wt%) the rapid hot press (RHP) technique was successfully developed and tested, and materials with graphene nanoplatelets and reduced graphene oxide were produced. Both types reached satisfactory parameters with respect to their microstructure and basic mechanical properties. Their electrical conductivity increased by four orders of magnitude. In SiC-CNT (up to 10 wt% CNT) a new technique of in-situ CNT preparation by CCVD was developed. This enabled to solve the problem with distributing of CNTs and in this way to increase the electrical conductivity by about three orders of magnitude. Generally, in materials with higher amounts of carbon additives mechanical properties were slightly reduced, mostly due to increase of porosity, this fact however usually did not lead to lower strength or wear resistance.

Keywords: Silicon Carbide, Graphene, Carbon Nanotubes, Electrical Conductivity, Wear, Hardness

INVITED SPEAKERS

Id-807

Manufacturing Radar Absorbing Materials by Using Magnetic Zinc Oxide Particles Synthesized by Sol-gel

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Abstract:
Radar works by sending out electromagnetic waves and seeing what comes back. When a wave strikes an object, it can undergo reflection, transmission and absorption. The various magnitudes of these quantities are dependent on the material properties and geometric factors such as size, shape etc. From a microscopic point of view, these interactions may be calculated quantum-mechanically from the atomic structure of the material. In this study it was aimed to produce radar absorbing materials especially for certain military applications focused on defence and security. By this manner, magnetic zinc oxide particles were synthesized by Sol-Gel. They were embedded to a polymeric matrix with different loading level to see the concentration dependence of particles' radar absorbing effect. After fabrication of magnetic zinc oxide reinforced plastic composite samples, they were characterized by X-ray diffraction (XRD), Fourier Transform Infrared (FTIR) and Scanning Electron Microscope-Energy Dispersive Spectroscopy (SEM-EDS). Under applied magnetic field, the produced composites exhibited the hysteresis loops of the ferromagnetic behavior with vibrating sample magnetometer (VSM). The saturation, magnetization and coercivity of the composites were obtained. In addition, radar absorbing test were applied as a primary objective of this research with a network analyzer. It was concluded that the zincoxide reinforced composites have electromagnetic properties which indicates potential application in high performance absorbing materials and it was indicated that increasing zincoxide powder amount in the composites leads to increase radar absorbing performance.

Keywords: Radar Absorbing Materials, Magnetic Properties, Zinc Oxide, Sol-gel

INVITED SPEAKERS

Id-816

Simulation of Particles Interaction with Defects on the Surface of Diamond, Graphene and Boron Nitride

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Abstract:
Nanodiamonds with impurity - vacancy complex defects are a non-conventional material with emerging ability to find various applications in many areas of high technology. It is known that nanodiamonds possess a unique set of properties combining high hardness and thermal conductivity with wear resistance, transparency, chemical inertness, biocompatibility, and nontoxicity. The nitrogen-vacancy complexes (NV complexes) determine the useful properties of nanodiamond fluorescence. At present, NV centers in diamond attract great interest due to the possible use of these defects as a unit cell of a quantum computer, as a working element in quantum cryptography, for magnetic and electrical measurements at the nanoscale, as biomarkers and sensors for medical and biological purposes. The boron-vacancy defects (BV complexes) can be considered as alternative candidates. In order to use the NV/BV center, it should be located in a nanometer-size diamond particle. However, in spite of the increasing role of surface phenomena accompanied by a decrease in the size of the working elements, the main numerous experimental and theoretical studies are devoted to the defects in the bulk of diamond. This study provides the results of quantum-chemical modeling of diamond surface comprising the most stable vacancies and nitrogen/boron - vacancy defects in the near-surface layers. It is found that the vacancy in the third layer, as well as the "vacancy in the third layer, impurity in the fourth layer" complex, changes the activation energy and heat of adsorption for the chemisorption of particles on the surface. The spin density for the most stable negatively charged defect on the C(100) surface is distributed between the three carbon atoms near the defect, and is thus similar to the spin density of a center in the bulk of diamond. However, the specific distribution of the spin density depends on the state of the surface. These geometric and spin parameters should be taken into account in planning, performing, and interpreting experiments with near-surface NV/BV center aimed at experiments aimed at creating a quantum computer, the development of cryptraphy, metrology, biological applications. The quantum-chemical simulation of the interaction of F^- and FHF^- ions with the single-crystal graphene and grain-boundary-containing graphene surface are represented. Some recent studies have shown the possibility of the fluorination reaction for graphene and few-layer graphene films with aqueous solution of hydrofluoric acid (HF). In our work we describe the ion adsorption states, estimated the energy characteristics of adsorption from associates with water molecules in different configuration. We show that a grain boundary affects the adsorption process.

Keywords: Modeling, Surface, Defects, Adsorption

INVITED SPEAKERS

Id-823

Monolithic Integration of III-V Quantum Dot Lasers on Silicon for Silicon Photonics

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Abstract:

The available of silicon lasers is the key technology for the whole Si photonics industry. But the indirect bandgap of silicon is a severe limitation, and, despite recent advances, these devices will not, in the foreseeable future, outperform their III-V counterparts. Much effort has been directed toward hybrid integration of III-V lasers with Si photonics platforms. Although impressive results have been achieved, on a longer term, large-scale integration of photonics circuits will rely on monolithic integration of laser sources on silicon.

In this talk, I will review our recent progress made in the direct growth of III-V light sources on silicon. I first briefly address issues related to the III-V/Si substrates itself before moving to results on III-V quantum lasers monolithically integrated on Ge, Ge-on-Si, and Si substrates.

Keywords: Semiconductor Laser, Quantum Dot, Monolithic Integration, Silicon Photonics

INVITED SPEAKERS

Id-834

Chip Design and Applications Based on the Resistive Random Access Memory

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Abstract:

ReRAM, which was first theoretically postulated by Leon Chua in 1971, has captured much attention as an emerging candidate material for the next generation of nonvolatile embedded memory because of its fast access speed, high reliability, good scalability, and Complementary Metal Oxide Semiconductor (CMOS) compatibility during the past decades. Our work designed a 1-Mb HfOX-based embedded Resistive Random Access Memory (ReRAM) device with a one-transistor-one-resistor (1T1R) structure in a 0.13um CMOS logic compatible process. To more applications of the future, we systematically investigated the material and chip working temperature range. It noted that this embedded ReRAM macro has a 1.6X working temperature range than previous design for some extreme environment. Using the peripheral-assisted technique, it can enable the error rate of the ReRAM macro under 0.5% which can reduce the complexity of ECC function. Experimental results show that, the ReRAM macro achieves a wider work temperature range (between -55 degrees and 150 degrees), which improves the reliability of the entire embedded ReRAM macro and has a high robustness as well. This makes embedded ReRAM macro possible in the applications of the extreme space, such as aerospace regions.

Keywords: Reram, CMOS, Macro, Temperature

INVITED SPEAKERS

Id-835

Spectroscopy of Semiconductor Nanocrystals

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Abstract:
Unique optical and electrical properties of semiconductor nanostructures and nanoparticles stimulate the growing interest in studying these fascinating objects. Ongoing studies cover not only basic research but also the broad applications range, e.g., in solar energy conversion, optoelectronic devices, molecular and cellular imaging, ultrasensitive detection, etc. Nanoparticles differ from bulk particles because of the high surface to volume ratio, which induces the structural and electronic changes. These differences depend on particle sizes, shape and surface characteristics. The enhanced surface area increases surface states, which change the activity of electrons and holes, and affects the chemical reaction dynamics. A significant feature of semiconductor nanocrystals is the quantum confinement effect, which leads to the spatial enclosure of the electronic charge carriers within the nanocrystal. Because of this fact one can use the size and shape of these “artificial atoms” to widely and precisely tune the energy of discrete electronic energy states and optical transitions. As a result, researchers can tune the light emission from these particles throughout the ultraviolet, visible, near-infrared, and mid-infrared spectral ranges. Vibrational properties of the bulk material are crucial for understanding vibrational properties of small particles. As consequence of miniaturization, we expect bulk modes to be shifted and broadening. In this paper, we discuss recent advances in the understanding of the nanostructure and optical properties of semiconductor nanocrystals. Spectroscopic methods, such as Raman, FTIR, Photoluminescence spectroscopy, etc., can provide a great deal of information both on the electronic and spatial structure of the nanocrystals. Linking these characteristics with the synthesis methods will play key roles in the further development of these particles for optoelectronic and biomedical applications.

Keywords: Spectroscopy, Semiconductor, Nanocrystals

INVITED SPEAKERS

Id-844

Layered oxides ss Convenient Energy Storage Materials for Sodium Ion Batteries

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Abstract:
Compared with traditional battery technology, lithium-ion batteries (LIBs) charge faster, last longer, and have a higher power density for more battery life in a lighter package. For the last two decades, Li-ion batteries have dominated the portable electronics industry and solid state electrochemical literature. However, Na and Na-ion batteries have re-emerged as candidates in energy storage medias due to the concerns over rising lithium costs in the future. Based on the wide availability and low cost of sodium, ambient temperature sodium-based batteries have the potential for meeting large-scale grid energy storage needs. In addition, since sodium is so abundant (4th most abundant element in the Earth crust), sodium-based batteries could provide an alternative chemistry to lithium batteries, and might become competitive to (LIBs) in certain other markets. Previous studies on sodium ion batteries (NIBs) presented many challenges and have shown that new investigations on sodium-ion technologies and electrode materials are still needed. New layered oxides, polyanion-based materials, carbons and other insertion materials for sodium-ion batteries hold promise for future sodium-based energy storage applications. Here, the energetic performance of a series of positive electrode materials for NIBs, with the general formula $Na_{2/3}MO_2$ where M: Co, Ni, Mn, Ti, will be presented. The relationship between the structure of these materials and their behavior when used in sodium batteries will be emphasized. The authors would like to thank OCP S.A. (Morocco) for the financial support. A part of this work was also done under the 'Storenergy' project (ERANETMED, EU-MENA 2016-2019).

Keywords: Batteries, Energy Storage, Materials, Oxides

INVITED SPEAKERS

Id-848

Massive Enhancement of Dielectric Properties of $NiFe_2O_4$/CNFs Nanohybrid for Supercapacitor Applications

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Abstract:

Nickel ferrite was prepared via wet chemical co-precipitation route. Carbon Nano Fibers (CNFs) were used to prepare$NiFe_2O_4$/CNFs nanohybrids. Polar solvent (ortho–xylene) was used for the dispersion of CNFs in ferrite matrix.X-ray diffraction patterns confirmed the formation of $NiFe_2O_4$/CNFs nanohybrids without any impurity peak. FTIR patterns showed two consistent characteristic absorption bands for tetrahedral and octahedral sites, confirming the formation of spinel structure of $NiFe_2O_4$. Scanning Electron Microscopy (SEM) images confirmed the coating of nickel ferrite nanoparticles on CNFs, which confirms the efficiency of deployed method. The dielectric properties were measured as a function of frequency at room temperature. Pure $NiFe_2O_4$showed dielectric constant of1.79×10^3 at 100 Hz, which increased massively to2.92×10^6 at 100 Hz with the addition of 20% by weight of CNFs, proving it to be potential candidate for applications in supercapacitors. On the basis of impedance analysis and Cole-Cole plot, the resistance is considerably decreased by the addition of CNFs in $NiFe_2O_4$. The pure $NiFe_2O_4$ has highest impedance values of 5.89×10^7 Ohm at 100 Hz while the $NiFe_2O_4$ /CNFs nanohybrid with CNFs (20% by weight) has the lowest impedance values of 4.25×10^3 Ohm at 100Hz, which proves this nanohybrid is useful for high-frequency applications.

Keywords: AC Impedance, Co-Precipitation, Fourier Transform Infrared Spectroscopy, Nanohybrid, X-Ray Diffraction

INVITED SPEAKERS

Id-854

Sol-gel Fabricated Silica/PEG Hybrids for Gene Delivery

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Abstract:

Attaching biomolecules within hybrid materials plays a major role in biomedical applications. The nucleic acids used in gene delivery must be protected from harsh conditions in the bloodstream. Apart from the viral vectors which may cause sudden immune responses, mesoporous silica is one of the best candidates for protecting and carrying genes to cells, then releasing them in cytoplasm to suppress patient gene transcription owing to its high biocompatibility and porous structure. Without cationic modification, neither naked nucleic acids nor silica can cross the cellular membrane due their negative surface charges; hence cellular uptake becomes difficult. Oligonucleotides (short nucleic acid strands) could be adsorbed on surface pores of cationically-modified silica however, cationic modification increases toxicity of the vectors. In today's methods, to facilitate protection in the blood and enhance cellular uptake, silica surfaces are coated with polyethylene glycol (PEG); a biocompatible polymer resistant to the immune responses in the body. Increasing surface modifications decrease the number of available oligonucleotide adsorption sites and limit the loading capacity of the vector. Sol-gel is a solution-based method that can be performed at room temperature. For the first time, it is shown that, oligonucleotides could be encapsulated in sol-gel derived mesoporous silica-PEG networks during synthesis, so that, they become dispersed not only on the surface but homogeneously throughout the inner structure. By this means, there would be no need to modify silica-PEG to adsorb oligonucleotides, they become protected from enzymatic denaturation in the blood and surface sites would be available for attaching cell-targeting molecules.

Keywords: Mesoporous, Silica, PEG, Sol-gel, Encapsulation, Gene Delivery

INVITED SPEAKERS

Id-860

Measurement-immune Quantum Secured Communications

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Abstract:

Perfect secret message sharing between two parties has been theorized by Shannon for the one-time pad cryptography underpinned by randomness, where the true randomness of the key is essential for a perfectly secured message transfer based on non-distinguishable fingerprints in the cypher. The practical issue of the secure message sharing, however, is in the key sharing method to set the initial configuration of the randomness between two parties. Although quantum cryptography has given theoretical solutions to this issue of secrete key sharing, potential leakage in both quantum channel and photon detectors has prevented it from perfect unconditional security. Here, we present a near perfect key sharing method for the quantum cryptography by applying randomness to the measurements, where even a complete copy of the cypher does not work for encryption. BSH acknowledges that this work was supported by ICT R&D program of MSIT/IITP (1711042435: Reliable crypto-system standards and core technology development for secure quantum key distribution network).

Keywords: Quantum Cryptography, Quantum Physics

INVITED SPEAKERS

Id-862

Tailoring Microwave Dielectric Properties of Ceramics for Information and Communication Technologies

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Abstract:
With the rapid progress for 5G wireless communication systems, much attention has been paid to dielectric ceramics with high performance to meet the demands for rapid signal propagation and prominent frequency selectivity at microwave and/or millimetre-wave frequencies. Several types of dielectric materials have been developed to meet the demands for these communication systems. Dielectric properties of ceramics are strongly dependent on the composition of ceramics, the chemical nature of constituent ions, the distance between cations and anions and the structural characteristics originating from the bonding type. Therefore, it is necessary that the intrinsic properties of ceramics should be controlled and designed. In view point of preparation of the ceramics, the dielectric properties are affected by the processing conditions as well as the extrinsic factors such as pores, grain boundaries and secondary phases which are inevitable in polycrystalline ceramics. The fundamental relationship between the structural characteristics and the dielectric properties are also necessary to search new microwave dielectric ceramics effectively. Based on these considerations, the tailoring dielectric properties of ceramics will be discussed. The prediction techniques of dielectric properties will also be introduced from the experimental point of view.

Keywords: Prediction Techniques, Microwave Dielectric Ceramics, Bond Valence, Octahedral Distortion, Dielectric Polarizability

INVITED SPEAKERS

Id-868

Low Field Microwave Absorption in Certain Spin Systems

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Abstract:

Ever since the low field microwave absorption (LFMA) was discovered in manganites, the phenomenon was reported in many other systems. It is to be noted that the phenomenon of LFMA is not observed in every magnetic material. Further, the hysteresis and line shapes strongly depend on sintering temperatures for some materials. And for example the LFMA hysteresis collapses at a characteristic temperature in the doped ZnO system. Thus, LFMA is a very interesting and intriguing phenomenon. Taking through a journey of LFMA in various materials, we shall present our recent results of the observation of LFMA, the associated hysteresis and other features in certain spin systems.

Keywords: Low Field Microwave Absorption, Magnetic Materials, Hysteresis, Line Shapes

INVITED SPEAKERS

Id-872

Geometry and Inertia of the Human Body

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Abstract:

The object of the paper is to present geometric and inertial quantities which have influence on human movement. From the external view body straight linear dimensions are used for presentation of the whole body and its segments, e.g. during measuring of body height or by comparing of a step length to the length of lower extremities. Curvilinear dimensions are used for measuring circumference of body parts. Body planar dimensions are taken into account when air resistance is calculated, while body volume is obtained when buoyancy is characterized. External dimensions can be obtained using anthropometric devices and image methods like photography, video. Internal view of the body is used for obtaining tissue data, especially area of surface of tissue image of a body layer. When multiplied by height of a layer one can obtain volume of tissues. Internal dimensions for living people can be obtained using such methods as computerized tomography or magnetic resonance imaging. Inertial quantities are whole body, segment, and tissue mass (absolute and relative), moment of inertia of the whole body and its segments, location of a center of mass according to the given coordinate system. All above quantities are presented in many papers. They are necessary for building of body models within transport analyses and biomedical engineering and also for sport and ergonomic analyses

Keywords: Geometry, Inertia, Human Body, Methods

INVITED SPEAKERS

Id-881

Silicon and Transition Metal Based Sol-gels: Biomedical Applications

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Abstract:
In the biological applications such as analysis of peptides, proteins, oligonucleotides, biomolecule complexes, post-translational modifications and mainly in proteomics, soft ionization mass spectrometric techniques which are Matrix-assisted Laser Desorption/Ionization-Mass Spectrometry (MALDI-MS) and Electrospray Ionization-Mass Spectrometry (ESI-MS) have been used very widely in recent years. Especially for the post-translational modifications, prior to the mass spectrometric analysis, different sample preparations have to be applied especially for the complex World-wide samples. In this study, different types of sol-gels showing specific affinity to the biomolecules were synthesized and applied to targeted biomolecules for the specific separation and enrichment prior to mass spectrometric analysis to eliminate interferences. Mainly silicon, zirconium, titanium and tantalum based sol-gels were synthesized modifying with different molecular weight polyethylene glycol (PEG) in order to change the polarity, roughness and surface morphology of sol-gels for different biomolecule applications. All synthesized sol-gels were characterized by Fourier Transform-Infrared (FT-IR) Spectrometry, X-Ray Diffraction Spectrometry and Scanning Electron Microscope (SEM). Specificity and selectivity of the sol-gels synthesized in this study was tested for phosphopetides and glycopeptides obtained from World-wide samples after the proteolytic digestion. Performance of the newly synthesized sol-gels was compared to the other materials which have been used in the market so far for the same purposes. It was noticed that the newly synthesized sol-gels showed high specific affinity and selectivity to different biomolecules depending to the nature structure, production medium, application pH of the sol-gels and the additives inside the sol-gels which were added into the gelation medium during the sol-gel production. This work was supported partially by The Scientific and Technical Research Council of Turkey (Project Number: 115Z241) and Ministry of Development-Republic of Turkey (Project Number: 2016 K 121230).

Keywords: Sol-gel, Phosphopeptide, Glycopeptide, Enrihment

INVITED SPEAKERS

Id-898

Past, Present and Future of Fractional Dynamics

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Abstract:

This paper presents the recent study of fractional dynamical systems. Fractional dynamical systems are system that feasible to explain the physical behaviour by fractional operator. The objective of this study is to present the some approaches that have been proposed in the literatures, to explain them using numerical and applications and future direction in this research field. Many of them are often characterized by power-law of non-locality and long-range dependence or fractal properties. The characterizations of fractional dynamical system are also given in form of phase space, bifurcation diagram and Lyapunov exponent.

Keywords: Bifurcation Diagram, Fractional Dynamics, Fractal Properties

INVITED SPEAKERS

Id-915

Texture Engineering of Lead-Free Piezoelectric Ceramics

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Abstract:

Lead-free ceramics have been receiving especial attentions as promising piezoelectric materials to replace $Pb(Zr,Ti)O_3$ (PZT)-based piezoelectric ceramics. Although $Bi_{0.5}(Na,K)_{0.5}TiO_3$ (BNKT)- and $(K,Na)NbO_3$ (KNN)-based ceramics are reported to be promising for piezoelectric applications, their piezoelectric properties must be further improved before they can replace PZT. The piezoelectric properties of BNKT- and KNN-based ceramics can be improved through compositional modification by preparing solid solutions. Further improvement in the piezoelectric properties can be achieved by controlling the grain orientation through texture engineering using anisotropic templates with plate-like shapes. Through the growth of aligned templates, texture engineering can produce samples containing grains aligned along certain crystallographic orientations instead of randomly distributed matrix grains. One of the most important parameters in texture engineering is the role of the template. Plate-like $Bi_{4.5}Na_{0.5}Ti_4O_{15}$ (BNT15) (or $Bi_{0.5}Na_{0.5}TiO_3$) and $NaNbO_3$ (NN) are generally used as templates for texturing of BNKT and KNN ceramics, respectively. These templates are prepared by the molten-salt method followed by the topochemical microcrystal conversion (TMC) process. In this study, we investigated the role and behavior of templates in texture engineering of BNKT- and KNN-based lead-free piezoelectric ceramics.

Keywords: Piezoelectric Ceramics, Lead-Free, Texture Engineering, Template

INVITED SPEAKERS

Id-945

Anatase Crystallization Core in a Sol-gel Process Led by Pentacoordinate Titanium *n*-Butoxide Derivatives

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Abstract:

The sol-gel process that occurs in a mixture of titanium butoxide ($Ti[O(CH_2)_3CH_3]_4$) and concentrated hydrochloric acid was studied. The resulting thin film can be converted to a TiO_2 anatase crystal via annealing at 400 °C, which is lower than in the case of using ligands such as acetyl acetone (500 °C). $Ti[O(CH_2)_3CH_3]_4$ would form a nucleation point for crystallization. However, the detailed crystallization mechanism for the formation of a thin film comprising anatase TiO_2 crystals using this raw material is not yet fully understood. I, therefore, aimed to identify the crystallization core led from the $Ti[O(CH_2)_3CH_3]_4$ in the mixture to clarify the crystallization mechanism at lower process temperatures. Two isomeric 5-coordinate water adducts of $Ti[O(CH_2)_3CH_3]_3Cl{\bullet}H_2O$ of structures d1 and d2 (see Figure 1) were determined as the main products in the mixture by Gibbs free energy calculations using density functional theory (DFT) and, ^{35}Cl nuclear magnetic resonance (^{35}Cl-NMR) spectroscopy. The various molecular structures present in a coating of the mixture were analyzed by DFT calculations, which indicated that structure d1 dimerized. A diamond-like $Ti{=}O_2{=}Ti$ structure was then generated. It further dimerized to give tetrameric structure. Infrared resonance spectroscopy analysis of the film coating confirmed the presence of the tetrameric compound. That compound can be considered as the crystallization core for anatase crystallization in the low process temperature (i.e., 400 °C), because it has similarities with the anatase crystal which includes a diamond-like $Ti{=}O_2{=}Ti$ structure.

Keywords: Titanium n-butoxide, Titanium Dioxide, Anatase, DFT, NMR

INVITED SPEAKERS

Id-957

Atomic Layer Deposition: Tailoring High Aspect Ratio Tio_2 Nanostructures

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Abstract:

The ongoing advances in the fabrication techniques over the last decades have allowed the shrinking of the devices to nanoscale dimensions, yielding a new generation of promising nanostructures as nanowires, nanorods or nanotubes. Among such nanostructures, anodic self-organized 1D TiO_2 nanotube layers have received significant scientific and technological interest, motivated by the semiconductive nature of the TiO_2, unique tubular architecture, chemical and mechanical stability, unidirectional electron transport through nanotube walls, biocompatibility, as well as simple and low cost fabrication process. An encouraging further step lies on the fabrication of TiO_2 nanotubular composite structures with new functionalities by the deposition of secondary materials. However, the shrinking to nanoscale dimensions brings the challenge of attaining conformal, homogeneous and continuous secondary material coatings. Conventional thin film deposition methods result inefficient and display serious limitations for the secondary material coating of high aspect-ratio nanostructures. To date, atomic layer deposition (ALD) is the only deposition method capable to deposit continuous and conformal layers into high aspect-ratio nanostructures with an unprecedented sub-nanometer thickness control.[4] Thus, TiO_2 nanotubular composite structures have been produced via ALD by the deposition of ultrathin films of materials as TiO_2, Al_2O_3, ZnO, or CdS, or homogeneous decoration with noble metal nanoparticles. The composite nanostructures display synergetic effects resulting in enhanced performance in a wide range of applications, such as photocatalytic, sensing, solar cell, catalytic, and battery.The presentation will focus on fabrication and experimental details, and recent photocatalytic, sensing, solar cell, catalytic, and battery reports will be presented and discussed.

Keywords: Atomic Layer Deposition, TiO_2 Nanotubes

INVITED SPEAKERS

Id-977

Models of Chaotic Oscillations in Magnetic Systems

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Abstract:

The models of nonlinear dynamics appear in many investigations coming from the different branches of physics, chemistry and molecular biology, as well. In addition these models usually behaves chaotically, which can be traced back to the underlying notion of nonlinearity. Moreover, the study of chaos provides new conceptual and theoretical tools enabling us to categorize and understand theses complex behavior.The tools for the theoretical and numerical investigation of nonlinear dynamical systems modeled by means of ordinary differential and difference equations are still in development. Chaotic behavior seems to be natural and their common occurrence is known in mechanical oscillators, lasers, nonlinear optical systems, chemical reactions and many other systems. Despite of its common occurrence and enormous practical and technological importance, the present knowledge of chaotic behavior phenomena is still insufficient. Mathematical models of chaotic behavior are formulated in terms of equations and are connected with physical character of variables and their relations to observable facts. They describe relations valid for many bodies and their interactions. This generality and strong experimental basis push forward advances in their mathematical description. With the aid of models we can formulate new problems, solve them and plan new experiments for their verification. One of the interesting phenomena connected with chaotic behavior is the chaotic oscillations in magnetic materials. The aims of this presentation is to discuss the properties of the models of chaotic oscillations in such magnetic materials e.g. in the dynamics of spin chains, in the motion of a spin in an external alternating magnetic field upon excitation of spin waves, and in nuclear spin systems. Besides the study of the problems from physical point of view, we will present the mathematical techniques, which shed a new light on the considered problems and give new ways to solve problems of theory of chaos .

Keywords: Chaotic Oscillation, Spin Chains, Nonlinear Optical System, Magnetic Systems

INVITED SPEAKERS

Id-979

Plasma and the Design of Nanocatalysts

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Abstract:

In recent direction of research, plasmas are being more and more used for or in catalysis. The aim is either to find alternative routes for a large scale production of e.g. new gases or to increase catalysis efficiency of catalytic materials. There are two systems where plasmas work for catalysis; i) in synergy systems of beneficial interactions between plasma and materials, or ii) in systems where plasmas are used for design of catalysts. The last aspect connected with design of nanocatalysts is opening the new opportunities for applications. Low temperature plasmas which are featured by partially ionized gases, which consist of electrons, various ions, and neutral species like molecules, atoms, and excited species, have proven to be great sources for the surface manipulations or supplying building blocks for nanomaterials. Furthermore, the specific plasma-surface interactions are leading to synergistic effects, where very little is understood in terms of basic processes taking place. The catalytic activity of nanomaterials is determined by their size, faceting, presence of steps, defects, strain, oxidation state and support material. In plasma catalysis, all these nanomaterial factors are influenced by plasma, thus affecting the sequent catalytic process. To understand these processes at atomic scale and mechanisms taking place, we implemented different low pressure plasma treatments of nanoscale materials such as nanowires or nanoparticles. As results of interactions of various plasma species including electrons or neutral atoms, the intrinsic properties of nanomaterials change. These observations are supported by analytical methods in order to unravel what is occurring on nanomaterial surface. Through the changes in the crystalline structure of material or reorganization of its surfaces, the functionality of materials in applications such as gas sensing, liquid purification, etc. is changed as well.

Keywords: Plasma, Nanocatalysts, Surface Design

INVITED SPEAKERS

Id-995

Advanced Methods for Consolidation of Powder Materials by Impulse Electromagnetic Fields

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Abstract:

Advanced technologies for the production of new materials and, in particular, nanostructured materials, using powder technologies require fundamentally new approaches for the formation and preservation of a given structural-phase state. Precision control of the state of materials in the process of consolidating powders of nanomaterials can be carried out using pulsed electromagnetic fields. The aim of the project is to study the effect of high-voltage and low-voltage pulsed electromagnetic fields in the technologies of powder consolidation. The experimental devices of spark-plasma sintering, flash-sintering, high-voltage consolidation and magnetic-pulse compaction are used in our laboratory for the production of advanced materials from metal powders, ceramic and composite powders. We can produce boron carbide, silicon carbide, uranium nitride, tungsten carbide - cobalt - diamond composites, tungsten heavy alloys, and others by electromagnetic methods of powder consolidation. Investigations into the welding of titanium and stainless steel have shown that application of a short high-voltage electric current pulse and pressure produces stronger welded joints composed of both similar and different metals of considerably different thickness. A combination of a short electric pulse with simultaneous high speed application of mechanical pressure in the weld zone causes high-speed deformation of the contact zone. The process of joint formation itself does not cause any appreciable diffusion during welding. Electric exploding of a tungsten carbide – cobalt material near-by high-speed steel surface forms on it a hardening coating. The essential structure properties of the formed coatings are determined by specifications of contact exploding electrode and the pulse current amplitude and duration. The hardening layers of tungsten carbide and pure nanocrystalline tungsten have been formed upon the surface of high-speed steel as a result of electric exploding. Experimental results to consolidation metal powders, ceramic and composites powders by electromagnetic methods presage fruitful results.

Keywords: Spark-plasma Sintering, Flash-sintering, High-voltage Consolidation, Magnetic-pulse Compaction

INVITED SPEAKERS

Id-996

The Core-Shell Au-graphene Quantum Dots (Au@GQDs) Nanoparticles Studied by Atomistic Simulations

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Abstract:

Graphene Quantum Dots (GQDs), consist of single or few layer graphene with a thickness of only a few nanometers, recently discovered are a new type of quantum dots (QDs) emitters with near graphene structure and sizes usually below 30nm. They exhibit excellent properties such as photocatalytic activity, energy storage property, electro conductivity etc . On the other hand, metal-GQDs nanocomposites are also used as alternatives to semiconductor QDs for bio-imaging applications due to their fluorescent and new physical properties. However, the development on two dimensional (2D) carbon based QDs is still unsatisfactory and under progress. Especially, atomistic simulations need to understand size dependent atomic and morphological structure. On this line, we have first presented a computational method for 2D graphene and its composites in core-shell structure nanoparticles by molecular dynamics method. Herein, the thickness of GQDs between 2-4nm is considered to create a core-shell structure of nanoparticles of Au@GQDs with diameter sub<10nm by combining the solid Au ones. The atomic simulations have been established for six nanoparticles by continuous heating up to room temperatures. Thus thermal and geometric stability diagram of nanoparticles at low temperatures have also computed. Size and thermal effect on the atomic structure and morphology of the nanoparticles have presented. By analyzing the results, it has found that there is in a good agreement with experiment. This study can guide the design of next generation graphene based nanostructures.

Keywords: 2D Graphene Quantum Dots, Au-Graphene Composites, Core-shell Nanoparticles

INVITED SPEAKERS

Id-1002

Sol-gel Spin Coated Metal Oxides for Extended-gate Field Effect Transistor Based Sensors

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Abstract:

Metal oxides are being extensively researched as sensor materials due to their superior chemical, thermal and mechanical stability compared to organic materials. Various sensor applications are applying these materials for chemical sensing, and varieties of metal oxides with their distinct physical structures are being applied for gas sensors. While there are many sensing architectures, our work focuses on the extended-gate field effect transistor (EGFET) sensor for chemical sensing applications. EGFET is an enhancement of ion-sensitive FET (ISFET) sensors in which the thin film sensing membrane is suspended by a metal wire to the gate of a commercialized MOSFET. This results in ease of fabrication process compared to ISFET where the sensing material has to be deposited directly on the MOSFET's gate. On the other hand, EGFET solves the typical challenges faced by ISFET which are thermal and light stability, and improves the sensor performance by facilitating better chemical stability due to the architecture. In EGFET only sensing membrane is dipped in the solution to be measured, but in ISFET the whole transistor will be immersed resulting in disturbance of the transistor performance. In this work, we will report on the application of sol-gel spin coated ZnO, TiO_2 and CuO thin films along with their bilayer composites, for the application of EGFET sensors. The effect of the spin coating parameters on the thin films characteristics and sensing behaviour will be discussed on top of the choice of materials suitable for specific measurands. A memristive sensing concept also will be introduced. This work is partially supported by the Niche Research Grant Scheme (NRGS) (Project code: 201911140004) by the Malaysian Ministry of Higher Education and Research Management Centre (RMC) of Universiti Teknologi MARA.

Keywords: Sol-gel Technology, Spin Coating, Metal Oxides, Extended Gate Field Effect Transistor Sensor

INVITED SPEAKERS

Id-1014

Transition Metal Doped Solid Oxide Fuel Cell Cathodes

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Abstract:

Fuel cells have become of great interest as a potential economical, clean and efficient candidate for alternative and environmental friendly power generation services. These systems offer several advantages compared to conventional electrical energy generation methods. Solid Oxide Fuel Cell (SOFC) is a high temperature fuel cell, dealing with generation of power as well as heat. Up to now many studies have been made to replace platinum, Pt, with a new cathode catalyst for intermediate temperature-solid oxide fuel cells (IT-SOFC) (500°C<T) range but research has become inadequate. Since Pt sources limited and very expensive could not meet the supply for the commercial fuel cells, the scientists started for searching new materials. There are two important aspects about SOFC cathodes, the effect of different cathode materials on the electrochemical performance of the electrode and the kinetics of the oxygen reduction reaction (ORR). Understanding in these concepts would lead to a better understanding and further improvements of SOFC systems. The production and evaluation of novel and supreme cathode electrodes used in IT-SOFC is aimed to employ cheaper metals (Ti, Fe, Co, Cr, Mn, V, B and Gd) by using superior properties of perovskite structure. The reaction of reduction of oxygen on metal/metal oxide surface is achieved within the complicated and multi-step mechanism. The completion of these steps at the same time depends on the nature of oxide ion carrier in cathode, atomic formation in crystal structure and microstructure of cathode materials. Due to these reasons, the production of intended novel and superior cathode materials is achieved by the systematic doping and implementation of different metals (Ti, Fe, Co, Cr, Mn, V, B and Gd) to perovskite crystal structure. The analysis of the impedance measurements generally required the use of three to four (RQ) circuits in series in the equivalent circuit model. Of the four cathodes synthesized, the LV05SC on YSZ showed the highest are area specific resistance. Hence, it is a better cathode material candidate.

Keywords: IT-SOFC, EIS, Oxygen Reduction Reaction (ORR), Perovskite

INVITED SPEAKERS

Id-1019

Electronic and Photonic Properties of the Organic Semiconductors with Theoretical and Experimental Techniques for Various Conditions: 2,2′:5′,2′′:5′′,2′′′-Quaterthiophene (4t)

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Abstract:
Organic semiconductors (OSCs) have widely investigated due to excellent electronic, optical, luminescence, photonic, photovoltaic,optoelectronic and applied science properties. 2,2′:5′,2′′:5′′,2′′′-quaterthiophene (4T) or α-quarterthienyl is p type semiconductor. The empirical formula and molecular weight of the 4T are $C_{16}H_{10}S_4$ and 330.51 g/mol, respectively. In this talk, we will talk on investigations of the electronic and photonic properties of the 4T organic semiconductor with advanced computational (theoretical) and experimental techniques for different solvents. We discussed the effects of these techniques and various solvents on the electronic and photonic properties of the 4T. We determined the application fields of the 4T and the best organic devices for this organic semiconductor. This study was supported by "The Management Unit of Scientific Research Projects of Muş Alparslan University (MUSBAP) under Project BAP-17-EMF-4901-09.

Keywords: Organic Semiconductors, Electronic and Photonic Properties, Quaterthiophene,

INVITED SPEAKERS

Id-1055

Internal Methane Formation and Reforming in a Pressurized Planar 30-cell Solid Oxide Cell Stack

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Abstract:
Electricity storage systems utilizing catalyst reactors combined with reversible electrochemical conversion of H_2O and CO_2 to CH_4 inside pressurized solid oxide cells stacks may achieve round-trip efficiencies (electricity-gas-electricity) of up to 80%. Combined with subsurface gas storage this could facilitate cost efficient seasonal electricity storage. Since the energy is stored as gas containing more than 95 percent CH_4 it can be directly used and stored in existing natural gas grids.
Here we present a 30-cell SOC stack operated in both electrolysis and fuel cell mode with carbonaceous gasses at 18.7 bar and 700 ˚C. The CH_4 concentration in the dry outlet gas from the stack increase from 0.22% at open circuit voltage condition to 18% at -0.17 A/cm^2 electrolysis operation condition. Degradation rates were comparable to those reported at ambient pressure with H_2/H_2O. Post mortem analysis of the stack reveal several degradation mechanisms including signs of coking at fuel gas outlet. Coking occurred although the H/C ratio was 7, enough to avoid equilibrium carbon formation. This is possibly related to preferential H_2 diffusion from the triple phase boundaries locally decreasing the H/C ratio at the reaction sites.

Keywords: Solid Oxide Cell Stack, Pressure, Methane, Efficiency, Coking

INVITED SPEAKERS

Id-1080

Tuning of Exchange Bias in Thin Film Structures Made from Nife and Irmn

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Abstract:

Exchange bias effect is widely useful in applications of spintronics, sensorics and magnetic recording, where, from a technological point of view, magnetic properties of materials play crucial role. To obtain certain magnetic properties of systems with exchange bias it is important to control hysteresis loop shape and value of its shifting. In many papers it was shown, that in thin films the exchange bias effect can be controlled by changing thicknesses of layers, their deposition sequence or using, for example, field-cooling or zero-field-cooling procedures. In this work, the main goal is controlling magnetic properties of bilayered and trilayered thin films structures NiFe/IrMn, IrMn/NiFe, NiFe/IrMn/NiFe by applying during deposition a magnetic field of a special configuration. As a result, we show the influence of external magnetic field, applied during deposition of mentioned thin film structures on their magnetic properties.

Keywords: Exchange Bias, Thin Film, Hysteresis Loop, Bilayered, Nife, Irmn

INVITED SPEAKERS

Id-1082

In situ Investigation of Calcium Oxalate Kidney Stone Biomineralization

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Abstract:

Calcium oxalate (CaOx), is the major pathological biomineralization in human kidney stones, which affect hundreds of millions of people worldwide and cost over $5 billion dollars per year. Due to the substantial human and economic burden, further research and imaging of CaOx nanoscale biomineralization is imperative. However, the electron microscopy (EM) necessary to visualize nanoscale structures of CaOx is technically difficult due to the beam sensitivity of the mineral, the effect of the vacuum, and the sample preparation. Furthermore, in situ nanoscale formation of beam sensitive CaOx has been limited to two-dimensional techniques such as atomic force microscopy. Objective: In situ EM real-time imaging of CaOx nanoscale biomineralization phenomena as well as Its chemical and structural characterization without requiring preservation of the sample. Here, CaOx was synthesized within an EM liquid flow holder (LF). The octahedral morphology of the CaOx is indicative of CaOx in the dihydrate hydration state (COD), in contrast to previous ex situ synthesis of the more stable CaOx monohydrate (COM) synthesized via chemical reaction in bulk solution. The COD crystals range from 50nm to 500nm across; the former being smaller than Abbe's limit. Significance: This nanoscale mineralization demonstrates the necessity of high-resolution imaging to study the in situ nucleation, growth, and adhesion of CaOx. An improved understanding of classical and non-classical mineralization may yield insight into high efficacy CaOx treatments and preventative medicine.The authors gratefully acknowledge NSF award #1710049, and NSF CAREER award #1564950.

Keywords: Kidney Stone, Biomineralization, TEM, Imaging

INVITED SPEAKERS

Id-1085

Real-Time TEM Observation of Electrochemistry and Failure in Battery Materials

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Abstract:
Electrodes in rechargeable batteries undergo complex electrochemically-driven phase transformations upon driving Li ions into their structure. Such phase transitions in turn affect the reversibility and stability of the battery. This presentation gives an overview of the PI's research program on in-situ transmission electron microscopy (TEM) of ceramic battery materials. In-situ TEM has been shown to be a very powerful technique in shedding light to some of the mysteries in electrochemical performance of new materials. Various anode materials including SnO_2 and MnO_2 were subjected to lithiation process and the transport of Li ions was visualized within their atomic structure. For SnO_2 nanowires, it was observed that the Li ion transport results in local strain development preferably along (200) or (020) plans and [001] crystallographic directions. The lithiation behavior in the presence of twin boundary defects was completely different compared to pristine state with no twin boundary defect. We showed that twin boundaries in general provide a more accessible pathway for Li ion transport. Anisotropic plastic deformation was also observed along [010] directions of MnO_2 nanowires. Sb-based intermetallics which have been proved to be promising anode materials for Li-ion batteries, are also capable of storing of sodium ions. We investigated the microstructural changes and phase evolution of such intermetallic nanowires using in-situ TEM. These alloys also exhibit a new cubic alloying phase that form by intermixing of the ABAB atomic ordering in hexagonal lithiated phase due to Li inclusion in their lattices. Our results indicate that the reaction between these alloys and sodium proceeds through a different pathway during the first compared to the subsequent cycles.

Keywords: Ceramics, Rechargeable Batteries, In Situ Transmission Electron Microscopy, Nanomaterials, Nanowires.

INVITED SPEAKERS

Id-1106

Advanced Microtubular Solid Oxide Cells for Operation in Both Fuel Cell and Electrolysis Modes

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Abstract:
In the last decade, we have manufactured extruded support tubes based on Nickel Oxide-YSZ (yttria stabilized-zirconia) by Powder Extrusion Moulding (PEM), followed by YSZ and $La_{0.8}Sr_{0.2}MnO_{3-\delta}$ (LSM)/YSZ deposition by dip coating. Microstructure of the anode support was optimized in order to achieve the maximum fuel utilization and as a consequence, a high performance of the cells. Experiments as a function of the fuel composition showed power densities above 500 mWcm^{-2} at 800 °C and 0.7 V, with high fuel utilization (~75%). Long-term durability studies were also performed for a period above 1000 hours. An increased performance in both fuel cell and electrolysis modes was achieved using LSCF oxygen electrodes, where the cells showed power densities of about 700 mW cm^{-2} at 800 C and 0.7 V in SOFC mode, and of 845 mA cm^{-2} at 800 °C and 1.3 V in SOEC mode. Next generation of cells include the development of advanced oxygen electrodes, including $Pr_2NiO_{4+\delta}$ (PNO), infiltration of $Nd_2NiO_{4+\delta}$ (NNO) into porous YSZ or by the addition of Pr and Mn oxides into standard LSM/YSZ composites. Their performance under both fuel cell and electrolysis modes will be shown, as well as short-term durability experiments.
Keywords: SOFC, Microtubular, YSZ, Fuel Cell, Electrolysis

INVITED SPEAKERS

Id-1115

New Antifouling Agents for Antifouling Composites

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Abstract:
Antifouling coatings are of great importance to prevent settlement of fouling organisms on the artificial surfaces. The artificial surfaces in which fouling coverage is observed very dense are ships' hull, heating systems, fish nets etc. The settlement of fouling organisms onto ships' hull causes problems such as increased fuel consumption, increased CO2 emission, introduction of invasive species to the new ecosystems, decreased maneuverability and decreased speed. The coverage of fish nets by fouling organisms results the increased weight of the nets, allergenic effects by fouling organisms to fishes inside the cages, decreased oxygen levels and increased temperature inside the cages compared to outside. These problems result with the economic harms. In the present report, the progresses in the antifouling agents will be presented and compared with the current technology. The environmental effects of the current coatings will also be discussed based on the reports in the scientific literature.
Keywords: Antifouling, Fouling Organism, Antifouling Biocides and Paints, Ships' Hull, Fish Nets.

INVITED SPEAKERS

Id-1115

Utilization of Polymeric Precursors to Address the Issues of Solid Oxide Fuel Cells

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Abstract:
Several problems associated with solid oxide fuel cells (SOFCs) prevent these promising devices from being commercially attractive. For example, the high co-sintering temperatures (1350-1450 °C) used to fabricate anode/electrolyte bilayers originating from the necessity to obtain gas-tight electrolytes result in composite anodes with coarse microstructures and hence, poor electrochemical activity. Similarly, the conventional electrode fabrication methods involving the sintering of electrocatalyst and ionic conductor powder mixtures yield microstructures characterized by large particle sizes and undesired resistive phases at the electrocatalyst/ionic conductor interface. Our studies focus on addressing the above-mentioned issues via the utilization of polymeric precursors of ionic conductor and/or electrocatalyst phases to fabricate SOFC electrolytes or electrodes. We have observed that polymeric precursor-based fabrication of SOFC components can potentially address all the high-temperature processing related issues of SOFCs. For example, we have been able to reduce the sintering temperature of gadolinia doped ceria (GDC) electrolyte from 1450 °C down to 1200 °C by infiltrating a polymeric GDC precursor into a pre-sintered porous GDC scaffold prior to heat treatment. This way, finer anode microstructure upon co-sintering with the electrolyte and thus yield higher electrochemical activity. Polymeric precursors can also be utilized to fabricate composite electrodes with nanoscale electrocatalyts-ionic conductor composite morphologies. Our recent experiments show that extremely low polarization resistances can be obtained when a mixture of electrocatalyst and ionic conductor polymeric precursors are deposited onto electrolyte substrates via spin/dip coating processes in the form of thin films and heat treated at temperatures as low as 500 °C.

Keywords: Solid Oxide Fuel Cells, Polymeric Precursors, Sintering, Electrochemical Activity

ORAL PRESENTATİON

Id-502

Chemical Machining of St37 Rod with $FeCl_3$

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Abstract:
Chemical machining is one of the oldest nontraditional machining processes. It applies chemical etchant to machine material. The method is very basic and economical to produce complex geometrical parts from thin sheet materials. The application of this method to cylindrical parts is not common. In this study, chemical machining process was employed to machine rod as cylindrical part. The selected material was 10 mm of diameter St37. The experimental study implemented ferric chloride which is known as universal chemical etchant for iron-based materials, at three different etchant solutions in two chemical machining temperatures (30°C and 50oC). The experimental set-up is based on upright drilling machine that has three different spindle speed values (250, 500 and 1500 rpm). It was observed that lower etchant concentration provided higher diameter reduction, surface roughness and cylindiricity. Moreover the effect of chemical machining temperature is examined and higher of this value produced faster machining.

Keywords: Chemical Machining, Ferric Chloride, Diameter Reduction, Surface Roughness

ORAL SESSION

Id-503

Etchants for Chemical Machining of Aluminium and Its Alloys

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Abstract:
Aluminium is one of the main engineering materials used extensively in aircraft and automotive industries where the weight is important factor. Chemical machining of aluminium and its alloys has widely been studied to produce parts. Chemical machining is based on selection of optimum chemical solution which is named as etchant for shaping the required material. In this study, chemical machining of aluminium and its alloys has been surveyed to provide scientific data for industrial applications. Other chemical machining parameters such as etchant concentration, chemical machining temperature and additives to main etchant have been extensively examined.
Keywords: Chemical Machining, Aluminium, Etchant, Temperature

ORAL SESSION

Id-510

Effects of Ausforming on Tensile and Impact Properties of ARAA

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Abstract:
Reduced-activation ferritic-martensitic (RAFM) steels are considered primary candidate for structural materials in the fusion reactors. One of major shortcomings of the steels is inferior creep resistance at elevated temperatures, which limits the maximum operation temperature below 550 °C. In conventional RAFM steels, the main obstacles to dislocation motion at high temperatures are carbides, and accordingly the evolution characteristics and stability of such carbides have great influences on the creep strength. Thermo-mechanical processing is one of the practical ways to control the microstructure of RAFM steel having a fixed chemical composition. We show here that high-temperature strength of ARAA can be considerably enhanced by thermo-mechanical processing that consists of Ausforming and tempering. A systematic study on effects of the process variables showed that the temperatures and amounts of Ausforming have great influences on grain structure and dislocation substructure of the as-Ausformed ARAA. It was found that a larger amount of Ausforming at the lower austenite regime is effective for the increase of density of dislocations and grain boundaries, and thereby provides more sites for nucleation of carbides. Such finer microstructure developed by thermo-mechanical processing eventually enhanced high-temperature strength and impact resistance of ARAA without the sacrifice of ductility. It is also found that morphological and crystallographic textures introduced by Ausforming have little influence on mechanical anisotropy.

Keywords: RAFM Steels, Thermomechanical Processing, Carbides, High-Temperature Strength, Aging

ORAL SESSION

Id-541

Attenuation of Gamma Rays Properties by Cement Paste – waste Paper Composites

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Abstract:
For the solution of environmental problems and sustainability or in order to remove the resource incompleteness, it is necessary to use recycles of the waste. In recent years, it has become widespread that various waste materials are used for various purposes in civil engineering as concrete aggregate and cement added material to be used for improving strenght and radiation shielding properties have increased. For his purpose, mix design was based on the standard of TS EN 196-1,2016 mortars was produced with, sand, cement, water and different ratios of waste paper. Waste paper was used as partial replacement as 0- 0.25-0.50-0.75, ratios of sand weight, and the Cement: Sand ratio as 1: 3, was keept in the studied mortars. The mortars obtained were characterized in terms of density, ultrasound velocity, compressive strength and attenuation of γ- rays with different energies. The attenuation coefficient and the tenth value thickness of samples were calculated and discussed.

Keywords: Recycling of Waste Paper, Cement Mortar, Attenuation of γ- rays, Sustainability

ORAL SESSION

Id-542

Conjugated Organic, Organometallic and Coordination Polymers for Solar Cell (SC) Application

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Abstract:

Poly-ynes constitute a fascinating class of solution-processable and property-tunable conjugated organic polymers for new materials applications. In organometallic poly-ynes, the photo-physical properties of metal fragments are coupled to those of the conjugated organic poly-ynes producing novel functional materials for opto-electronic applications. For example, the incorporation of heavy Pt metal along the poly-yne backbone introduces large spin-orbit coupling to allow light emission from the triplet exited states. Consequently, Pt(II) (poly-ynes) serve as model compounds to study the photo-physical properties of conjugated organic poly-ynes. Poly-ynes and Pt(II) (poly-ynes) incorporating a wide range of conjugated spacers have been widely investigated in our laboratory.

Cu(I) is well known for its ability to form, in association with various types of bridging and terminal ligands, poly-nuclear species of various shapes and sizes where weak bonding interactions between the closed-shell metal centers are generally present. Cluster of rhomboid Cu_2I_2 dimers, cubane Cu_4I_4 tetramers, and the infinite $Cu_\infty I_\infty$ zigzag or stair-step polymers are well-known for their rich photo-physical properties. The design and development of some novel coordination-driven self-assembled Cu(I)halide clusters incorporating acetylide-functionalized pyridine ligands in our laboratory has opened the opportunity to explore the chemistry and photo-physics of these novel metal-organic framework (MOF) materials. In this paper we present the design, synthesis and photovoltaic properties of a series of poly-ynes and Pt(II) (poly-ynes) incorporating phenothiazine spacer. The synthesis of a series of arylethynylpyridine coordinated CuX complexes in the presence of phosphine co-ligands containing anchoring carboxyl and sulfonic acid groups will be presented. The photo-physical properties and solar cell application of the new materials will be discussed with structural analysis of model compounds.

Keywords: Poly-ynes, Pt(II) (poly-ynes), Coordination Polymers, Cu(I) Clusters, Solar Cell, Metal-organic Framework.

ORAL SESSION

Id-554

Polylactide / Halloysite Nanocomposite Foams: Particle Dispersion and Mechanical Strength

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Abstract:
Polylactide (PLA) foams have been used in biomedical applications such as scaffolding and tissue engineering due to its biocompatibility. However, its brittleness and low melt strength limit its wide range of applications. In this study, halloysite nanotube (HNT) reinforced PLA foams were prepared in order to improve the properties of the material. PLA/HNT composites were compounded on twin screw extruder within constant concentration of HNT (0.5%wt.). In extruder processing, compounding was realized in two different ways and then they were compared. In the first one, PLA/HNT was melt mixed by the addition of 1% (wt) azodicarbonamide (AC) in order to enhance the dispersion of the nano particles in the matrix. In the second one, azodicarbonamide was not added into the extruder while PLA/HNT was compounded. After melt mixing process, neat PLA and PLA/HNT pellets were foamed by chemical foaming on a conventional injection molding machine and tensile test samples were obtained. Mechanical test and morphological investigations were made in order to observe the effects of HNT presence and HNT dispersion on tensile properties of PLA and its foam cell generation. It has been seen that HNT addition in that small amount could rise the tensile strength of PLA/HNT about 50% and elongation increased 77 % when compared with that of neat PLA foam. Morphological results showed that HNT could improve the cell formation of PLA nanocomposite foams. The presence of AC in melt mixing resulted in a slight increment in tensile properties.

Keywords: Poly(lactic acid), Injection Molding, Chemical Blowing Agent, Microcellular Foaming Process

ORAL SESSION

Id-569

Investigation of Light Trapping from Porous Silicon Surface for the Enhancement of Silicon Solar Cell Performance

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Abstract:

In this work, an innovative porous silicon structure was utilized as an effective anti- reflective layer for silicon solar cell construction. Silvaco Technology Computer Aided Design (TCAD) tools were used to construct the three structures of the porous silicon layers which were no porous, single porous and double porous. Athena process simulator was used to create the no porous silicon structure (as control device) and the single porous silicon structure. While the double porous structures were created at the n-type and p-type surfaces of the silicon solar cell by using the Device Editor (DEVEDIT) tools. The three simulated structures were imported to the Atlas device simulator tools to simulate the current-voltage(I-V) characteristic and the spectral response of the solar cell. The simulation results of the three structures were compared with the fabrication results obtained by Ramizy et.al. Finally, the efficiency extracted from the double porous solar cell is 9.55%, the single porous is 9.32% and the no porous structure exhibited 4.83% efficiency. The double porous silicon solar cell showed an ability to effectively trapping the light collected in the solar cell and thereby improve the efficiency of the solar cell compared to the no porous and the single porous silicon structure.

Keywords: Silvaco TCAD, Athena, Devedit, ATLAS, Porous Silicon, Anti-Reflective Layer

ORAL SESSION

Id-582

Interaction of Electromagnetic Waves with Multi Periodic Modulated Dielectric Filling of a Regular Waveguide

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Abstract:

The propagation of transverse – electric (TE) and transverse – magnetic (TM) signal waves in the waveguide with arbitrary cross section is considered. It is assumed, that the dielectric filling of the waveguide is modulated on z coordinate (the axis $0z$ is the axis of the waveguide) under multi periodic law with small modulation indexes $m_{n\varepsilon} << 1$ $(n = 1,2,3,4,5)$. The wave equations for H_z and E_z describing TE and TM fields in the waveguide are received. With help of change of variables these differential equations are reduced to the Mathieu – Hill equations with periodic coefficients. Analytic solutions of these equations are found up to small modulation indexes in the first degree in the region of weak interaction between the signal wave and the modulation wave, when the first – order Wolf – Bragg condition for the waves reflected from seals at their interference is not satisfied. The received results show, that TE and TM fields in the waveguide represent the sum of spatial harmonics (zero, plus and minus first) with various amplitudes.

Keywords: Waveguide, Electromagnetic Waves, Modulated Filling, Signal Wave, Modulation Wave

ORAL SESSION

Id-584

Characterization of Polyamide 12 Powder Processed by Selective Laser Sintering

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Abstract:

Selective laser sintering (SLS) is a layer-by-layer advanced manufacturing technique that generates the plastic parts from three dimensional model using thermoplastic powder. Thermoplastic powder material is exposed to high temperature for a long building time during the laser sintering process. This leads to degradation of PA12 powder. Degradation defects on the process are minimized by blending 30-50% virgin powder into the existing powder at each cycle of the production. Nonetheless orange peel texture has been observed on the parts. Also, the dimensional accuracy and the mechanical strength dropped after each production. Eighth cycle of the production seems to indicate the fully degraded powders. Therefore, multiple methods for full characterization, such as, fourier transform infrared spectroscopy analysis (FTIR), thermogravimetric analysis (TGA), differential scanning calorimetry analysis (DSC), scanning electron microscope analysis (SEM), particle-size distribution (PSD), melt flow index test (MFI), surface roughness test, mechanical tests (tensile test, hardness) and molecular weight measurements have been conducted for eight building cycles. Based on the analysis and interpretation of the results, PA12 powder refreshment cycles have been set. These guidelines can help users to increase the lifespan of the PA12 powders.

Keywords: Selective Laser Sintering, Degradation, Polymer Powder Characterization, PA12 Thermoplastic Powder

ORAL SESSION

Id-586

Joining of Soda Lime Silicate Glass to Powder Metallurgical Pressed Dissimilar Ti-304L Metal Joint by Heat Treatment in Air

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Abstract:

Glass to metal and dissimilar metal joining is important for heat collecting units employed in parabolic through solar collectors for improving energy efficiency. Joining of soda lime silicate glass to powder metallurgical pressed Ti – 304 L dissimilar metal joints in air ambient was investigated in this study. Glass cylindrical piece having 10 mm outer diameter and 1.25 mm thickness could be partially joined to powder metallurgical joined Ti-304L dissimilar cylindrical piece having outer diameter of 20 mm and Ti layer thickness of 1 mm and 304L thickness of 1.5 mm. Scanning electron microscope investigation showed that titanium layer was oxidizing in air first and then reacting with glass at interface causing some bubble formations at joining interface. For the used sample size and profiles, partially joined glass layer was remained intact suggesting that residual stress levels stayed relatively low for the glass. Glass to Ti-304L joining failed from oxidized titanium layer at glass – metal interface suggesting that oxidized titanium had relatively high residual stress levels at failed regions. According to ANSYS14 Multiphysics modeling, residual maximum principal stress levels were quite high for oxidized titanium layer at interface and reached to 500 MPa levels in failed regions. However, modelling results showed residual maximum stress levels were lower at the order of 90 MPa levels for the joined glass that remained intact. Bubble formation in glass layer near joining interface was found to be affecting and complicating residual stress levels according to scanning electron microscope observations and modelling results.

Keywords: Soda Lime Silicate Glass, Titanium, 304L, Joining, Powder Metalurgy, Ansys14, Residual Stress Modelling

ORAL SESSION

Id-592

Synthesis and Magnetic Characterization of Cu Substituted Barium Hexaferrites

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Abstract:

Cu^{2+} ion substituted nanocrystalline $BaFe_{12}O_{19}$ ($Ba_{1-x}Cu_xFe_{12}O_{19}$ ($0.0 \leq x \leq 0.5$) hexaferrite powders were synthesized by sol-gel combustion route and its effects on structure, morphology and magnetic properties of barium hexaferrite ($BaFe_{12}O_{19}$) were presented. X-Ray Powder Diffraction (XRD), Scanning Electron Microscopy (HR-SEM), Transmission Electron Microscopy (HR-TEM) and Fourier Transform Infrared (FT-IR) analyses revealed the M-type hexagonal structure of all samples. VSM (Vibrating Sample Magnetometer) analyses showed that all samples have strong ferromagnetic behavior at room temperature. The crystallite size varies in a range of 23.30-35.12 nm. Both HR-SEM and HR-TEM analyses confirmed the hexagonal morphology for products. A minimum of 40.49 and a maximum of 54.36 emu/g estimated specific saturation magnetization (σ_s) were observed for $Ba_{0.5}Cu_{0.5}Fe_{12}O_{19}$ and $Ba_{0.9}Cu_{0.1}Fe_{12}O_{19}$ NPs, respectively. The remnant magnetization (σ_r) has a minimum value of 21.27 emu/g belonging to $Ba_{0.5}Cu_{0.5}Fe_{12}O_{19}$ and has a maximum value of 28.15 emu/g belonging to $Ba_{0.7}Cu_{0.3}Fe_{12}O_{19}$ NPs. The coercive fields are between 1726 Oe and 2853 Oe. K_{eff} (calculated effective anisotropy constants) is changing from 2.31×10^5 to 3.23×10^5 Ergs/g. It was observed that the strong magneto-crystalline anisotropy fields, (H_a) above 11.0 kOe for all samples which confirmed that all samples are hard magnet. Due to their small crystallite size (smaller than 50 nm) and high saturation magnetization, $Ba_{1-x}Cu_xFe_{12}O_{19}$ ($0.0 \leq x \leq 0.5$) nanoparticles can be employed as magnetic recording materials.

Keywords: Barium Hexaferrites, Magnetic Properties, Morphology, Hard Ferrites, Hyperfine Interactions

ORAL SESSION

Id-597

Development of pH Independent Cyclodextrin Capped Silica Hybrids as Nanocarrier for Control Drug Release

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Abstract:
In past nanomedicine has undergone rapid development due to designing of inorganic nanovehicles that can safely reach the targeted organ after passing through various physiological barriers in the human body. The inorganic materials as a nanocarrier have emerged as promising alternatives to organic systems for a wide range of biomedical applications. Among series of inorganic materials, silica has attracted significant interest because of their unique properties such as hydrophilic surface, highly porous , versatile silane chemistry, excellent biocompatibility and ease of low cost of synthesis. Hydrophobic core is considered as beneficial for drug loading but hydrophilic surface of silica blocks opsonization that limits the targeted delivery of drug in the human system. It requires further functionalization of pre synthesized material in order to encapsulate the loaded drug with different targeting species. The present study is planned to synthesize silica based material and functionalized with titanium and vanadium chloride to enhance its properties. Later on silica materials were loaded with cisplatin drug and further modification with β-cyclodextrin carried out to act as a gatekeeper for the control release of loaded drug. The material were subjected to different characterization techniques such FTIR, SEM, XPS and XRD. The formation of modified and gated silicates was confirmed by the presence of IR peak at 475 cm^{-1}.Scanning electron microscopy (SEM) image of synthesized product reveals the. The X-ray diffractometry (XRD) pattern reflects the presence of several crystalline peaks and its particle size is 50 nm that can be calculated by Debye Scherer equation.

Keywords: Nanomedicine, Nanovehicle, Titanium, Vanadium, Drug

ORAL SESSION

Id-599

Effect of Growth Atmosphere on the Surface Morphology, Depolarization and Optical Constants of Polycrystalline ZnO Thin Films

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Abstract:

ZnO thin films were deposited on crystalline Si (1 1 1) substrates at temperature < 50 °C using RF-magnetron sputtering technique. The effect of growth atmosphere on surface morphology, depolarization and optical constants over a wide wavelength range of the films was examined. The ZnO films sputtered in a pure N_2 and in an Ar atmospheres exhibit a polycrystalline structure with different preferred orientations. The root-mean square (RMS) average surface roughness was calculated from AFM images of the thin films: these results indicated that the RMS average surface roughness was less for the films deposited in a pure N_2 than for the films deposited in an Ar atmosphere. Also, the equality of the surface of the thin films was obtained through the depolarization measurements. The film deposited in a pure N_2 shown almost zero depolarization (< 2) with the degree of polarization (P) of 0.98 for the most desired spectral range, indicates that the beam is completely polarized. While the depolarization and P value found to be about 15% and 0.85, respectively for the films deposited in a pure Ar. The optical constants of the ZnO thin films sputtered in a pure N_2 and in Ar atmospheres were determined using spectroscopic ellipsometry through the Genosc™ Herzinger–Johs parameterized semiconductor oscillator functions and multiple Gaussian oscillator models in the wavelength range 190 – 2200 nm.

Keywords: ZnO, Depolarization, Spectroscopic Ellipsometry, Gaussian Oscillator Models

ORAL SESSION

Id-606

A Meshless Method Based on Symmetric RBF Collocation for Neutron Diffusion Problems

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Abstract:

In this study we have worked on the numerical solution of neutron diffusion equation with the symmetric radial basis function collocation method. For the spatial approximation of the neutron flux, multiquadric, inverse multiquadric and Gaussian basis functions are used as the interpolation functions. To test the performance of the method both external and fission source problems are considered in two-dimensional Cartesian geometry. The effect of the shape parameter on the convergence and stability of the numerical algorithm is also investigated. The results have shown that the symmetric RBF collocation method converges exponentially, and it is possible to obtain highly accurate multiplication factors and neutron flux distributions with this algorithm.

Keywords: Neutron Diffusion, Meshless Methods, Radial Basis Functions, Symmetric Collocation

ORAL SESSION

Id-623

Metal Semiconductor Core-Shell Nanoparticles and Nanowires

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Abstract:
Ag, Au, CdS, ZnS, Ag@CdS, Au@CdS, Ag@ZnS and Au@ZnS core-shell nanoparticles and nanowires have been formed in helium droplets by helium nanodroplet technology. CdS, ZnS, Ag@CdS, Au@CdS, Ag@ZnS and Au@ZnS nanoparticles and nanowires have been obtained in the helium droplets for the first time in this study. These nanostructures have been characterized by the transmission electron microscopy (TEM) and UV-Vis-spectroscopy techniques. Compared with bulk CdS and ZnS, the absorption spectra of CdS and ZnS nanoparticles show the blue-shift in the band gap energies due to the quantum confinement effect. The absorption peaks of Ag@CdS, Au@CdS and Au@ZnS nanostructures show the red-shift compared with Ag and Au nanoparticles. The absorptions of Ag@CdS, Au@CdS, Ag@ZnS and Au@ZnS core-shell nanostructures are enhanced in a wide range of visible region compared with bare CdS and ZnS nanostructures. This enhancement is due to the surface plasmon resonance effect. CdS, Ag@CdS and Au@CdS nanostructures evolve from nanoparticles to nanorods and branched nanowires. This evolvement can be explained by the combined effect quantum vortices and multicentre growth.

Keywords: Metal Semiconductor, Core-Shell Nanoparticles and Nanowires, Quantum Confinement Effect, Surface Plasmon Resonance

ORAL SESSION

Id-626

Class Based Storage Strategy Based Mathematical Programming Approach for Hazardous Materials Storage

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Abstract:
The paper presents Storage Location Assignment Problem(SLAP) using a new mathematical programming approach for class based storage assignment in Hazardous Materials Storage (HMS). Class-based storage strategy is widely used in practical dividing all stored items into a number of classes according to their turnover. These classes are easily flammability, corrosive, toxic, oxidizing, explosive substances, and compressed gasses. Material Safety Data Sheets (MSDS) are used for determining the special needs of storing criteria. SLAP problem is solved using a new proposed mathematical model. Main objective of our approach is to a class of items with higher turnover allocated to region closer the warehouse depot. As a results, assigning to materials onto dedicated storage areas with considering the storage constraints of item-to-location and item-to-item in chemical warehouse. Moreover, the item-to-location constraints mean that the item has specified characteristics needs to be stored into lower racks, for Item-to-item constraints, some items should not be stored closing to each other. These constraints confine the storage assignment strategy environmental. Mixed integer mathematical model is solved using Branch and Bound algorithm to minimize traveling distance inside the warehouse. The results indicated that the proposed approach improved the picking efficiency significantly and decreased prevalence of all unexpected situations such as death due to dangerous, injured, and trouble.

Keywords: Class Based Storage, Mixed Integer Mathematical Programming, Hazardous Materials Storage

ORAL SESSION

Id-627

Hazardous Waste Recycling in Turkey: End of Life Tire Case

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Abstract:

In many countries, businesses are held liable for their wastes. Also they are obliged to recycle or dispose of these wastes. One of the economically valuable wastes that recycled is end of life tires (ELT), although it can cause serious damage to the environment if it is not controlled. In Turkey, special legislation for ELT has been developed and the principles of recycling and disposal of ELT collection have been determined by these laws. In this context, producers must plan their activities taking into account the environmental factors during the life of a product, recycle or destroy the ELTs with minimal harm to the environment. In this study, ELT recycling process and management system were researched. A new mixed integer mathematical model is proposed for the collection, transport and recycling of the ELT. Since the dimension of the current problem is not suitable for finding the optimum solution, a clustering first- route second approach is proposed also. The routes between determined recycling plants and the cities which would be waste collected are found by branch and bound algorithm. The proposed approach was validated on a case study.

Keywords: ELT Management, ELT Recycling in Turkey, Mixed Integer Nonlinear Programming, Clustering Analysis

ORAL SESSION

Id-628

Analysis of the Most Important Factors that Affecting Tensile and Shear Strength of Dual-phase Steels using Taguchi Method

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Abstract:
Dual-phase steels are high-strength steels which are heat treated to contain both a ferrite and martensite microstructure for extra strength. They have high formability, low alloy content and high strength.
In today's competitive environment, the aim of businesses are to produce quality products at low cost. The quality is considered substantially in products selection. In this study, the DP 600 series of the dual-phase steel group, which has become widespread in the automotive sector in recent years, is discussed and the most important factors affecting the tensile and shear strength of these automotive sheets are analyzed using the Taguchi method of quality improvement methods. The most important advantage of the Taguchi method is to reduce the number of experiments to be performed using orthogonal arrays. This saves time, labor and cost. Firstly, the average and S/N ratio for each experiment using the L16 orthogonal array are calculated and found which levels are more appropriate for the factors. Then, ANOVA is performed in order to determine the factors, which significantly affect the tensile and shear strength of dual-phase 600 type automobile sheets.

Keywords: Dual-phase, Taguchi Experimental Design

ORAL SESSION

Id-630

Influence of Boron Addition on Magnetic Properties of Sm_2Fe_{17} Alloy

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Abstract:
The purpose of this study is to investigate the effects of boron additions on magnetic properties of stoichiometric Sm_2Fe_{17} alloy. In the experimental process, the alloy ingots with nominal compositions of $Sm_2Fe_{17}B_x$ (x=0, 1, 2, 3, 4) were prepared by arc-melting followed by heat treatment at 1000 °C for 2 h under vacum. In the magnetic susceptibility measurements, for the sample without boron the signals decreased at about 130 °C corresponding to the Curie temperature of Sm_2Fe_{17} phase which has been also detected in the XRD measurements. With the boron addition Curie temperature increased and reached to its highest value of 362 °C fort he sample at x=4. In the XRD measurements, the peaks diffracted from the planes of hard magnetic Sm_2Fe_{17} phase observed in the sample without boron has been disappeared with the boron addition. For all samples the major peaks belong to the α-Fe phase. According to the magnetization measurements, the saturation magnetization value of the sample without boron is 155.52 emu/g, it decreased to its lowest value of 97.93 emu/g for the sample x=4. Boron addition was resulted in an evolution of the phase constitution that caused changes in magnetic properties of the alloys.

Keywords: Arc Melting, Magnetic Properties, Curie Temperature, Rare-earth Permanent Magnets

ORAL SESSION

Id-649

Investigation on the Effect of Direct Current and Integrated Pulsed Electrochemical Etching of n-Type (100) Silicon

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Abstract:

This paper investigates the differences of structural characteristics between direct current photo-electrochemical etching (DCPEC) and integrated pulsed photo-electrochemical etching (iPEC) techniques on porous silicon formation. The n-type Si (100) were fabricated by using both techniques with a current density of 20 mA/cm^2 for 20 min in electrolyte consists of aqueous Hydrofluoric Acid (HF) and Ethanol, C_2H_5OH with ratio of 1:4. An additional pulse cycle of 14 ms with T_{on} of 10ms and T_{off} of 4 ms were being supplied for iPEC porous silicon sample. Finding from both samples showed that the pore formation was affected by the etching techniques used. Different shapes and sizes of the pore can be seen from top view images of the samples. Field Emission Scanning Electron Microscopy (FESEM) images demonstrated the formation of non-uniform square-like shape pores with a porosity of 21% for DCPEC sample. Meanwhile, the sample prepared by iPEC technique form a mixed of circular and crossed shape pore with a higher porosity of 29%. This difference in pore formation mechanism may be attributed to the T_{off} that presence in iPEC sample as it allows the sample to eject the H_2 bubbles and at the same time allow fresh HF to penetrate into the pores and react with the substrate, which can enhance the etching rate. Energy-dispersive X-ray spectroscopy (EDX) results show strong signal from silicon atom at peaks of 1.8 keV. The sample prepared by DCPEC sample have greater value of silicon atom (88.87%) compared with iPEC sample (79.61%). This could be due to having smaller and shallower porous structures and larger crystallite size of silicon.

Keywords: Porous Silicon, Integrated Pulsed Electrochemical Etching, Porosity

ORAL SESSION

Id-651

Slot-die Coated Active Carbon Films for Hydrogen Storage Applications

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Abstract:

Slot-die technique for the deposition of Active Carbon layers has been discussed in this paper. Thin films composed of Active Carbon, have been achieved using the slot-die coating technique for the Hydrogen storage. Carbon nano-particle inks are used in the process for the deposition of layers on flexible PET substrates whereby the Roll-to-Roll system provided the continuous feed of the flexible substrate. Different parameters affecting the process and the deposited layer thickness and uniformity such as stand-off distance, flow rate and substrate speed have been examined as well to come up with an optimized parameter combination. Layers with fine uniformity are achieved and an operating envelope is constructed between the applicable values of coating speed and flow rate. Flow rate below 0.9 mL/hr and more than 1.75 mL/hr was deemed unfit for the process. Based on these values the substrate speed of 70mm/s ~ 100mm/s is determined to be the recommended speed. The thickness of the deposited films varied from 3 μm to 8 μm with varying flow rate and stand-off distance. The process was first simulated using a commercially available multiphysics package and then validated by the experiment results. The deposited films were characterized for the surface morphology and roughness apart from transmittance porosity. The cost-effectiveness, room-temperature operation, environment friendliness and simplicity of the process with its possible integration with high throughput manufacturing processes like Roll-to-Roll process makes it an idyllic candidate for deployment in the challenging field of Hydrogen storage at a large scale.

Keywords: Activated Carbon, Hydrogen Storage, Fuel Cells, Slot Die Coating

ORAL SESSION

Id-657

Electroless Deposition of Cobalt-Zinc-Boron Coatings Using Morpholine Borane as a Reducing Agent

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Abstract:
Electrolessly deposited cobalt coatings have been widely used in different industries such as electronics, automotive, aerospace, medical, petrochemical, food military etc. This wide field of application can be explained by a well-known combination of properties, including high corrosion resistance, excellent wear resistance, uniformity of coating thickness and magnetic properties. It is well known that metal-zinc alloy coatings can provide better surface properties with respect to corrosion resistance and mechanical properties than pure metal coatings. In this study, we present a simple electroless deposition method of cobalt-zinc-boron coatings using morpholine borane as a reducing agent, aminoacetic acid (glycine) as a ligand, zinc sulfate heptahydrate and cobalt sulfate heptahydrate as zinc and cobalt sources. The deposition of coatings was performed from a freshly prepared solution at 25 to 55 ºC, pH in the range of 5-9. The composition of the cobalt-zinc-boron coatings was investgated by means of ICP-OES. The morphology of cobalt-zinc-boron coatings was studied using FESEM. It has been determined, that the rate of electroless deposition of cobalt-zinc-boron coatings and their composition depends on the concentration of zinc sulfate and reducing agent, as well as on pH and temperature of the plating solution. Electroless deposition of cobalt-zinc-boron coatings can be performed in a wide temperature range from 25 to 55 ºC. After appropriate conditions had been selected, high-quality cobalt coatings containing 1.3 wt. % to 8 wt. % of zinc and 0.17 wt. % to 1.92 wt. % of boron were obtained.

Keywords: Electroless Deposition, Cobalt, Zinc, Boron, Morpholine Borane

ORAL SESSION

Id-658

Carbon Based Metal and Metal Oxide Supported Nanocomposites: Fabrication, Characterization, Application

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Abstract:
Nanoscale materials are very important in many industries. There are many various synthesis methods such adsorption, electroless deposition, galvanic displacement or microwave irradiation methods which let to fabricate nanomaterials. Nanoparticles-based catalysts are usually heterogeneous catalysts broken up into metal nanoparticles in order to speed up the catalytic process. Metal nanoparticles have a higher surface area so there is increased catalytic activity because more catalytic reactions can occur at the same time. Nanoparticle catalysts can also be easily separated and recycled with more retention of catalytic activity than their bulk counterparts. In the present work, Pt, Au and Co nanoparticles deposited on the different surfaces such as CeO_2/carbon, Nb_2O_5/carbon, carbon and graphene were fabricated using the rapid microwave heating and adsorption methods. The synthesized catalysts were examined by Transmission Electron Microscopy, X-ray Diffraction and Inductively Coupled Optical Emission Spectroscopy. The electrocatalytic activity of the Pt, Au and Co supported catalysts towards the oxidation of alcohols and reduction of oxygen was investigated by cyclic voltammetry, chrono-techniques and rotating disk electrode linear sweep voltammetry. Metal nanoparticles of ca. 1-15 nm in size were successively deposited onto the surfaces of CeO_2/carbon, Nb_2O_5/carbon, carbon and graphene. Metal nanoparticles were uniform and well dispersed on the mentioned surfaces. It has been found, that the modified catalysts show enhanced electrocatalytic activities towards alcohols oxidation as well as oxygen reduction reactions in comparison with those at the bulk platinum or gold catalysts.

Keywords: Metal Nanoparticles, Metal Oxides, Electro-oxidation, Oxygen Reduction

ORAL SESSION

Id-660

The Effects of Intumescent Flame Retardant and Nanoclay on Mechanical and Thermal Expansion Properties of High Density Polyethylene Composites

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Abstract:
In this work, ammonium polyphosphate and melamine were added as a flame retardant to the nanoclay reinforced high-density polyethylene composites. Ammonium polyphosphate and melamine were added at weight ratios of 0 wt.% and 20 wt.% to the polymer matrix and their proportions are changed. The addition of nanoclay was carried out at weight ratios of 2 wt.% to the polymer matrix. Blending operations were performed by premixing with a mechanical stirrer and melt extrusion technique with twin screw extrusion respectively. The samples were produced by injection molding. Tensile tests, three-point bend tests, tear tests, Izod impact tests and thermomechanical analysis were carried out to investigate the mechanical and thermal expansion properties. Mechanical test results showed that addition of intumescent flame retardant systems and nanoclay decrease the tensile strength values while increase slightly flexural strengths. However, it has been observed that the addition of additives increases the flexural modulus of the polymer composites.

Keywords: High Density Polyethylene, Ammonium Polyphosphate, Melamine, Nanoclay, Tensile Test, Three-point Bend Test, Izod Impact Test, Thermomechanical Analysis

ORAL SESSION

Id-671

Biomechanical Analysis of C5-C6 Spinal Unit with Artificial Disc by Finite Element Method

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Abstract:

Spinal fusion and total disc arthroplasty are used in the surgical treatment of cervical disc degeneration. When mobility is desired in the functional spinal unit (FSU), total disc arthroplasty is preferred instead of fusion. In this study, the effects of artificial disc prosthesis on the biomechanical behavior of the C5-C6 functional spinal unit were investigated by finite element method. Firstly, three-dimensional model of C5 and C6 vertebras were created using a computerized tomography (CT) images of a healthy human neck. The annulus and nucleus portions of the intervertebral disc was modeled separately, and the mechanical properties of annulus was defined by using anisotropic hyperelastic material model. The mobility of the intact model consisting of intervertebral disc, joints and soft tissues was validated by experimental and numerical studies in the literature. In the second step, artificial disc with ball and socket type replaced between C5 and C6 by total disc arthroplasty method was modeled and the finite element analysis of the vertebral unit was performed. Finally, the effects of the artificial disc on the biomechanical behavior of the FSU were compared with the numerical results of intact disc.

Keywords: Cervical Disc, Total Disc Arthroplasty, Disc Prosthesis, FEA

ORAL SESSION

Id-673

Characterization of Thin Film Boron Nitride Coatings and Observation of Graphitic Boron Nitride

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Abstract:
In most engineering design applications involving machinery, complex mechanisms and etc., with rotary, relative or reciprocating motions, friction/wear properties of contacting surfaces affect the overall performance. One solution is using high hardness thin film coatings to improve part's performance by reducing wear effect. A recent candidate; Cubic boron nitride (c-BN), has recently come to the scene as a new generation thin film solution providing high hardness values with sufficient wear resistance and chemical stability. Furthermore, BN also demonstrates graphitic properties making it a candidate for nanotechnology applications. In order to achieve the best performance from this thin film system, the phase compositions (h-BN, w-BN, c-BN, e-BN), lattice match, phonon dynamics, interfacial, buffer layer and epitaxial dynamics including nucleation should be investigated. For this purpose, PVD grown BN thin films have been studied using Raman, IR, optical spectroscopy, XRD, AFM, and SEM microscopy techniques. The results obtained from these techniques have been correlated to micro hardness and scratch tests. Our results show that hexagonal and cubic hybrid bond explosive (e-BN) phase has been observed which exhibited graphitic properties.

Keywords: Boron Nitride, Cubic, Characterization, Thin Film, Graphite

ORAL SESSION

Id-677

A New Approach to Non-invasive 3D Optical Measurement of Round Surfaces

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Abstract:
Precise measurement of wear profiles in large areas of round surfaces such as shafts, suspension bars and high-deviation geometry surfaces is a challenge. It originates to the change in the optical depth compared to the imaging focal volume combined with astigmatism and chromatic aberration introduced by the optics. This results in non-linear reference plane limiting 3D optical measurements on round surfaces which is required especially in industrial applications and large roughness surfaces. In order to overcome this challenge, a new instrumentation method has been developed. This method relies on angular slicing of optical images with digital image optimization. This method has been used for measurement of irregular wear in quality testing of round surfaces which provides information on estimating the surface lifetime after prolonged use. In conventional contact-based measurements, wear can generally be measured in only one axial direction at a certain angle. In addition, there is no exact comparison between the reference surface and the worn surfaces along the angular direction. The method presented here does not only models three-dimensional round surfaces but also measures the geometrical parameters in micron accuracy. According to the results obtained using this new approach better than 3D depth accuracy of 15 microns has been achieved in suspension bars with diameters up to 40mm from 25cm imaging distance.

Keywords: 3D Optical Measurement, Digital Image Processing, Suspension Bar, Wear

ORAL SESSION

Id-684

Comparison Foaming Behavior of Polylactic Acid and Polypropylene

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Abstract:

Polymer foams have wide application area due to their light weight, resistance to impact, their ability of insulation, damping properties for specific applications. In this study, two different thermoplastic materials, polylactic acid (PLA) and polypropylene (PP) were used to compare their foaming ability in foam injection molding. Chemical foaming agent, azodicarbonamide, was used in foam injection molding and tensile test samples were obtained by injection molding. Mechanical strength of the polymer foam samples were investigated by tensile test. Scanning electron microscopy was applied in order to observe the difference cell morphologies of PLA and PP foams. It has been seen that 1,25 % higher cell density and 39,8 % bigger cell size have been seen the PLA foam when the results were compared with PP. Weight reduction was also 21,5 % higher in PLA foams due to its better foam cell morphology.

Keywords: Polymer Foam, Polylactic Acid, Polypropylene, Injection Molding, Cell Morphology, Mechanical Strength

ORAL SESSION

Id-687

Investigation the Effect of Auto-focus and Auto-threshold Algorithms in Advanced Nodularity Analysis of Austempered Ductile Iron Castings

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Abstract:
Austempered ductile iron castings (ADI) have a wide range of application areas including defense, automotive, heavy-duty machinery industries due to its promising mechanical properties. ADI could provide excellent combination of high strength, toughness and wear resistance. Those excellent combination of mechanical properties can be achieved by a specific microstructure composed of spheroidal graphite particles in an ausferritic matrix. The size, area and number fractions as well as the nodularity of graphite particles have a profound effect on the mechanical properties. In order to realize the excellent combination of mechanical properties of ADI, controlling those parameters related to graphite nodules following the casting operation is crucial, and more critical than other grades of ductile irons. Previous studies has shown that controlling nodularity via spatially resolved wide area mapping reduces representativeness problems and hence improves the statistical reliability. In this contribution, studies on auto-thresholding and auto-focusing algorithms used in advanced nodularity analysis are presented. The results show that those algorithms have significantly improved the reliability of the analysis regarding the size, number and area fraction as well as the nodularity of graphite particles. The presented approach not only improves the accuracy and representativeness of the nodularity analysis but also enables spatial mapping. This spatial knowledge provides better and directed feedback to casting operations of parts with cross-section or geometry variations, and also help us to understand the underlying physical mechanisms of variations in the microstructure.
Keywords: Auto-threshold, Auto-focus, Image Analysis, Nodularity, Austempered Ductile Iron Castings

ORAL SESSION

Id-694

Impact Loading Performance of Polymer Foam Core Aluminum Sandwich Panels

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Abstract:

In this study, two different foam core Aluminum face sheets sandwich panels were developed. The core materials were selected as EPP (Expanded Polypropylene) and XPS (Extruded Polystyrene) foams. Two aluminum face sheets and foam cores were combined with flexible epoxy based adhesives, under 20 N static compression load. The average density of the produced sandwich panels was 0.4 g/cm3. Produced specimens were performed 3 point bending experiments under impact loading. Impact loading experiment was modeled by FEA and compared with the experimental results. Damage behavior of the sandwiches was observed with camera records, and post-mortem analysis was performed. The results show that the produced sandwiches damaged perfectly plastic deformations with face sheets and core. There was not any adhesive and cohesive failure in the core and face sheets interfaces.

Keywords: Aluminum Sandwich Panel, EPP Foam, XPS Foam, Impact Loading, FEA

ORAL SESSION

Id-695

Sound Absorption and Mechanical Properties of the Glass Bubble/Cotton Fibre Waste/Recycled Acrylonitrile Butadiene Styrene (ABS) Hybrid Composite Materials

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Abstract:
Recyclability is one of the key subjects in the Automotive industry to reduce environmental pollution and economic aspects. Today, in an average passenger car, around 150-200 kg polymer materials have been used. One of the most used plastics in the vehicles is Acrylonitrile Butadiene Styrene (ABS) polymer. In the presented study, A recycled ABS based sound insulation composite material was developed by reinforcing with Cotton Fiber Wastes (CFW) and Glass Bubbles (GB). Recycled ABS is dissolved under room temperature with chemical solvents and mixed with different weight percentage (10%, 20%, 30%) CFWs and (5%,10%, and 15%) GBs. The mechanical properties, the sound insulation coefficient and sound transmission coefficients of the developed materials were obtained. The developed materials were concluded according to CFW and GB weight percentages.

Keywords: Sound Insulation, Cotton Fiber Wastes, ABS, Glass Bubbles, Hybrid Composites, Recycling, Mechanical Properties

ORAL SESSION

Id-697

Effects of Ammonium Polyphosphate/Melamine Additions on Mechanical, Thermal and Burning Properties of Rigid Polyurethane Foams

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Abstract:

Rigid polyurethane foams are widely used as thermal insulation materials. However, the foams have fairly poor fire performance. Therefore, different flame retardants are used to enhance the fire resistance of the foams. Meanwhile, it should be pointed out that flame retardant additions into the foams may deteriorate the thermal and mechanical properties of the foams. In this study, intumescent flame retardants are synthesized by using ammonium polyphosphate / melamine in different ratios, namely 3/1, 2/1 and 1/1. The flame retardants were added into the rigid polyurethane foams in 10 wt %. The thermal conductivity, compressive strength, thermogravimetric analysis and UL 94 burning characteristics of the foams were determined and compared. As a result of the experiments, it was found that the best fire resistance can be satisfied with ammonium polyphosphate/melamine (3/1) addition. However, there were slightly increasing in thermal conductivity and decreasing in compressive strength of the foam.

Keywords: Rigid Polyurethane, Ammonium Polyphosphate, Melamine, Mechanical, Thermal, Burning

ORAL SESSION

Id-702

Influence of Type of Process Control Agent on the Synthesis of Ag8ZnO Composite Powder

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Abstract:

In this study, the effect of different types of process control agents (PCA) on the particle size and morphology of Ag8ZnO composite powder was investigated. For this purpose, commercial elemental silver (Ag) and zinc oxide (ZnO) powders were initially mixed with different types of PCAs; and then milled in a two stationary planetary-type ball mill with a ball-to-powder weight ratio of 10:1 and a milling speed of 300 rpm. The usage of PCAs is advantageous to eliminate or minimize agglomeration and to decrease the tendency of cold welding among powder particles. However, contamination from the PCA essentially leads to interstitial contamination, since the PCAs used are mostly organic compounds containing carbon, oxygen, and nitrogen. Hence, it is of importance to investigate the nature of PCA and milling duration that both influence the performance of electrical contacts. Characterization of starting and ball-milled powders was investigated using scanning electron microscopy (SEM) and laser diffraction analysis (Mastersizer). It was found that final powder particle sizes significantly affected by the nature of PCA. Besides, morphology of powders and microstructural analyses prove that the type of PCA is also crucial in obtaining homogeneous mixture of the constituent powder particles.

Keywords: Ball Milling, Composite Powders, Process Control Agent, Silver-Based Electrical Contact Materials, Zinc Oxide

ORAL SESSION

Id-714

Investigation of the Effects of Boron Derivative Ulexite on the Properties of Polyurethane Based Composite Materials for Insulation

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Abstract:
Polyurethane based materials are used in many industries such as heat insulation and automotive industry. Polyurethane based materials are usually preferred due to thermal and electrical insulation, lightness, durability, ease of design and production, high compression strength and corrosion resistance in these areas. One of the characteristics of polyurethane materials that should be emphasized is its easy flammability. Depending on the properties of the polyurethane materials, the combustion mechanism can spread heat, toxic gases and corrosive compounds. These harmful effects can be reduced by increasing the strength of the polyurethane against burning by applying different techniques at the production stage. The most common practice among these techniques is to add flame retardant additives to the polyurethane during production. The properties expected from polyurethane materials vary according to application areas. The properties such as thermal conductivity, density, temperature resistance and mechanical strength, give information on the purpose of using the produced material. For this purpose, in this study, properties such as flammability, thermal conductivity, density, temperature resistance and compression strength, were determined for polyurethane based materials and newly produced polyurethane based materials with flame retardant additives. It is aimed to examined thermal, mechanical, physical properties especially flammability, by adding ammonium polyphosphate, pentaerythritol, and ulexite with different weight ratios into the polyurethane.

Keywords: Polyurethane, Boron Derivative Ulexite, Flame Retardant, Heat Transfer Coefficient, Compression Strength

ORAL SESSION

Id-718

Influence of Cu and Ni Alloying on the Microstructure and Mechanical Properties of Austempered Ductile Iron Castings

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Abstract:
Austempered ductile cast iron (ADI) offers a good combination of high tensile and fatigue strength, good ductility, toughness, wear resistance and damping characteristics, lower density in an economical way. This excellent combination of properties is due to the specific microstructure of ADI; which is composed of spheroidal graphite particles on an ausferritic matrix. The ausferrite consists of acicular ferrite and high carbon retained austenite; which is produced via austempering heat treatment after casting. The term austemperability describes the largest cross-section on which completely ausferritic microstructure can be produced without the presence of ferrite, pearlite or other unwanted micro-constituents. The alloying additions of Cu or Cu+Ni increases austemperability, which means completely ausferritic stuructures can be produced on larger cross-sections. In the present study the effect of the alloying additions of Cu and Cu+Ni on mechanical properties and microstructure of ADI was studied. For that purpose, Y-block specimens having a lean composition, 0.8%Cu and 0.8%Cu+0.4%Ni alloying additions were cast. After austempering treatment tensile tests were conducted and the fracture surfaces were analyzed. The microstructure characterization has been performed using optical microscope, scanning electron microscope, electron back-scatter diffraction technique and also X-ray diffraction. The results show that the Cu alloyed specimen has higher strength but lower elongation. When austempered for longer durations the Cu+Ni alloy contains more retained austenite, its elongation increases but hardness is slightly lower than the rest. Those differences in mechanical properties were attributed to the fraction and morphology of the austenite phase of the matrix.

Keywords: Ductile Cast İron, Austempering, Alloying, Mechanical Properties, Microstructure

ORAL SESSION

Id-723

Mixed-Metal System Based on Mixed-Valent Dinuclear Ruthenium (II,III) Carboxylate and Tetracyanidopalladate (II)

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Abstract:

Dinuclear ruthenium(II,III) carboxylates with a lantern-type dinuclear core, $[Ru_2(O_2CR)_4]^+$, have attracted much attention as unique spin source with metal-metal bonding, where the mixed-spin state is stable. We have engaged in synthesis of mixed-metal complexes of dinuclear ruthenium(II,III) carboxylate with cyanidometalate linking ligands. We found ferrimagnetic behaviors in mixed-metal systems with hexacyanidoferrate(III) $Fe(CN)_6^{3-}$ and octacyanidotungstate(V) $W(CN)_8^{3-}$. On the other hand, weak antiferromagnetic interaction was observed in mixed-metal complexes with dicyanidoargentate(I) $Ag(CN)_2^-$, tetracyanidonickelate(II) $Ni(CN)_4^{2-}$, and tetracynidoplatinate(II) $Pt(CN)_4^{2-}$, and hexacyanidocobaltate(III) $Co(CN)_6^{3-}$. It should be noticeable that the mixed-metal complex with tetracyanidoplatinate(II) has a porous structure with adsorbing property for nitrogen gas. Mixed-metal complex of ruthenium acetate with tetracyanidopalladate(II) can be expected to have a two-dimensional structure by assembling of dinuclear ruthenium unit and linking ligand. In this study, we will discuss on this system in the hope of obtaining new magnetic materials.

Keywords: Antiferromagnetic Interaction, Mixed-valent Ruthenium, Two-dimensional Magnetic Compound

ORAL SESSION

Id-733

Cu Doping Induced Structural and Optical Properties of Bimetallic Oxide Nanodots by the Vertical Spark Generation

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Abstract:

Bimetallic oxide nanodots (NDs) were deposited on the glass substrates by using the modified sparking technique with the Zn and Cu metal tips. The diameters of metal oxide NDs are about 25 nm and 50 nm which were obtained by Cu-Cu and for Zn-Zn tips respectively from the scanning electron microscopy analysis. When the Zn-Cu tips were used, the mixture of nanowires and nanodots were observed. The atomic percentage of zinc and oxygen were observed as 78% and 22%, respectively using Zn-Zn tips, and that of copper and oxygen were observed as 60% and 40%, respectively using Cu-Cu tips from energy dispersive X-ray spectroscopy measurements. When Zn-Cu tips were used, Zn and Cu were dominant compared with the oxygen. The thicknesses of the layers coated with the Zn-Zn, Zn-Cu and Cu-Cu NDs were determined as about 160 nm from the optical response. The PL emission peak was observed in the ultraviolent band with Zn-Zn tips and it was shifted to the higher wavelength (red shift) with Zn-Cu tips. It was observed that the island growth occurs in the horizontal geometry of tips and the growth metal oxide species are more strongly bonded to each other than to the substrate. However, NDs have more uniform distribution in the vertical geometry of tips. Therefore, there is an intermediate combination of layer growth and island growth on the substrate. This study was supported by The Scientific Research Unit of Mehmet Akif Ersoy University with the project numbers as 172-NAP-13,173-NAP-13, 0324-NAP-16, and 0356-NAP-16.

Keywords: Bimetallic Nanodots, Metal Oxide Thin Films, Optical Properties

ORAL SESSION

Id-734

Nonlinear Optical Properties, Optical Limiting and Optical Switching in Natural Materials

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Abstract:

The optical nonlinearity of several natural materials such as Henna, Curcumin, and Hibiscus was studied. The nonlinear absorption and nonlinear refractive of the materials were measured using Z- scan technique. The nonlinear properties were utilized to demonstrate optical limiting and all-optical switching. The pump and probe technique was used to exhibit all-optical switching. The switching characteristics can be utilized to generate all-optical logic gates such as simple inverter switches, (NOT) NOR, AND NAND logic functions.

Keywords: Nonlinear Optics, Optical Limiting, Optical Switching, Natural Materials

Id-735

Influence of Lubricant Inclusion on the Rheological Behaviour and Residence Time Distribution of Ethylene Vinyl Acetate Copolymer During Single Screw Extrusion

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Abstract:

It is the general purpose of this study to investigate the effect of lubricant inclusion on the rheological behaviour and residence time of polymeric materials during single screw extrusion. An ethylene vinyl acetate copolymer was used as the polymeric material and stearic acid which is commonly used to improve the flow characteristics of the polymers was used as the lubricant. In the experimental part of the study, first; ethylene vinyl acetate copolymer granules were coated by the lubricant and then extruded by means of a single screw extruder in combination with a completely transparent barrel. Such set up also enabled in situ flow visualisation of polymeric materials throughout the extrusion process. The residence time distribution was consequently calculated by means of "styrofoam-particulate tracer method" developed for our experiments. In this method, effluent stream incorporating styroform-bead tracers was collected at a defined time interval, under different screw extrusion operating conditions, and collected samples were then pressed into circular film form. Measurement of the tracer concentration in this pressed film was performed by means of an image analyzing system and results were reported as a function of time. Tests were performed and data were reported for three different screw speeds performed at 70 °C operating temperature value.

Keywords: Rheology, Extrusion, Residence Time, Single Screw

ORAL SESSION

Id-739

Investigation of Internal Curing and Temperature Effect on Lightweight and Heat Insulated Mortar with Recycled Concrete Aggregate

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Abstract:

One of the best recycling forms of waste in the construction sector is to use it in concrete or mortar. In this study, recycled concrete pieces and bottom ash were used as aggregates in the mortar. In addition, expanded perlite, which is a material providing lightness, heat insulation and fire resistance, is also used as aggregate. Calcium aluminate cement was preferred as binder to improve fire resistance. Four parameters considered to be important in the study were used; internal curing, cement amount, aggregate ratio and temperature. The Taguchi Method has been used to determine optimum levels of parameters. For this, optimization of a multi-response problem was carried out by the Taguchi Method considering the flexure and compressive strength, dry unit weight, water absorption, capillarity, thermal conductivity, temperature resistance and cost output response with L16 test pattern and the obtained results were examined and evaluated.

Keywords: Mortar, Recycled Concrete Aggregates, Bottom Ash, Expanded Perlite, Lightness, Heat Insulation and Fire Resistance, Internal Curing, Taguchi Method

ORAL SESSION

Id-740

Tribological Properties of Tungsten Carbide (Wc) and Zirconium Carbide (Zrc) Reinforced Aluminum Matrix Hybrid Nanocomposites

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Abstract:
This study aims to investigate of effects of tungsten carbide (WC) and zirconium carbide (ZrC) nanoparticles on dry sliding wear performances of pure aluminum. Composites (Al-1WC and Al-1ZrC) were fabricated by powder metallurgy. Also, Al-WC-ZrC composite material containing 0.5 wt.% WC and 0.5 wt.% ZrC as reinforcing phases was produced to evaluate synergetic effects. Hardness test was performed for all specimens. Wear tests were conducted with applied different loads (5N, 10N and 20N) during 1000 meter sliding distance. Results clearly show that homogenously distribution of nanoparticles was achieved according to the Scanning Electron Microscope (SEM) results. The hardness of pure aluminum was increased significantly. Wear performance was also improved considerably with the addition of nano-reinforcements.

Keywords: Tungsten Carbide, Zirconium Carbide, Powder Metallurgy, Nanocomposites

ORAL SESSION

Id-757

Employment of Auco Catalyst as Anode in Direct Borohydride-Hydroxide Peroxide Fuel Cells

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Abstract:
In this work gold-cobalt (fiber-shaped) (denoted as $AuCo_{fiber}$/Cu) catalyst have been formed by electrodeposition technique and galvanic displacement. At first, the sub-layer of the fiber-shaped Co was deposited on the copper surface. The gold crystallites were then deposited on the Co_{fiber}/Cu electrodes by their immersion into the gold(III)-containing solution for different time periods. The morphology and composition of the catalysts were examined by means of Field Emission Scanning Electron Microscopy, Energy Dispersive X-ray Spectroscopy, X-ray diffraction and Inductively Coupled Plasma Optical Emission Spectroscopy. The electrochemical behavior of the fabricated catalysts towards borohydride oxidation was examined by means of cyclic voltammetry. Single fuel cell tests were performed by employing the prepared $AuCo_{fiber}$/Cu catalysts as the anode and a Pt sheet as the cathode. The anolyte was composed of 1 M $NaBH_4$ + 4 M NaOH and the catholyte contained 5 M H_2O_2 + 1.5 M HCl. It was found that Au particles in size of 15-100 nm were deposited on the Co_{fiber}/Cu electrodes after their immersion into the gold(III)-containing solution for 0.5-5 min. It has been determined that the Au loadings were in the range from 11 to 84 μg_{Au} cm^{-2} in the $AuCo_{fiber}$/Cu catalysts. The direct borohydride-hydroxide peroxide fuel cells exhibited an open circuit voltage of 1.9 V and the peak power densities up to 188 mW cm^{-2} at a temperature of 25°C were obtained.

Keywords: Au, Co, Borohydride, Fuel Cell

ORAL SESSION

Id-764

Corrosion Behaviour of as Cast β-$Mg_{17}Al_{12}$ Phase in 3.5 wt.% NaCl Solution

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Abstract:
In this study, corrosion behaviour of β-$Mg_{17}Al_{12}$ phase was studied as comparing pure magnesium. The corrosion tests were carried out by immersion tests and potentiodynamic polarisation measurements in 3.5% NaCl solution. Compared to pure magnesium, β-Mg17Al12 phase has 2.7 times and 1.8 times lower corrosion resistance according the potentiodynamic polarization and immersion test results, respectively. Hardness test was also showed that β-Mg17Al12 phase was 3.4 times harder than pure magnesium.

Keywords : $Mg_{17}Al_{12}$, Pure Magnesium, Corrosion, Intermetallic

ORAL SESSION

Id-765

A Comparative Study on Microstructure Properties of Az91 Magnesium Alloy with Silicon Addition Using Ceramic Mold

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Abstract:
In this study, comparatively microstructure and hardness properties of AZ91 alloy with the addition of 1.95 wt.% silicon were investigated by using ceramic mold. For this purpose, the alloys were provided to solidfy in different rates owing to use that mold. Alloys poured into this mold showed a rapid cooling behavior due to copper in the base, while cooling rate decreased on the top zone. The results showed that α+Mg main matrix phase is present in AZ91 structure, Mg-Al eutectic and $Mg_{17}Al_{12}$ intermetallic phases extending along grain boundaries were observed in the main matrix as well. As the cooling rate increases, the grain boundaries of $Mg_{17}Al_{12}$ intermetallic phases were increased. The $Mg_{17}Al_{12}$ phase at grain boundaries was partially fragmented by the addition of Si. Coarsen Mg_2Si phases were also formed with the addition of 1.95 wt.% silicon. The hardness values were increased with the increasing of cooling rate and the addition of silicon.

Keywords: AZ91, Ceramic Mold, Microstructure, Hardness

ORAL SESSION

Id-768

Obtainment of Copper(II) Fluoroborate by High-Energy Impacted Ball-Milling

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Abstract:

In this study, copper(II) fluoroborate, one of the special boron products, was synthesized by high energy impacted ball milling method and characterization studies were carried out by means of FTIR and BF_4^- ion selective electrode. Copper fluoride and elemental boron were used as reactants in the study. Mechanochemical method by means of ball milling was carried out, in a three-dimensional spex-type ball mill in an argon atmosphere. Specimens prepared at different mole ratios were mechanically milled in a ball mill for a fixed time to determine the optimum mole ratio and the reaction period was optimized in the next step. As a result of the experiments, the most efficient reaction was obtained when reactant mole ratio (nB / $nCuF_2$) of 0.85: 1 and reaction period of 1500 minutes. Copper(II) fluoroborate was produced with a yield of 84.5% under the optimum conditions.

Keywords: Copper(II) Fluoroborate, Ball Milling, Mechanochemical Reaction

ORAL SESSION

Id-771

Face-Dependent Janus-Effects of Multilayered Graphene Embedded in Transparent Organic Light-Emitting Diodes

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Abstract:
With increasing demand for transparent conducting electrodes, graphene has attracted considerable attention, owing to its high electrical conductivity, high transmittance, low reflectance, flexibility, and tunable work function. Two faces of single-layer graphene are indistinguishable in its nature, and this idea has not been doubted even in multilayered graphene (MLG) because it is difficult to separately characterize the front (first-born) and the rear face (last-born) of MLG by using conventional analysis tools, such as Raman and ultraviolet spectroscopy, scanning probe microscopy, and sheet resistance. In this paper, we report the striking difference of the emission pattern and performance of transparent organic light-emitting diodes (OLEDs) depending on the adopted face of MLG and show the resolved chemical and physical states of both faces by using depth-selected absorption spectroscopy. Our results strongly support that the interface property between two different materials rules over the bulk property in the driving performance of OLEDs.

Keywords: Graphene, NEXAFS, OLED

ORAL SESSION

Id-774

Influence of Aluminum Oxide Addition on Dry Sliding and Corrosive Wear Performances of Copper Matrix Composites

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Abstract:
Present study focuses on effect of aluminum oxide (Al_2O_3) content on dry sliding and corrosion wear behavior of Cu based composites which are generally preferred in engineering applications. Nickel was used as 4 wt. % in this study as a binding agent in order to develop wetting ability between matrix and reinforcement. Cu-4Ni matrix composites were fabricated via powder metallurgy incorporating different amount of Al_2O_3 (3, 5 and 10 wt.%). Hardness tests were performed for all samples. Wear tests were conducted using three different loads (5N, 10N and 20N) under both of dry and corrosive (3.5 %NaCI) conditions. Results showed that, hardness of the composites increased with increasing Al_2O_3 content. Al_2O_3 additions also lead to improve wear resistance of copper matrix composites. Coefficient of friction values of specimens decreased with the addition of reinforcement content. Abrasive wear mechanism was generally observed for all samples especially for higher loads according to the Scanning Electron Microscope (SEM) results.

Keywords*:* Powder Metallurgy, Copper, Aluminum Oxide, Corrosive Wear

ORAL SESSION

Id-796

Spatially-resolved Chemical Analysis of Photodecomposition and Doping Effect of Fluoropolymer-Covered Graphene

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Abstract:
Many efforts have been devoted on chemical modification of graphene layer to modulate its electrical properties. In the previous report, laser irradiation on the CYTOP (Cyclic Transparent Optical Polymer) covered graphene layer induces chemical modification wherein carbon fluoride is formed on the graphene surface. This results in the insulating I-V characteristics, which have been attracting much research interests on it. However, the direct analytical evidence of the fluoride formation on graphene surface is not yet studied. In this presentation, the photo-decomposition of fluoropolymer-covered graphene and its effects on the electrical properties of embedded graphene using spatially resolved X-ray photoemission spectroscopy. From the comparative approach to the photo-decomposition and chemical analysis, we clearly prove that the fluorine atoms of the CYTOP are desorbed from the sample surface by photon irradiation, resulting in a change of difluoride into a monofluoride form. As this photo-induced chemical modification proceeds, the dipole field changes strongly, which is responsible for the field-driven Dirac point realignment of the graphene layer. The desorption temperature of the photo-modified fluoropolymer was similar to that without photon irradiation (286 °C; ～0.047 eV); this similarity means that photo-modification did not cause chemical interactions between the fluoropolymer and graphene.

Keywords: Cyclic Transparent Optical Polymer (CYTOP), Fluoropolymer and Graphene

ORAL SESSION

Id-798

Prediction of the Asphalt Mixture Performance Prepared with Recycled Fine Aggregate by Using Response Surface Analysis

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Abstract:

Aggregate that is used in asphalt mixture is usually obtained from natural resources, such as basalt, granite and limestone which are exploited and processed into crushed stone with various sizes and specific gradation. The ever increasing economic cost and lack of availability of natural material have opened the opportunity to explore locally available recycled materials. Experimental studies can be strength by using numerical methods. By using these methods, without made so much experiment, material performance can be predicted easily. In this study, performance of asphalt mixtures prepared with recycled aggregates was measured by using response surface analysis (RSA) method. For this aim, recycled aggregates obtained from chip seal roads were used as fine aggregate with new aggregates in asphalt mixtures. Recycled aggregates were added into the mixture with 25,50,75,100 percent ratios. 50/70 and 70/100 penetration bitumens were used as binder in the prepared mixtures. In order to the measure perfromance of mixtures, marshall stability, flow, cantabro and moisture susceptibility experimental tests were performed. The results obtained from RSA showed that, the estimation models have R^2 values higher than 50. This means that, RSA can be used as a numerical method for the prediction of asphalt mixture perfomance.

Keywords: Highway Pavement, Concrete Aggregate, Recycling, Waste Management

ORAL SESSION

Id-810

Cu_2O Based Homostructure Fabricated by Electrodeposition Method

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Abstract:

The fabrication of Cu2O-based homojunction was successfully done on fluorine doped thin oxide (FTO) glass substrate by using copper acetate based solution through electrodeposition method. The deposition time of p-Cu2O fabrication on n-type Cu2O thin film was varied and optimized. Other parameters such as potential deposition, bath temperature and pH value of solution were kept constant at -0.4V vs Ag/AgCl, 40 ℃ and pH 12.5, respectively. It was found that the optimum deposition time for homostructure Cu2O thin film was 2 hours. Structural, morphological, and optical properties were characterized using X-ray diffraction (XRD), Field Emission Scanning Electron Microscope (FE-SEM) and Ultraviolet and visible Absorption Spectroscopy (UV-Vis), respectively. The Photoelectrochemical measurement was also done to investigate the polarity of the films.

Keyword: Copper Oxide, Homostructure, Electrodeposition

ORAL SESSION

Id-815

Confocal Raman Microscopy Analysis of Graphene Foam Prepared on Ni and Ni(Cu) Foam and Polymer Film Samples

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Abstract:

This work reports the confocal Raman spectroscopy and imaging of graphene foam prepared on Ni and Ni(Cu) foam using atmospheric pressure chemical vapour deposition (AP-CVD). This includes polymer film samples prepared via a process known as film blowing. The confocal Raman spectroscopy imaging of graphene on Ni foam (grown for shorter growth time) revealed variation in the number of layers, i.e. monolayer, bilayer and few-layer graphene with a larger fraction of mono and bilayer (Fig. 1). To further reduce the number of layers in the as-grown graphene foam the Ni foam was doped with Cu in AP-CVD using a copper foil manufactured for graphene growth. From a Ni foam doped with Cu (Ni(Cu) foam), a graphene foam showed only monolayer and bilayer with a large fraction of the bilayer (≈75% coverage). This may have a potential as a high-current response current collector for supercapacitor applications. Furthermore, this work also reports the effectiveness of a volatile insecticide (i.e. malathion) by using a trilayer polymer film, whereby the middle layer comprised poly(ethylene-co-vinyl acetate) impregnated with malathion sandwiched between two polyethylene outer layers. These layers acted as semi-permeable membrane-like barriers that slowed down the release of the malathion to the surfaces of the film. Confocal Raman spectroscopy and imaging of the trilayer polymer film revealed the slowed release of the malathion to the surfaces of the film. This may have potential as alternative mosquito control interventions.

Keyword: Confocal Raman Microscopy, Graphene Foam, Ni, Ni(Cu) Foam and Polymer Film Samples

ORAL SESSION

Id-822

Effect of Colemanite on Thermal Properties of Recycled Polyethylene

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Abstract:

Boron is known the rare elements moreover, one of the most important element for future engineering. Naturally, boron presents on the earth in soil and rocks and minerals called as a tincal, ulexite, colemanite, boracite, datolite and so on. Besides of the healthy benefits, it has numerous application area form agricultural application to space technology and usually boron derived chemicals from nanoscale to macro such a borones, borates, borohydrides, boronic acids and other boron compounds. But this derived chemicals effects to final product unit cost. Turkey has approximately 70 % of boron reserve all over the world. In this study, usage of boron mineral was investigated as a raw material without any chemical formation of colemanite. For this purpose polyethylene-colemanite composites was produced and characterized thermally and mechanically. Polyethylene was used as a binder and colemanite as a matrix material. Used materials were characterized before process via FTIR, DSC, TGA-DTA and SEM. Thermal mechanical analysis (TMA), three point bendingApmas, shore hardness, limit oxygen index and morphological analysis were conducted on final samples. The results show that colemanite was play ultimate role for flammable properties and mechanical performance could be changed according to amount of colemanite.

Keywords: Colemanite, Recycled Polyethylene, Composite

ORAL SESSION

Id-824

Microstructures, Anti-Bacterial Property and Corrosion Behaviour of of Ti-51at%Ni and Ti-23at%Nb Shape Memory Alloys Used for Biomedical Applications

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Abstract:

Ti-based shape memory alloys such as Ti-Ni are used as medical devices due to their excellent biocompability, mecahnical porperties and corrosion resistance. Howeve rnickle is recently known as a toxic element that can cause hypersensitivity on the human body. Therefore the development of nickel-free Ti alloys such as Ti-Nb for biomedical applications has become an obession among researchers. The aim of the present work was to study and compare between the microstructues, phases, anti-bacterial and corrosion behaviour of Ti-51at %Ni and nickel-free Ti-23at%Nb shape memory alloys. The alloys were produced by powder metallurgy followed by two different sintering methods, namely, microwave sintering (MWS) and spark plasma sintering (SPS). The corrosion behaviour of the alloys was investigated by potentiodynamic polarizaton technique in simulated body fluid and the anti bacterial test was conducted using the agar disc diffusion technique with *E.coli* bacteria. Both alpha and beta phases were observed in the alloys which has significant influence on the overall properties of the alloys. The alloys produced by SPS has less porosity comapre with those porduced by MWS. It was also found that Ti-23at%Nb show better anti-bacterial property compared to Ti-51at %Ni irespective of their fabrication methods. However the two alloys seem to show almost similar corrosion behaviour with slight increase in corrosion resistance for Ti-23at%Nb due to the presence of passive layer on its surface.

Keywords: Shape Memory Alloys, Powder Metallurgy, Corrosion

ORAL SESSION

Id-829

Conductive Polymer Doped with MoS_2 Coatings for the Corrosion Protection of Mild Steel

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Abstract:

In recent years, due to environmental and ecological concerns, chromatizing and phosphatizing coatings are undesirables. The discovery of the conducting polymers electrochemically synthesized as polypyrrole (PPy) polythiophene and polyaniline (PANI) bring an alternative process for the protection of oxidizable metals against the corrosion. Most of investigations of these conducting materials are mainly based on the electropolymerization of their monomers on noble metals or inert materials. However, the anodic dissolution of working electrode before attaining the oxidation potential of the monomer constitutes the main problem for the electrodeposition of polymers on oxidizable metals. Therefore, it is necessary to find new electrochemical conditions for slowing down electrode dissolution without preventing electro polymerization. Electro polymerization of pyrrole, aniline and thiophene on iron and steel surfaces has been performed in aqueous medium in the presence of oxalate as supporting electrolyte. The oxalate counter ion slows down the iron dissolution by leading to the formation of a passivation layer on the working electrode surface, and the electropolymerization starts on. Passivation of mild steel by electrochemically coating with conductive polymer was studied. Adherent and homogenous polyaniline and polypyrrole films doped with MoS_2 were electropolymerized onto mild steel in 0, 1 M oxalic acid by Chrono Amperometric method. The coatings obtained on the mild steel are characterized by SEM. The corrosion performance of PPy, PANI and PPy doped with MoS_2 film coated on mild steel was evaluated in sulfuric acid medium by Tafel Polarization method. The polypyrrole exhibited good corrosion protection properties. The PPy coating has higher corrosion performance than PANI and PANI doped with MoS_2. The polypyrrole doped with MoS_2 showed the best corrosion performance in those coatings. This was attributed to the greater stability of the PPy+MoS_2 layer deposited on mild steel. The obtained film PPy+MoS_2 was shown to have high stability and low permeability in sulfuric acid solution.

Keywords: Corrosion, Conductive Polymers, Electropolymerization, MoS_2

ORAL SESSION

Id-831

Enhancement of Interfacial Polarization of LSCF-SDC Composite Cathode by Using the Current Collecting Layer

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Abstract:

$La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$ (LSCF) is a widely used cathode material for their mixed ionic-electronic conducting (MIEC) behavior. In this work, we have attempted to enhance the electrical performance of LSCF-samarium doped ceria (SDC) composite cathode by using current collecting layer (CCL). Crystal structure, microstructure, band gap, mechanical, chemical composition, electronic conduction and interfacial polarization of the prepared powders were evaluated. We have also elucidated the effect of with and without LSCF based CCL on the interfacial polarization (R_p) of the LSCF-SDC cathode. Results reveal that the addition of high ionic conducting SDC electrolyte has a negligible effect on the phase structure and particle size, but has a significant influence on the band gap and electrical conductivity of LSCF cathode. As a consequence, the area specific resistance (ASR) value of LSCF increased from 0.138 Ω cm^2 to 0.481 Ω cm^2 for LSCF-SDC composite cathode. This increase is due to the addition of SDC which blocked the conduction path between the LSCF particles and therefore imposes a large impact on its R_p value. The electrochemical performance of LSCF-SDC composite cathode could be improved more than 6 times if the in-plane electronic conducting for current collection is used. Electrochemical measurement reveals that the printing a thin CCL minimizes the R_p value, resulting in a lowest ASR value of 0.087 Ω cm^2 at 800 °C for LSCF-SDC composite cathode. This demonstrates that the mass transport process of oxygen ions through the bulk and surface exchange reaction of oxygen at the cathode surface of the LSCF-SDC composite electrode is enhanced.

Keywords: Solid Oxide Fuel Cells, Cathode, Composites, Band Gap, Interfacial Polarization

ORAL SESSION

Id-833

Polydimethylsiloxane(Pdms) as a Potential Antenna Substrate

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Abstract:

The objective of this study is to investigate the potential material of PDMS as flexible antenna and the electrical properties. A stretchable and flexible antenna design fabricated with thin copper (Cu) as radiating element and using the potepolydimethylsiloxane (PDMS) as substrate is presented. Thin copper sheet based conductor has been a good material due to its low cost and high electrical conductivity. The advantages of using PDMS as flexible substrate are that they are inexpensive and able to withstand mechanical strains. Dielectric constant of PDMS is about 2.76 to 3.00. In the antenna design, the ground plane is separated from the transmission line and patch of the antenna by the dielectric substrate. PDMS is acts as an encasing the patch radiator and ground plane. Cu appeared as a conducting part while PDMS as a substrate. The targeted resonant frequency of the designed antenna is 2.4 GHz and has been achieved in the simulation using CST software. From the dielectric constant measurement, the relative permittivity εr of PDMS was found to be 2.76 to 3.00 across the measured frequency and lossy tangent, $\tan\delta$ of 0.01 to 0.05 that operate at 0.2 to 5 GHz. The proposed antenna has shown a good return loss performance and radiation pattern. The energy radiated at the outermost of the antenna, having an omnidirectional pattern which is normal to the patch and is compatible for Body Centric Wireless Communications and wearable antenna application.

Keywords: PDMS, Flexible Antenna, PDMS Substrate

ORAL SESSION

Id-842

Numerical Investigation of Combustion Characteristic of Reactivity Controlled Compression Ignition Engine

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Abstract:

The major challenge for automobile manufacturers is to meet the engine's emissions standard (EURO 6). Several solutions have been proposed by the researchers to reduce diesel engine emissions. The reactivity controlled compression ignition (RCCI) technique is a promising combustion technique due to it is potential in reducing engine emissions and improving overall performance. In this study a mixture of natural gas (NG) fuel and diesel fuel for CI engine has been investigated. The 4 – cylinder engine with dual fuel mode has been built and simulated using GT power professional software. The NG was injected to the engine port with different ratios and the diesel fuel was injected directly to the cylinder to initiate the combustion process. The effect of several engine output parameters such as cylinder pressure, cylinder temperature, heat release rate, engine power, premixed ratio of NG and diesel fuel, injection pressure and engine efficiency on the engine performance and emissions have been calculated and fully discussed. The results showed that the NOx is reduced noticeably and the engine performance is enhanced by means of controlling and optimizing various fuels induction parameters.

Keywords: Engine simulation, Dual fuel engine, Combustion, Emissions, Alternative fuel

ORAL SESSION

Id-843

Influence of Hydrochloric Acid Concentration and Ore Particle Size on the Selective Leaching of Rare Metals From Low-Grade Ores

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Abstract:
Although rare metals are demanded in various industrial fields, their usage are quite limited because of their high prices. Conventional technologies of producing rare metals begins with relatively high-grade ores, which have at least more than 45% rare metals. However, the deposit of high-grade rare metal ores is regionally biased and their selling prices are relatively high. In this study, we investigate an alternative technology of producing rare metals; for example, titanium, using low-grade ores with less than 20% rare metals. Low-grade rare metal ores are more abundantly buried than high-grade ores, and they can be purchased much less expensively. We propose a hydrochloric acid leaching process of a low-grade ilmenite having 18% titanium in order to increase its titanium content to more than 85%. Major strategy is to maximize selective iron leaching from the low-grade ilmenite leaving behind titanium unleached in the ilmenite. Selective leaching between iron and titanium were controlled by manipulating experimental variables such as hydrochloric acid concentration and ilmenite ore particle size. In addition, the usage of reducing agent such as oxalic acid in the leachant influenced considerably the selectivity between metals leaching from the low-grade ilmenite.

Keywords: Rare Metal, Leaching, Low-Grade Ore, Titanium

ORAL SESSION

Id-851

A Multisource Power Management Interface for Energy Harvesting Circuits

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Abstract:

In this paper, an efficient power management interface has been investigated using different green energy sources which are solar, piezoelectric and thermal energy transducers. A PE transducer drives the minuscule rectifier, solar and thermoelectric transducers drives the boost converter and then a high level voltage level selector (HVLS) circuit is used for the selection of voltage. Measured results show that the adaptive power management can be used when any of the input is active. It is simulated using PSPICE simulator and implemented using discrete components and then the regulator is fixed at the out to get the constant 1.8V.

Keywords: Energy Harvesting, Rectifiers, Full Bridge Rectifier.

ORAL SESSION

Id-864

Sloshing Displacement Measurements Based on Morphological Image Analysis

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Abstract:

Sloshing of the contained liquid is an important issue, which needs to be dealt with in the design of moving liquid storage tanks, such as fuel tanks subjected to earthquakes. Numerical methods such as the finite element method or smoothed particle hydrodynamics are commonly used to analyze the sloshing response of liquids in the design of liquid storage containers. The analysis results obtained from numerical methods are usually validated through the comparison of free surface displacements obtained from laboratory tests conducted on scaled tank models. However, the equipment required for measurement can be quite costly and the setup of the measurement system for moving containers can be a tedious process. In order to simplify the measurement setup and reduce the associated cost, we propose a measurement system based on morphological image analysis using a stationary HD camera. In order to verify the validity of the proposed method a shaking table test was conducted on a transparent prismatic liquid tank subjected to a simulated earthquake base motion. The liquid tank was filled with colored water to facilitate image analysis. The video record of the experiment was processed by the proposed algorithm implemented in the MATLAB environment to measure the free surface displacements on the right wall of the tank. The free surface displacements obtained from the video record by automated image analysis were congruent with the manual measurements conducted on the individual video frames.

Keywords: Sloshing, Liquid Storage Tanks, Morphological Image Analysis, Free Surface Tracking, Shake Table, Earthquake

ORAL SESSION

Id-867

Seismic Vulnerability Assessment of Historical Unreinforced Masonry Buildings in Osijek Using Capacity Spectrum Method

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Abstract:

The limitation of deformation, the desired level of bearing capacity of the structural elements and the dissipation of the energy produced by the earthquake, ensures sufficient bearing capacity, stiffness and ductility of structures. These requirements are met by buildings, which are designed and constructed in accordance with the latest technical regulations for buildings exposed to the earthquake. Most of the existing buildings in the city of Osijek do not meet these requirements. For the purpose of considering possible responses of such structures to the earthquakes and their estimates of seismic vulnerability, it is possible to use a Capacity Spectrum Method. Calculation of seismic vulnerability by this method is based on the expected behavior of the building, obtained by overlapping the demand curve and capacity curve. The performance point is the point at which the capacity curve intersects the reduced response curve, at which capacity and demand are equal. The values of spectral displacement obtained for the performance point of a specific building class are used as the input parameters for the fragility curve for different levels of damage. This method will be applied on the collected database of traditional unreinforced masonry buildings of the city Osijek in Croatia. The database is prepared and the main characteristics of the buildings are processed using geographic information system.

Keywords: Seismic Vulnerability Assessment, Historical Unreinforced Masonry Buildings, Capacity Spectrum Method, Geographic Information System

ORAL SESSION

Id-885

Synthesis and Characterization of Hydroxyapatite Produced by Microwave-Assisted Precipitation Technique

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Abstract:
In medical applications, the compliance and integration of bone with implant are a critical issue. Biocompatible metal substrates coated by suitable materials such as calcium phosphates, especially hydroxyapatite exhibit excellent biocompatibility, high mechanical strength, good corrosion resistance and toughness. The use of this type of material coatings on the implant surfaces has recently drawn many researchers' attention. Many methods such as sol-gel and dip coating, electrochemical and electrophoretic deposition, plasma spraying, hot isostatic pressing and pulsed laser deposition have been employed for the production of hydroxyapatite artificially. Among these methods microwave-assisted precipitation technique in a simulated body fluid solution is the simplest and most efficient way to produce hydroxyapatite. Hydroxyapatite with a suitable molar ratio of Ca/P is bioactive, biocompatible and osteoconductive, and enhances direct attachment of implant to bone. In this study, hydroxyapatite powders were produced by microwave-assisted precipitation. The precipitates were washed with ethanol and ultra-pure water to remove impurities and other metallic salts, dried at 100 °C overnight, and then calcined at 900 °C for 2h. The powder samples were analyzed in detail by SEM-EDX, XRD and FTIR. Analysis results showed that experimental parameters such as microwave irradiation power and exposure time had a considerable effect on Ca/P molar ratios, surface morphologies and crystallinity of the powders.

Keywords: Hydroxyapatite, Microwave Irradiation Power and Time, Multiple Regression Analysis

ORAL SESSION

Id-886

The Structural, Morphological and Optical Properties of Cdo Thin Films Prepared by Peg Assisted Silar Method

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Abstract:
In this study, nanocrystalline cadmium oxide (CdO) thin films were prepared on soda lime glass substrates by the successive ionic layer adsorption and reaction (SILAR) technique with and without PEG as surfactant. The effect of PEG concentrations of the growth solution on the structural, morphological and optical features of the CdO films was investigated by means of X-Ray diffraction (XRD), scanning electron microscopy (SEM) and UV-Vis spectroscopy, respectively. The crystal phases of the samples and their crystallinity quality have been analyzed by the XRD measurements. The results obtained from the XRD analysis showed that the preferred growth orientation of the CdO films strongly depend on PEG concentrations. Similarly, SEM images showed that the surface morphologies of the CdO films were influenced by the addition of PEG concentration. From the UV–Vis spectra of the films, it was seen that the optical energy band gap (E_g) of the CdO films were dramatically affected by the amount of PEG content. The investigations showed that the amount of PEG doping during the growth of CdO nanostructures has a significant impact on the physical and optical properties of CdO thin films.

Keywords: Thin Films, CdO, SILAR

ORAL SESSION

Id-895

Topological Analysis of Nuclear Pasta Phases

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Abstract:
Nuclear matter under extreme pressure as in the inner layers of neutron stars form exotic topological states. The states between core and inner crust were recently investigated using Monte Carlo simulations. They were named 'nuclear pasta phases' as their topology resembles Italian dishes. The topology plays extremely important role in these phases and it is supposed that it can be used to determine physical properties of these states like stability, which is unresolved.

In the presentation mathematical analysis in terms of algebraic topology is presented. These topological characteristics provide deep insight into the nature of the pasta phases. The presentation also contains short introduction to algebraic topology, which helps to understand derivations and it is intended for the scientists that are not familiar with this language.

Keywords: Pasta Phases, Neutron Star, Topology, Algebraic Topology

ORAL SESSION

Id-901

Investigation of Alumina/Graphene Mixtures Thermal and Electrical Properties into Polypropylene (Pp) Matrix Based Composites

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Abstract:

Thermal conductivity of polymers can be increased by loading high thermal conductive materials like ceramic, carbon and metal based or mixtures of each other's. In this study, for production of high thermal conductive and electrically insulator composites, Alumina/Graphene hybrid filler prototype mixtures were manufactured. Alumina/Graphene content of the filler mixtures was prepared at 50:0, 49:1, 47:3, 45:5 and 43:7 (w/w) ratios and Alumina/Graphene combinations of fillers loaded polypropylene (PP) matrix composites prototypes were produced at 3:2 polymer/filler weight ratio by high speed thermo-kinetic mixer. Thermal and electrical behaviors of the composites were investigated by differential scanning calorimeter (DSC), simultaneous differential thermal analysis (SDT), thermal conductivity measurement equipment and electrical conductivity measurement equipment. It was observed that the crystallization temperatures of the composites increased with increasing amount of graphene in the composite. At the same time, it was observed that the thermal conductivity values started to rise after 5% of the initial drop by the increase of the amount of graphene in the composite. The thermal conductivity of the composites increased with the addition of graphene. No meaningful change in the electrical conductivities of the composite materials was observed.

Keywords: Thermal Conductivity, Composite, Polypropylene (PP), Graphene (G), Alumina (Al_2O_3)

ORAL SESSION

Id-925

Determination of Optimum Conditions for Production of Highly Porous Carbon by Chemical Activation Method

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Abstract:
Activated carbon is a complex and crude from of graphite. Compared to graphite, activated carbon enjoys an unusual imperfect structure that is tremendously porous ranging from nanopore to milipore sizes. Its graphite-like structure yields the carbon its very large surface area which takes a great advantage to adsorb a wide range of compounds. Although the production of activated carbon from the substances comprising coal and coal tar pitch has been in use, its production via agricultural wastes is possible. In this study presented, as a potential activated carbon, canola straw was selected and obtained by chemical activation. The new carbons produced were characterized by proximate, ultimate analysis, Brunauer-Emmett-Teller (BET) surface area, Scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD). Besides, the effect of experimental parameters on chemical and pore properties of the activated carbon materials was modeled and optimized. The dependence of the properties on the parameters was formulized by regression analysis.

Keywords: Activated Carbon, Characterization, Optimization

ORAL SESSION

Id-927

Effect of Ulexite on Mechanical, Thermal Properties and Flame Retardancy of Polypropylene

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Abstract:
Polymeric materials, due to their inherited flammability, are compounded with flame retardant additives to fulfill fire resistance criteria to be used particularly in electrical and electronics applications. Increasing demand on fire retardant polymers has led to the investigations about manufacturing safe and environmental flame retardant polymers for several industries. For this reason, flame retardant additives have to be added to prevent the polymers from burning. Many halogen containing and halogen-free flame retardant additives are used to improve the flammability properties of plastics. Among them, aluminum hydroxide, bromides, organophosphorus, antinomioxide, chlorides and boron based minerals (ulexite, colemanite, and borax decahydrate) are the common flame retardant materials that are added to polymers to prevent or delay the burning of the thermoplastics. In this study it was aimed to improve the fire retardant performance of halogen free flame-retardant polypropylene (PP) while maintaining thermal stability and good mechanical properties. Ammonium polyphosphate (APP), pentaerythritol (PER) and ulexite were used to improve flame retardancy of polypropylene. Ulexite filled PP granules were obtained by the addition of ulexite powder at concentrations of 1-4 wt% by using twin-screw extruder. Then, composite materials were fabricated by injection molding method. Thermal, mechanical and flame retardant performances of composites were investigated by several characterization techniques. Limiting Oxygen Index (LOI) value higher than 32% was obtained by the addition of ulexite (1-4wt%) to polypropylene when APP and PER fractions were 22.5 wt% and 7.5 wt% respectively. It was observed that tensile properties of composites increased slightly when ulexite was used. It can be said that the flame retardant additives do not change the mechanical properties much. PP has a melting temperature of 163ºC and when APP + PER is added, the melting temperature increased. However the melting temperature does not change when boron additive, ulexite, was added. Decrease in coefficient of thermal expansion was obtained when flame retardant additives are added to polypropylene composites.

Keywords: Ulexite, Flame Retardant, Polypropylene Composites, Mechanical Properties, Thermal Properties,

ORAL SESSION

Id-929

Polyethylene Filled with Almond Shells Particles: Mechanical and Thermal Properties

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Abstract:
Polyethylene is a thermoplastic polymer with variable crystalline structure and applications ranging from grocery bags to bullet proof vests. The main reason for the frequent use of polypropylene is low cost, easy processing and high performance. With regard to industrial applications, the most used systems are filled with natural fillers or fibers, as low cost fillers especially for polyethylene. The natural fillers and polymer composites filled with natural fillers are a low cost materials with minimal impact on the environment. Agricultural waste filled plastics will play a major role in making sustainable products of the future. This makes it possible to conveniently use, in many cases, polyethylene in several applications. The aim of this study is to investigate mechanical and thermal properties of polyethylene based composites prepared with different almond shells powder content. In this paper, polymer composites filled with various filler loading (5, 10, 15 and 20wt.%) were prepared by compounding polyethylene and almond shell. The powders were mechanically blended with polyethylene high speed thermokinetic mixer (Gulnar Makina, Turkey) at 2000 rpm. All specimens for mechanical tests were molded using a hot press molding. Thermal properties of the composites were studied by thermal gravimetric analysis (TGA), differential scanning calorimeter (DSC), and dynamic mechanical analyzer (DMA). Morphology of the composites was investigated by scanning electron microscopy (SEM). Significant change in melting point temperature was not observed. The loss and storage moduli increased with increasing almond shells powder weight fraction.

Keywords: Almond shells, Polyethylene, Thermal properties, Mechanical properties, Composite materials

ORAL SESSION

Id-931

The Radioactive Inventory of the Solid Wastes Resulted from the VVR-S Nuclear Research Reactor Decommissioning

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Abstract:
The radioactive inventory of the solid wastes resulted from decommissioning of the VVR-S research reactor from Bucharest, Romania is assesed and compared to the estimated ones. The activated and contaminated structures are dismantled and cut. The radioactive wastes are placed in 220 l drums and analysed by gamma ray spectrometry method and managed according to the activation/contamination degree, radionuclides components and its dimensions. The inventory at about 2.00E+11 Bq resulted from the components decommissioned far to this moment is concentrated in the 6.6 tons of radioactive waste and represents 33.2% from the estimated ones. It wasn't take in considering the contribution of the biological concrete shielding and the cast iron vessels of the reactor block. The estimated inventory, at about 6.00 E+11Bq for 703.1 tons of radioactive wastes, was obtained by calculation. The ^{60}Co, 38.6%, was identified in all components. The radionuclides hard to detect such as: ^{59}Ni, ^{55}Fe and ^{63}Ni are in the aluminium, graphite and cast-iron components and the activities were calculated based on ^{60}Co activity, using the scaling factors method. ^{137}Cs (1.54E+10Bq) is detected especially in the automatic controller bar also, in the aluminium and stainless-steel components. In the aluminium channels and sheaths from the active core was detected ^{125}Sb. ^{152}Eu, ^{154}Eu and ^{155}Eu are detected in small quantities in the aluminium components. Also, ^{238}U, ^{235}U was detected in the aluminium channels and sheaths from the active core and ^{241}Am in the plastics from horizontal channels.

Keywords: Decommissioning, Radioactive Waste, Activity, Inventory

ORAL SESSION

Id-935

All-laser Scribed Monolithic CdTe Solar PV Mini-Modules Grown by MOCVD

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Abstract:

The inorganic CdTe thin film photovoltaic (PV) technology has become more appealing for large-scale utilization thanks to the recent world records reported (22.1% for best cell and 18.6% for best module). The absorber layer in CdTe devices is commonly fabricated using a vacuum based physical vapor deposition method such as close-space sublimation (CSS) and vapor transport deposition (VTD). Metalorganic chemical vapor deposition (MOCVD), on the other hand, is an alternative non-vacuum method, also enabling ease with layer alloying/doping and decent cell performance (up to ~15%). Scaling-up potential of MOCVD devices was also illustrated using in-line deposition tool and fabrication of monolithic mini-modules. However, all-laser scribed module fabrication has not been demonstrated, as the earlier devices used a combination of methods such as laser/mechanical scribing, inkjet printing/masked evaporation of metal to achieve the required isolations, P1, P2, and P3, respectively, to the front contact (transparent conducting oxide, TCO) layer, the semiconductor (p-n junction) films, and the back contact metal. In this study, we have developed all-laser scribed MOCVD CdTe mini-modules with simplified device processing and narrower dead-zone between the scribes. First, suitable laser scribing parameters were defined for P1 and P2/P3 scribes utilising a 532nm ns-pulsed laser. Second, the problem of alkaline-diffusion from the float glass substrates through P1 scribe was addressed using a straightforward photo-lithography step with the CdTe absorber acting as the natural UV light mask. A comparison was then made between mini-modules fabricated using all-laser scribing vs. hybrid (laser scribing/mechanical scribing/thermal evaporation) methods, whereby the dead-zone is reduced by 80% for all-laser processing. Effect of cell width on module performance will also be reported.

Keywords: Photovoltaic, Solar Cells, CdTe, MOCVD

ORAL SESSION

Id-936

The Effect of Various Minerals on Sound Absorption and Other Properties of Polypropylene

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Abstract:
Human comfort requires an environment with low decibel levels free of unwanted noises occuring from a variety of sources such as manufacturing machines, vehicles, and, from daily activities. For example, the sewage systems should be as silent as possible, especially in the course of discharge of kitchen appliances. Noise is also a danger for health, disrupting the sleep and other activities, and thus influences the cognitive and emotional responses. The controlling of noise is a very important in today's structural design. Engineers seek for new materials and arrangements to enhance the sound attenuation. Materials such as glass wool, foam, mineral fibers and their composites are generally used in sound attenuation. It is known that sound absorbing capacity for composite materials depends on the proportion of filler material within the polymer matrix. However higher filler ratios degrade the other properties of polymers, such as mechanical properties.
The aim of this study is to obtain the more suitable filler material without degradation of other properties of polymer material as much as possible. The sound-absorbing properties of different minerals filled polypropylene composites were investigated in this study. Polypropylene based-composite granules were produced by using twin-screw extruder. Some test specimens were obtained by injection molding process. It was seen that the type of mineral affected tensile and flexural properties of polymers. The effect of mineral type on melt flow rate of polymer was studied. The thermal stability of composites were evaluated by using thermogravimetric.

Keywords: Sound-absorption, Composite, Mechanical properties

ORAL SESSION

Id-947

Experimental and Numerical Study of the Sloshing Modes of Liquid Storage Tanks with the Virtual Mass Method

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Abstract:
Accurate prediction of the vibration characteristics of the sloshing motion is essential for the analysis and design of liquid storage tanks subjected to base motion. The virtual mass method is a computationally efficient approach to determine the hydrodynamic forces generated by incompressible and inviscid fluids in accelerated containers since the virtual mass method involves meshing of the fluid boundaries rather than the entire fluid domain. Hydrodynamic actions of the sloshing liquid are taken into consideration by coupling a virtual fluid mass matrix to the structural points on the wetted regions of the tank wall. Analysis of the free surface displacements of the contained liquid can be carried out using the virtual mass method and this paper focuses on the application of the virtual mass method for the analysis of the vibration frequencies and mode shapes of the sloshing modes in rectangular and cylindrical liquid storage tanks. Firstly, the theoretical background for the analytical solution of the mode shapes and modal frequencies is presented for rectangular and cylindrical liquid tanks. This is followed by the description of the procedure used to apply the virtual mass method to obtain the sloshing modes and mode shapes of the contained liquid. The effects of various surface mesh topologies on the predicted vibration characteristics are compared with the analytical solutions as well as the results of a comprehensive experimental study conducted on scaled rectangular and cylindrical containers mounted on a shake table.

Keywords: Virtual Mass Method, Meshing, Liquid Storage Tanks, Sloshing

ORAL SESSION

Id-949

Finite Element Simulation of Rotary Shaft Lip Seals

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Abstract:
Radial lip seals operate between stationary machine body and rotating shaft during relative motion under continuously contacting to provide the sealing mechanism. This contact affects the deterioration of the machine system owing to frictional heat generation and wear. During shaft rotation, a thin liquid (lubricant) film usually emerges between seal lip and shaft contact zone interface. Therefore, the complete modeling of a radial lip seal is very complicated. In this study, a Hyperelastic elastomer based radial shaft lip seal thermomechanical simulations with internal heat generation and thin lubricant film were performed using nonlinear explicit Finite Element Analysis. The FEA results under complex boundary and nonlinear material behavior conditions were obtained and compared with the experimental results. The frictional heat generated temperature distributions on seal lip, shaft and contact zone were presented. Also, seal lip deformation and wear behavior were analyzed.

Keywords: Finite Element Analysis, Radial Lip Seals, Thermomechanical Analysis, Heat Generation, Hyperelastic Material Models

ORAL SESSION

Id-975

Dose Rate Calculation and Shields Estimation for the Reactor Vessels Model Simulation Concept Using Microshield Code at the Vvr- S Nuclear Research Reactor

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Abstract:

The VVR-S Nuclear Research Reactor owned by Horia Hulubei – National Institute for Physics and Nuclear Engineering (IFIN-HH), was built in Romania between: 1955 - 1957. The research reactor operated until 1997 and was permanently shut-down in 2002. During his life time, it was functional for a period of 113467 h, including 2000 h at 3.0–3.5 MW power. It had a utilization factor of 65 % with an average of 1 MW thermal power. VVR-S means that is a thermal neutrons reactor model S moderately cooled and reflected with distilled water, fueled with enriched uranium 10% in the beginning and 36% subsequently. Maximum values of dose rate at external aluminum vessel wall were between 3,5 mSv/h. and 9 mSv/h. Maximum values of the inner aluminum vessel near the active core were between 7,85 mSv/h. and 16,62 mSv/h in conformity with the location the experimental channels. Problematic dose rate appeared only on the vessels part that included reactor core – maximum value was 140 mSv/h at 10 cm, near thermal column inside the aluminum vessel,. Oher internal values vary between 400 µSv/h and 35 mSv/h at 10 cm from the wall. The principal radionuclides implicated were: ^{60}Co, ^{137}Cs, ^{152}Eu and ^{154}Eu with theirs correlation factors respectively for (^{90}Sr-^{90}Y) for beta emiters radionuclide evaluation. We needed to respect the radiation protection program the radiation dose limit is 20 mSv/year for the personnel professionally exposed, For this reason the simulation of the potential dose rate exposure and the shield calculation was necessary.

Keywords: Decommissioning, Simulation, Dose Rate Calculation, Shield Estimation

ORAL SESSION

Id-976

Improving Thermal Properties of MMA Based Polymer Matrix by the Incorporation of in-situ Surface Modified SiO_2 Nanoparticles

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Abstract:
Composite materials are gaining importance due to the increased demand in materials having unique properties. By the incorporation of the nanoparticles (NPs) into organic materials their mechanical characteristics are considerably improved leading to the new fields of application. The method of the incorporation is implemented chemically or physically. In the chemical method, the surface of NPs is modified with functional silanes to ensure the bonding between organic matrix and NP. In this study, SiO_2 NPs of 10-15nm in isopropyl alcohol are surface modified with [3-(Methacryloyloxy)propyl]trimethoxysilane and [3-(Methacryloyloxy)propyl]triethoxysilane. After addition of Methyl methacrylate (MMA) into the NP solution they are cured in the presence of Benzoyl peroxide as a thermal initiator at 70°C temperature. The structure, morphology and thermal properties of the obtained bulk materials were investigated by FT-IR, SEM-EDX, TG-DTA and DSC. It is found out that NPs were homogeneously distributed throughout MMA matrix. Based on the studies of infrared spectroscopy, their interaction was chemical nature. As the share of the NPs was increased, the temperatures of both glass transition and thermal decomposition of polymer were risen, which makes its use at elevated temperature possible.

Keywords: SiO_2, Nanoparticle, Polymer, Composite

ORAL SESSION

Id-987

Dielectric Relaxation and Leakage Current Behavior in Ferroelectric $Ba_{0.85}Sr_{0.15}TiO_3$ Thick Films Deposited on Ag-Pd/Al_2O_3 Substrate by Screen Printing Method

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Abstract:

Metal–insulator–metal structures, employing the ferroelectric $Ba_{0.85}Sr_{0.15}TiO_3$ (BST) thick films, were fabricated by screen printing techniques on Ag-Pd/Al_2O_3 substrates.The microstructure of the films was characterized by X-ray diffraction (XRD) and scanning electron microscope (SEM). The dielectric properties of BST thick films were studied by complex impedance spectroscopy over a wide frequency range (10^{-1} to 10^6 Hz) and temperatures in 25°C to 350°C range. The ac conductivity and relaxation mechanism in $Ba_{0.85}Sr_{0.15}TiO_3$ thick films have been investigated systematically. The impedance analysis shows two major contributions associated with the grains and the grain boundaries. The modulus mechanism indicates the non-Debye type of conductivity relaxation in the materials, which is supported by the impedance data. The activation energy value is found to be 0.7 eV, which suggests that the electrical conduction in the BST thick film is mainly due to the mobility of ionized oxygen vacancies. Moreover, the conduction mechanisms in BST thick film have been investigated in the Au/$Ba_{0.85}Sr_{0.15}TiO_3$/Ag-Pd/Al_2O_3 capacitor. The good dielectric properties associated with low leakage current, make the $Ba_{0.85}Sr_{0.15}TiO_3$ thick film be a promising candidate for dielectric capacitor applications. Thick film BST also effectively fills the technological gap between thin films and ceramics.

Keywords: Thick Film, Screen Printing, Dielectric Properties, Leakage Current

ORAL SESSION

Id-994

Bioactivity Characterization of Bioceramics Produced from Sea Snail Turritella Terebra

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Abstract:

Hydroxyapatite (HA) Ca_{10} $(PO_4)_6(OH)_2$ is utilized in biomedical engineering as metallic implants coatings for bone grafts, drug delivery, bone regeneration thanks to its osteoconductive and osteoinductive properties and similarity with a major mineral constituent of bones and hard tissues. Tricalcium phosphate (TCP, $Ca_3(PO_4)_2$) is a bioceramic material that is suitable for tissue engineering applications where the implanted material should be designed to be progressively resorbed in body and replaced by new bone owing to its high biodegredation features. In this study, calcium phosphate bioceramics were produced via mechanochemical method using the sea snail *Turritella terebra* as a calcium source at 450 °C, 850 °C, 1000 °C and 1200 °C followed by sintering. As the sintering temperaure increases different calcium phospate bioceramics were obtained with a decreasing pore size. FT-IR, SEM, BET, XRD, ICP-OES analyses were applied for complete characterization. Biodegradability test in TRIS fluid and bioactivity tests were carried out. Bioactivity in vitro tests showed hydroxyapatite formation when materials were immersed in simulated body fluid (SBF) and high rate of cell viability was determined based on MTT assay after 24 hours and 7 days incubation. Degradation of the samples was evaluated via pH changes for 7 days. Results exhibited that produced hydroxyapatite and β-TCP bioceramics have ideal pore size property supporting bone tissue growth and cell proliferation and they can be a good candidate for clinical applications owing to low production cost and natural–biological origin.

Keywords: Bioceramics, Hydroxyapatite, Turritella Terebra, Tricalcium phosphate

ORAL SESSION

Id-1009

Determining the Critical Fraction of Solid Value in Casting Process with Fuzzy Expert System Approach

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Abstract:
Casting is one of the basic manufacturing techniques as it used to manufacture many industrial products and daily life appliances. To predict some casting parameter values such as critical fraction of solid value provides an advantage in casting process. Fuzzy logic and expert systems are techniques of artificial intelligence. In recent years, they have used for industrial applications such as production planning frequently. In this study, fuzzy expert system model was developed for determining the critical fraction of solid values in casting process. Thus, number of experiment conducting to obtain desired casting results in casting process can be decrease. This also provide a decrease in casting costs.

Keywords: Casting Process, Fuzzy Expert System, Critical Fraction Of Solid

ORAL SESSION

Id-1012

Modeling for Gas Bubble Evolution in Nuclear Fuels

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Abstract:
The fission gases xenon and krypton are unceasingly generated in irradiated nuclear fuel, which is a sintered compact of granular uranium dioxide in the current commercial light water reactors (LWRs). As a consequence of their low solubility in UO_2, the fission gases tend either to precipitate into bubbles or to be released to the free volume in the rod. Fission gas release and gas bubble swelling are critical issues for the fuel performance of LWRs. Released fission gas can reduce the thermal conductivity of the fuel-clad gap and cause temperature and pressure increases in the fuel pellet, whereas gas bubble swelling can increase the contact pressure between the fuel and clad, and lead to clad failure. Therefore, understanding and predicting the behavior and evolution kinetics of fission gas are essential for enhancing the fuel performance codes and the development of high burn-up reactor technologies. A quantitative phase-field model was developed to predict the evolution of gas bubbles in nuclear fuels. The model takes into account temperature, gas bubble internal pressure, interfacial energy between bubble and matrix, and elastic strain energy within the material. The model can handle real equilibrium concentrations of vacancies and gas atoms, which is in the order of 10^{-10} to 10^{-11} at 1500K. Case studies include time-dependent bubble size evolution as a function of temperature, vacancy and gas generation rates; interaction between gas bubbles and distribution of gas bubble sizes, etc. The following figure shows the evolution of vacancy concentration and gas atom concentration under a vacancy generation rate of 10^{-3} atoms/s and a gas atom generation rate of $5x10^{-4}$ atom/s. The work was supported by Research Grants Council of Hong Kong (PolyU 152636/16E) and a NSFC grant (No. 51672232).

Keywords: Nuclear Fuel, Gas Bubbles, Modeling

ORAL SESSION

Id-1034

Broadband Photodetector Based on ZnO Nanowires and Hybrid Nanocompozite

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Abstract:

Broadband photodetections is required in a large range of applications, including imaging systems, optical metrology, bio-chemical sensing. PbS Quantum Dots (QDs) have been used in the last years for low-cost detectors covering a broad spectral range, from visible to short-wave infrared (SWIR), due to their size-tunable absorbtion spectra. ZnO, due to its wide bandgap is a suitable material for UV detection and the combination ZnO nanowires (NWs) -PbS QDs have been proposed to improve the solar cell and photodetectors performance.

The paper presents a solution processd photodetector that combines ZnO NWs and PbS QDs based hybrid naoncomposite. To extend the spectral range in SWIR, large PbS QDs with first excitonic absorption peak ~1400 nm have been used. PbS QDs solution was mixed with a P3HT:PCBM polymer blend to improve the absorption in the green range, to facilitate ambipolar transport and the charge extraction from the PbS QDs. The paper presents the device fabrication, operation and characterization results. ZnO NWs were grown by hydrothermal method on a seed layer RF sputtered on glass substrate with pre-patterned ITO electrodes. The solution PbS-QDs:P3HT:PCBM was layer-by-layer deposited using a combination of spin and drop casting steps to obtain a dense, uniform layer without cracks, that covers the nanowires. The upper electrode was evaporated on top of the blend. The hybrid photodetector exhibits a broad spectral range, from UV to SWIR with high responsivities at low input power, up to 1 A/W in UV, 0.6A/W at 550 nm and 0.7 A/W at 1450 nm.

Keywords: Optoelectronics, Photodetectors, Quantum Dots, Nanowires

POSTER SESSION

Id-472

Physical Fatigue Analysis of Silicone Milking Liner with Comparative Study of Mechanical Testing and Virtual Finite Element Engineering

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Abstract:
The use of silicone in milking machine liners is becoming more prevalent in the dairy industry. The elastic silicone liner is the main piece of the milking device that contacts the cow's teat; subsequently, liner execution in draining is of incredible concern from a financial and herd wellbeing stance. Elastic silicone liner in milking units differs by special higher effect. The liner modeled in this research assures higher yield of milk and minimum sliding level among those available in the market. The objective of this study was to determine the physical performance characteristics of a silicone liner in the process of being developed. The liner is characterized by newer silicone or silicone. Special design of cone shape and elastic liner of special material assure milking process without cup coming down onto the base during milking, and eliminating mammilla canal compression. Hence, for good passage of mammilla canal, additional pulling off of the milking unit at the end of milking process that increases the load on udder and injures the teat is not required. At the design stage, milk liner was required a fatigue analysis including thermal and stress analyze of the 3000 m3 pressure vessel throughout random flow. The operating environment conditions were accepted as basis for heat transfer coefficient. A flow thermal analysis was realized and the data obtained were steered to a finite element stresses computation. The relevance of the design was determined by fatigue factor and whole stress amount. Regression analysis was used to calculate wall thickness, cavity height of milk liner. Liner type, vacuum, and the interaction of liner type with vacuum were associated with the frequency of liner slips and major vacuum fluctuations in both trials. Liner slips, major vacuum fluctuations, manual adjustments, unit fall offs, and milking time increased at a lower operating vacuum. Results indicate that machine liner design and construction and operating vacuum influence the occurrence of liner slips. Optimization of vacuum setting and liner design could improve machine milking. Studying the performance of silicone liners will help determine how the physical benefits of silicone relate to diary production.

Keywords: Physical Fatigue Analysis, Finite element analysis, milk liner, Silicone.

POSTER SESSION

Id-475

Sintering Aids for LTCC Electronic Elements - Heating Microscope Studies and Microstructure Analysis

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Abstract:
Lowering of the sintering temperature of a ceramic material to a level acceptable for LTCC (low temperature cofired ceramics) technology without deterioration of its properties desired for a given application is often a big challenge. In this work, the effect of a few low melting compounds, mixtures and glasses on the sintering temperature of varistor and microwave ceramics destined for multilayer LTCC elements was analyzed basing on the observations in a heating microscope. It was found that 5 wt.% of each of additives: Li2CO3, LiF and AlF3-CaB4O7 causes a significant decrease in the sintering temperature of a microwave substrate material - willemite Zn2SiO4 below temperature of 980°C enabling co-sintering with cheap commercial conductive AgPd pastes. Furthermore, addition of 5 wt.% of % Li2CO3 or 50% of SiO2-B2O3-Al2O3-CaO-MgO glass leads to the same effect in the case of another candidate for microwave substrates – diopside CaMgSi2O6. For two varistor ceramics – conventional based on doped ZnO and Cu2Ta4O12 with the perovskite structure of CaCu3Ti4O12 type, 4 wt.% of AlF3-CaB4O7 mixture was used as an efficient sintering aid. Good sinterability at low temperatures of the microwave and varistor ceramics with modified composition was confirmed by scanning electron microscopy studies.

Keywords: LTCC, Glass-Ceramics, Sem Analysis, Heating Microscope, Varistors, Microwave Ceramics

POSTER SESSION

Id-490

Characterization of High Density CeO_2-based Electrolyte

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Abstract:

Co-doped ceria electrolytes of $Ce_{0.80}Nd_{0.2-x}Sm_xO_{1.90}$ (x = 0.05, 0.10, 0.15) powders were prepared using the Pechini method. Aim of the present study was to investigate the effect of co-doping on the ionic conductivity of ceria (CeO_2) and its use as an electrolyte material for intermediate temperature solid oxide fuel cells. Results of the X-ray diffraction analyses showed that all powders calcined at 600°C for 4 hours were single phase with cubic fluorite structure. The average crystallite sizes calculated by the Scherrer formula were between 24 and 30 nm. Samples were sintered at 1400°C for 6 hours to obtain dense ceramics (over 93%). The two-probe a.c. impedance spectroscopy was used to study the ionic conductivity of co-doped ceria samples. Effects of co-doping on the crystal structure and electrical conductivity of ceria were compared with the singly doped ceria sample.

Keywords: SOFC, Co-doped, Ceria, Electrolyte, characterization

POSTER SESSION

Id-497

Seismic Vulnerability of Some Ancient Masonry Structures in Antalya

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Abstract:
Ancient masonry structures are very important to carry cultural heritage to the future generations. therefore, it is very important to protect them against to disasters like earthquake. Ancient masonry structures are particularly vulnerable to dynamic actions, especially seismic actions. Antalya is located in a moderately seismic zone. Many earthquakes occur in this city in the last few decades. In this paper, some historical masonry structures have been selected which are located in different districts of Antalya, built similar geometry. In this paper investigation regarding the possibility of using simplified methods of analysis and simple indices as indicators for fast screening and decision to prioritize deeper studies of historical masonry buildings and to assess vulnerability to seismic loading. Selected masonry buildings were assessment by using simplified method and finite element method.

Keywords: Cultural Heritage, Masonry Buildings, Seismic Vulnerability, Finite Element Analysis

POSTER SESSION

Id-499

A Comparative Study of Polyaniline/MWCNT with Polyaniline/SWCNT Nanocomposite Films synthesized by Microwave Plasma Polymerization for the Purpose of Optoelectronic Applications

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Abstract:
In this work we report a comparative study of nanocomposite films synthesized by in-situ microwave plasma polymerization of aniline monomer in the presence of plasma functionalized multiwall carbon nanotubes (MWCNTs) with that in the presence of single wall carbon nanotubes (SWCNTs). The microwave plasma polymerization was carried out with a novel method that had coupled an atomizer head (automotive fuel injector) to inject the monomer and the CNTs simultaneously into the plasma reactor. The pristine CNTs were functionalized during its path to the substrate through the plasma environment in the plasma reactor to obtain uniform dispersion within the PANI matrix. Scanning electron microscopy (SEM) and Atomic Force Microscopy (AFM) were employed to characterize the pure PANI and PANI/CNTs nanocomposite films and to study their surface morphology and roughness. It was observed that the morphology as well as the roughness showed variation with the kind of CNTs that was used and their loading percentage in the film. X-ray diffraction (XRD) and SEM revealed homogeneous coating of PANI onto the CNTs indicating that carbon nanotubes were well dispersed in the polymer matrix. The interaction between the quinoid ring of PANI and the CNTs causes PANI chains to be adsorbed at the surface of CNTs, thus forming a tubular core surrounding the CNTs. This was confirmed from Fourier transform infrared spectroscopy (FT-IR). The overgrowth of CNTs particles by PANI governs all the process and can easily be observed through the increasing films thicknesses with CNTs concentration. The FT-IR spectrum designated a band at ~1134 cm-1 which is considered as a measure of the degree of electron delocalization and consequently it is the characteristic peak of PANI conductivity. The intensity of this peak increases with the addition of CNTs, which agrees well with our increased conductivity values. Films conductivity was examined by Hall Effect; the nanocomposite films showed highest conductivity of 7.8 S/cm for film of plasma functionalized pristine MWCNTs of 1.5 wt% loading percentage with in-situ polymerization, of 29 S/cm for film of ($Ar+O_2$) plasma pre-treated MWCNTs of the same loading percentage, of 25 S/cm of plasma functionalized pristine SWCNTs of 1.5 wt% loading percentage with in-situ polymerization and of 50 S/cm for film of pre-carboxylated SWCNTs of the same loading percentage, compared to that of pure PANI film of 10-8 S/cm only. It is believed that the composite films have touched their percolation threshold at this loading percentage of both kinds of the used CNTs.

Keywords: Polyaniline Composite, Single-Walled Carbon Nanotubes, Plasma Polymerization

POSTER SESSION

Id-513

Synthesis and Characterization Hybrid Materials (TiO_2/ MWCNTs) by Chemical Method and Evaluating Antibacterial Activity against Common Microbial Pathogens

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Abstract:

TiO_2/MWCNTs Hybrid material was prepared by sol-gel method using mixture of $TiCl_4$ and HCl as source of TiO2. In this method a certain amount of MWCNTs was added to mixture of $TiCl_4$, HCl and socking overnight followed by calcinating at 550 ºC for 2h forming MWNTs/TiO_2 hybrid. The modified MWNTs with TiO2 nanoparticles have been characterized by X-Ray Diffraction XRD and Transmission Electron Microscopy TEM which reveals the formation of TiO_2 nanoparticles and decorated MWCNTs surface through soaking in mixture of $TiCl_4$ overnight. Besides, the antimicrobial activity of MWCNTs and TiO_2/MWCNTs Hybrid material was evaluated against Gram-positive and Gram-negative pathogenic bacteria to improve the possibility of samples as a new antibacterial strategy to reduce the rate of infections.

Keywords: Antimicrobial Agents, TiO_2 Nanoparticles, Carbon-Based Nanoparticles, Photocatalytic Materials, Tio_2/Mwcnts, Hybrid Material

POSTER SESSION

Id-522

Preparation and Characterization of Low Dielectric Permittivity Substrates Based on Diopside, Willemite and Cordierite

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Abstract:

Low dielectric permittivity and low dielectric loss are crucial for microwave ceramic substrates because such features enable higher signal propagation speed, lower attenuation, higher selectivity of operating frequency. In this paper, three low dielectric permittivity ceramics, diopside $CaMgSi_2O_6$, willemite $Zn2SiO_4$ and cordierite $Mg_2Al_4Si_5O_{18}$, were fabricated and characterized. All materials were synthesized by conventional solid state reaction method - diopside at 1300°C, willemite at 1150°C and cordierite at 1350°C. Sintering process of the ceramics was performed in the range 1300-1400°C. X-ray diffraction analysis of the synthesized powders confirmed single phase composition of diopside and willemite. For the third material, besides main crystalline phase of cordierite, the presence of crystoballite SiO_2 and spinel $MgAl_2O_4$ was revealed. Scanning electron microscopy was used for the examination of the microstructure of the sintered ceramics. Dielectric behavior of the substrates was investigated by impedance spectroscopy in the temperature range from -30 to 150°C at frequencies 100 Hz- 2 MHz. The substrates based on diopside, willemite and cordierite were well densified and showed low dielectric permittivity in the range 6-7 and low dielectric loss (below 0.003) at higher frequencies. The main disadvantage of these materials was high sintering temperature, although its lowering would be possible by the use of appropriate sintering aids.

Keywords: Low Dielectric Permittivity, Diopside, Willemite, Cordierite, Sintering Aids, Microwave, Ceramics Substrates

POSTER SESSION

Id-523

Structure, Magnetic and Electric Properties of $Bi_{0.5}Pb_{0.5}(Fe_{0.75}Nb_{0.25})O_3$ Multiferroic

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Abstract:
Magnetoelectrics are part of a larger group of multiferroics which possess at least two ferroic-orderings in the same phase. The most widely studied and used magnetoelectric oxides are ABO_3 perovskites which have the prototypical cubic structure. This structure is characterized by a large A cation at the corners of the cubic unit cell and small B cation which is placed in the middle of the cell in the centre of oxygen anion octahedra.

Bismuth ferrite $BiFeO_3$ (BFO) is one of the most important multiferroic perovskite oxides (TC = 1100 K, TN = 643 K). Lead iron niobate $Pb(Fe_{0.5}Nb_{0.5})O_3$ (PFN) exhibits a broad ferroelectric transition around 370–380 K and two diffuse magnetic transitions at 150 K and around 10 K.Magnetoelectric 0.5BFO-0.5PFN solid solution adopt at room temperature rhombohedrally distorted perovskite-like crystal structure (R3c space group). In which Fe^{3+}/Nb^{5+} cations are distributed randomly in the B sublattice. It was shown that increasing the number of Fe-O-Nb linkages lead to reduction of iron magnetic moment. According to theoretical calculations the solid solution has an insulating properties with energy band gap about 1.6 eV.Magnetoelectric properties of the above solid solution were characterized using Mössbauer spectroscopy, differential thermal analysis, impedance spectroscopy, magnetization and magnetoelectric effect measurements. According to the obtained results the material is antiferromagnetic with Neel temperature 460 K and ferroelectric with Curie temperature 630 K. Magnetic hysteresis loop is not fully saturated up to 56 kOe and is characterized by small coercivity 1.5 kOe and saturation remanence 11 emu/mol.

Keywords: Multiferroics, Crystal Structure, Magnetization, Mossbauer Spectroscopy, Magnetoelectric Effect

POSTER SESSION

Id-527

Optimization of the Effects of Wire Electrical Discharge Machining Parameters on Component Dimension and Shape Tolerances

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Abstract:
In this study, the effect of cutting parameters on dimension and shape tolerances of components is investigated. Nine pieces of cylinders with dimensions 10x10mm are cut by using M303 extra plastic mould steel. Sumitomo denko SBG type wire with a 0.25 mm diameter is used. Table feed rate, pulse on time and pulse off time are used as machining parameters. Pulse off time adjustment, maximum current of main power supply, auxiliary power supply network, main power supply voltage, servo reference voltage, wire feed rate, wire tension, dielectric fluid circulation pressure were kept constant during the experiments. Three dimensional coordinate measuring equipment is used to measure the tolerances of dimensions and shapes. Wire electrical discharge machining parameters are optimized by using Taguchi optimization technique. In order to optimize the wire electrical discharge process, Grey Relational Analysis optimization method is used. The optimal machinability of M303 extra plastic mould steel with wire electrical discharge process will be successfully determined in this study. With Grey Relational Analysis, obtained optimum values are; 9 mm/min table feed rate, 8 µs pulse on time, and 8 µs pulse off time.

Keywords: Wire Electrical Discharge, Dimension and Shape Tolerances, Cutting Parameters, Taguchi Optimization Method, Grey Relational Analysis

POSTER SESSION

Id-538

Preparations Doped CuO Thin Film and Study Its Antibacterial Activity

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Abstract:

In this work, prepared Mn doped CuO thin film by using spray pyrolysis method; Mn doped CuO with different volume ratios (0%, 2% & 4%). The films thicknesses measured by laser interference, this method based on interference of the laser beam reflected from thin film surface and substrate. The antibacterial activity show that the growth inhibition ability of CuO thin films against E. coli and S. aureus to increase significantly with increasing in the Mn doping level, (2% and 4%) respectively, The antibacterial activity of CuO nanostructures is increased with the increase in the Mn dopant concentration The crystalline structure of the deposited films was examined by using X-ray deffractometer, it was show that all the films were polycrystalline having anatase phase only, the films with different doping ratio exhibited characteristic peaks of anatase crystal planes ($1\bar{1}1$) and (111) at (35.6o and 38.73 o) direction, respectively. The SEM images of the CuO film doped with 2% Mn show a smoother surface compared with the other prepared films.

Keywords: CuO Film, Mn Dopant, Spray Pyrolysis Method

POSTER SESSION

Id-539

Experimental Investigation of the Machinability of Caldie Cold Work Tool Steel with Ceramic Inserts

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Abstract:
In this study, Caldie cold work tool steel was subjected to hard turning with ceramic cutting inserts. The hardness of workpiece material was increased from 24 HRC to 60 HRC hardness. In experimental studies, cutting conditions were determined as 90,120 and 150 m / min for cutting speed, 0.05, 0.1 and 0.15 mm/dev for feed rate levels, respectively. After machining tests, cutting forces and surface roughness values were optimized using the Taguchi technique. The effects of experimental parameters (cutting speed and feed rate) on cutting forces and surface roughness were calculated with analysis of variance (ANOVA). Surface roughness values were evaluated after machining by removing 20 cm3 of chip volume through the workpiece to examine cutting insert wear. The abrasion mechanisms at the cutting inserts were evaluated by examining microscope and SEM images. In the results of hard turning experiments with ceramic tools it was determined that the feed rate was the most effective parameter on the surface roughness. It was observed that when high feed rate was used in experimental conditions, the cutting insert was worn more.

Keywords: Hard Turning, Tool Wear, Taguchi, ANOVA

POSTER SESSION

Id-545

Prediction of Plain Circular Jet Flow with Artificial Neural Networks

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Abstract:

In this study, an ANN model was established by using experimental measurement values at low speed subsonic wind tunnel of which length is 75 cm and experiment test section are 32 cm x 32 cm and model results were compared with experimental values and then, the prediction was made for the unmeasured tunnel stream values.

In the wind tunnel, when the jet velocity 25 m/s, four tunnel velocity; 0, 5, 10 and 20 m/s were used. At the four measurement stations; x/D=0,3, x/D=12,5, x/D=31,2 and x/D=50, experimental measurements were made by using hot wire anemometer. Plain circular jet flows at x/D=0,3 and x/D=50 stations with average tunnel flow velocities of 7,5 m/s and 15 m/s were studied by using Artificial Neural Networks (ANN). The data was obtained and evaluated by graphics.

Keywords: Coaxial Jet, Turbulence Measurement, Plain Circular Tube, Computational Fluid Dynamics

POSTER SESSION

Id-548

Optimization of Drilling of Carbon Fiber Reinforced Polymer (CFRP) with the Grey-based Method

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Abstract:

The present study investigates the effect of cutting speed, feed rate and drill diameter on thrust force, delamination factor, surface quality and drill wear in drilling carbon fiber reinforced polymer composite (CFRP). The drilling tests are conducted with solid carbide drills cutting tools. In order to determine the optimum cutting conditions, Taguchi Method will be used in the experimental design. Grey Relational Analysis (GRA) and analysis of variance (ANOVA) will be used to optimize the drilling parameters of these composites.

Keywords: Carbon Fiber Reinforced Polymer Composites, Drilling; Taguchi Method, Grey Relational Analysis

POSTER SESSION

Id-550

Band Gap Study of Photonic Crystal Fiber

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Abstract:
Photonic crystal fiber PCF with silica/air hexagonal holes arrays and filling the first rings by silicon and the tunable photonic band gap PBG effect of photonic crystal fiber is proposed. The silicone with higher refractive index (>1.45) is filled into the air-holes of photonic crystal fiber to cancel the index guiding fiber effect and maximize the photonic band gap fiber effect. The proposed fiber takes full advantage of the sensitivity characteristic by create of photonic band gap fiber in-plane (in-plane gaps) and achieves a high band gap by filling the second holes ring close to the guiding core fiber by silicon; resolution in the plane of the fiber and out of plane, respectively, which are better than other fiber with silica/air hexagonal holes arrays.

Keywords: Band Gap, Fiber, Filling Factor, Propagation Constant, Silica, Silicone, Holes Arrays

POSTER SESSION

Id-562

Energy Recovery Analysis in a Type Pressure Regulation Measuremant Stations in Istanbul, Esenyurt

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Abstract:
It is important process to convert energy sources into electrical energy as much as gaining energy.After producing naturalgas which is one of the most common energy sources and classifield as fossil fuel, is sold by the natural gas and petrol companies to the World by compression it in the compressor stations .Gas companies compress incoming gas which is lost in the pipeline into 35-75 bar equal to the loss rate and transfer it to the A type pressure regulation measuerement stations .In this stations ,natural gas that coming with high pressure is reduced to 12-19 bar by throttle valve .This process is happening on Joule-Thomson effect ,hence no energy is produced on this process.There is a big amount waste of producable ectrical energy on that situation .

Keywords: Pressure Regulation Measurement Stations (RMS), Turbine, Energy, Efficieny

POSTER SESSION

Id-568

Air Leakage Measurement and Analysis in High-Pressure Self-flanged Rectangular Cross-sectional Air Ducts

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Abstract:

The air leakages through the air ducts of air conditioning systems (ACSs) applied to residential, commercial, industrial, and healthcare buildings cause higher energy consumption costs, less thermal comfort, worsening of internal air quality and air change ratio. Also, the leakages affect negatively the design parameters of ACSs. The processed air due to the leakages cannot be transmitted to the target regions to be conditioned which not only increases energy consumption but also disable the system to operate at design conditions. The fundamental purpose of this study is to experimentally determine the suitable torque strength on the bolt coupling in high-pressure self-flanged rectangular cross-sectional air ducts (HPSFRAD) to eliminate air leakages through the bolt couplings. The orifice used during the tests to measure the air leakages was established in accordance with ISO 5167-1:2003 and ISO 5167-2: 2003. The inner surface of the tested air channels is 16.25 m2. In order to figure out the rate of the air leakages in HPSFRAD, the tests were carried out at the air pressure levels of 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, and 2500 Pa with the torque strengths of 6,8,10,12,14, and 16 Nm at each pressure levels. As a result, the most appropriate torque strength values on the bolt coupling depending upon air pressures were determined experimentally in the high-pressure air ducts.

Keywords: Air Duct, Air Leakage, Torque Strengths, High Pressure, Self-Flanged

POSTER SESSION

Id-572

Dye-sensitized Solar Cell Using Gel Polymer Electrolytes Based on Organic Dye

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Abstract:
Dye-sensitized solar cells (DSSCs) has been fabricated with electrolytes containing I−/I−3 redox couple using Poly(1-vinylpyrrolidone-co-vinyl acetate) (PVP-co-VAc)/ poly(methyl methacrylate) PMMA and a mixture of potassium iodide (KI) and tetra propyl ammonium iodide (TPAI) salts. The quasi-solid state gel polymer electrolytes were prepared using 2:1 by solution cast method. The solar cells have the structure of FTO/TiO_2-ZnPc-dye/electrolyte/Pt/FTO. The performance of the DSSCs has been exploring by varying the weight ratio of the binary salts in the electrolyte and iodine. The DSSC fabricated with the TPAI salt electrolyte containing 30wt% (+I2) exhibited a higher efficiency of 1.32 %. However, the DSSC with a double-salt electrolyte includes 25 wt% TPAI/ 5 wt% KI (+I2) exhibited the best power conversion efficiency of 1.1% under 1000 W/m2 light intensity. While the DSSC fabricated with KI salt electrolyte containing 30 wt% (+I2) exhibited a good efficiency of 0.948 %. The highest IPCE values at 680 nm for C1, C2, and C7 sensitized solar cells are 24.97%, 21.01%, and 19.41%, respectively. The low values of IPCE are a result of poor regeneration efficiency and poor charge collection efficiency. Field emission scanning electron microscopy (FESEM) images show that the TiO_2 nanoparticles are comparatively well dispersed but are irregularly shaped due to agglomeration as a result of low solubility.

Keywords: Dye-Sensitized Solar Cells (Dsscs), Gel Polymer Electrolyte, Binary Salts, Zinc Phthalocyanine.

POSTER SESSION

Id-580

Failure Evaluation of Galvanized High Carbon Steel Wires

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Abstract:
High carbon steel wires are subjected to patenting heat treatment after the surface cleaning process to obtain sufficient mechanical strength and toughness properties. As a result of this process, thin lamellar perlitic microstructural features suitable for subsequent diameter reduction processes were obtained. Before entering the hot dip zinc bath, the surface is again subjected to pre-surface preparation. Afterwards, the wires reach the targeted coating thickness due to the dipping time in the molten zinc bath at 450 ^{o}C and a bright and smooth surface finish is desired by cooling with air or water after stripping at the exit of the bath. Various discontinuities can be observed in the galvanized layer depending on the cooling rate and surface preparation process quality. The risk of failure to the galvanized wire due to these discontinuities during subsequent shaping or during diameter reduction is very high. In this study, a failure analysis was carried out on galvanized spring steel. The results showed that the failure is related to two main factors: the relatively poor surface quality and the unsuitable cooling rate of the wires at the exit from the galvanizing bath. In order to explain the origin of the failure, systematic metallographic investigations were performed by means of scanning electron microscope on both the wire surface and zinc layer cross section. Mechanical behavior of wire are investigated on lifespan testing.

Keywords: High Carbon Steel Wire, Galvanizing, Failure Analysis

POSTER SESSION

Id-590

Electronic Properties of $Li_{1-x}K_xMgN$ Heusler Alloy for Optoelectronic Application

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Abstract:
I have performed first princeples method to determine electronic properties of cubic $Li_{1-x}K_xMgN$ ternary Heusler semiconductor alloy using density functional theory with the value for x=0, 0.25, 0.75, 1. The exchange and correlation effects are treated using generalized gradient approach based on Perdew et al. I have used modified Becke-Johnson potential to obtain accurate band gap results. From the electronic band gap calculation I have found that the direct band gap of the alloy varied from 1,0 ev to 2,7 ev. Because of the bandgap range, $Li_{1-x}K_xMgN$ can be a good candidate for visible and IR optoelectronic application. From the structural calculation I have found that the lattice parameter of cubic $Li_{1-x}K_xMgN$ varied from 4,9 A to 6,0 A. This range gives opportunitiev to grow the alloy on many common substrates like Si, GaAs, Ge, InP. Finally, I have also calculated the density of states in order to understand some properties of the materials such as the band structure, bonding characters and dielectric functions.

Keywords: Density Functional Theory, Half Heusler, Electronic Properties, Structural Properties

POSTER SESSION

Id-598

Examination of Magnetostriction, Dielectric and Magnetic Properties of $SrCu_{0.33}Ta_{0.67}O_3$-$Co_{1-x}Mn_xFe_2O_4$ (0 < x < 1.0) Multiferroics

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Abstract:

A research involved the $SrCu_{0.33}Ta_{0.67}O_3$-$Co_{1-x}Mn_xFe_2O_4$ (SCTO-C_xM_{1-x}FO) ceramic materials, which are multilayered composites of (2 – 2) type. It was found for planar structures, a magnitude of magnetoelectric effect is determined by the magnetostrictive and piezoelectric properties of individual components (layers). A series of doped Mn samples with different layered configurations (f–m; f–m–f; m–f–m; f–m–f–m–f; m–f–m–f–m), where f and m stand for ferroelectric and magnetic regions, respectively, were examined for complex characterization of magnetostriction, dielectric and magnetic properties. An exploration of the magnetic properties of SCTO-C_xM_{1-x}FO system (x = 0.0; 0.2; 0.5; 0.7) was included magnetization measurements (VSM) and dynamic magnetic susceptibility (AC Magnetometry). On the other hand, the magnetostriction measurements were performed as a function of intensity and direction of the applied magnetic field H. In turn, dielectric properties of the SCTO-C_xM_{1-x}FO multilayered composites were determined by impedance spectroscopy (EIS) and DC electrical resistivity measurements. A complementary results of the investigated ceramic heterostructures will be discussed.

Keywords: Multiferroic Materials, Electroceramics, Multilayered Composites, Tape Casting

POSTER SESSION

Id-607

Performance Evaluation of Different Air Venting Methods on High Pressure Aluminum Die Casting Process

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Abstract:
In the automotive industry, die casting technology is used in the production of many parts in series. Due to increased customer demands and reliability expectations, tightness properties are dominant in aluminum alloy based cast parts. In order to acquire the tightness property, it is necessary to control the gas porosity at the casting structure. High pressure die casting aluminum alloy products generally contain gas porosity in certain sizes and ratios due to gas compression during high speed injection of molten metal into the die cavity. Proper die design and evacuation of the air in the die and also optimized process parameters have a very critical precaution to reduce the gas porosity. Today, various venting, valve and vacuum systems are used to facilitate the evacuation of die air. The use of venting systems in the process increases both product quality and process efficiency. In this study, the performance of 3D venting system and mechanical valve performance in high pressure aluminum alloy (AlSi10Mg) casting process with cold chamber were compared on MAGMASOFT die casting simulation and process efficiency (OEE) reports. As a result of the experimental studies of the 3D vents system, the gas porosity and machine shutdown times can be significantly reduced.

Keywords: Die Casting, Aluminum Alloy, Efficiency, Gas Porosity, Vent

POSTER SESSION

Id-610

Development of New Nanoparticle Sensor Sensitive to Antioxidants

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Abstract:
The protective effect of endogenous antioxidants (mainly polyphenolic compounds, with phenolic acids and flavonoids) seems to be extremely important in preventing oxidative stress, so that, regular intake of fruits and vegetables, the main source of these antioxidants in the diet, has been demonstrated to reduce the risk of cancer and cardiovascular diseases. With regard to the high relevance of antioxidants to public health, development of simple, cheap, fast, sensitive and selective analytical methods with low detection limits for determination of antioxidant capacity of antioxidant-rich foods and other dietary supplements has become fundamental. In this work, it is aimed to develop a novel nano-sensor based on silver nanoparticle-chitosan composite film for detection of antioxidant compounds crucial in healthy diet, utilizing the amazing surface properties of nanoparticles. Modified chitosan based composite film was synthesized with crosslinking method in the colloidal silver solution which was prepared by using chemical reduction method that employed trisodium citrate. This polymer film was characterized using fourier transform infrared spectroscopy (FTIR) and physical properties (stability, number of usage etc.) was optimized. This composite film aimed to be used as nano-sensor for determination antioxidant capacity was applied to standard antioxidant compounds, their synthetic mixtures and food samples, respectively. Thus analytical presicion, accuracy, selectivity and additivity was tested. The proposed methodology was validated and the data obtained with nano-sensor was statistically compared (using the ANOVA test) to those found by reference methods.
Keywords: Antioxidant Capacity, Silver Nanoparticles, Nano-Sensor, Food Extracts

POSTER SESSION

Id-612

Influence of Different Ecoquench Temperature on High Carbon Steel Wire Mechanical Properties

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Abstract:
Patenting heat treatment wires in the production of bead wire, spring wire, prestressed concrete wire and wire rope provide suitable microstructural properties for subsequent diameter reduction steps. The process of patenting in the fluidized bed, which is a faster and more environmentally friendly process than the conventional lead bath, is carried out in two stages: After heating to the austenitizing temperature, a thin perlite structure is obtained after cooling at the appropriate speeds in the fluid sand bed. Both high tensile strength and ductility can be achieved by suitable patenting conditions. The effect of fluid bed temperatures and cooling rate on the success of the process is of critical importance. In this study, mechanical properties (tensile, elongation, elongation ratio, torsion) and microstructure effects of different fluidized bed temperatures for 0,83 carbon wires at 3.5mm diameter were investigated.

Keywords: High Carbon Steel Wires, Fluidized Bed Temperature, Pearlite, Mechanical Properties

POSTER SESSION

Id-613

Investigation of the Effect of Cnt Reinforcement Ratio on Mechanical and Morphological Properties of A356 Matrix Composites

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Abstract:
In this study, it is aimed to investigate the effect of carbon nanotube reinforcement ratio on the mechanical and morphological characteristics of carbon nanotube reinforced aluminum matrix composite materials. For this purpose, CNT-A356 composites were fabricated by reinforcing the aluminum matrix A356 material with carbon nanotubes (CNT) in 4 different ratios (0, 1, 1.5 and 2). The powder metallurgy method was used in the production of composite samples. Powdered A356 and CNTs were mixed by ball milling for 1 hour and pressed cold in the powder compacting mold. The mold was then removed into a functional oven and samples were hot pressed at 200 ° C for 1 hour. The compacted composite powder samples were sintered at 550 ° C for 1 hour in a 10-6 millibars vacuum environment. Hardness measurements, abrasion tests and microstructure analyzes of the produced samples were carried out. As a result of experimental studies; It has been observed that the CNTs are located in the heaps expecially between the matrix grains. Also a more hollow structure is formed by increasing the CNT ratio. Moreover, as the hardness values decreased while the CNT ratio exceeded 1%, weight loss increased. The composition with the highest hardness value was measured at 1% CNT. The study is important in terms of supporting research on the need for materials with high strength / low density ratio in today's automotive industry.

Keywords: CNT, A356, Powder Metallurgy, Cnt Ratio, Reinforcement

POSTER SESSION

Id-616

Analytical Study of Coronal Mass Ejection and Sunspot Number During the Interval 2010 – 2014

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Abstract:

Coronal mass ejections (CMEs) are represented as bright mass of hot plasma, ejected from the active regions of the solar corona in different directions and different rates. Computer programs have been written in this research to analyze the information obtained from Large Angle and Spectrometric Coronagraph (LASCO) aboard the Solar and Heliospheric Observatory (SOHO). The data was taken from Coordinated Data Analysis Workshop catalog and was represented by the width and mass of the CMEs, and the exact time of the events which was presented by the year, month, and day. The data was entered into the MATLAB program from CDAW for the period from 2010 to 2014. As a result, 5166 events were analyzed. In this paper, two main parts are presented: First part, statistical analysis of CME width and occurrence, where all data for each month was plotted and discussed. The objective of this part was to relate the number of CME occurrences with their width. The second part of the rate of sunspot number was also calculated in this work for part of the 24th cycle, where data was collected from 2008 till 2016. The data of the year 2017 was not taken. Sunspot number was compared with the number of CMEs during that period, and the results showed that narrow CME are highly associated with sunspot number.

Keywords: Coronal Mass Ejection, Sunspot, Solar Cycle, Magnetic Field

POSTER SESSION

Id-619

Study the Dielectric Properties of $Bi_{2-x}Li_xPb_{0.3}Sr_2Ca_2Cu_3O_y$ Compound

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Abstract:

This work was performed to investigate the effect of Li substitution on the dielectric properties of $Bi_{2-x}Li_xPb_{0.3}Sr_2Ca_2Cu_3O_y$ compound were (x = 0, 0.1 and 0.3). Solid state reaction methods was used to prepare $Bi_{2-x}Li_xPb_{0.3}Sr_2Ca_2Cu_3O_y$ compound for (x = 0, 0.1 and 0.3 X-ray diffraction analysis showed an orthorhombic structure for all samples. The dielectric properties for the samples samples such as a.c conductivity, dielectric constant and loss of factor as a function of frequency in a range (1000Hz-5MHz) were determined. It is clear that values of ac conductivity is remain constant till a certain value of frequencies, which depends on the x content then increased at higher frequencies. The dielectric constants ($\varepsilon 1$ and $\varepsilon 2$) and the dielectric loss $|\tan\delta|$ of the samples are strongly depend on the frequency of the applied ac field, as well as depends on the Li concentration. The dielectric behavior in this compound can be explained based on the assumption that the mechanism of dielectric polarization is similar to that of conduction.

Keywords: Dielectric Properties, Bi-2223, Li, Substitution

POSTER SESSION

Id-624

New Equations for Lattice and Electronic Heat Capacities, Enthalpies and Entropies of Solids: Application to Diamond

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Abstract:
New equations for lattice and electronic heat capacities, entropies and enthalpies at constant volume and constant pressure derived by using kinetic theory, Kirchhoff and Stefan-Boltzmann laws and Wien radiation density equation were applied to the experimental constant volume and constant pressure heat capacity data of diamond. The temperature corresponding to 3R/2 is proportional to Debye temperature. The relationships between these temperatures and dimensions were given. The temperature dependence of these temperatures and non-monotonic behaviour were discussed. The heat capacity and entropy values predicted by the proposed models were compared with the values predicted by the Debye models. The enthalpy values predicted by the proposed models were compared with the given values. The phonon absorption equilibrium constants of diamond were obtained.

Keywords: Radiation, Heat Capacity, Entropy, Enthalpy, Dimensionality, Equilibrium Constant, Diamond

POSTER SESSION

Id-634

Wind Tunnel Experiments and CFD Simulations for Gable-roof Buildings with Different Roof Slopes

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Abstract:

Gable-roof buildings with different roof slopes were investigated by wind tunnel experiments and computational fluid dynamics (CFD) simulations. Firstly, wind tunnel experiments on roof models with three different slopes (α=10^o, α=20^o, and α=30^o), were conducted to create a measurement database of the time-averaged velocity, turbulent kinetic energy, and pressure coefficient around the building. Later, analyses for the grid resolutions and turbulence models of the CFD simulations were performed for the α=20^o roof slope model. The performance of the CFD simulation with the selected grid resolution and turbulence model was examined and validated by comparing the results of the simulation with the measured data for all the roof pitches. Generally, for the numerical results were found to be in good agreement with the experimental results, despite some differences. Finally, the effect of the roof slope on the buildings was investigated using the CFD simulations.

Keywords: Wind, CFD, Roof, Simulation

POSTER SESSION

Id-635

CFD Analysis of Unmanned Aerial Vehicles Moving in Group

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Abstract:

It is very important to make aerodynamic analyzes of unmanned aerial vehicles moving in groups and to identify reliable zones for vehicles. It should be determined at what speeds and closeness the vehicles of the flying vehicles along the specified routes should be located within the frame. In this study, the models of the propellers of an unmanned aerial vehicle were constructed with Computational Fluid Dynamics (CFD) and the flow characteristics around this model were investigated numerically.

Keywords: Drone, CFD, Vehicle, Simulation

POSTER SESSION

Id-656

Prediction of the Fracture Voltage of TiO_2-doped Zno-Bi_2O_3-Mno-CoO Ceramics Produced by the Chemical Precipitation Method with Using Artificial Neural Networks

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Abstract:

In this study, TiO_2 (2.5 and 5.0 wt. %) doped ZnO-Bi_2O_3-MnO-CoO were produced by chemical precipitation method. In the ceramics produced, the effect of TiO_2 addition, sintering temperature and time on breakdown voltage was experimentally measured and mathematical model was developed according to these results. Based on the developed mathematical model and experimental results, an artificial neural network model was developed to determine the effect of TiO_2 on the breakdown voltage depending on the sintering temperature and time and estimated by the breakdown voltage values. The results of the mathematical model and the artificial neural networks were statistically compared with the anova test.

Keywords: : Breakdown Voltage, Mathematical Model, Artificial Neural Networks

POSTER SESSION

Id-661

Effect of Ageing Temperature on Corrosion Resistance and Electrical Conductivity of AA7075 Produced by Powder Metallurgy Method

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Abstract:

In this study the effect of ageing temperature of corrosion and electrical conductivity of AA7075 produced by powder metallurgy method was investigated. In the study, produced AA7075 Al alloy samples which are produced powder metallurgy method, were quenched after solution treated at 485 °C for 2 hours, then they were aged at three different temperatures (110 °C, 120 °C and 130 °C) for 24 hours. Aged samples hardness and density measurements were carried out and they were characterized by SEM, EDS, XRD. Corrosion tests were carried out using potentiodynamic polarization technique, a cyclic polarization measurement at a scan interval of ±750 mV and scan rate of 1 mV/s in 0.1 M H2SO4 solution. Electrical conductivity values were calculated (IACS %) according to ASTM B193-02 standards. As a result of the study, the highest hardness values were measured with aged samples at 120 °C. In addition, the highest electrical conductivity and the lowest corrosion resistances values were obtained with aged samples at 120 °C.

Keywords: Ageing Temperature, AA7075, Powder Metallurgy, Corrosion Resistance, Electrical Conductivity.

POSTER SESSION

Id-663

Effect of Carbon Nanotube Content on the Wear Behaviours and Electrical Conductivity of Cu-CNT Composites Produced by Powder Metallurgy Method

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Abstract:
In this study the effect of carbon nanotube content on the wear behaviours and electrical conductivity of Cu-CNT composites produced by powder metallurgy method was investigated. The scope of the study five different amount of carbon nanotube (%0. , %1.0 , %1.5, %2.0, % 2.5) were added into pure Cu powders and mechanical milled 360 min. The mechanical milled Cu-CNT powders were cold pressed under 600 MPa load and sintered in atmosphere controlled furnace at 1000 ^{o}C for 1 hour. Microstructure examinations, hardness measurements, and wear tests and electrical conductivity were carried out. As a result of the study the hardness and electrical conductivity values were increased with increasing CNT content up to 1.5 %. Then decreased with increasing CNT content. Wear test results were compatible with hardness results. The lowest weight losses were measured with 1.5 % CNT content.
Keywords: Carbon Nanotube, Cu, Wear Behaviour, Electrical Conductivity, Powder Metallurgy

POSTER SESSION

Id-664

An Investigation of the Wear Behaviours and Electrical Conductivity of Nano Al_2O_3 Particle Reinforced Cu Composites

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Abstract:

In this study the effect of nano Al_2O_3 amount on the wear behaviours and electrical conductivity of Cu-nano Al_2O_3 composites, produced by powder metallurgy method, was investigated. The scope of the study five different amount of nano Al_2O_3 (0.5%, 1.0%, 1.5%, 2.0%, 2.5%) were added into pure Cu powders and mechanical milled 240 min. The mechanical milled Cu- Al_2O_3 powders were pre-shaped by cold press under 600 MPa load. pre-shaped samples were sintered in atmosphere controlled furnace at 1000 oC for 1 hour. Microstructure examinations, hardness measurements, and wear tests and electrical conductivity were carried out. As a result of the study the hardness values were decreased with increasing Al_2O_3 amount. Wear test results were compatible with hardness results. The highest weight loss was measured with 2.5 % Al_2O_3 content. The maximum electrical conductivity value was measured with 0.5 % Al_2O_3 amount.

Keywords: Nano Al_2O_3, Cu, Wear Behaviour, Electrical Conductivity, Powder Metallurgy

POSTER SESSION

Id-667

The Effect of Ageing Temperature in T6 Heat Treatment in Mechanical Properties of AA7075

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Abstract:

In this study, the effect of ageing temperatures in T6 heat treatment on the microstructural changing and mechanical properties of AA7075 were investigated. The samples were quenched after solution treated at 485 °C for 2 hours. The natural ageing were applied for 1 hour, then artifical ageing were carried out at five different temperature (100-140 °C) for 24 hours. Hardness measurements, microstructure, XRD examinations and tensile tests of aged samples were carried out. As a result of the study, the hardness values and ultimate tensile stress (UTS) values were increased by increasing ageing temperatures up to 120 °C, then it was decreased by increasing ageing temperature. UTS values were compatabile with hardness values and maximum UTS values were obtain in aged samples at 120 °C.

Keywords: AA7075, Ageing Temperature, Microstructure, Tensile Strength

POSTER SESSION

Id-669

The Effect of Milling Time on Microstructure and Wear Behaviours of AISI 304 Stainless Steel Produced by Powder Metallurgy

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Abstract:

In this study, the effect of milling time on wear behavior of the AISI 304 stainless steel produced by the mechanical alloying method was investigated. In the study element powders were prepared and mechanical milled at five different milling times (30, 60, 90, 120 and 150 min) in a mechanical alloying device. The milled powders were pre-shaped and sintered at 1300°C for 1 hour and cooled to room temperature in the furnace. Produced samples microstructure and XRD examines were carried out. Wear tests were performed using a pin-on-disc type wear testing device. As a result of the study, the hardness values were decreased by increasing milling time.

Keywords: AISI 304, Mechanical Alloying, Milling Time, Hardness, Wear

POSTER SESSION

Id-678

Experimental Investigation of Buckling Loads of Glass/Epoxy Composites Modified with Nano Particles

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Abstract:

In this study, the effects of the carbon nanotubes and nano clay particles on strength and load carrying capabilities of modified E-glass/epoxy composite plates are determined experimentally. The composite plates are modified with 0% (neat), 0.5% particle weight fractions based on the weight of composites, such as multi-walled carbon nanotubes (MWCNT) and nano clay (NC). Beside of the effects of the nano particles, also the effects of fiber orientations such as (0^o, 30^o, 45^o, 90^o) on strength and load carrying capabilities of composite plates are determined experimentally. The addition of 0.5 wt% multi wall carbon nanotubes (MWCNT) and nano clay particles to composites increases the critical buckling load almost 30% and 12%, respectively.

Keywords: Epoxy, Glass Fiber, Nano clay, MWCNT, Buckling Load

POSTER SESSION

Id-681

The Effect of Nanoparticle Adhesive on the Mechanical Properties of Glass Fiber Composite Materials

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Abstract:

In this study, the effects of the graphene and calcium carbonate, silicon ocside particles on the mechanical properties of filled E-glass/epoxy composite plates are determined experimentally. The content of the particles used for the employed specimen is 0.3, 0.5, 0.7 wt.%. Moreover, the addition of particles to composites increases the mechanical properties.

Keywords: Glass Fiber, Nano Composite, Mechanical Properties

POSTER SESSION

Id-703

Template-assisted CVD Growth of 3D Graphene Foam as Electrode Material in Solar Cells

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Abstract:

Recently, there is an increased interest in developing new materials and associated technologies for the efficacy replacement of the classical electrodes used in solar cells. Owing to the richness of its optical and electronic properties (high electrical and thermal conductivities, high chemical stability and large surface area), 3D graphene offers a significant potential towards advanced sustainable, and environmentally friendly photovoltaics. Using a template-assisted growth method, this study is aiming for a better control of 3D-graphene morphology, structure and transport properties of a paramount importance when considering this material for solar cell applications. Hence, the present study proposes an investigation and optimization of the chemical vapor deposition grown 3D graphene structures and their subsequent surface engineering for application as both counter electrodes and photoanodes in dye-sensitized solar cells.

Keywords: 3D Graphene, Solar Cells

POSTER SESSION

Id-705

Improvement of a Magneto Photonic Ring

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Abstract:
Photonic crystals (PCs) have gained significant interest worldwide over the last two decades due to the existence of a band gap PBG, and the ability to control electromagnetic waves, these crystals are structures of which the refractive index varies periodically in one, two or three directions of space, introducing a defect (point or line or both) in these structures, the periodicity and completeness of the band gap is broken and the propagation light can be located in the PBG region. Numerous PC-based optical devices are proposed both theoretically and experimentally. Ring-based optical filters offer improved selectivity, greater size scalability, and greater flexibility in fashion design. When magneto-optic materials and photonic crystals are combined, new components based on magneto-photonic crystals emerge to exalt the non-reciprocal effects of propagation. As part of this work we use magneto-photonic crystals to design and ameliorate telecommunication device like the ring.

Keywords: Photonic Crystals, Magneto-photonic, Filling Factor, Propagation Constant, Silica, Holes Arrays

POSTER SESSION

Id-707

Improvement of Tribological Properties of Steel Camshaft by Plasma Nitriding

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Abstract:

In this study, the effect of plasma nitriding on microstructure, hardness and tribological properties of 31CrMoV9 quality steel camshafts was investigated. For this purpose, the NC codes to be used during the production of the steel camshaft in the first stage 31CrMoV9 analysis were determined by the ESPRIT program and the machining simulation and then the machining was carried out by turning-milling-grinding processes. Plasma nitriding was conducted on machined and grinded camshafts for 120 and 240 minutes for each gas mixture at the gas mixing ratios of 80%H2+20%N2, 90%H2+10%N2, 94%H2+6%N2 at 500°C. Plasma nitrided camshafts were subjected to optical microscopy, SEM, XRD analyzes and mechanical tests (hardness and wear). For the steel camshaft made from 31CrMoV9 steel, the optimum hardness (735 HV0,1) and the wear resistance (1,80mg/ 500cycles), were obtained from the diffusion layer depth (250µm) and the white layer thickness (17µm) reached 240 min. plasma nitriding of the 94%H2+6%N2 gas mixture.

Keywords: 31CrMoV9, Plasma Nitriding, Wear, Tribology, Camshaft, Diffusion Coating

POSTER SESSION

Id-708

Plasma Nitriding Process of Cast Camshaft to Improve Wear Resistance

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Abstract:

The aim of this study was to investigate the effect of plasma nitriding heat treatment on the microstructure, hardness and abrasion resistance of the GG25 grade gray cast iron camshaft. For this purpose, in the first stage, casting simulation was carried out by using NOVACAST computer software program of GG25 grade gray cast iron camshaft to optimize casting quality and production of camshaft with sand casting method. Casting process was performed between at 1410-1420°C and casting time was between14-16 sec. Plasma nitriding was carried out for 120 minutes and 240 minutes for cast gray iron camshafts for each gas mixture at gas mixture ratios of 80%H2+20%N2, 90%H2+10%N2, 94%H2+6%N2 at 500°C. Plasma nitrided camshafts were subjected to optical microscopy, SEM, XRD analyzes and mechanical tests (hardness and wear). For the cas iron camshaft made from GG25 grade, the optimum hardness (602 HV0,1) and the wear resistance (1,90mg/500cycles), were obtained from the diffusion layer depth (600µm) and the white layer thickness (22µm) reached 240 min. plasma nitriding of the 94%H2+6%N2 gas mixture.

Keywords: GG25 Cast Iron, Plasma Nitriding, Wear, Tribology, Camshaft, Diffusion, Metal Casting

POSTER SESSION

Id-709

Property Improvement of Subzero/Cryogenic Heat-treated Camshafts Made of 8620H, $16MnCr_5$ and $100Cr_6$ Steels

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Abstract:

Several types of camshafts that made of 8620H, 16MnCr5 and 100Cr6 steel were subzero and cryogenic heat treated and the effect of these heat treatment parameters such holding duration and temperature on the microstructure, retained austenite volume ratio, hardness and wear resistance were investigated. Camshafts for all kind of steels were grinded and different heat treatment cycles have been applied. 8620H, 16MnCr5 grade camshafts were carburized at 925°C'in endogas (%20 CO, %40N2, %40H2) atmosphere between 1440 minutes. At the end of carburing, 8620H, 16MnCr5 and 100Cr6 camshafts the diffusion temperature was decreased to 840°C (holded 90 min.) which is the austenizing temperature and the samples were hardened in oil at 60°C (holded 30 min.). Samples were subzero treated at -100°C for 210 minutes and were tempered at 185°C for 120 minutes. The microstructure was revealed that the subzero/cryogenic heat treatment increased the hardness up to 62 HRc and increased the wear resistance of camshafts surface. The decrease in the retained austenite ratio was observed from %25 to %5-10 after cryogenic heat treatment. All of steels the hardness values were increased with the transformation of retained austenite into martensite. This increase is the result of the transformation of martensite from retained austenite and the carbide precipitation mechanism.

Keywords: Camshaft, Subzero/Cryogenic Heat Treatment, Retained Austenite, Wear, Hardness, 8620H, 16MnCr5, 100Cr6

POSTER SESSION

Id-710

The Effects of Austempering Heat Treatment on the Mechanical Properties of Heavy Vehicles Cam Shaft Made of Different Analysis Ductile Cast Iron

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Abstract:
The aim of this study was to investigate the effect of the austempering treatment applied on spheroidal graphite cast iron with different chemical analyzes; microstructure, hardness, tensile strength and abrasion resistance. For this purpose; sand mold casting models of camshafts were prepared and casting simulation was carried out with the NOVACAST program and optimized the casting quality of camshafts and production was realized. For the spheronization process, Fe-Si-Mg alloy is used. Casting was carried out at 1430°C and casting time was 15 seconds. In different analyzes, a cast camshaft was subjected to a 90 min austenitizing process at 900°C under a mill vacuum furnace. The camshaft was then transferred to a salt bath (50%KNO3+50%NaNO3) at 260°C and austempering was applied for 30-60-90-120-150-180-210 min's. After finishing the austempering period, the camshafts are removed from salt bath and cooled in the air. Microstructure analysis, microhardness (HV) measurements, tensile tests, pin-on-disk wear tests of camshafts were performed with optical microscope that were produced by 3 different chemical analyzes and 7 different austempering times. In this study, the tensile strength values of the austempered structure, camshaft core which has been formed in 90 min. duration which has the combination of excellent strength and ductility, have been brought from the level of 711.42MPa to 1423.34MPa.

Keywords: Camshaft, Austenitizing, Austempering, Tensile Properties, Wear Properties, Microhardness

POSTER SESSION

Id-712

The Effects of Heat Treatment on the Tensile Properties of Camshaft Made of GGG70 Series Spherical Graphite Cast Iron

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Abstract:
The aim of this study is to investigate the effects of austempering and induction hardening on the tensile properties of GGG70 ductile cast iron for cam shaft production. For this purpose, cam shafts have been produced by sand mould casting method. For nodulizing process, Fe-Si-Mg alloy has been used and Fe-Si-Ba-Ca-Al alloy has been for inoculation process. The casting has been done between 1420-1440°C and the pouring time was in between 11-13 sec. The casted cam shafts have been austenitized at two different temperatures and time under controlled furnace atmosphere. The austenitized cam shafts have been quenched into the molten salt bath at 320°C temperature and held 90 min and then cooled in air. By this way, austempering heat treatment has been applied. After that, surface hardening process was conducted by induction hardening machine with medium frequency. Microstructures of cam shafts have been examined by optical and mechanical tests (hardness and tensile tests) have been performed. The fracture surfaces of tensile specimens were examined by SEM analysis. Results show that austempering heat treatment increases the tensile strength of cam shaft as-cast condition. Tensile strength of the cam shaft increases with increasing austenitizing temperature, time and induction hardening. The highest tensile strength 1285MPa, has been obtained from the induction hardened cam shaft austenitized at 900°C and 90 min time.

Keywords: Camshaft, Austenitizing, Austempering, Induction Hardening, Tensile Properties, Analysis

POSTER SESSION

Id-713

Effects of Molybdenum and Boron Additions of Fe-based Metal Matrix Composites by Warm Compaction Method

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Abstract:

In this study, mechanical behavior of iron base (Fe-0.8 C-2.0 Cu-3.0 Ni-X Mo-Y B (%wt) X=1.2, 1.8; Y=0.2, 1.0) metal matrix composite (MMC) was investigated for gear production by powder metallurgy. MMC has produced by warm compaction method followed by free sintering in controlled Ar gas atmosphere. Green composite has produced under 650 MPa pressure at 160°C temperature. The green products have been sintered various temperatures (1050, 1150 and 1250°C), at 90 minute. Effect of Mo and B additions were investigated on hardness, wear resistence, density and microstructure of the composite samples. The worn surfaces of the samples have been examined under scanning electron microscopy (SEM) and analyzed by energy dispersive spectroscopy (EDS) and X-ray diffraction method (XRD). The results have showed that hardness and wear resistance of the samples increases with increasing temperature and molybdenum and boron addition. The highest hardness and wear resistance have been obtained at the composite sample produced at 1250°C sintering temperature and %1.8Mo-%B1.0 addition.

Keywords: Powder Metallurgy, Warm Compaction, Microstructure, Composites, Mechanical Properties.

POSTER SESSION

Id-719

Electrical and Radiological Tests for the Characterization of the Cavity-ionization Chamber of IFIN-HH

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Abstract:

In order to assure the traceability of measurements in radiotherapy for air kerma, in cooperation with CEA-LNHB, the Collective of Radiation Metrology, Testing and Dosimetry from the "Horia Hulubei" Institute for Physics and Nuclear Engineering from Romania, designed and performed a cavity ionization chamber.The electrodes of the chamber are made of graphite /1/. The components of the detector and technologies of final processing of these components, as well as of polishing and cleaning are presented in another paper/1/. The aim of this paper is to present some of the electrical and radiological characteristics of the chamber. In the present paper, we present the work done to determine the following parameters: the leakage current, the I-U characteristic curves. This work was partly supported by the EMPIR Project 14 RPT 04 ABSORB and partly by the IFA-CEA Project C4-02 CATRAS.

Keywords: Ionization Chamber, Radiotherapy, Air Kerma

POSTER SESSION

Id-720

The Effects of Heat Treatment on the Microstructures and Mechanical Properties of Powder Metallurgy Nb-V Microalloyed Steels

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Abstract:
In this study, the effects of heat treatment on the microstructures and mechanical properties of powder metallurgy (PM) Nb-V microalloyed steels (Fe + % 0,25 C + %0,075 Nb+%0,075V) are investigated. Argon gas was used as sintering atmosphere. The microstructure and mechanical properties of the Nb-V added PM microalloyed steel were examined by optical microscopy, scanning electron microscope (SEM) and tensile tests. Experimental results show that microalloyed steels can be produced by PM technology and the heat treatment affects the microstructure and mechanical properties of microalloyed PM steel. Nb-V microalloyed steels are heat treated by A (Orginal simple), B (785 ºC/5'/H2O) and C (785 ºC/5'/425 ºC/120'/25 ºC) and D (825 ºC/30'/ H2O) heat treatment. Microstructure tensile strengths of the samples are compared and observed that the sample not heat-treated has low yield and tensile strength, and higher % elongation. B and D heat treated samples are observed having ferrite and martensite phase. C heat treated samples are observed having ferrite and bainite phase. D heat treated samples had higher yield and tensile strength.

Keywords: Heat Treatment, Nb-V Microalloyed Steel, Powder Metallurgy, Mechanical Properties.

POSTER SESSION

Id-726

Seismic Vulnerability Assessment of Reinforced Concrete Frame Structure by Finite Element Analysis

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Abstract:

Performance of structures depends on the vulnerability of the structure and the seismic hazard of the region. As part of the Mediterranean-Transasian belt, the Croatian territory is located in an earthquake prone area. Implementation of earthquake-resistant building design rules is essential in order to mitigate the damages of earthquakes affecting settlement areas. Performance-based evaluation of buildings may be conducted through fragility curves developed for different levels of performance. In this paper, a reinforced concrete frame structure was designed as a moderately ductile building according to EN 1998:2004-1. Incremental dynamic analysis of the nonlinear numerical reinforced concrete model is implemented in the software package SeismoStruct, wherein the frame elements (column, beam) were defined as finite elements. The seismic risk of the model is estimated by probabilistic analysis that takes the randomness of seismic excitation into account and evaluates the probability of exceeding a certain critical condition. Seven real time histories selected from European Strong–motion Database were used. The structural behaviour is observed based on maximum interstorey drifts through the entire height of the building for each seismic excitation. The results obtained by incremental dynamic analysis of the nonlinear numerical model are also compared with an empirical seismic vulnerability method - Macroseismic method. The article outlines the importance of proper design and following building codes as well as the fact that empirical and analytical methods give results that can be significantly different and difficult to compare.

Keywords: Seismic Vulnerability, Finite Element Analysis, Reinforced Concrete Frame

POSTER SESSION

Id-745

Investigation on the Effect of Delay Time During Pulse Chemical Etching of Porous Silicon Formation

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Abstract:

A set of porous silicon (PS) layer was produced by pulse chemical (PC) etching using a solution of HF:C_2H_6O in a composition ratio of 1:4 with delay time varying from 0 to 4 minutes. The set is compared with the one porous silicon sample that was etched by using conventional direct current (DC) etching technique. All the samples was etched at a current density of J = 10mA/cm2 for 30 minutes. In the PC process, the current was supplied through a pulse generator with 14ms cycle time (T) which the on time (Ton) was set to 10ms and pause time (Toff) is set to 4ms respectively. FESEM showed that the variation of delay time Td affects the pore formation. The pores structure produces on sample with 2 minutes delay time is more uniform compared to other samples. Through EDX results, it can be seen that the composition of silicon in the PS samples is high with minimal presence of oxide element. The AFM results indicates that the surface of the samples is getting regular as the delay time is introduced and being increased. XRD results showed the crystallite size of all samples.

Keywords: Porous Silicon, Pulse Chemical, Field Emission Scanning Electron Microscopy, Energy Dispersive X-Ray Spectroscopy, X-Ray Diffraction

POSTER SESSION

Id-754

Investigation of CVD Graphene modified with Pt Nanoparticles for Methanol and Ethanol Electro-oxidation

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Abstract:

In the present study graphene monolayer (GR), deposited on the Ni/SiO_2/Si substrate by chemical vapor deposition (CVD), has been used as a substrate for the depositing of Pt nanoparticles. The deposition of Pt nanoparticles on the surface of CVD graphene was performed by immersion of the GR/Ni/SiO_2/Si samples into the Pt(IV) containing solution at a temperature of 25 ^{o}C for various time periods. The surface morphology and structure of the obtained Pt/GR/Ni/SiO_2/Si catalysts were examined using scanning electron microscopy (SEM) and energy dispersive X-ray analysis (EDX). Electrocatalytic properties of the Pt/GR/Ni/SiO_2/Si catalysts were evaluated towards the electro-oxidation of methanol and ethanol in an alkaline medium by means of cyclic voltammetry and chrono-techniques. It has been determined that the Pt/GR/Ni/SiO_2/Si catalysts exhibit a significantly higher electrocatalytic activity towards the electro-oxidation of methanol and ethanol in an alkaline medium, compared with that for the pure GR/Ni/SiO_2/Si electrode and seems to be a promising anode material for direct methanol and ethanol fuel cells (DMFC and DEFC).

Keywords: Graphene, Gold, Methanol, Ethanol, Electro-Oxidation

POSTER SESSION

Id-755

Electroless Deposition of CoB alloys Doped with Mn or Fe

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Abstract:

Kinetics of electroless deposition of CoB alloys doped with Mn or Fe has been investigated. The CoB alloys doped with Mn or Fe have been deposited on the copper surface using morpholine borane as a reducing agent. The morphology, structure and composition of the obtained CoBMn and CoBFe alloys have been characterized by means of Field Emission Scanning Electron Microscopy, Energy Dispersive X-ray Analysis and Inductively Coupled Optical Emission Spectroscopy. The influence of concentration of the reactants on the composition of CoBFe or CoBMn alloys and the deposition rate has been investigated. The prepared CoBFe and CoBMn alloys were examined as catalysts for the catalytic generation of hydrogen from an alkaline sodium borohydride solution. The hydrolysis of sodium borohydride has been investigated at different solution temperatures by measuring the amount of hydrogen generated.The CoBFe alloys contained from 2.2 to 18.1 at.% of Fe and from 1.8 and 2.4 at.% of B, whereas the CoBMn alloys contained from 0.04 to 0.21 at.% of Mn and from 1.3 to 2.2 at.% of boron. The highest deposition rate for the CoBFe and CoBMn alloys was approximately 2.2 and 4.8, respectively, μg cm^{-2} h^{-1}. It was found that the CoB alloys doped with Mn shows the enhanced catalytic activity towards the hydrolysis reaction of sodium borohydride, compared with that for CoB alloys doped with Fe.

Keywords: CoB, Mn, Fe, Electroless deposition

POSTER SESSION

Id-756

Enhanced Activity of CVD Graphene Decorated with Au Nanoparticles towards Hydrazine Electro-oxidation

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Abstract:

In the present study, the commercially available CVD graphene-Ni/SiO_2/Si (Graphene-Supermarket) template was used for the fabrication of the efficient electrocatalyst for the electro-oxidation of hydrazine in an alkaline medium. The CVD graphene-Ni/SiO_2/Si template was decorated with Au nanoparticles using the galvanic displacement method. Field emission scanning electron microscopy, energy dispersive X-ray analysis and inductively coupled plasma optical emission spectroscopy were used for the characterization of the morphology, structure and composition of the prepared CVD graphene-Ni/SiO_2/Si, decorated with Au nanoparticles. The electrochemical behavior of the prepared catalysts was investigated towards the electro-oxidation of hydrazine in an alkaline medium by means of cyclic voltammetry and chronoamperometry.Data on the peculiarities of various electrodes are compared and discussed on the basis of electrochemical data. It has been determined that the CVD graphene-Ni/SiO_2/Si with Au nanoparticles shows significantly enhanced activity towards the electro-oxidation of hydrazine, compared with that for the pure Au electrode and CVD graphene-Ni/SiO_2/Si.

Keywords: Graphene, Gold, Hydrazine, Electro-oxidation

POSTER SESSION

Id-758

Investigation of Cobalt-Boron and Platinum-Cobalt-Boron as Anode Catalysts for Direct Borohydride-Hydrogen Peroxide Fuel Cell

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Abstract:
Cobalt-boron and platinum-cobalt-boron catalysts have been deposited on the copper surface (denoted as CoB/Cu and PtCoB/Cu) by the electroless deposition and galvanic displacement methods and studied as possible anode materials for direct borohydride-hydrogen peroxide fuel cells ($NaBH_4$-H_2O_2). The fuel cell measurements have been performed at four temperatures of 25, 35, 45 and 55 ºC on a lab-scale direct alkaline $NaBH_4$-H_2O_2 single fuel cell. Polarization curves have been recorded with the aim to evaluate the fuel cell performance using each prepared anode catalyst. It was found that the peak power density values in the range of 86-145 and 146-234 mW cm^{-2} were attained at temperatures of 25-55 ^{o}C for the CoB/Cu and PtCoB/Cu (9.8 to 14.4 $\mu g_{Pt} cm^{-2}$) catalysts, respectively, used as the anodes. The highest specific peak power density of 21.5 kW g_{Pt}^{-1} was obtained when employing the PtCoB/Cu anode catalyst with Pt loading 14.4 μg_{Pt} cm^{-2} at a temperature of 55 °C.

Keywords: Pt, Co, B, Borohydride, Fuel Cell

POSTER SESSION

Id-759

Hydrogen Generation from Sodium Borohydride Solution Catalyzed by PtCoMn/Carbon Catalysts

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Abstract:
The carbon supported PtCoMn and CoMn catalysts were prepared by the electroless metal deposition method followed by the galvanic displacement. At first, the CoMn catalysts were deposited on the surface of carbon powder using the morpholine borane as a reducing agent. Then, the Pt nanoparticles were deposited on the CoMn/carbon catalyst by their immersion into the Pt(IV)-containing solution for 10 min. The prepared catalysts were characterized using Field Emission Scanning Electron Microscopy, Energy Dispersive X-ray Spectroscopy and Inductively Coupled Plasma Optical Emission Spectroscopy. The catalytic activity of the carbon supported PtCoMn and CoMn catalysts was investigated towards the hydrolysis reaction of sodium borohydride by measuring the amount of hydrogen generated. It was found that the significantly higher hydrogen generation rate was obtained for the PtCoMn/carbon catalyst, compared with that for the CoMn/carbon catalyst.

Keywords: Hydrogen Generation, Pt, Co, Mn

POSTER SESSION

Id-762

Evaluation of Fracture Toughness and Crack Propagation of Aluminum Alloy 7075-T6 with Chromium Oxide Coating

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Abstract:

Fatigue crack formation is the most important factor affecting the occurrence of damage in parts under repeated stresses. In this context, intensive researches are continuing on the protective hard coatings in the aviation and automotive sectors in order to increase the fatigue life especially in aluminum alloy parts. It is necessary to increase the surface resistance of the part in order to increase the fatigue crack resistance. Chromium oxide (Cr_2O_3) based dense thermal spray coatings are widely used in many industrial applications due to high corrosion resistance, high hardness and high surface resistance. This research investigates the growth of fatigue cracks on 7075-T6 aluminum alloy CT specimens (ASTM E399) with thermal sprayed (flexicord) and detailed characterization studies on fracture surfaces to determine crack propagation retardant effect. The variation of the fracture toughness depending on the coating thickness was investigated

Keywords: Thermal Spray, Chromium Oxide, Crack Propagation, Aluminum Alloy

POSTER SESSION

Id-782

In Rresearch of the Solid Particle Erosive Wear Behaviour of Different Oxide Based Ceramic Thermal Spray Coatings Before and After Heat Treatment

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Abstract:

Thermal spray coatings are used to improve wear performance in many industrial applications. Particularly on coated metal surfaces there are limited study on the erosive wear behavior. The solid particle erosive wear mechanism of lamellar, heterogenous thermal spray coatings are still not clearly defined. In this study, erosive wear rate and wear mechanism of different oxide (Alumina, Zirconate, Spinnel, Chromia) based ceramic coatings are investigated before and after heat treatment (700^{o}C, 60h). With the electron microscope (SEM), 3D profilometry the wear track surfaces and the wear mechanism have been studied in detaily. It has been found that the microstructural properties and thickness of the coating have a significant effect on the wear rate performance. It has been observed that heat treatment at 760^{o}C for 60h, increases the solid particle erosion resistance of all oxide coatings. Discontinuities in the coating structure significantly affect the wear life of the thermal spray coatings.
Keywords Thermal Spray, Oxide Ceramics,Wear, Solid Particle Erosion.

POSTER SESSION

Id-802

Effect of Thermo-elastic Damping on Transverse Waves Propagating in a Single-wall Carbon Nanotube

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Abstract:

This paper concerned with the study of the effect of thermo-elastic damping on transverse waves propagating in a single-wall carbon nanotube. The Q-factor for thermoelastic damping is investigated for transverse wave propagating in the nanotube. As a physical model, cylindrical shell is considered and the Donnell–Mushtari–Vlasov (DMV) approach is applied. The influences of the room temperature and radial thickness of the nanotube on the vibration behaviors are discussed. The effects of the room temperature and radial thickness of the nanotube on the quality factor are examined numerically. It can be shown that the Q-factor is proportional to the radial thickness of the nanotube. On the other hand, the opposite trend is appeared with the change of room temperature. It means that the Q-factor for a single-wall carbon nanotube decreases with the increase of the room temperatures.

Keywords: Transverse Waves, Thermo-Elastic, Damping, Single-wall Carbon Nanotube, Quality Factor

POSTER SESSION

Id-812

Investigation of the Additive Effects on the Mechanical Properties of E-glass Reinforced Thermoset Composites

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Abstract:

Thermoset composites have extensive usage in automotive, defense industry and aerospace industry. It is important that improvement of strength and mechanical properties of composites. In this study various additives and various weight ratios of additives have been added to the e-glass reinforced epoxy resins. The effects of additive types and addititve ratios on the mechanical properties of composites were examined experimentally. The samples were produced by hand lay up method. The tensile strength of modified samples is increased significantly.

Keywords: Epoxy, E-glass, Composite, Additive, Mechanical properties

POSTER SESSION

Id-820

Effect of Brazing Temperature on the Shear Strength of Nickel Base Superalloy Joints

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Abstract:

In this study, Nickel base superalloy was brazed by using (NiTi and NiTiAl) alloys which are an active filler alloys under protective atmosphere (using a high purity 99.999 Argon gas). Five brazing temperatures (1135, 1025, 985, 825, 725 ºC) were chosen based on the solidus temperatures of NiTi and NiAl filler alloys in order to investigate the effects of these temperatures on the performance of the brazed joints. Brazing processes were carried out over a period of time (15min) to ensure that the filler alloys were melted completely. The performance of brazing process was evaluated in terms of bonding strength by shear test. The results revealed that a maximum value of shear strength (29MPa) was obtained at brazing temperature (985ºC) as compared with other temperatures. It was observed that the highest shear strength was influenced by the formation of (Ni_3Ti) phase.

Keywords: Brazing, Active Filler Alloy, Brazing Temperatures, Nickel Base Superalloy, Shear Strength

POSTER SESSION

Id-827

Engineering Analysis of Acrylonitrile Butadiene Styrene Material Prototype Component Subjected to Tensile and Bending Loads in the Fused Deposition Modeling Process

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Abstract:

The purpose of this paper is to present a finite element computational analysis of a 3D printing technology on acrylonitrile butadiene styrene (ABS) material mechanical strength based on material fused deposition modeling. The determination of this investigation is to model the performance of this ABS material to obtain the equivalent non-linear minimum stress-strain curves based on tensile and bending loads. Experiments were performed to achieve optimum mechanical material rigidity in controlling of extrusion temperature, infill pattern, additive layer height and different thicknesses of extruded fibers for optimum physical stress-strain. A systematic approach processing parameter on the mechanical properties and dimensional precision of FDM parts was devel oped to model processing parameters on the final part's mechanical properties, dimensional accuracy and building time in FDM. The obtained results are employed for the formation of macro-scale finite element models, which enable to simulate the total structural response of 3D printed sample components subjected to tensile and bending loads. Finite element models that are produced with consideration to microstructure of 3D printed samples simulated flexural and tensile experiments. The validation of the models was performed by comparing the computed results against the experimental ones, where satisfactory agreement has been demonstrated within a marked range of thicknesses of additive layers. Certain inadequacies between computed against experimental results were observed in case of thinnest and thickest additive layers. The principle explanation of the reasons of inadequacies takes into account the poorer quality of mutual adhesion in case of very thin extruded fibers and too-early solidification effect. The obtained results from this research provided total material structural response of 3D printed samples subjected to mechanical loads to support designers' model prototype.

Keyword: Finite Element Analysis, Tensile and Bending Loads, Fused Deposition Modeling

POSTER SESSION

Id-828

Biomaterial Structural Analysis of Total Elbow Prosthetic Implant Replacement Arthroscopy by Means of the von-Mises Stress Response in Computational Engineering

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Abstract:

The elbow joint is a compound structure that gives a vital capacity as the mechanical connection in the furthest point between the hand, wrist and the shoulder. The elbow's capacities incorporate situating the turn in space for fine developments, intense getting a handle on. Loss of elbow capacity can extremely influence exercises of day by day living. It is vital to perceive the one of a kind life structure of the elbow, including the difficult geometry and delicate tissue structures. The biomechanics of the elbow joint can be separated into kinematics, settling structures in elbow reliability, and constrain transmission through the elbow joint. The detached stabilizers incorporate the hard articular geometry and the delicate tissue stabilizers. A limited component investigation of elbow embed is exhibited for the elbow subjected to an inner and outer weight stacking in computational mechanics. The pivot sort prosthesis in this exploration was intended for supplanting the humeroulnar joint and stress examination was acknowledged by limited component technique utilizing ANSYS programming. A limited component model of the interface was made utilizing Solidworks 17.0. Static investigation of tetrahedra strong components utilizing multipass versatile component fitting was performed for all examinations. Settled contact focuses were made at similarly separated interims along the interface. The tissue that interfaces with the bone was settled, and a 18N drive was connected to the finish of the prosthesis to make a 6 Nm torque. Examinations were done utilizing estimations of 35 kPa and 70 kPa. The range of Poison's proportion was 0.4–0.5. What's more, to survey the affectability of the model to the variable crosswise over physical displaying by limited component examination. The paper shows an entire examination of the probabilistic structure for the von Mises stretch. Von Mises stresses are a nonlinear capacity of the stress vector segments.

Keywords: Biomaterial, Total Elbow Prosthetic Implant Replacement, Nonlinear FEA, Titanium Alloys

POSTER SESSION

Id-832

Electrical Resistance Characterization of Allotropic ß→α-Sn Transition on High Tin Content Solder Alloys with Application of Different Inoculators

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Abstract:

Tin (β-Sn) is one of the most important materials in the electronics technology, since this is the base metal of soldering technology. The “tin pest” is a spontaneous allotropic transition of the metallic β-Sn to non-metallic α-Sn below 13.2°C. In basic case the transition is slow to initiate due to a high activation energy, however the presence of materials with the same crystal structure and close lattice parameters to the α-Sn (so called “inoculators”) or very low temperatures can speed up the process considerably. Therefore, the identification and characterization of tin pest in Sn-rich solders and surface finishes is crucial for electronics working in sub-zero temperatures in aeronautical, aerospace and automobile applications. The phenomenon can be characterized by electrical resistance measurements, since there is the change from metal to semiconductor leading to considerable electrical resistance change. In this work, the allotropic transition of β to α-Sn was characterized by electrical resistance measurement in in SnCu1 and Sn99Ag0.3Cu0.7 alloys inoculated by InSb, CdTe and α-Sn. Samples were prepared using mechanical treatment of two different sample sizes and stored at -18°C for 40 days. The electrical resistance measurement has proven that it is good characterization method for the tin pest phenomenon. It has shown that the transition has considerable characteristic differences at the different alloys and inoculators, like different nucleation, growth and the saturation stages. The results were explained and confirmed by scanning electron microscopy. These obtained conclusions can help to understand the phenomenon even more deeply.

Keywords: Solder Alloy, Tin Pest, Allotropic Transition Of Tin, Electrical Resistance

POSTER SESSION

Id-850

Investigation of the Effect of Curing on Improvement of Uniaxial Compressive Strength Properties by Construction Demolition Waste

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Abstract:
Turkey has entered in the process of urban transformation after 1999 Marmara earthquake. New buildings are being constructed instead of the structures that losing sustainability in this process. If the wastes from the collapsed buildings throw to nature, they will cause environmental pollution. In addition this waste will cause problems in the area due to the large size to be stored. At first on this subject Turkey Ready Mixed Concrete Association realize a project is ‘’Research of reusing potential of construction and demolition wastes that consisted urban transformation project’’. In this study kaoline clay is accepted as natural soil sample and added construction demolition waste at different rates. The compaction test was made on prepared samples and the maximum dry density values at the optimum water content was obtained. Then soil samples compacted at the optimum water content obtained and Uniaxial Compressive Strength test performed. The end of the experiments positive results obtained and has been determined that construction demolotion wastes are useful to improve in the clay soil formation.

Keywords: Construction Demolition Waste, Soil Improvement, Uniaxial Compressive Strength.

POSTER SESSION

Id-865

Determination of Plastic Hinge Length for RC Beams Designed with Different Failure Modes under Static Loading

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Abstract:
Inelastic deformation without substantial loss of strength can lead to the dissipation of seismic energy in reinforced concrete structures during the earthquakes. Inelastic deformations are concentrated in specific areas within the structure so called plastic hinge zones and they are designed to redistribute the plastic moments. Rest of the structure is allowed to deform elastically. Dynamic response of the entire structure relies on these specific areas where plastic hinges are defined once the response of the structure reaches the yielding point. Therefore, modeling them as close to its real location value within the structural element plays an important role especially in numerical analysis. The behavior and location of plastic hinge of reinforced concrete elements has been studied by conducting experiments. More research still need to be done by considering different parameters due to the high complexity engaged in the behavior. With the help of non-linear finite element modelling techniques such experiments considering different parameters can be conducted numerically. This study involves parametric study to determine the plastic hinge length of reinforced concrete beams using experimentally verified nonlinear finite element approach. Different failure behavior of reinforced concrete beams is selected as the parameter in the numerical analysis. Different failure modes are achieved with three different steel reinforcement ratio and with three different shear span ratio defining failure by means of ductility and slenderness, respectively. Thus, the parametric study is performed to assess the influence of the tension reinforcement and shear span to depth ratio of reinforced concrete beams to the plastic hinge length. Length of the plastic hinge region involving rebar yielding zone and concrete crushing zone are determined for each numerical beam.

Keywords: Reinforced Concrete Beams, Plastic Hinge Length, Finite Element Analysis

POSTER SESSION

Id-877

Method to Measure and Predict the Aerospace Structure Acoustic Performances

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Abstract:

Aviation noise is an underestimated threat that can cause a number of short- and long-term health problems for communities, flight crew and passengers. One of the most common ways to reduce the noise inside the helicopter/aircraft cabin is using materials/structures capable to maximum absorb and in the same time to transmit a lowest acoustic energy from outside exterior noise sources to inside cabin. The current approaches are to directly measure the structures acoustic performances or to use numerical simulations from commercial software's to predict it, but those methods are or time or money consuming and for academic world (PhD students) are not always suitable. The research work presents an original and simple method to obtain the acoustic performances for different structures, starting from the known acoustic properties (literature, tables, materials specifications, etc.). The prediction process is constructed on multiple measurements on aerospace materials and structures in order to have the premise for the acoustics coefficients. Experiments were performed using impedance tubes accordingly with SR EN ISO10534-2 (absorption coefficient). Based on individual and combined experiments on different types of materials and identifying dependencies on the data obtained experimentally, the paper will provide an accurate analytical method to predict the absorption coefficient for different structure that can be used in aerospace field. Therefore, in this study, the authors developed an analytical statistical estimation method and verify its effectiveness by comparing the results with those of experiments.

Keywords: Experiments, Prediction, Statistics, Acoustic Absorption Coefficient, Aerospace Structure

POSTER SESSION

Id-878

Mechanical Property Evolution of Polymeric Composites Immersed in Jet Fuel

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Abstract:

The aim of the present study was to evaluate the jet fuel influence on tensile strength of a prepreg based polymeric composite material. This environmental suitability test was necessary to determine if the composite is suitable for a fuel tank and can replace the existing metallic materials used in fuel tank applications. For this analysis, the kerosene-type jet fuel (JET A-1) was used as moist environment. To accomplish the goal of the study, composite samples were submerged in a closed container with jet fuel for a period of 137 days in ambient conditions, and afterwards, a different treatment was applied to composite material sample batches. A vacuum assisted drying process was ensured for one sample batch. Tensile tests were carried out on each sample batch, and it was concluded that the jet fuel reduces the tensile strength of the epoxy composite while increasing the elastic modulus. The moisture absorption showed that accelerated dry process ensures the partial desorption of kerosene, but it doesn't ensure the improvement of composite's mechanical properties. The overall conclusion of the study is that the jet fuel has a negative influence over the studied bare carbon fibre reinforced polymer tensile strength on long term due to degradation of polymeric matrix.

Keywords: Jet Fuel, Composites, Tensile Strength, Moisture, Fuel Tank

POSTER SESSION

Id-879

Analytical Approaches to Study the Differences Occurred in the RGB Images Captured Thru Gamma-Ray Irradiated Optical Windows

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Abstarct:

When exposed to ionizing radiation fields, the optical windows are affected by the energy deposition, their transparency starting to be affected. The main goal of the present paper is to find different analytical methods to study and highlight these transparency changes. In order to fulfill the proposed goal, several optical windows were exposed to gamma-ray to obtain different absorbed dose values. The exposed samples were placed in front of a color standard, and high quality pictures of them were taken. The digital images were decomposed in their individual color components, and, further, their associated RGB histograms were obtained. The RGB histograms were compared and evaluated for each pair of irradiated/unirradiated optical windows, by using several analytical approaches. Higher relative differences were observed as a function of the increased absorbed dose value ("browning effect" magnitude). A quasi-linear dependence was observed up to a value of 10 kGy, regardless the used analytical approach, which indicates that this method can also be used for "unknown" absorbed gamma-ray doses estimations. The quasi-linearity region can be extended by using optical windows having different thicknesses, considering the fact that absorption coefficient is given in mm^{-1} units.
Keywords: Gamma-ray, optical window, color standard, RGB histogram.

POSTER SESSION

Id-880

The Evolution in Time of Mechanical Properties of Cement Matrices Containing Nickel Ferrocyanide Sorbents

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Abstract:
The immobilization of radioactive waste in cement based matrix is the most used method, applied in the world by the countries developing nuclear energy programs.The wastes produced by nuclear activities are very diverse and under certain circumstances affect the rate of hydration on cement and/or reduce the quality of product. To respect waste acceptance criteria for disposal, the matrix must be stable in time from chemical, physical, mechanical and geometric point of view.The mechanical characterization of the radioactive waste conditioning matrix is very important during the final disposal stage in the radioactive waste management. The conditioned matrix of radioactive waste must have good mechanical properties to assure the material integrity during handling, storage, transport and long term stability in the final disposal environment. One of the most relevant mechanical properties applicable to cement based material is its compressive strength.This paper gives information about the influence of ferrocyanide sorbents used at the liquid radioactive waste treatment for removal of cesium on the mechanical behavior of cement matrix. The purpose of this paper is to obtain data on samples prepared with ferrocyanide and cement, necessary for the approach the medium and long term assessment of the safety and performance for waste packages.

Keywords: Radioactive waste, Mechanical tests, Conditioning matrix.

POSTER SESSION

Id-884

Microwave-assisted Hydroxyapatite Coating of Ti6Al4V Alloys and Investigation of Adhesion Strength

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Abstract:

The response of bone to the coated surface and the biocompatibility of medical implants depend strongly on the physical, chemical and morphological properties of the surface. The coating of biocompatible materials enables the integration of bone and metal implant more effectively.Owing to their excellent biocompatibility, osteoconductivity, and mechanical properties, titanium and its alloys, one of the most suitable coating materials, have been extensively employed in dental and orthopedic applications and also biomedical implants. Calcium phosphate substances with a suitable ratio of Ca/P are bioactive, biocompatible, and osteoconductive and enhance direct attachment to bone. To that end, to boost the bioactivity of titanium alloys, uniform hydroxyapatite coatings were prepared onTi6Al4V titanium alloy substrates using microwave-assisted immersion method. Simulated body fluid (10X SBF) , prepared according to the Kokubo protocol, used during all the experiments. The effect of the number of cycle i.e. exposure time to a constant microwave irradiation of 800 W, on the coating thickness, surface morphology and adhesion strength were thoroughly studied. The coated alloy samples were washed with ultra-pure water to remove impurities and other metallic salts, dried at 100 °C overnight. The samples were analyzed in detail by Optical Microscopy, SEM-EDX, XRD, and FTIR. Adhesion strength was also carried out by tensile testing. It was found that coating thickness and adhesion strength were kept unchanged after a certain number of cycle.

Keywords: Microwave-assisted coating, Titanium alloys, Hydroxyapatite.

POSTER SESSION

Id-887

Design of Two Stage Operational Amplifier with Zero Compensation for Accurate Bandgap Reference Circuit

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Abstarct:
Operational Amplifier (Op Amp) has a wide range of applications in converters, comparators, voltage generators etc., and can be designed flexibly based on application. Bandgap reference has a pivot role in mixed circuit analysis. The requirement of constant voltage irrespective of temperature, process and voltage variations has been essential in the circuits with analog and digital applications. Bandgap reference circuit design has operational amplifier circuit as a crucial entity for generating constant voltage reference. An efficient operational amplifier with low power consumption is to be dealt with bandgap reference circuit for higher throughput. As discussed operational amplifier have several applications but a simple design with low power, high gain and a reasonable phase margin with sufficient unity gain band is required for bandgap reference circuit. A 5V bandgap reference circuit design can be initially started with design of a two stage Operational amplifier with zero Compensation operated at 5V supply. The operational amplifier is designed precisely and efficiently with zero compensation and obtained a gain of 73.52 dB, unity gain bandwidth of 3.89 MHz and phase margin of 63.23^0 with a power consumption of 923.7μW using 180nm technology. The designed operational amplifier is to be used in designing of bandgap reference circuit

Keywords: Operational Amplifier, Bandgap, Amplifier.

POSTER SESSION

Id-897

Design of a Ccomputer Model to Rock Mechanics

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Abstract:
This paper describes the use of computer tool to solve geotechnical problems occurring in underground mine and open pit design. In situ and other variables which control stress field in the surrounding rock. The knowledge of the theoretical and applied science of the mechanical behavior of rock is essential. Large sets of field measurements were analyzed and in situ stress tensor were estimated for underground mine design.
Keywords: Rock, stress, tensor, mining, Matlab.

POSTER SESSION

Id-899

Sensitivity of Vibration Sensor Based on Bidomain Lithium Niobate Crystal

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Abstarct:
At the previous APMAS congress we reported a novel high-temperature vibration sensor based on bidomain lithium niobate crystal. We discovered that the 70x5x0.5 mm^3 cantilevered bidomain crystal was able to produce 200 μV/nm at low frequency vibrations (down to 2 Hz) and more than 1 mV/nm at the first resonance mode (500 Hz).In this study we improved external electronic circuit in order to obtain higher sensitivity to acceleration. Our new sensor prototype has piezoelectric element shorter than previous, but demonstrates an ability to detect low frequency excitations with output coefficient up to 7 V/g (here g = 9.8 m/s^2 is acceleration of gravity). Sensitivity at resonance is 96 V/g. Due to high Curie point, weak temperature dependence of piezoelectric coefficients of lithium niobate and absence of glue layer in the construction, bidomain $LiNbO_3$-based sensor is able to withstand more than 450 °C. The study was supported by the Ministry of Education and Science of the Russian Federation (Federal Targeted Programme for Research and Development in Priority Areas of Development of the Russian Scientific and Technological Complex for 2014-2020) (Project ID RFMEFI57816X0187).

Keywords: Lithium Niobate, Vibrational Sensor, Single Crystal, Bidomain, Bimorph

POSTER SESSION

Id-900

NiTi SMA Parts Production with Different Porosity Ratios

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Abstract:

NiTi SMA has widespread use in commercial and scientific fields with its recycling effect. Today, NiTi SMA alloys, which have different usage areas, are expected to have different properties in their usage area. At the beginning of these properties, it is necessary to produce the necessary porosity (implant technology) and compact structure (high density material) parts. For this reason, in this study, NiTi SMAs were produced with porous structure and compact structure. Parts production from 57% theoretical density to 90% theoretical density could be achieved.

Keywords : NiTi SMAs, Porous structure.

POSTER SESSION

Id-902

Investigation of MoS Doped PPy and PANI Coatings on Steel Corrosion in Alkaline Medium

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Abstract:
One of the common ways of protecting the metal from corrosion is to form a film on the metal surface or coating it with a suitable material. Unfortunately, as long as there is a needle-like gap in the coating, water and oxygen will reach the metal surface and start corrosion. In this study, polypyrrole, polyaniline, polypyrrole + MoS and polyaniline + MoS coatings were obtained on steel in 0, 1 M oxalic acid by Chrono Amperometric method. Electropolymerization was carried out by applying a constant voltage1.3 V. The effect of these coatings on corrosion of steel was determined by Tafel Polarization method and characterized by SEM. As a result of experiments, it is determined that these obtained homogenous and adherent coatings are effective against corrosion. The best protective coatings against corrosion is obtained by polyaniline, polypyrrole, polyaniline + MoS and polypyrrole + MoS coatings, respectively. The reason why the polypyrrole + MoS coating is the best protection can be explained by the fact that the pyrrole oxidation potential is lower than the aniline oxidation potential and that the micro pores formed on the metal surface are covered by MoS nanoparticles.

Keywords: Steels and Steel Production Technologies

POSTER SESSION

Id-903

Synthesis of Silicon-carbon Films by High-Frequency Deposition

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Abstract:
Silicon-carbon diamond-like films are a promising class of amorphous materials. Due to its unique physical properties – high hardness, low coefficient of friction, high chemical resistance and radiation resistance, they find an application in various fields of industry, mainly as protective coatings.There are many methods of synthesis of diamond-like films. However, currently the development of new technologies is an important task.This work presents a method of silicon-carbon films production by high-frequency deposition from the vapor mixture. This method is based on the diamond-like films synthesizing technology. Here we managed to resolve the main drawback of this technology - the uncontrollable amount of background impurities in the resulting films.The specimens described in this work were investigated by atomic force microscopy and ESCA. The absence of background impurities in the samples, and the presence of the ratio of sp2 and sp3 links, typical for silicon-carbon films. The method of receiving allows creating doped silicon-carbon films with well-defined physical properties, primarily conductivity, eliminating the influence of background impurities.

Keywords: Silicon-Carbon, Diamond-like Carbon, Films

POSTER SESSION

Id-905

2D-Fractal Models of Textured Polymer Coatings of Sheet Metal

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Abstract:
Nowdays, the evaluation of the optical properties of textured polymer coatings of sheet metal (color difference, gloss, etc.) with the required parameters is carried out often visually, without using special optical devices. Therefore, it is necessary to develop a method of the "color-texture" convergence for these coatings with standard samples.For this purpose, we preliminary studied microphotographies of the surfaces of samples with polyester coatings, and concluded that they indead are rough ones. Using the method of scanning probe microscopy, we investigated the surface texture of these samples in more detail and showed that the largest number of peaks on the surface has a height in the range exceeding the level of roughness, and the distribution of defects on surfaces has a fractal character. These defects lead to a strong light scattering in special optical devices primarily intended for the analysis of the smooth surfaces. We analyzed the effect of the parameters of Gaussian and 2D fractal functions (Weierstrass, Julia et al.) on the profile of rough surfaces and the degree of their calibration, namely, the number and amplitude of surface defects (peaks).The optimal model was selected on the base of the comparison of statistical moments of surface profiles calculated from fractal models and moments obtained from the analysis of samples scans.

Keywords: Textured Polymer Coatings, 2D Fractal Models, Rough Surfaces, Scanning Probe Microscopy

POSTER SESSION

Id-914

The Degradation Characteristics of 9Cr-1movnb Aged under High-Temperature

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Abstract:
Ferritic 9Cr-1MoVNb(modified grade 91) is widely used in various industries such as power plants, petrochemical industries, and nuclear reactors because of the high creep resistance and low coefficient of thermal expansion. However, the heat-resistant steel is inevitably exposed to high temperature for a long time due to characteristics of the applied environment and undergo degradation of microstructure and mechanical properties. Therefore, evaluation on the degradation characteristics of heat-resistant steel must be carried out. In this study, the artificial aging was conducted at 650 ℃ to evaluate degradation of mechanical properties for 9Cr-1MoVNb. After artificial aging, the change of the microstructure was observed by scanning electron microscope and optical microscope. And precipitates at grain boundary were analyzed by energy dispersive X-ray spectroscopy. The degradation of mechanical properties was investigated by a tensile test: tensile strength, yield strength and elongation. As a result, microstructure and mechanical properties was degraded with increase of aging time. This research was a part of the project titled “Build a clean thermal power generation demonstration test bed, funded by ‘the Ministry of Trade, Industry and Energy, Korea." (201611101000090)

Keyword: 9Cr-1MoVNb, Artificial Aging, Microstructure, Mechanical Properties, Degradation

POSTER SESSION

Id-916

Evaluation on Sensitization of Inconel 600 by DL-EPR Test

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Abstract:
Nickel alloys have been widely applied to the material of steam tube and gas turbine of the various power plant owing to excellent corrosion resistance and mechanical properties. However, undesirable precipitates and Cr-depleted zone are formed at the grain boundaries in the temperature range from 450 ℃ to 850 ℃. This is sensitization phenomenon of nickel alloy, which degrades its corrosion resistance and mechanical properties.In this study, artificial aging was carried out at 650 ℃ to evaluate degree of sensitization(DOS) of Inconel 600 by double-loop electrochemical potentiokinetic reactivation(DL-EPR) method. The 0.1M H_2SO_4 + 0.001M KSCN solution was used as electrolyte. The temperature of solution was about 25℃. The maximum current density in the forward scan loop(Ia) and the reverse scan loop(Ir) was measured through DL-EPR curves. And the DOS was calculated as Ir/Ia. Scanning electron microscope(SEM) with EDS and 3D microscope were used to analyze surface after DL-EPR test. As a result, the DOS value and surface damage were accelerated with increase of aging time. This research was a part of the project titled “Build a clean thermal power generation demonstration test bed, funded by ‘the Ministry of Trade, Industry and Energy, Korea." (20161110100090)

Keyword: Inconel 600, Sensitization, DL-EPR Test

POSTER SESSION

Id-917

Evaluation Of Electrochemical Characteristics Of Aluminum Alloys Under Marine Environment

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Abstrac:
Al-Mg based aluminum alloy has been widely used as a hull material due to its excellent workability and weldability. In general, aluminum alloys are known to have excellent corrosion resistance in the atmosphere. However, corrosion resistance is deteriorated due to passive film breakage by chlorine ion under sea water environment. For example, corrosion damage of aluminium alloys can lead to pitting corrosion and stress corrosion cracking. Therefore, in this study, we investigated the corrosion damage characteristics of aluminum alloy materials in seawater. Various electrochemical experiments were carried out to determine the corrosion characteristics. Every electrochemical experiment was performed by exposing an effective area of 1 cm2 in natural sea water environment, with Ag/AgCl reference electrode and platinum counter electrode. After the experiments, the morphologies and damage depth on the surface were observed with scanning electron microscope (SEM) and 3D microscope. This research was a part of the project titled 'The project for 100ft mega yacht construction including in R&D for main technologies', funded by the Ministry of Oceans and Fisheries, Korea. And This research was a part of the project titled 'Next generation Korea-model fishing vessel development & test-bed application', funded by the Ministry of Oceans and Fisheries, Korea.

Keyword: Aluminum Alloy, Corrosion, Seawater

POSTER SESSION

Id-918

Caviatation Characterisitics of Shot Peened Gray Cast Iron in Seawater

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Abstract:
Recently, the trend of high output including aircraft, automobile, ship, and other mechanical equipment would require their lightweight components. Therefore, various surface treatments have been investigated to improve the fatigue resistance by hardening the surface of material. The widely used surface hardening methods are high frequency heat treatment, carburizing, nitriding, surface rolling, and shot peening etc. In particular, shot peening technology can maintain the toughness of the center area of material and improve the design ability due to enhancing strength of material's surface. However, shot peening processing condition is very important. The reason is that shot peening effect is directly influenced even if only one factor will be changed. Therefore, we tried to obtain the optimum shot peening processing condition to achieve the shot peening effect for the gray cast iron.The shot peening equipment had a pneumatic device which project high pressure compressed air through a nozzle. The shot ball had 0.4 mm in diameter and 50.6 ~ 54.5 $H_{R/C}$ in hardness. The distance between the nozzle and the specimen was 10 cm, and the shot ball projection pressure was 4 bar. The shot peening time was varied to 5~60 sec. For evaluation of improvement by shot peening, cavitation experiment was performed for both non-shot peened and shot-peened specimen. Ultrasonic vibratory cavitation apparatus for the generation of cavitation was used in accordance with ASTM standard G32-92, vibrating at 20 kHz of frequency. As a result, the shot peened specimen exhibited the excellent cavitation resistance characteristics under marine environment.

Keyword: Shot peening, Gray cast iron, Cavitation, Seawater

POSTER SESSION

Id-919

Caviatation Characterisitics of Electroless Nickel Plated Gray Cast Iron in Coolant

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Abstract:

High damping capacity and wear resistance of gray cast iron are considerably greater than that of steel or other cast irons. Therefore, gray cast iron is traditionally chosen in many industrial applications such as cylinder liner, cylinder head, turbocharger, automotive rotor and brake disc etc. These mechanical properties of gray cast iron are sensitive to the graphite morphology. However, cavitation damage often occurs on the cylinder liner surface which is surrounded by coolant. Because graphite on the surface is removed by cavitation impact and then it acts as a notch that stress is concentrated. In this study, electroless nickel plating was performed on the gray cast iron to prevent cavitation damage of the cylinder liner. And then, in order to evaluate durability of electroless nickel plating layer, cavitation experiment was carried out according to modified ASTM G32 regulation. It was conducted with opposite vibration method of the vibration generating device using the piezoelectric effect. The amplitude was set to 50 μm by static amplitude automatic control. An electronic balance that can measure down to 10^{-4} g was used to weight specimens before and after test to calculate the weight loss and cavitation rate. And scanning electron microscope (SEM) and 3D microscope were used to analyze the surface damage behavior after cavitation experiment. As a result, cavitation resistance of gray cast iron was significantly enhanced by the electroless nickel plating.

Keyword: Electroless Nickel Plating, Gray Cast Iron, Cavitation, Cylinder Liner

POSTER SESSION

Id-920

Determination of Optimum Protection Corrosion Condition for Offshore Wind Turbine Tower Substructure Steel Using Potentiostatic Slow Strain Rate Test

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Abstract:

Corrosion is a major problem in offshore environments due to extreme operational conditions and the presence of corrosive medium, and therefore corrosion protection measures are essentially employed to protect the wind tower substructure from aggressive corrosion. Impressed current cathodic protection (ICCP) is considered as an effective method to protect the metallic structure against corrosive medium. In applicaiton of ICCP, optimization of protection potential is important because if the steel structure is over-protected, the structure becomes vulnerable to corrosion damage caused by cathodic disbonding or hydrogen embrittlement. Therefore, optimization of protection potential is essential to select the best possible condition for corrosion protection. In this study, S355ML steel specimens for offshore wind turbine tower substructure were exposed to various anodic and cathodic potentials under slow strain rate loading in natural seawater solution .The specimens were submitted to tensile testing using slow strain rate testing machine to evaluate mechanical properties of the steel with different conditions. Surface characterization was performed using optical microscopy and scanning electron microscope before and after the experiments. The result of the study revealed that the mechanical properties of the steel changed drastically with different applied potentials.

Keyword: Corrosion, Impressed Current Cathodic Protection (ICCP), Steel, Offshore

POSTER SESSION

Id-922

Determination of Tritium Contents in Decommissioning Materials Using Full Combustion Method

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Abstract:
An apparatus based on Full Combustion method was designed and built for determination of tritium content in incinerable and non-incinerable solid samples.The protocol consists of oxidation in two steps of the samples in oxygen atmosphere, HTO quantitative retention and determination of obtained tritiated water activity at Liquid Scintillation Counter.The overall yield of the incineration stage and HTO retaining were predetermined using virgin materials controlled contaminated with polystyrene doped with testosterone-1,2-^{3}H and full combustion using the protocol presented above. The obtained yields were of 96.8 $\pm$ 2.1% for incinerable samples and 94.2 $\pm$ 3.2% for non-incinerable solid samples. The determined yields have been used for correction of the obtained experimental values. The new equipment was used in the radiological characterization of irradiated polyethylene/Li_2CO_3 composite and Fluental from VTT Finland and decommissioning materials from TRITIULAB Romania.

Keywords: Tritium, Full Combustion, Radioactive Wastes, Decommissioning

POSTER SESSION

Id-923

Determination of Punctual Dose and Surface Dose Distribution Using Alanine Dosimeter and Gafchromic Films

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Abstract:
At Magurela platform is commissioned a new laser-plasma accelerator facility (LPA) at ELI NP – (http://www.eli-np.ro/ro) which present unique ability to produce a wide particle species (gamma, electrons, protons, medium weigh nuclei) with high energies. Within this new infrastructure will be developed innovative research in the fields of radiobiology.Using LPA method a transient electromagnetic pulses with very high intensities are produced. This is of particular importance for establishing of dosimetric systems, the using of electronic devices being inappropriate. The chemical dosimeters represent the unique solution for characterization of radiations fields generated by LPA.In this paper was analyzed the characteristics and opportunity to apply at ELI NP of two dosimeter types: Alanine Dosimeter (for punctual dosimetry) and Gafchromic film EBT3 type (for surface dose distribution).The radiation fields emitted by LPA was simulated using a 60Co gamma irradiator, build and put inside of a hot cell.The dose distribution at different distance from the 60Co source and inside of the biological cassette designed for ELI-NP E5 Area were determined using alanine dosimeters and EBT3 films.The obtained results validate both analyzed systems for use in the characterization of the radiation fields emitted by LPA.

Keywords: Dosimetry, Alanine dosimeter, Radiochromic film, Radiation metrology.

POSTER SESSION

Id-924

Release of C-14 and H-3 from Irradiated Graphite of the Thermal Column of Vvr-S Reactor to Solution and Gas Phase

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Abstract:
Generally, C-14 is produced in all types of reactors, mainly through neutron-induced reactions with isotopes of carbon, nitrogen and oxygen. They are present in the fuel, fuel cladding, coolant, moderator and structural materials of the reactor. The majority of C-14 in irradiated graphite arises through the irradiation of nitrogen-14 (n,p) reaction, while carbon-13 (n,γ) reaction is the second greatest contributor. Irradiated graphite contains a range of activation products but, from the point of view of geological disposal, another radionuclide which has to be taken into account is tritium (H-3 or T), produced through neutron induced reaction Li(n,α)T.In this study we have investigated the release of C-14 and H-3 into gas and solution phase from two intact samples of irradiated graphite which have been cut from the thermal column disc located near the VVR-S reactor core.An experimental apparatus has been designed and manufactured to measure the total release of C-14 (and H-3) to gas phase from irradiated graphite. The experimental results regarding the release of C-14 and H-3 from VVR-S irradiated graphite to liquid show that a major fraction of the total release occurs in the first months and a slower release on long time scale. However, these results should be applied cautiously for a long time prediction.The project has received funding from the European Union's Seventh European Atomic Energy Community's FP7/2007-2013 under grant agreement no. 604779, the CAST project and from Executive Unit for Financing Education Higher Research Development and Innovation of Romania, Project no 41/2015.

Keywords: Irradiated Graphite, Release, C-14, H-3

POSTER SESSION

Id-928

Multi-Analytical Study of Degradation Processes in Perovskite Films for Optoelectronic Applications

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Abstract:
Perovskite-structured materials are among the most promising candidates for use in the next generation photovoltaics owing their unique optical properties, very high photoconversion efficiencies and small manufacturing costs. On the other hand, due to certain peculiarities of the solid-state arrangement and chemical composition they can be a source of accelerated device degradation when unshielded from heat or moisture, or under intensive UV illumination. Degradation mechanisms in the hybrid (organic/inorganic) thin-film perovskites are therefore a subject for intensive studies in the last few years. Devices based on the inorganic-only perovskites are basically more stable but at the expense of photovoltaic performance.In our work, a combination of three instrumental techniques, optical microscopy (WLI), X-ray diffraction (GIXRD, XRR) and mass-spectrometry (ToF-SIMS with depth profiling) is used for analyzing time, temperature and light induced degradation in thin films of perovskite-type materials. Using the vacuum evaporation technique, two types of films were fabricated, hybrid and all-inorganic, with lead iodide and bromide as a matrix, respectively. The vertical mass transfer, intermixing of components and changes in morphology and crystalline arrangement were tracked over a long-time period. Several results important for the device application will be discussed in the talk. This work is supported by RSF grant # 17-79-10397.

Keywords: Perovskites

POSTER SESSION

Id-930

Mechanical Properties of Quartz-Added Pp Based Composites Produced by High Speed Thermo-kinetic Mixer

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Abstract:
Micronized quartz powders reinforced polypropylene (PP) composites were fabricated by using high speed therme-kinetic mixer. The effect of micronized quartz on the mechanical properties of PP composites was investigated. Mechanical tests were carried out to determine tensile and flexural properties of composites. Dynamic Mechanical Analysis of composites was performed to determine their thermo-mechanical properties, such as storage modulus and loss modulus. The results indicate that the tensile strength of PP decrease with addition of micronized quartz. Flexural strength, tensile modulus and flexural modulus of PP increased with the addition of 10 wt% micronized quartz.

Keywords: Polypropylene, Quartz, Composites

POSTER SESSION

Id-932

Study of the Detection of Defects in Track U50 Using Eddy Current Testing Techniques

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Abstract:

In this paper, we have successfully simulated the behavior of a Non-Destructive Testing (NDT) system composed of an absolute pancake type sensor operating on the surface of a Vignole track U50 using Comsol-multiphysics software. This work aims at highlight the importance of the adapting a multi sensor system I the order to ensure a complete scan surface besides the defection of longitudinal regardless of its position and orientation. The variation of impedance is function of the physical and dimensional features of the system; we orient our objectives to study the influence of control parameters as the frequency, its thickness and the lift-off.

Keywords: Eddy Current, Non-Destructive Testing, Track U50.

POSTER SESSION

Id-938

Characteristics of Wood Sawdust/EPDM Rubber Composites Processed by Irradiation

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Abstract

This paper presents our experiments on obtaining and characterization of polymeric composites based on wood sawdust and ethylene-propylene–terpolymer rubber (EPDM). EPDM rubber was cross-linked both through a classic method – using benzoyl peroxide at high temperature and an unconventional method at room temperature – the electron beam irradiation. The control blends, obtained using benzoyl peroxide as curing agent, were prepared by blending on a laboratory roller and the control sample curing was accomplished on hydraulic press at 160 C. The composites were packed in polyethylene film and irradiated using the ALID 7 of 6.23 MeV electron accelerator, in atmospheric conditions and at room temperature of 25°C. Physical and mechanical properties such as hardness, modulus at 100% elongation and tensile strength indicate a significant improvement as a result of adding wood sawdust to blends. Better results have been obtained using cross-linking by electron beam irradiation. The cross-linking rates of samples, measured using the Flory-Rehner equation increase as the amount of wood sawdust in blends and the electron beam irradiation dose increases. The swelling parameters of samples significantly depend on the amount of wood sawdust in blends, because the latter have hydrophilic characteristics.

Keywords: Ethylene-propylene–terpolymer Rubber, Wood Sawdust, Irradiation, Physical–mechanical Characteristics, Crosslink Density, Swelling Parameters.

POSTER SESSION

Id-939

Radiation Vulcanization of EPDM Rubber with Polyfunctional Monomers

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Abstract:

Ethylene-propylene copolymers and ethylene-propylene-diene terpolymers (EPDM) are among the most versatile synthetic rubbers. The most important stage in EPDM rubber processing technology is vulcanization/cross-linking. During vulcanization/cross-linking, rubber molecules with chain configuration are linked by chemical bridges/bonds and the rubber mass turns from its plastic mass into an elastic one. In this study, we have presented the effect of the polyfunctional monomers triallylcyanurate (TAC), triallylisocyanurate (TAIC), trimethylopropane trimethacrylate (TMPT), ethylene glycol dimethacrylate (EDMA) and zinc diacrylate (ZDA) on the crosslink density of ethylene-propylene–terpolymer rubber (EPDM) cross-linked by electron beam (EB) processing. The dependence of cross-link density on the irradiation dose was determined in a dose range of 50 to 500 kGy. Samples were prepared on an electrically heated laboratory roller. For preparation of EPDM with polyfunctional monomers, the blend constituents were added in the following sequence and amounts: 100 phr EPDM and 3 phr PFMs (TAC, TAIC, TMPT, EDMA and ZDA, respectively). The samples prepared as was described above, were packed in polyethylene film and irradiated using the ALID 7 of 6.23 MeV electron accelerator, in atmospheric conditions and at room temperature of 25°C. The control blends, obtained with benzoyl peroxide as curing agent, were prepared by blending on a laboratory roller and the control sample curing was accomplished on hydraulic press at 160 C. The results showed an increase in crosslink density due to the introduction of polyfunctional monomers.

Keywords: Vulcanization, Ethylene-propylene–terpolymer Rubber, Polyfunctional Monomer, Electron Beam

POSTER SESSION

Id-940

Biodegradable Hydrogels Based on Acrylamide, Acrylic Acid and Sodium Alginate Synthesized by Electron Beam Irradiation

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Abstract:

The poly(acrylamide co-acrylic acid) – sodium alginate hydrogels were prepared by free-radical copolymerization in aqueous solutions using electron beam irradiation in the dose range of 2 kGy to 6 kGy. The influence of the absorbed dose on the swelling properties, the diffusion coefficient and network parameters of hydrogels, were investigated. The structure and morphology of hydrogels were characterized by Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM). The hydrogels were obtained by irradiation using the ALID-7 of 6.23 MeV electron beam accelerator in atmospheric conditions and at room temperature of 25°C. The electron beam effects are related to the absorbed dose (D) and absorbed dose rate (D*), the most important parameters in the electron beam irradiation. The performances of polymerization and copolymerization processes are provided by the strict control of these parameters. In our experiments the electron beam dose rate was fixed at 2 kGy/min in order to accumulate doses between 2 kGy and 6 kGy. The absorbed dose was determined using the graphite calorimeter and conventional Fricke dosimeter.

Keywords: Hydrogels, Electron Beam Irradiation, Cross-linking, Trimethylolpropane Trimethacrylate

POSTER SESSION

Id-941

New Type of Polyelectrolyte Obtained by Electron Beam Irradiation

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Abstract:
The paper presents the obtaining, characterization and testing of a new type of polyelectrolyte based on acrylamide (18,75%), acrylic acid (between 6.25 and 18.75%) and sodium alginate (1 and 2%), for flocculation purposes. Two types of monomeric solutions were irradiated in electron beam at room temperature and in atmospheric conditions with doses between 0.5 and 2 kGy using the ALIN 10 of 6.23 MeV electron accelerator. The potassium persulfate (0.025%) was used as reaction initiator in both of them. The flocculants thus obtained were characterized using various physical and chemical methods in order to determine conversion coefficient, residual monomer content, intrinsic viscosity, molecular weight and radius of gyration. In order to investigate how the sodium alginate interacts with the acrylamide structure the Fourier Transform Infrared Spectroscopy (FTIR) was done. The flocculation characteristics were evaluated in 0.2 wt % blue kaolin suspension at room temperature (20-25 ^{0}C) using the standard Jar test apparatus (Velp FC 6S, Italy).

Keywords: Polyelectrolyte, Electron Beam Irradiation, Acrylamide, Sodium Alginate

POSTER SESSION

Id-942

Influence of Isochoric Annealing on the Properties of the $(FeCoZr)_x(CaF_2)_{(100-x)}$ Nanocomposites Produced in the Argon and Oxygen Atmosphere

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Abstract:
To study the effect of annealing on the electrical properties the sample of the nanocomposite $(FeCoZr)_x(CaF_2)_{(100-x)}$ with metallic phase content produced by ion sputtering with beam of argon and oxygen was selected. The analysis was made on the basis of frequency-temperature dependences of the conductivity $\sigma(f, T)$. Studies carried out by stand to measuring of AC electrical properties of nanocomposites and semiconductors. The measurements have been performed using alternating current within the frequency range of 50 Hz – 1 MHz for measuring temperatures ranging from77 K to 373 K. Each time, immediately after completing the measurements, the sample was subjectedto 15-minute isochoric heating in a tubular furnace in atmospheric air, starting from 398 K to 773 K with a step of 25 K.For the nonannealed sample, it was observed that the conductivity σ almost does not change its value in the whole frequency range. After annealing at T_a = 598 K, the conductivity changes its value and decreases by 4 orders of magnitude at lower frequencies .But as the frequency increases, its value increases and reaches similar values as for the sample before annealing. Lowering the value σ after annealing at 548 K can be caused by the oxidation of the surface of the nanoparticles of the metallic phase during the diffusion of oxygen from the air.

Keywords: Metal-Dielectric Nanocomposites, Annealing, Argon and Oxygen Atmosphere, Electrical Properties

POSTER SESSION

Id-943

Structural-Phase Model of the State of Nanocrystaline Layers $(FeCoZr)_x(CaF_2)_{1-x}$ After High-Temperature Treatment

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Abstract:

In this work thermogravimetric-DTG/DSC analysis result for samples of nanocomposite metal-dielectric $(FeCoZr)_x(CaF_2)_{100-x}$ with different metallic phase content are presents *x*. The analysis showed that the mass of the nanocomposite changes into two stages. In the first stage, starting from 25°C and up to approx. 400°C, the mass gradually decreases from the value of 25.19 mg to the value of 24.47 mg. This is related to the evaporation of moisture and other volatiles from the surface of the sample that settle on it during storage. In the second stage, a rapid increase in mass begins and achievement maximum value of 29.18 mg, almost 16% more than weight of the dried sample. This is related to the oxidation of the metallic phase particles by the oxygen that diffuses into the layer from the air. The heating of samples of the nanocomposite $(FeCoZr)_x(CaF_2)_{(100-x)}$ while getting higher temperatures causes, initially, the formation of oxide layers on the surface of the metallic phase nanoparticles, then leads to their increasing oxidation until complete oxidation. At the same time, the number of oxygen atoms per atom of the metallic phase increases. For x=45.4 at.% it is about 0.75, for x=57 at.% it is about 0,98 and for x=68 at.% it is about 1,08. On this basis, a structural-phase model of the state of nano-grain layers after high-temperature treatments was proposed. The model assumes that there are three types of nanoparticles in the nanocomposite. The first of these are nanoparticles from a metal alloy, the second is a metallic phase nanoparticles with the coating of oxides of these metals on the surface, the third - completely oxidized nanoparticles of the metal phase.

Keywords: Nanocomposite, Thermogravimetric, Treatment, Oxidation

POSTER SESSION

Id-944

Water Nanodrops in Cellulose Materials Impregnated with Insulating Oil

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Abstract:

The study investigated the DC conductivity of cellulose impregnated with insulating oil with different moisture content. Cellulose materials are often used as a solid component of paper-oil insulation of power transformers. In paper it was found that dependence of conductivity on the moisture is far stronger than linear dependence described in ion conductivity models. In this paper it was clearly demonstrated that in damp pressboard impregnated with insulation oil DC conductivity is determined by the moisture and occurs due to hopping (tunnelling) of electrons. The result opens opportunity to determine the problem of the level of humidity in oil impregnated cellulose.In studies, the results are presented in this paper, used the electrical pressboard production company Weidman with a thickness of 1 mm. This sample was dried in a vacuum chamber for 72 hours at 80 °C. Next, pressboard were saturated with humidity from free air, and thus overlap with the increase in its mass. After obtaining the set moisture value pressboard immersed in insulating oil to the impregnation. The time of the impregnation process was about 6 months.PDC method (Polarization Depolarization Current) was used for the study on the measurement stand. Three-electrode measurement system with a sample of pressboard is placed in the climatic chamber.In the work was calculated the average number of water molecules in nanodrop, which amounts to $n \approx 220$. Diameter of those nanodrops is around 1.5 nm. Our experiments show that in environment of cellulose impregnated with insulating oil, water creates nanodimentional clusters – nanodrops.

Keywords: Nanoparticle, Water, Nanodrops, Cellulose

POSTER SESSION

Id-952

Design of Two-stage of Amp Using 180nm CMOS Technology for Low Power and High Speed Operation

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Abstract:

The work presented here is the design of a two-stage op amp using 180nm CMOS technology, which can be used for low power and high-speed operations. Mostly in electronic circuits, Op Amp is widely used due to its advantages. Using the basic topology of a two-stage Op Amp, we have designed an Op Amp, which meets the desired specifications of the user. This design is useful where Gain, bandwidth, linearity, noise and output swings are essential. In the design of two-stage Op Amp, the circuit consists of 1.8V power supply that draws 5µA current. On doing AC analysis, we find out the gain as 87dB, phase margin as 67º and bandwidth as 4.87MHz. The slew rate determines the speed of the circuit and hence by simulation we noted that slew rate value as 4.126V/µS and later performed DC analysis and noted the input common mode range with 0.07-1.65V. Therefore, from the obtained result we can say low input voltages can drive the op amp. The power dissipated in the circuit is 75µW. Low power and high-speed OTA can be designed by modifying the designed two stage Op Amp.

Keywords: Op Amp, Amplifier,CMOS.

POSTER SESSION

Id-955

Research on the Effect of Mıcrostructure Mechanıcal Propertıes of Pressıng Technıque in Steels Produced by Powder Metallurgy

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Abstract:

In this work, the effect of pressing technique on the microstructures and tensile behaviors of two powder metallurgy (PM) steel with different composition were investigated. Weighed powders for the desired chemical composition were mixed in an industrial conic mixer for 1 h and then cold and warm pressed at 700 MPa with a die. The pressed PM steels were sintered at 1400 ◦C for 1 h in the pure (99.999%) Ar gas atmosphere. PM steels with different pressing technique were analyzed in terms of microstructure and tensile test. Results indicated that PM steels with warm pressing technique showed the highest values in yield strength (YS) and ultimate tensile strength (UTS).

Keywords: Powder metallurgy; steels; microstructure; mechanical properties, Pressing Technique

POSTER SESSION

Id-958

Comparative Effect of Gamma Irradiation, Drying, and Freezing on Sensory and Hygienic Quality of Parsley

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Abstract:
Minimal processing of herbs damages tissues and the products deteriorate faster than their unprocessed equivalent. Post-harvest treatments reduce alteration rate, but lower sensory quality. Research showed the effects of drying, freezing, and irradiation, but omitted comparing them. The aim of this study was to determine their effect on the sensory quality of parsley by evaluating consumers' preference. Minimal processing paired with gamma irradiation (0.7 - 2.7 kGy) was evaluated for color, texture, and aroma. The results were correlated with biochemical and microbiological parameters that reflect sensory characteristics: chlorophyll, water content and microbial load. The effect was compared with natural drying and freezing. Principal component and cluster analysis of sensory scores generated a consumer preference map and parsley irradiated with 0.7 - 1.4 kGy was preferred. Drying affected the sensory quality of parsley by significantly decreasing the content of chlorophyll. Freezing preserved aroma and color, however, assessors preferred the fresh-like minimally processed parsley. Thus, ionizing radiation up to 1.4 kGy had a smaller effect on the sensory quality of parsley than drying and freezing. Doses of 0.7 - 1.4 kGy increased by one week the shelf-life of parsley by reducing the contamination flora. A dose of 2.7 kGy decreased by 5 log CFU/g the total plate count. The microflora recovered, however, during storage with a growth rate proportional to radiation dose. In conclusion, irradiation can be applied to minimally processed parsley to significantly extend shelf-life: doses of 0.7 - 1.4 kGy can guarantee a shelf-life of 30 days at 4°C.

Keywords: Chlorophyll, Preference Map, Principal Component Analysis, Microflora, Yeast And Mold Count

POSTER SESSION

Id-963

Dose Distribution in Low Energy Exposure and Measurement Accuracy with Passive Dosimeters Used in Radiation Protection Dosimetry

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Abstract:

The dose measurement accuracy depends besides the quality and limits of the type detector and the technical method used to calibrate the dosimeters, the processing and interpretation of the recorded results. Generally, dose measured at high energy has a good repeatability and area distribution. These features are given by radiation quality, energy fluence and radiation interaction with the detector material. To low energy exposure, the interaction between incident particles and detector materials generate special phenomena which complicate the dose estimation process. More than this, in x-ray exposure case, the radiation quality can generate the dose variations even within a fairly small exposed area. In radiation therapy or radiation investigation, the dose distribution knowledge in the investigated area it is especially. The investigated area has to be well scanned or the dose attributed into the volume mass by radiation therapy planning must be uniformly distributed. On the other hand, the studding of radiation uniformity from a point source help the dose assessment for all body in case of occupational exposures. In this way, the halide film and thermoluminescence dosimeter were expose at Am 241 standard source and x-ray generator at different dose of radiation. For a conventional true value of 0.5 mSv the dose mediate on each three (12 x 5) cm^2 film and three (12 x 5) cm^2 Tl dosimeters were 0.46 ± 0.02 mSv and 0.48 ± 0.14 mSv respectively; regarding dose of 1.0 mSv, the dose mediate on five film dosimeter (12 x 5) cm^2 and three TLD were 0.9 ± 0.14 mSv and 0.97 ± 0.085 mSv. In case of x-ray exposure, the studied surface area was more tightly. The x-ray tube voltages were 40 kV, 80 Kv, 130 Kv. The optical densities were mediated on those three voltage values considering that an occupational exposure could work with different voltage values during on one month of monitoring. So, for a conventional true value of 0.51 ± 0.02 mSv the optical densities recorded on the film under plastic and window filters are 3.48 ± 0.24 and 3.45 ± 0.26 optical density unit respectively; the optical densities are 5.09 ± 0.34 and 4.97 ± 0.29 for a conventional true value of 1.07 ± 0.05 mSv.

Keywords: Passive Personal Dosimeter, Dose Distribution, Occupational Exposure

POSTER SESSION

Id-965

Properties of Polyurethane Foam According to Foaming Agent

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Abstract:
Hard polyurethane foam was synthesized by using water, HCFC-141b, HFC-245fa, HFO-1233zd (LBA) and HFO-1336mzz (FEA-1100). The effects of foaming agent on foam synthesis and physical properties of foam were examinedThe internal temperature of the foam did not differ depending on the type of physical foaming agent during the production of the foam. In the case of water, the temperature of the foam was highest due to the heat generated by the reaction with isocyanate.The loss rate of foaming agent in the foam manufacturing process was the largest in water, and the physical foaming agent showed a tendency to increase the loss ratio as the boiling point was lowAmong the foaming agents tested, HFC-245fa showed the highest compressive strength. This was confirmed by SEM analysis that HFC-245fa formed a small cell. Although HFO-1233zd exhibited the lowest thermal conductivity, it was confirmed that the compression strength and glass transition temperature were lowered by decreasing the degree of crosslinking.

Keywords: Rigid Polyurethane Foam, Blowing Agent, HFO, Mechanical Property, Thermal Conductivity

POSTER SESSION

Id-972

Study of the Competing Influence of Different Intermolecular Interactions on the Structure of Ferroelectrics

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Abstract:

The main problem of statistical theories describing equilibrium properties of low-molecular ferroelectrics at the microscopic level is that the simulation is carried out on a predetermined crystal lattice. However, the lattice type and the crystallographic parameters can be changed under the influence of temperature, pressure and external electric fields. The Ising model is usually applied for simulations of the ferroelectric systems, but it is an oversimplification. This approach is only suitable for researching the properties of substances that have specific axes in the non-ferroelectric phase.In this work, the modified Potts model considering the changes of lattice size and the sublattice shift is used for studying of ferroelectric systems. In this model, the sizes of the crystal lattice and the specific axes are determined for each step of the simulation based on the Monte Carlo method and depend on the relative location of sublattices. It was shown that the lattice type is determined by the competing influence of intermolecular interactions (dipolar-dipolar, exchange interactions, Lennard-Jones potential, etc). The lattice parameters are calculated for various intermolecular interactions at low temperatures. The dependencies of lattice type and crystallographic distances on parameters of Lennard-Jones potential, orientational interactions and temperature are obtained. The conditions under which the system may be ferroelectric are determined. It was shown that crystallographic parameters of lattice and the value of spontaneous polarization change drastically at a certain temperature. The values of critical temperatures, at which the system transits from anisotropic phase to isotropic, are expressed as adependence on the ratio of constants of intermolecular interactions.

Keywords: Ferroelectric, Orientational Interactions, Phase Transitions, Type of Crystal Lattice, Monte-carlo Method

POSTER SESSION

Id-978

The Influence of Gamma Radiation on the Quality of Traditional Romanian Products Obtained from Minced Meat

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Abstract:

The use of ionizing radiation leads to the inactivation of microorganisms, eliminates or significantly reduces the number of pathogens and has the effect of extending the shelf life while preserving the nutritional and sensory properties of chilled meat, red meat and poultry. However, traditional dishes of minced meat have been omitted. The purpose of this research is to study the main organoleptic and physico – chemical changes of Romanian traditional product obtained from minced meat treated with ionizing radiation. In order to evaluate the changes resulted from the radiation treatment, samples of frozen products were irradiated at doses of 1 kGy, 2 kGy and 5 kGy. After irradiation samples were grilled and the organoleptic (appearance and shape, color, consistency, smell and taste) and physico – chemical characteristics (sodium chloride, hydrogen sulfie and pH) were determined. The results showed organoleptic improvements of flavor, smell and juiciness together with changes in the amount of sodium chloride, hydrogen sulfie and pH (the reaction for hydrogen sulphide was negative, sodium chloride was 1,2 – 1.5 and pH 6,4 – 7,3). Thus, the organoleptic and physico-chemical parameters were significantly influenced by the dose of irradiation used, and a dose of 2 kGy is recommended for the treatment of Romanian traditional product ("pasta de mici" and traditional sausages) obtained from minced meat.

Keywords: Quality, Irradiation, Minced Meat, Traditional Ptoduct

ORAL SESSION

Id-997

Natural Nanohydroxyapatite Synthesis via Ultrasonication from Donax Trunculus Bivalve Seashells and Production of Its Electrospun Nanobiocomposites

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Abstract:

In the present study, hydroxyapatite (HA) and tricalcium phosphate (TCP) bioceramics were prepared via a practical, ultrasonic conversion method from *Donax trunculus* seashells. These seashells are one of the most common bivalve molluscs of the Mediterranean Sea and can be used as a natural, stable raw material for bioceramic production. Ultrasonication, a powerful method for nano-sized ceramic production, was chosen to synthesize different ceramic phases easily. Raw shells are consisted of calcite and aragonite structures. To synthesize HA and TCP bioceramic materials, first the calcium oxide content of the shells were identified via DTA (Differential Thermal Analysis) and then a calculated amount of phosphoric acid was added drop by drop to obtain the exact stoichiometry. After synthesis, the resultant bioceramics were sintered at 800-850°C for HA and 400-450°C for TCP phases. For bioceramic phases X-ray diffraction (XRD), infrared (FTIR), scanning electron microscope (SEM) studies were performed. On the other hand, electrospinning method was used to prepare nanobiocomposites from biocompatible polymeric material as the matrix and the obtained natural bioceramics as reinforcer of the composite system. Three different compositions were used and optimum electrospinning conditions were adjusted to prepare these electrospun structures. Biocomposites were evaluated in terms of structure, mechanic, morphology and biology. The effect of bioceramic content was also discussed. It is revealed that the obtained electrospun nanobiocomposites are good candidates for various tissue engineering purposes due to their enhanced biological and mechanical properties.

Keywords: Marine Sourced Bioceramics, Ultrasonic Conversion, Elektrospun Biocomposites, Tissue Engineering.

POSTER SESSION

Id-1004

The Effect of Nugget Sizes on Tensile Peel Loading in Resistance Spot Welding of Dp800 and Twip950 Steel Sheets Used in Automative Industry

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Abstract:

This paper presents an experimental study on resistance spot welding of DP800 and TWIP950 steel sheets used in automative industry. DP steel sheets having 1.2 mm thicknesses and TWIP sheets having 1.4 mm thickness were joined by using resistance spot welding as lap joint. A timer and current controlled resistance spot welding machine having 120 kVA capacity and a pneumatic application mechanism with a single lever was used to prepare the specimens. Welding periods were chosen as 5, 10, 15, 20, 25 and 30 cycles (1 cycle=0,02 s) and also welding currents were increased from 6,33 kA up to 15,7 kA. The electrode force was kept constant at 4 kN. The prepared welding specimens were exposed to tensile-peel test and micro and macro-structures of specimens were investigated by means of an optical microscope and scanning electron microscope (SEM) in order to see the joinability of DP and TWIP steel sheets by resistance spot welding. Finally appropriate welding current and time were advised to the users.

Keywords: Resistance Spot Welding, DP Steel, TWIP Steel, Automotive Industry

POSTER SESSION

Id-1005

Investigation of Wear Properties of Toughened Epoxy Resin Using Silane Terminated Urethane

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Abstract:
Un-modified epoxy resins are generally brittle after cure. Several attempts have been made to improve fracture resistance of epoxies. A more recent method to improve the toughness off brittle epoxy is interpenetrating network (IPN) grafting approach. In this study, wear properties of toughened epoxy polymer using a silane terminated urethane were investigated. With this aim, epoxy-based hybrid materials with various concentrations were prepared from bisphenol A-type epoxy resin and a silane terminated urethane. It was presented that in addition to a dispersed second phase formation, an IPN structure was also be formed through the addition of silane terminated urethane. Firstly, silane including inorganic part was synthesized from poly(hexamethylene carbonate) diol and 3-isocyanatopropyl trimethoxysilane. The solutions were mixed with epoxy mixture to obtain hybrid solutions. Various hybrid solutions were prepared using different epoxy/inorganic part solution compositions. The effects of IPN on the wear properties of hybrids were investigated. The composites are characterized using a scanning electron microscopy (SEM).

Keywords. Interpenetrating Network (IPN), Epoxy, Wear

POSTER SESSION

Id-1007

Tribocorrosion Behaviour of Electroless Ni-P Coating on AA7075 Aluminum Alloy

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Abstract:

Ni-P coating was deposited on an AA7075 aluminum alloy by electroless nickel coating process, and its structure, morphology, microhardness and tribocorrosion behaviour were evaluated. Coating characterization was done using optical microscope (OM), scanning electron microscope (SEM), and X-ray diffraction (XRD) techniques. Tribocorrosion tests were performed under open circuit potential using a reciprocating ball-on-plate tribometer where a 10 mm diameter alumina ball was used as counter material, and two different normal loads (5 N and 10 N) were applied during 45 min. The Ni–P coating's microhardness and tribocorrosion performance were higher than untreated AA7075 aluminum alloy. However, a significant influence of the test load on the tribocorrosion performance was observed in the NiP coating mainly due to decreased load carrying effect given by the hard Ni-P.

Keywords: AA7075 Aluminum Alloy, Electroless Ni-P Coating, Tribocorrosion.

POSTER SESSION

Id-1013

Nonlinear Effects on Chiral Optical Rogue Waves

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Abstract:
The nonlinear schr"odinger (NLS) equation with management is used to construct the optical rogue waves called rogons, which are propagating in fibers filled with chiral materials. The propagation of these waves is affected by more than one nonlinear effect like the nonparaxiality, optical activity, third-order dispersion and differential gain or loss term. The modified Darboux transformation (MDT) method is used to determine rogue wave solutions which reveal the key of simultaneously controllability of the above effects on their propagation, showing their potential applications in optical fibers and in variety of complex systems.

Keywords: Optical Rogue Waves, Rogons, Optical Fibers, Nonparaxiality, Optical Activity, Modified Darboux Transformation

POSTER SESSION

Id-1015

Ag^+ Dopped Hydroxyapatite Coatings on Sand Blasted Textured Ti-6Al-4V Alloy for Biomedical Applications

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Abstract:

Spin coating method is a promising process to obtain hydroxyapatite (HA) thin films. Hydroxyapatite is known to be biocompatible and bioactive due to its chemical similarity with bone minerals. Titanium and its alloys are used widely as biomaterials due to their excellent biocompatibility, mechanical properties and errosion resistance. According to diverse in vitro and in vivo tests, HA implant coatings have demonstrate an improved bone apposition as compared to uncoated implants in the first several weeks after operation. Due to increasingly worrying infections in implants, it is desired to use an antibacterial agent such as silver, which has resistance to different bacterial strains, two solutions of hydroxyapatite (HA) and hydroxyapatite with silver (HA-Ag) were synthesized in this regard. Were deposited by spin coating twenty layers on the surface of titanium alloys with four different roughness like 45 µm, 90 µm, 125 µm and 250 µm and a heat treatment was finally applied to titanium alloys coated with HA and HA-Ag at a temperature of 600°C. The obtained samples were characterized by phisical characterization means of X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX) and by biological characterization means of antimicrobial test and cellular viability. The experimental results indicated that deposition of HA and HA-Ag occurred on the surface of titanium alloys in the form of a thin film, and that the biological activity of the implant has attractive properties that can optimize the production of hard tissue implants.

Keywords: Ag Dopped Hydroxyapatite, Biomedical Applications, Spin Coating

POSTER SESSION

Id-1016

Electrical Conductivity and Dielectric Properties of Rare Earth Ions Doped in Zinc Sodium Phosphate Glass

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Abstract:

The zinc phosphate glass doped with some rare earth ions of the composition $Na_{2-3x}M_xZnP_2O_7$ with x = 1 mol % (where M = Ce, Pr and Eu), were synthesized using classical melting and quenching processes electrical and dielectric properties including dielectric constant, $\varepsilon'(\omega)$, loss, $\tan\delta$, as well as electric ac conductivity, σ_{ac}, have been investigated over a wide continuous frequency range of 10^{-2}Hz to 1MHz and temperature range 283K to 473K. by means of impedance spectroscopy. These studies have revealed that the conductivity decreased and activation energy increased with increasing ionic radius from Eu to Ce doping due to the size mismatch, which has been attributed to the hindrance to the strengthening of Coulomb force offered by rare earth ions. The exponent s decreased with increasing temperature revealing that the conduction inside the studied material is insured by the correlated barrier hopping (CBH) model.

Keywords: Phosphate Glasses, Rare Earth, CBH Model, Electrical Conductivity, Impedance Spectroscopy, Dielectric Behaviour

POSTER SESSION

Id-1017

Hygrothermal Effect on MWCNT-filled Epoxy Resin Electrically Conductive Adhesives

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Abstract:

To-date, limited studies are found in the literature on the reliability performance of electrically conductive adhesive (ECA) using multiwalled carbon nanotube (MWCNT) fillers. Hence, this study aims to provide an understanding on the performance of the ECA with the objectives (i) to study the electrical conductivity and (ii) joint strength of ECA with varying conductive filler's aspect ratio and environmental conditions. Here, epoxy with MWCNT aspect ratio of 55.5 and 1666.5 were subjected to 85°C and 85% RH for up to 96 hours. The test specimens were prepared in accordance with ASTM F390-11 using a four-point probe for electrical conductivity measurement while the lap shear test was conducted with reference to ASTM D1002-10 using a universal testing machine. For the thermal aging study, the ECA samples were conditioned in a humidity chamber at 85 °C and 85 % of relative humidity to assess the reliability performance of the ECA. Overall, it was found that ECA filled with higher aspect ratio of MWCNT exhibit better electrical and mechanical stability when subjected to hygrothermal aging. Moreover, the presence of moisture attack has yield in an increase in the electrical conductivity of the ECA with thermal aging period. Meanwhile, lap shear results revealed a contradicting trend. Regardless of the amount of MWCNT filler loading, voids are created in the epoxy matrix of the ECA, which results in a decrease in the shear strength of the ECA, when the samples were subjected to thermal aging.

Keywords: ECA, MWCNT, Aspect Ratio, Hygrothermal Aging

POSTER SESSION

Id-1025

Effect of Line Width and Thickness on Flexible Printed Electronic Circuit Electrical Performance

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Abstract:
Flexible and printable electronics is among the rapidly growing field in many applications. Their performance are affected by many factors such as the interaction between the conductive ink circuit and the type of flexible substrate used as the printed board. In this paper, the effect of the conductive ink circuitry line width and thickness to the flexible printed electronic (FPE) electrical performance is investigated. Commercial type conductive ink and polyethylene terephthalate (PET) flexible substrate was applied to formulate the FPE circuit, using screen printing technique and cured at room temperature, with varying circuitry line width (between 1.00mm to 3.00mm) and thickness (between 0.05mm to 0.25mm). The final resistivity for all samples were later tested using digital multimeter. Results for the experiments showed that the electrical resistivity of the FPE samples were inversely proportional to the dimension of the circuit line and width. The results obtained shall be used in the next project stage as benchmarking data to establish design guidelines related to circuitry geometrical parameters to obtain optimum FPE electrical performance in actual application.

Keywords: Flexible Printed Electronic Circuit, Conductive Ink, Electrical Performance

POSTER SESSION

Id-1027

The C_5^A and C_6^A Axial Nucleon to Delta Form Factors in Chiral Effective Field Theory

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Abstract:
We calculate the dominant axial nucleon to delta form factors C_5^A and C_6^A to third chiral order in relativistic chiral effective field theory. The explicit inclusion of the delta in chiral perturbation theory requires a power counting that properly incorporates the Delta-Nucleon mass difference which is small compared to the chiral symmetry breaking scale. In order to have a consistent power counting we consider the complex-mass scheme (CMS). This renormalization scheme is found out by splitting the bare parameters of the Lagrangian into complex renormalized parameters and counter terms. Among the axial form factors the most important contribution comes from C_5^A for Nucleon-Delta. The form factor C_6^A can be related to C_5^A thanks to the partial conservation of the axial current. Then, we also analyze the ratio of two form factors. The expected value in chiral limit for this ratio is one assuming partial conservation of axial current (PCAC) and pion dominance. Thus, this ratio is plotted as a function of Q^2, and we discuss the shape of the data depending on the Q^2. The results for the axial form factors C_5^A and C_6^A are analyzed in terms of experimental data and compared to previous findings in the framework of other approaches.

Keywords: Effective Field Theory, Form Factors, Nucleon, Delta, Axial Current, Complex Mass Scheme, Power Counting

POSTER SESSION

Id-1030

Growth Temperature Effects on Some Physical Properties of Vanadium Oxide Thin Films

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Abstract:
In this study, vanadium oxide (VO_x) semiconductor films were deposited on glass substrates using ultrasonic spray pyrolysis (USP) technique. The effect of the substrate temperature on the physical properties of the deposited thin films was investigated. For this purpose, the aqueous solutions of 0.05M VCl_3 prepared were sprayed on the glass substrates at a substrate temperature of 225, 275, 325 and 375°C for 30 minutes and deposited at a flow rate of 5 ml/min. Structural properties of VO_x thin films were investigated by taking x-ray diffraction (XRD) patterns and it was found that the films contained more than one phase. Transmittance and absorption spectra were taken to examine the optical properties of deposited films. The forbidden energy gaps of the films were determined using the optical method. The electrical properties of the films were investigated using current-voltage (I-V) characteristics taken at room temperature and in the dark, and electrical resistivity values were calculated using two-probe techniques. In addition, the conductivity types of the films were determined using hot probe technique. Surface morphologies were analyzed by scanning electron microscope (SEM) images. Also, elemental analyzes were performed by energy-dispersive x-ray spectroscopy (EDS). We would like to thank you for the financial support provided by the Canakkale Onsekiz Mart University Scientific Research Projects under the project number FBA-2016-722.

Keywords: Vanadium Oxide, Ultrasonic Spray Pyrolysis, Electrical and Optical Properties, XRD, SEM

POSTER SESSION

Id-1031

Thermomechanics of Polyethylene Terephthalate (PET) and Thermoplastic Polyurethane (TPU) as Based Materials for Silver Flakes Stretchable Conductive Ink

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Abstract:

Stretchable conductive ink (SCI) is one of the important technology for electronic interconnects. Among the key challenges in successful development of such materials are to offer high electrical conductivity and good adhesion in polymer-based substrates without compromising on the mechanical reliability of such devices. This paper presents the characteristics of Polyethylene Terephthalate (PET) and Thermoplastic Polyurethane (TPU) SCI based-materials in terms of their strainability, conductivity and hydrophobicity under thermal effect. The experimental work involved electrical conductivity measurement using a 4-point probe, contact angle measurement and surface profilometer for surface analysis following loading the samples to varying strain and temperature in-situ. Electrical resistivity of TPU SCI-based material increased with an increasing strain, with a magnitude lower than those of the PET SCI-based material. Such observation is possibly due to superior interface lamination during stretching. Moreover, the hydrophobicity performance of TPU SCI-based material is relatively better than those of the PET SCI-based materials. In addition, PET becomes more hydrophilic due to the formation of surface oxide when subjected to high thermal loading. It was also found that both materials reached high moisture stability when TiO_2 coating is applied as surface protection. In These observations showed the correlation between the temperature and strain effect on the performance of the SCI.

Keywords: Thermal Strain, Sheet Resistance, Stretchable Conductive Ink

POSTER SESSION

Id-1048

Performance of NaCl Electrolysis Cell to Produce Acid and Alkali for Sequestration of CO_2 into $nCaCO_3$ Using Waste

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Abstract:

Carbon dioxide (CO_2) emissions into the atmosphere and the oceans become a growing concern from the last few decades because of its effects on the rise of global temperature. It is a prediction of IPCC (intergovernmental Panel on Climate Change) that if CO_2 emission continues to grow unhalted then by 2100 the mean surface temperature will rise upto 4^{o}C. The IPCC and other reports suggest that CCS (Carbon Capture and Sequestration) is the most economically feasible way to mitigate CO_2 emissions. CCS refers to several emerging technologies related to capturing and storage of CO_2 into different geological sites. Mineralization, i.e., converting CO_2 into carbonates and bicarbonates, is also a potential technique to alleviate issues related to emission of CO_2. However, mineralization is not economically feasible for storing CO_2, as expensive chemicals are required for extraction and carbonation of Ca ions. Recently, a method for production of high purity nano calcium carbonate ($nCaCO_3$) starting from waste inorganics (Concrete, Steel slag) using both HCl and NaOH for sequestration of CO_2 has been suggested. In order to make the process economically feasible, an energy efficient method for production of HCl and NaOH is required. If an electrolysis system can produce both HCl for Ca extraction and NaOH for carbonation with low energy consumption, mineralization of waste inorganics becomes an economically feasible approach to mitigate environmental CO_2 emissions. For this purpose, NaCl electrolysis system with three compartments was fabricated; 1) an anode compartment for hydrogen oxidation, 2) a cathode compartment for hydrogen evolution, and (3) a central compartment between the anionic and cationic exchange membrane where the NaCl solution is introduced.

Keywords: NaCl Electrolysis, nano-CaCO3, HCl, NaOH

POSTER SESSION

Id-1051

Synthesis of Small Novel Imaging Agents For Apoptosis Imaging Using SPECT/CT

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Abstract:

Apoptosis plays a key role in the pathogenesis or etiology of disease. Because most anticancer and therapeutic drugs induced apoptosis to kill the cancer cells, hence molecular imaging of apoptosis can be very useful in the early detection of disease, staging of tumor, and the efficacy of on going chemotherapy or radiation treatment. Moreover,the apoptosis monitoring can help to develop new drugs for the treatment of cancer and metastases. In the present study two SPECT based imaging probes 125I- iodophenyl malonic acid 1 and 99mTC-methyl-pentyl-malonic acid 2 have been synthesized to detect apoptosis in vivo.

Keywords: SPECT/CT, Imaging, Radiolabeling, 99mTc, Apoptosis

POSTER SESSION

Id-1057

Solid-state High-power UV Led Sources for Calibration of Orbital Telescopes

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Abstract:
All EUSO missions, such as Mini-EUSO, K-EUSO or JEM-EUSO, as well as the TUS mission will require the use of a Ground Light System (GLS) for instrument in-orbit periodic calibration. Insofar, and owing essentially to the AUGER GLS, the available light sources have been mainly lasers and Xe flash-lamps systems originally developed and used for the calibration of ground-based UV telescopes. As such, we will present a preliminary study of a solid-state high-power UV LED-based light source prototype developed for use as part of the GLS system for in-orbit calibration purposes. Such a light source could provide a more cost-efficient high mobility alternative for the GLS stations planned to be deployed at several locations on the globe along the UV telescopes ground-track.
Keywords: High-power UV LED, UV Telescopes Calibration, JEM-EUSO, Ground Light System GLS

POSTER SESSION

Id-1057

Solid-State High-Power UV Led Sources for Calibration of Orbital Telescopes

E. M. Popescu[1,2], A. Caramete[1], L. Caramete[1], G. Chiritoi[1], A. Pavălaș[1], R. Balașov[1]

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Abstract:

All EUSO missions, such as Mini-EUSO, K-EUSO or JEM-EUSO, as well as the TUS mission will require the use of a Ground Light System (GLS) for instrument in-orbit periodic calibration. Insofar, and owing essentially to the AUGER GLS, the available light sources have been mainly lasers and Xe flash-lamps systems originally developed and used for the calibration of ground-based UV telescopes. As such, we will present a preliminary study of a solid-state high-power UV LED-based light source prototype developed for use as part of the GLS system for in-orbit calibration purposes. Such a light source could provide a more cost-efficient high mobility alternative for the GLS stations planned to be deployed at several locations on the globe along the UV telescopes ground-track.

Keywords: High-power UV LED, UV Telescopes Calibration, JEM-EUSO, Ground Light System GLS

POSTER SESSION

Id-1062

Tin as an Excellent Electrocatalyst for All-Vanadium Redox Flow Batteries

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Abstract:

Among the modern electrochemical conversion and storage technologies, all-vanadium redox flow batteries (VRFB) are an attractive candidate. The anode and cathode reactions of VRFB are comprised of vanadium redox couples V(II)/V(III) and V(IV)/V(V), respectively. However, the kinetics of these redox reactions are slow at carbon felt electrodes. This results in poor performance, especially at high current densities due to the increase of overpotentials. Therefore, electrocatalysts can play an important role in improving the performance of VRFB through acceleration of vanadium reaction kinetics at the electrodes. Tin is studied as a novel electrolcatalyst for VRFB technology and based on its deposition potential, it is introduced in the electrolyte. Through introduction in the acidic vanadium electrolyte and in situ electrodeposition, tin nanoparticles help accelerate the reaction kinetics of vanadium couples and improve the charge transfer processes at the electrodes, as evidenced through cyclic voltammetry and electrochemical impedance spectroscopy. The effect is more pronounced for the anode redox couple as the tin deposition takes place in its vicinity. The galvanostatic charge/discharge cycling shows significant improvement in VRFB key performance parameters of energy efficiency, specific discharge capacity, cycling stability and electrolyte utilization. At a high current density of 150 mA cm^{-2}, the energy efficiency is improved by 3.7% with the corresponding increase in specific discharge capacity by 26.2%. This is further supported by the comprehensive characterization of the electrodes through analytical techniques of SEM, SEM-EDS and XPS. Thus, tin may be an effective catalyst in boosting the commercialization of VRFB systems.

Keywords: All-vanadium, redox flow batteries, tin, carbon felt, electrocatalyst

POSTER SESSION

Id-1067

Synthesis, Characterization, Thermodynamics and Luminescent Properties of Lanthanide Complexes of N'-(2-hydroxybenzylidene)-2-pyridinecarbohydrazide and N'-(2-methoxybenzylidene)-2-pyridinecarbohydrazide Schiff Base Ligands

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Abstract:

N'-(2-hydroxybenzylidene)-2-pyridinecarbohydrazide and N'-(2-methoxy benzylidene)-2-pyridinecarbohydrazide Schiff base ligands and their lanthanide (III) {Tb(III), Eu(III), Sm(III), Dy(III) and La(III))} complexes were synthesized and characterized by elemental analysis, spectral analysis (infrared spectra (IR), ^{1}H and ^{13}C NMR), molar conductivity and thermogravimetric analysis. The luminescence properties such as quantum yield, band width and life time of the synthesized compounds in solid state and in solutions will be investigated. Compounds will be screened for antibacterial and antifungal activities against multidrug resistant clinical bacterial and fungal isolates using agar well diffusion and minimal inhibitory concentration methods. Scavenging activities of the compounds on 1,1-Diphenyl-2-picrylhydrazyl radical (DPPH•) radical will be studied in DMSO at a different concentration range. Complexes were used as catalysts for the oxidation of aniline and its derivatives.

Keywords: Lanthanide Complexes, Luminescence, Catalysts

POSTER SESSION

Id-1068

Synthesis, Characterization, Catalytic and Biological Activities of First Row Transition Metals Complexes Derived from 2-Floro-N-((2-Hydroxynaphthalen-1-Yl)Methylene)Benzohydrazide

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Abstract:

A bidentate Schiff base ligand 2-fluoro-N'-((2-hydroxynaphthalen-1-yl) methylene) benzohydrazide was synthesized from the condensation of hydroxynapthldehyde with 2-flurobenzoic hydrazide in molar ratio 1:1. Five new Metal complexes with general formula [M $L_2(NO_3)$]NO_3.XH_2O [M= Zn (II), Cu (II), Co (II), Ni (II), Mn (II)] [X=1,2] were prepared. The complexes were characterized in the solid state and in solution using elemental, EPR, thermogravimetric analysis, ^{1}H-NMR, ^{13}C-NMR, Molar conductivity measurement, Elemental analysis, UV-Vis spectroscopy and IR spectroscopy. All M (II) complexes are 1:1 electrolyte as shown by their molar conductivities. The results showed that M (II) ion of all complexes displayed a coordination number of six by bonding via azomethine nitrogen, carbonyl oxygen of ligand and one bidentate nitrate group via its oxygen atoms. The catalytic activities of all complexes were examined in the oxidation of aniline and its derivatives result showed that complex 2 had the highest activity. The antibacterial activities of complexes have been tested against several pathogenic bacteria to assess their inhibition behavior. Both complexes 2 and 3 were found to exhibit activity against positive-Gram bacteria.

Keywords: Catalysts, Aniline Oxidation, Antimicrobial

POSTER SESSION

Id-1071

Regioselective Synthesis and X-ray Structure of Diiodophenyl Boronic Acid Derivatives via Metal-Iodine Exchange of 5-Substituted-1,2,3-Triiodoarenes

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Abstract:

A unique 2,6-diiodophenylboronic acid and 2,3-diiodophenylboronic acid derivatives have been synthesized via regioselective Metal-Iodine Exchange (MIE) of 5-substituted 1,2,3-triiodoarenes is reported. The regioselectivity of the reaction per se is remarkably controlled by the nature of C-5 substituent providing either the desired diiodophenylboronic acids in moderate to good yields and with high site-selectivity. The X-ray structures of the prepared compounds are well performed and clearly showed the boronic acid and iodine groups. The diiodophenylboronic acids were then examined for in-vitro antimicrobial activity against four strains of bacteria Micrococcus luteus (ATCC 9341), Bacillus Cereus (ATCC 11778), Escherichia coli (ATCC 25922) and Serratia marcescens (ATCC 27117) and one fungal strain Candida albicans using well diffusion assay and dilution method. It indicated that (5-fluoro-2,3-diiodophenyl)boronic acid (compound 16B) possess the most potent antibacterial and antifungal activity with MIC of 2.6 mg/mL for M. luteus and C. albicans. This report discloses a one-step protocol to access hitherto unknowns 2,6-diiodophenylboronic acid and 2,3-diiodophenylboronic acid derivatives that is scalable, good in scope, no chromatography is needed and indeed difficult to be prepared by other means.

Keywords: X-ray Structure, Synthesis, Boronic Acids, Catalysis

POSTER SESSION

Id-1072

Effects of Process Parameters on Mechanical and Metallurgical Properties in High Pressure Die Casting of Magnesium Alloys

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Abstract:

High pressure die casting (HPDC) of magnesium (Mg) alloys has been the fastest grown up and the most globally developed section in magnesium industry. HPDC of complex shape Mg alloy products have increased considerably in recent years. But low mechanical and metallurgical performance of the casting products could be experienced due to defects in HPDC of Mg alloy parts under heavy working conditions. Process technologies should be modified and process parameters need to be optimized for the use of Mg based alloy products as high performance casting parts. The correct selection of the process parameters means the correct manufacturing of the casting parts. There is a wide range of suggested process parameters for HPDC of different Mg alloys in the literature. This paper specifies optimum process parameters for the required mechanical and metallurgical properties of the die casting parts, experimentally. Experimental tests were performed by using Taguchi experimental procedure to determine the optimum process parameters in cold chamber HPDC of Mg alloy parts. It is aimed to minimize the available range of process parameters in the literature for high mechanical properties and low porosity content of casting products by conducting the designed experiments in an industrial scale mass production line considering the product quality.

Keywords: Magnesium Alloy, High Pressure Die Casting, Process Parameters, Product Quality

POSTER SESSION

Id-1076

Dismantling of the Separator from the Vvr-S Nuclear Research Reactor Active Core

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Abstract:

Nuclear Research Reactor VVR-S from the Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH) - Magurele, the first research reactor built in Romania, was put into operation in 1957 and finally shut down in 1995. In the period between 2010 until 2020 the reactor is under decommissioning. The paper present the dismantling of the separator from the reactor active core. In order to dismantling the separator in the reactor hall a biological protection was set up for the personnel with dimensions (4x4x2 m) consisting from concrete blocks (60x60x80 cm).

The separator and its mantle have been longitudinally/transversely cut from distance with a Powermax 105 plasma jet cutter in easy-to-handle segments. Before, during and after the cutting operation, aerosol monitoring was carried out by installing the FHT 2000 and AMS-4 beta air monitors. Because the measured dose rate was high (4-8 mSv/h), the resulting cut-off segments were stored in a cast iron drum, R 207, the value of the dose rate measured at the outer drum contact was 550 µSv/h (without lid 2.3 mSv/h). Throughout these operations, personnel wore Pb aprons, Saphydose Gamma isotropic electron dosimeter and TLD thermoluminiscent dosimeter.

Keywords: Decommissioning, Dismantling, Separator, Radiological monitoring

POSTER SESSION

Id-1077

Photo-Induced Aggregation of Colloidal Metal Nanoparticles

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Abstract:
Colloidal solutions of silver and gold nanoparticles were prepared via the chemical reduction method. The prepared solutions were illuminated by laser lights of different wavelengths to investigate the effect of light in aggregating the colloidal nanoparticles. The aggregation state of metal nanoparticles was monitored by following the changes occur to their absorption spectra as a result of illumination. The shift as well as the broadening of the characteristic surface plasmon resonance peak reflects the changes occur to the aggregation state of colloidal nanoparticles. Results showed that illumination by light forces metal nanoparticles to aggregate into large clusters which are clear from the noticed reduction and shift of the absorption peak of these colloidal solutions.

Keywords: Silver, Gold, Nanoparticles, Colloid, Aggregation

POSTER SESSION

Id-1078

Measurement of Radon Concentration Levels in Soil and Indoors of Kano City, Nigeria

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Abstract:
Radon concentration in soil and indoors of Kano city in Nigeria was measured during raining season using time integrated passive radon dosimeter containing CR-39 Solid state nuclear track detector. This work is the first attempt to measure the radon concentration levels in soil and Indoors of Kano city. The radon concentration in soil was found to range from 1.40 kBqm^{-3} to 4.99 kBqm^{-3}. The Radon activity concentration indoors varies from 20.84 Bqm^{-3} to 100 Bqm^{-3}. Buildings made from mud are seen to have higher levels of radon compared to building made from concrete and bricks. It is worth mentioning that all the results of radon concentration in the study area are within the global allowed limits.

Keywords: CR-39, Effective Dose, Concentration Levels, Nigeria

POSTER SESSION

Id-1079

Measurement of Natural Radiation and Radon Concentration in the Schools of District of Ajloun, Jordan

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Abstract:

Radon concentration levels were measured in soil and indoors of the schools of Ajloun district using time integrated passive radon dosimeter containing CR-39 detectors. The study revealed that the highest radon concentration in soil was in Ibbin schools (4.84 ± 2.05 kBq/m^3) and the lowest concentration was in Ballas schools (3.21 ± 0.71 kBq/m^3). The mean radon gas concentration in the soil of Ajloun schools was about 4.07 kBq/m^3. For indoor radon measurements, the highest concentration was in Ibbin schools (140.92 ± 34.57 Bq/m^3) and the lowest value was in the schools of Ajloun city itself (104.1 ± 26.67 Bq/m^3). The mean indoor radon concentration for the schools of Ajloun district was about 122.31 Bq/m^3. This mean radon concentration is higher than the previous measurements of radon levels for various dwellings of Ajloun district. This may be related to the bad ventilation system of the schools, the windows and doors are kept closed most of the day. Furthermore, the specific activity concentrations of natural radionuclides in the soil of investigated schools were determined using HPGe detectors. The activity concentrations of ^{238}U, ^{232}Th, ^{40}K, ^{226}Ra and ^{137}Cs are 49.805 ± 24.690, 23.974 ± 4.004, 261.117 ± 16.352, 47.23 ± 3.32, 3.93 ± 0.85 Bq/kg respectively.

Keywords: Ajloun district, Jordan, Radon, Radon Indoors, HPGe Detectors, Natural Radionuclide

POSTER SESSION

Id-1091

Determination of Mass Attenuation Coefficient Parameters of Bismuth Borate and Lead Borate Glasses Doped PDMS at Characteristic Gamma Energies

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Abstract:

The gamma ray mass attenuation coefficient, half value layer and mean free path parameters of polydimethylsiloxane (PDMS), PbO-B2O_3 and Bi_2O_3-B_2O_3 glasses doped PDMS have been determined using MCNP code and XCOM program for different gamma energies, 84.25, 661.6, 1173.2, 1274.5 and 1332.5 keV. In addition, the obtained results of half value layer were compared the experimental results available in the literature.

Keywords: PDMS, Lead Borate Glasses, Bismuth Borate Glasses, MCNP, XCOM

POSTER SESSION

Id-1092

A Comparative Study on Aluminium Laser Cathodes Modified by Thermal and Plasma Oxidation

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Abstract:

Aluminium is one of the most common materials used as gas-discharge lasercathodes owing to its ease of processing, shaping and low cost. On the other hand, aluminium is prone to a strong surface erosion during the bombardment with charged and accelerated particles within a pressurised gas medium. The oxide layer on aluminium acts as an effective protective layer against erosion and re-sputtering. The morphology and thickness of the oxide layer leads to inhomogeneous charge distribution which reduces the life-time of the cathode significantly. In this study we carried out a comparative study on controlling and modification the thickness and morphology of the oxide layer on aluminium using thermal oxidation and plasma assisted oxidation. Oxides layers formed by these corresponding methods have been analyzed using High Resolution Transmission Electron Microscopy (HRTEM), X-ray Photoelectron Spectroscopy (XPS) and Spectroscopic Ellipsometry. A custom plasma chamber was used to analyse the emission properties of prepared surfaces.

Keywords: Aluminium, Plasma Oxidation, Plasma Chamber, Thermal Oxidation, Aluminium Laser Cathodes

POSTER SESSION

Id-1098

Investıgatıon of Mechanıcal Propertıes of Polyester Fıber, Acrylıc Fiber and Polyamide Fiber Reinforced Composıtes

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Abstract:
Composite materials are the materials used knowing or not by human kind to solve the problems for thousands of years. They are obtained by combining two or more materials whose properties are different. In comparison with the alternative materials. Although, they have many superior properties, their weakness enforced the manufacturers to produce new composite materials based on polymers in order to improve their properties in recent years. Composites materials in different structures are manufactured using different matrixes and reinforced elements depending on the technological development.The most widely used polyester fiber is made from the linear polymer poly (ethylene terephtalate), and this polyester class is generally referred to simply as PET. High strength, high modulus, low shrinkage, heat stability, light fastness and chemical resistance account for the great versatility of PET. Polyester fibers are used in tyre reinforcements, fabrics for conveyor belts, safety belts, coated fabrics and plastic reinforcements with high-energy absorption. Also polyester fiber is used as cushioning and insulating material in pillows, comforters and upholstery padding.Acrylic fiber is a synthetic fiber that closely resembles wool in its character. Acrylic fiber is composed of acrylonitrile and a comonomer. The comonomer is added to improve dyeability and the textile processability of the acrylic fiber. Acrylic fiber is produced with two different systems: wet spinning and dry spinning. Acrylic fiber can be supplied as producer-dyed either by pigmentation of the dope or with jel dyeing systems. It can be used 100% alone, or in blends with other natural and synthetic fibers.Polyamide has good mechanical properties and high wears resistance in addition to chemical resistance to many chemicals. It has also a high flexibility and durability.

Keywords: Polyester Fiber, Acrylic Fiber, Polyamide Fiber, Araldite Resin, Composite Materials

POSTER SESSION

Id-1107

Electrochemical Biosensors Based on Graphene for DNA Detection in Healthcare

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Abstract:

Quantification of biological events is of great importance for biomedical applications. Biosensors have truly brought a revolution in diagnosis and preventive healthcare by allowing detection of molecular traces of cells using a biorecognition element and a transducer. Electrochemical biosensors have emerged as one of the most promising and robust analytical tools in recent years, being highly sensitive, selective, simple, low-cost and rapid response. In this work, we propose to develop electrochemical graphene biosensors on industrial screen-printed carbon electrode (SPCE) for DNA detection, molecules which play key roles in the regulation of gene expression. Graphene oxide modified SPCE has been prepared by drop-casting approach and reduced electrochemically in KCl electrolyte or by direct electrodeposited reduced graphene oxide. Cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) measurements were performed with a potentiostat Autolab model Pgstat 204. The structure and chemistry of the electrodes were investigated by Raman and XPS analysis. After DNA immobilization, we observed a sensitive decrease of the current in CV and an increase in the charge transfer in EIS curves, demonstrating the good sensibility of our graphene modified electrodes towards DNA sensing. This work was supported by a grant of the Ministry of Research and Innovation, Operational Program Competitiveness Axis 1 - Section E, Program co-financed from European Regional Development Fund "Investments for your future" under the project number 154/25.11.2016, P_37_221/2015, SMIS code 108117, “A novel graphene biosensor testing osteogenic potency; capturing best stem cell performance for regenerative medicine” (GRABTOP).

Keywords: Graphene, Biosensors, Electrochemistry, DNA Molecules

POSTER SESSION

Id-1109

Investigation of Ferrocyanide Sorbents Immobilised in Portland Cement by X-Ray Diffraction at Different Period of Time

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Abstract:

The use of nuclear techniques and applications as top methods in different areas generated a special waste, the radioactive waste. Radioactive wastes are generated in a variety of physical and chemical forms, including gases, liquids and solids. To improve the safety of disposal, it would be necessary to immobilize these wastes to produce a long term stable solid waste form. The embedding of radioactive waste in Portland cement matrix is the most used method, applied in the world by the countries developing nuclear energy programmes, but not all the radioactive waste are compatible with the normal cement matrix because of negative effects of some chemical reactions developed during the hydrolysis and curing steps of cement paste. The ferrocyanide sorbents used for the low and intermediate aqueous radioactive waste treatment must be conditioned in a long term stable matrix. The stability of matrix – radioactive waste system is an essential condition to assure the radiological safety during the final disposal and is directly connected with physical-chemical reaction between the system components and structural modifications which lead to performance parameters imposed by the waste acceptance criteria in repository. The chemical stability is an important property which must be considered to ensure cement waste form durability. The chemical stability for cementitious materials is a complex issue due to the chemical reaction which occurs between the major product of the cement matrix and nickel ferrocyanide sorbents. Considering that significant structural changes appear after the samples were kept for a medium-long time into the laboratory simulating disposal conditions it was chosen different period of time in order to characterize the samples.

Keywords: Radioactive Waste, XRD, Sorbents, Conditioning Matrix.

POSTER SESSION

Id-1114

Characterization of Sol-gel Derived HfO_2 Thin Films

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Abstract:

The microstructure and optical properties of high-κ HfO_2 gate dielectric films fabricated by sol-gel method have been investigated. The solution is formed by dissolving hafnium tetra-chloride in ethanol and mixing with acetic acid and DI water. Then, HfO_2 thin films have been deposited on glass substrates by dip coating with a pulling out speed of 10 cm/min. The films were sintered at 600℃ for 60 minutes. The powders and the films were characterized by using X-ray diffraction (XRD), scanning electron microscopy (SEM), ultraviolet-visible spectroscopy (UV-Vis) and prism coupler. The results show that the films had a refractive index of 1.97 with an approximate thickness of 992 nm and an optical band gap of 3.98 eV.

Keywords: HfO_2, Sol-gel, Waveguide

POSTER SESSION

Id-1116

Synthesis and Characterization of $La_{1-x}Ca_xCoO_3$ Thin Film Cathodes for Solid Oxide Fuel Cells

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Abstract:
Upon long term operation, Solid Oxide Fuel Cell (SOFC) cathode materials such as $La_{1-x}Sr_xMnO_3$ (LSM) and $La_{1-x}Sr_xCoO_3$ (LSC) have been shown to exhibit phase segregation at their outer surfaces, mainly due to the mismatch of host La^{3+} and dopant Sr^{2+} cation sizes. The segregated phases result in a decrease in the oxygen reduction reaction (ORR) activity. Therefore, in an attempt to obtain a chemically more stable cathode, $LaCoO_3$, doped with Ca^{2+} (instead of Sr^{2+}) which has a cation radius close to that of La^{3+}, is investigated in the present study.
Here, $La_{1-x}Ca_xCoO_3$ (LCC) was fabricated in the form of a thin film coating on Yttria-Stabilized Zirconia (YSZ) electrolyte substrates by a facile and cost-effective polymeric precursor method. The phase and microstructural evolutions of LCC thin films were determined by x-ray diffraction (XRD) and scanning electron microscopy (SEM) analyses respectively, performed on samples annealed at 500, 700 and 800 °C for 3 hours in air. The electrochemical performance of the LCC cathodes were determined by electrochemical impedance spectroscopy (EIS) measurements, yielding cathode polarization resistance values as low as 5,45 ohm.cm^2 at 630 °C. Prolonged EIS measurements were performed at 630 °C to determine the long-term stability of the developed LCC thin film cathodes.

Keywords: Solid Oxide Fuel Cells, Impedance Spectroscopy, $La_{1-x}Ca_xCoO_3$, Cathode, Thin Films.

POSTER SESSION

Id-1118

Use of Fluoroquinolone Antibiotics in the Purification of Water

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Abstract:
Irradiation of Fluoroquinolone with UVA radiation is known to produce a variety of reactive oxygen species. Spectroscopic and chemical evidences indicate that the oxygen reactive species produced by the irradiation fluoroquinolones include superoxide ions (O_2^-), hydrogen peroxide (H_2O_2), singlet oxygen ($^1O_2$) and hydroxyl radicals ($OH^.$). These reactive oxygen species can be utilized in the destruction and mineralization of organic pollutant in contaminated water.Three Fluoroquinolone have been tested for the ability to destroy and mineralize contaminants in polluted water. These fluoroquinolones are ciprofloxacin, norfloxacin and pefloxacin. All of the three antibacterial agents demonstrated the ability to react with organic pollutant in spiked water samples. Studying the kinetics of the mineralization demonstrated that the order of production of oxygen reactive by the bacterial agents studied is norfloxacin> pefloxacin > ciprofloxacin. The reaction of the reactive oxygen species with organic pollutant is inhibited with a variety of quenchers such as sodium azide, catalase, and superoxide dismutase indicates that the major reactive oxygen species produced by the three antibacterial agents is singlet oxygen.

Keywords: Fluoroquinolones, Oxygen Reactive Species, Photosensitization

POSTER SESSION

Id-1119

Antimicrobial Wound Dressings Used in Skin Tissue Regeneration

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Abstract:

The healing treatment for wounds caused by accidents or diseases such as foot ulcer is a part of a field which, from the time it was first introduced, is in a continuous development. Today the ability to understand the healing mechanism and the needs of patients, is a step forward in treating affected tissue. Although the medical world is in constant evolution, increasingly worrying cases of patients with wound infections due to the resistance of microorganism to drugs are still a problem. In this sense, the research field has made it possible to investigate several types of materials that can be used as wound dressings. Thus, these materials must have properties such as biocompatibility and the ability to retain a large amount of exudate. But, of course very important, to form composite bioactive dressings with antibacterial agents, that act like a barrier against the activity of bacteria in wounds. All these properties improve and accelerate the wound healing process.In this work is described the method of obtaining nanofiber dressing by the electrospinning technique. Electrospinning technique may be seen as method to manufacture hybrid materials because as finished material can take properties of each component and improve them. The research aims to obtain and characterize a new type of antimicrobial dressings based on zinc oxide and sodium alginate for use in multiple biomedical applications. The zinc oxide powder, obtained with different shapes and grain size, is used as antimicrobial agent along with sodium alginate which moreover is used to increase the biocompatibility of the dressing. Analyzes such as X-ray diffraction (XRD), scanning electron microscopy (SEM) were performed to determine the physical properties of the obtained powders and composite fibers. Their antimicrobial activity was tested against Gram- negative E. coli and Gram- positive S. aureus and C. albicans, the results obtained on bacteria testing, are suitable for the use of composite fibers based on zinc oxide and alginate in the regeneration of affected skin tissue.

Keywords: ZnO, Nanostructures, Biomaterials

POSTER SESSION

Id-1123

The Utilisation of Nepheline Syenite in Bone China Body

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Abstract:
This study was carried out to see whether nepheline syenite could be an alternative raw material for the replacement of cornish stone. Previously, prepared reformulated body had not sufficient mechanical properties compare to the classical bone china body. For that reason, this study investigated controlled milling operation to obtain bimodal particle size distribution in order to provide better mechanical properties. The reformulated composition was milled at different times from 3 hours, to 24 hours. It is aimed to obtain appropriate coarse to fine particle size ratio which is approximately 10 to improve the packing ability of the particles. The slips after milling were dried at 110°C and granulated with 10 wt.% of water content. Pellet and rectangular bar shaped samples were produced from granules by uniaxial dry pressing under the load of 40 MPa. The samples were sintered for 2 hours at a rate of 3 ºC/min at 1200, 1225 and 1250 ºC. After the sintering, they characterised for bulk density, water absorption (%) and firing shrinkage. The mechanical behaviour of sintered samples were characterised by measuring elastic modulus and flexural strength at room temperature. In addition, phase analysis were done. As a result, the biomodal distribution of sample was obtained for 24h milling. For this sample 2.55 g/cm^3 density and zero water absorption were obtained at 1225 ºC. In addition, the elastic modulus and flexural strength value was measured as 77 GPa and 102 MPa respectively.

Keywords: Bone China, Nepheline Syenite, Particle Size Distribution

POSTER SESSION

Id-1125

Resistive Switching in Al doped ZnO Nanoparticle Incorporated PVA Drop Casted on Aluminium Foil

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Abstract:

$Al_x\,Zn_{1-x}\,O$ nanoparticles with wurtzite structure and average crystallite size of 30-50 nm were first prepared by chemical pyrophoric method described elsewhere. 0.5 w/v% PVA solution was prepared in water with continuous stirring for one hour. 0.5 w/v % AlZnO nanoparticles were dispersed in the PVA solution and ultrasonicated for 15 minutes until a clear solution was obtained. The w/v% error bar is only 0.001%. This solution was drop casted on Aluminium foil. I-V characteristics of the fabricated device were recorded using Agilent B1500 semiconductor parameter analyser at room temperature in the range 0 to 3.5 V. The measurement has accuracy up to 1pA for current and 5 microvolt for voltage. We observed consistently a resistive switching jump from high resistive state to low resistive state of about 3 orders magnitude at 3.5 V. The switching behaviour has been analysed in terms of various conduction mechanisms available in literature.

Keywords: Resistive Switching, AlZnO Incorporated PVA Nano Composite, Drop Casting

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