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PREFACE

It is our great pleasure to welcome you to the 4th International Symposium on Characterization (ISC'24), an event dedicated to exploring the forefront of innovation, research, and collaboration across diverse fields. This abstract book encapsulates the spirit and breadth of the symposium, offering a glimpse into the wide-ranging ideas, methodologies, and discoveries presented by our esteemed participants.

The abstracts included here represent contributions from scientists, scholars, practitioners, and emerging researchers from around the world, each bringing unique insights and expertise to their respective areas. Together, these abstracts underscore the collective drive to push the boundaries of knowledge, foster interdisciplinary dialogue, and address pressing global challenges. From groundbreaking theories to practical applications, each submission reflects a shared commitment to advancing both our understanding and our impact.

We extend our gratitude to all the authors for their dedication, to the reviewers for their invaluable feedback, and to the organizing committee for their hard work in bringing this symposium to life. We also thank our sponsors, whose generous support has made this gathering possible.

We hope that this abstract book serves not only as a record of the event but also as a source of inspiration, sparking new ideas, collaborations, and pathways for future research. We look forward to the lively discussions, questions, and collaborations that will emerge from this symposium and beyond.

Thank you for joining us, and we wish you a productive and inspiring symposium.

Prof. Dr. Atilla Evcin

Chair, 4th International Symposium on Characterization (ISC'24)

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The Characterisation of Alkaline earth Aluminoborosilicate sealing glasses for SOFCs Applications

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Abstract
The alkaline earth oxide silica swapped BaO glasses of the system BaO-ZnO-La_2O_3-Al_2O_3-B_2O_3-SiO_2 have been investigated to study their suitability for use as a sealing material in solid oxide fuel cell (SOFC) applications. The relevance of the different characterization techniques to understand the behaviour of these glasses has been assessed by studying the mechanical properties, thermal and electrical properties and densities of these glass samples. Furthermore structural information was also obtained through the use of Raman and Fourier transform infra-red spectroscopies. The T_gs of these glasses suggests they could be used for intermediate temperature SOFCs. The mechanical properties are generally comparable to other glasses and the thermal expansion coefficients of some of the samples in glass and glass-ceramics form meet the optimal values required for sealing glasses and has shown potential for use in SOFC sealing applications.

Keywords: BaO-ZnO-La_2O_3-Al_2O_3-B_2O_3-SiO_2, characterization, glass and glass-ceramics
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Recent Advances in Solder Alloy Etching for Improved Characterization

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Abstract
This article discusses how to use chemicals etching to study solder alloys, the focus is primarily on a lead-free solder known as Sn-3.0Ag-0.5Cu (SAC305). Additionally, the study encompasses alloys such as Sn-Bi, Sn-Zn, Sn-Zn-Bi, and Sn-Bi-Ag. It details a range of scenarios in which these solder alloys undergo thorough analysis using various etching methods, including conventional, deep, and selective etching. Beginning with an introductory overview of solder alloys and the fundamentals of etching techniques, the article progresses to discussing the equipment utilized and the results for each method. These findings are contrasted with case studies drawn from other research work. There is a focus on the contrasting aspects, outcomes, and new insights each method offers, particularly examining the efficiency, benefits, and future potential. Special emphasis is given to the use of selective electrochemical etching for the characterization of solder joints. By compiling recent research, technical characterization, and key discoveries from various literature, the article offers a comprehensive understanding of etching applications in the study of solder joints.

Keywords: Sn-3.0Ag-0.5Cu, characterization, Sn-Bi, Sn-Zn, Sn-Zn-Bi, Sn-Bi-Ag
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Microstructural characterization of boride Titanium alloy Ti6-Al4-V and corrosion resistance

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Abstract
Titanium alloy Ti6-Al4-V is widely utilized in several domains. Nevertheless, its hardness prevents it from being used in tribological applications, such as the production of large composite tools for the automotive and aerospace sectors. In this study, a powder-pack-boriding method employing an Ekabor II powder combination is presented for producing the boride layer on titanium alloy Ti6-Al4-V at 900, 950, and 1000 °C for 2, 4, 6, and 8 hours. Optical microscopy was utilized to assess the microstructure, mechanical characteristics, and characterization of the alloy. Microhardness measurements, X-ray diffractometry (XRD), and energy-dispersive X-ray spectroscopy (EDS) were used to characterize the formed boride layers using scanning electron microscopy (SEM). The microstructural analysis demonstrated a homogeneous and complex boride layer with a thickness ranging from 22 to 175 µm, mostly composed of TiB and TiB_2 phases. Following the boriding process, the surface hardness of the titanium alloy Ti6-Al4-V rose from 406.7 to 1200.5 HV0.1. The developed boride layer's higher surface hardness increased the titanium alloy Ti6-Al4-V's wear resistance by almost 30 times. The findings show that there is evidence of boride layer production along with increasing layer thickness and hardness as temperature or time parameters rise. Using the potentiodynamic polarisation method, the behavior of the treated samples tested for corrosion was evaluated; the results showed no passivation in the boride layers and reduced corrosion potential.

Keywords : Titanium alloy, boride layers, characterization, corrosion resistance.
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Superalloys and Thermal Barrier Coatings; Aggressive Environments in Aeroengine

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Abstract
Nickel-based single-crystal superalloys have been widely used for blades and vanes of the aeroengine hardware. The main goal of these alloys is to provide high-temperature strength owing to their γ-Ni/γ'-Ni_3Al structure under an aggressive working environment. However, alloying elements used do not provide the desired oxidation resistance to the components To provide optimum oxidation resistance and improve engine working efficiency, a system of the coating is applied which is commonly known as thermal barrier coating (TBC) system In general, TBC system comprises of two layers i.e. ceramic topcoat (TC) and an underlying metallic layer as a bond coat (BC). However, there is one additional layer between BC and TC grown either during service or manufacturing is known as thermally grown oxide (TGO) i.e., Al_2O_3. One of the crucial parts of the TBC system is the nickel aluminides (βNiAl) layer that is used as BC material. Most often, such a layer governs the TC life in the absence of foreign object damage. For example, various modes of failure are reported in the literature such as rumpling, stress, and interdiffusion. In this work, bond coat and associated trends are highlighted in the light of experimental observations.

Keywords: TBC, BC, TGO, REs, Turbine blades, aero-engines
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Evaluation of the Properties of Microneedle Systems Obtained by Masked Stereolithography

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Abstract

Microneedle systems are very well suited for pharmaceutical applications, including transdermal drug delivery which allows for the improvement of the drug's bioavailability and is a painless alternative to conventional injection procedures. Among the numerous methods of manufacturing microneedle systems, masked stereolithography (MSLA), categorized as an additive manufacturing technique, stands out. Thanks to the high resolution of even several tens of micrometers, it is possible to obtain products with complex geometries with very high accuracy. The research conducted included the obtaining and characterization of microneedle systems made from acrylic photo-curable resin. Samples with different microneedle geometries were obtained, and their reproducibility was evaluated by microscopic observations. The mechanical properties of the microneedles were also evaluated, the determination of which is necessary to verify the suitability of the obtained products for the indicated application. The presented results are promising in terms of increasing the application potential of the MSLA method for obtaining microneedle systems. The proposed method makes it possible to obtain different types of microneedles, whether solid, coated, hollow, or hydrogel-type, which is also an important aspect in the context of the method's broad application potential. The work was performed as a result of the research project no. 2021/42/E/NZ7/00125 (ID: 526262) financed by the National Science Centre (Poland).

Keywords: Masked Stereolithography, Microneedle Systems, Mechanical Properties.

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Effect of Activation Conditions of Boron-Containing Calcined Clays on Hydration Kinetics in Cement Matrix

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Abstract
In the production process of boron ore, significant amounts of waste limestone and clay are generated, posing substantial challenges in storing and disposing of these by-products. The potential utilization of boron mine wastes as raw materials in various industrial sectors, particularly in the cement industry, has encouraged research efforts. In cement production, the thermal activation of clays to obtain reactive artificial pozzolans leads to a reduction in emission levels by up to 70% compared to Portland cement clinker production, as well as significant energy savings. Therefore, the potential and effects of boron-containing calcined clays in cement production have become an important research topic. The impacts of boron-containing calcined clays on cement performance have been determined by optimizing various activation parameters. These parameters include grinding, temperature, time, boron content, and calcination conditions. The effects of calcination and hydration processes on the mechanical properties of cement mortar, including pozzolanic activity assessment methods, are also discussed in detail. Optimizing the activation parameters of boron-containing calcined clays can significantly contribute to achieving the desired performance and properties in cement production.

Keywords: Calcined clay, boron waste, cement, activation, optimization, hydration.
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Exploring MXene Material for Enhanced Optical Fiber-Based Surface Plasmon Resonance Sensors

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Abstract
This study investigates the utilization of MXene material to enhance the performance of optical fiber-based surface plasmon resonance (SPR) sensors. MXene, a two-dimensional material with unique properties, offers promising opportunities for improving the sensitivity and selectivity of SPR sensors. By incorporating MXene into the sensing platform, we aim to enhance the detection capabilities, particularly focusing on applications related to lead detection. The proposed research explores the fabrication, characterization, and optimization of MXene-integrated optical fiber SPR sensors for efficient lead detection. Experimental results and analysis will be presented to demonstrate the effectiveness of MXene in enhancing the sensitivity and performance of the SPR sensor platform. This research contributes to advancing the field of optical sensing technology and offers potential applications in environmental monitoring, healthcare, and beyond.

Keywords: Fiber-based SPR sensor, MXene, Heavy metals, Arc-shaped fiber.
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Characterization of carbon nanomaterials and their composites for thermal interface applications

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Abstract
Carbon nanomaterials, such as carbon nanotubes, graphene nanoplatelets (GNP), graphene, graphene oxide, carbon nanofibers (CNF) and carbon black (CB), have been extensively researched in last two decades owing to their remarkable properties such as high specific surface, strength, electrical and thermal conductivity. In particularly, thermal conductivity of these nanomaterials makes them highly valuable fillers for making thermal interface materials (TIMs). TIMs are used in the form of thermal pastes, adhesives or pads for improving contact between the mating surface and hence facilitate heat dissipation from microprocessors, semi-conductor devices and LEDS. This paper will present characterization of various carbon nanomaterials carried out by scanning electron microscope (SEM), transmission electron microscope, atomic force microscope, X-ray diffraction (XRD) and Raman spectroscopy. These carbon nanomaterials-based epoxy and silicone composites were characterized by SEM and XRD pole figure methods to evaluate dispersion and orientation of carbon nanomaterials, respectively. The thermal conductivity of the composites was determined by hot disk methods and heat dissipation ability of these composites in the form of adhesives, pastes and pads was evaluated by guarded hot plate method. GNP /epoxy and CNF/epoxy composites offered the best performance as thermal interface adhesives compared to CB/epoxy and commercial thermal interface adhesive. The thermal contact resistance of the developed adhesives depends on their viscosity/conformability, bond line thickness, filler particle size, roughness of the substrate and thermal conductivity.

Keywords: Carbon nanomaterials, carbon nanotubes, graphene nanoplatelet
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Evolution of the structural and thermal properties of Ti-Al Thermal alloys

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Abstract
This study focuses on the study of microstructural properties of the binary alloys Ti-Al. A set of samples alloy Ti-X m. % Al were prepared by vacuum induction HF from mixtures of powders of Ti and Al purity laboratory cold compacted in pellet form. The search for all possible phases in the binary alloys Ti-Al was used to identify the microstructure and to the microstructural evolution in these alloys based on aluminum content. A detailed study of DRX has been observed on the phases, Al_3Ti, Al_2Ti, TiAl Ti_3Al and which are still subject of research in materials for industrial applications

Keywords: Ti-Al alloys, XRD, phases, identification of phases, microstructure
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Microstructural and Mechanical Behavior of AM60 Magnesium alloy Weldment

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Abstract
The aim of this work is to investigate the microstructural behavior of welded joints in magnesium alloy AM60. In this study, the parts were assembled using the TIG alternating arc welding process. The welded joint was analyzed using optical microscopy (OM) and scanning electron microscopy (SEM). The chemical compositions of the existing phases are determined using EDS and XRD techniques. The mechanical properties of the junction are determined by a tensile test and a microhardness profile. We find that the metallographic analysis of the joint shows three zones such as: the base metal (BM), the heat affected zone (HAZ), and the fusion zone (FZ), due to the thermal effect produced by the TIG heat source. Microstructural and EDS analysis showed a dendritic structure in the melt zone, with the eutectic Mg17Al12 phase surrounded by the α-Mg solid solution. With regard to the mechanical properties, a low microhardness of order 55 HV was observed in the latter zone, which justifies the coarse structure of the grains compared with the others.

Keywords: Weldability, Magnesium, Microstructure, TIG Processing, Mechanical properties.
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Effect of Laser Beam Welding on Microstructural and Mechanical Properties of 2017-T3 Aluminum Alloy

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Abstract
Laser beam welding (LBW) has found wide applications in several fields, including electronics, aerospace, and automobile industries,and others industries. The present research work evaluates the metallurgical and mechanical behavior of 2017-T3 structural-hardening aluminum alloy weldment using the fibre laser Yb:YAG welding process. Experiments were carried out using optical microscope (OM), scanning electron microscope (SEM), X-ray diffraction (XRD), and mechanical testsby the micro-hardness (HV 0.5). The results show a significant reduction in weld seam width. A fine dendritic microstructure with epitaxial orientation in the fusion zone (FZ). The width of the heat affected zone (HAZ) is too thin and very fine-grained due to the high heat density and high welding speed, which meant that only the keyhole phenomenon came into play. Vickers micro-hardness values were measured as 145 ± 5 HV for base metal. The fusion zone showed the lower hardness values (about 100 ± 5 HV).

Keywords: Automatic laser welding, Laser Yb -YAG process, Aluminium, Characterisation.
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Effect of Electrode Coating on the Microstructural and Mechanical Properties of S235JR Steel Weldment

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Abstract
Electrode coating plays a very important role in the manufacturing of low-carbon steel welds. However, there are few investigations on the effect of coating type on welding quality. In the present work, the microstructural and mechanical behavior of S235JR low-carbon steel welded with shielded metal arc welding (SMAW) technique using two different filler electrodes, the first being the basic-coating electrode E7018 and the second the cellulosic-coating electrode E7010 was investigated. Experiments were carried out using optical microscope (OM), X-ray diffraction (XRD), and mechanical tests, such as micro-hardness (HV 0.1) and tensile strength. The results show that the microstructure of the base metal (BM) has a fine-grained, coaxial, ferrito-perlitic structure. The microstructures of the fusion zone (FZ) of both welds show the presence of different ferrite morphologies (polygonal (proeutectoid) ferrite αP, acicular ferrite αA, Widmanstätten ferrite αW and intergranular ferrite αI), and pearlite. There is a clear difference between the two micrographs, particularly with regard to acicular ferrite, which is fine and in high content in the basic fusion zone compared with the cellulosic fusion zone. The heat-affected zone (HAZ) of the basic weld is larger than that of the cellulosic weld. Vickers micro-hardness values were measured as 165 ± 5 HV for base metal. The cellulosic fusion zone demonstrated the lower hardness values (about 145 ± 5 HV). The highest ultimate tensile strength (UTS) observed in the cellulosic welded joint was 445.10 MPa, but the highest elongation (E) was that of the basic welded joint (12.95 %).

Keywords: Low-carbon steel, S235JR, SMAW, Microstructure and mechanical properties.
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Dissociation of W-rich M_6C carbide in Co-26Cr-10Ni-8W alloy by plastic deformation

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Abstract
Abstract- In this study, an attempt to investigate strain-induced phase transformation in Co-26Cr-10Ni-8W alloy using up to 50% cold rolling has been made. The primarily as-cast microstructure of Co-26Cr-10Ni-8W alloy consists of M_6C and $M_{23}C_6$ carbides while the obtained results showed that M_6C carbide is dissociated by the carbon traps in dislocations generated during the plastic deformation.

Keywords- Cobalt based alloy, Rolling, Carbides, Plastic deformation.
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Correlation Between the Atomic Radius of Dopant Elements and the Photocatalytic Efficiency of Titanium Dioxide (TiO_2)

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Abstract
This study investigates the impact of dopant atomic radius of copper, cobalt and cadmium on the photocatalytic efficiency of anatase TiO_2 xerogels. 2 at.% of Copper (Cu), 2 at.% of cobalt (Co) and 2 at.% of cadmium (Cd) are inserted into titanium dioxide (TiO_2) lattice as acetates. The samples were annealed at 550°C for 20 minutes. as confirmed by. All samples crystallize into pure anatase phase only. The grain size values are 24.01 nm for undoped TiO_2, 16.52 nm for 2 at.% Cu:TiO_2, 13,57 nm for 2 at.% Co:TiO_2 and 9.78 nm for 2 at.% Cd:TiO_2. The grain size decrease (DCu-TiO_2 > DCo-TiO_2 > DCd-TiO_2) can be correlated to the increase of the atomic radius (r (Å)) of copper (1.86Å), cobalt (2.01Å) and cadmium (2.43Å) ($r_{Cu} < r_{Co} < r_{Cd}$). Also, The band gap energies (Eg) of undoped TiO2, 2 at.% Cu:TiO_2, 2 at.% Co:TiO_2 and 2 at.% Cd:TiO_2 are 3.44, 3.34, 3.23 and 3.19 eV, respectively. During 420 minutes, the concentration rates of methylene blue (MB) are 30% for undoped TiO_2, 22% for 2 at.% Cu:TiO_2, 15% for 2 at.% Co:TiO_2 and 8% for 2 at.% Cd:TiO_2. Accordingly, the resulting degradation percentages are 70 % for undoped TiO_2, 78 % for 2 at.% Cu-TiO_2, 85 % 2 at.% Co-TiO_2 and 92 % for 2 at.% Cd-TiO_2. Specifically, the highest degradation percentage of 92% is ascribed to doping TiO_2 with cadmium (Cd) since it reveals the smallest grain size (9.78 nm) and the lowest band gap energy (3.19 eV). This result confirms the observed correlation between a narrower band gap and smaller particle size with higher degradation efficiency.

Keywords: Sol-Gel, Xerogel, Degradation rate, Methylene Blue, Anatase, TiO_2
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Crystal Structure and Hirshfeld Surface Analysis of E-1-(3-nitrophenylazo)-2-naphtol

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Abstract
In the title compound, the molecule $C_{16}H_{11}N_3O_3$ belongs to the family of azo dyes, and the asymmetric unit displays an intramolecular N—H···O hydrogen bond. In the light of a single crystal X-ray study, it is evident that of the tautomeric forms (Azo-hydrazone), the hydrazone form is the predominant form in the solid state. The naphthol and benzene fragments attached to the -N=N- moiety adopt the s-trans conformation. Furthermore, the molecules are nearly coplanar, implying a dihedral angle of 2.63 (5)°. There are only two types of intermolecular interactions in the crystal structure: strong hydrogen-bonding C—H···O interactions and π-π stacking interactions. The importance of C— H···O interactions in the molecular packing is reflected in the relatively high contributions made by O···H/H···O contacts to the Hirshfeld surface, i.e., 28.5%.

Keywords: Azo dyes, X-ray diffraction, crystal structure, intermolecular interactions, Hirshfeld surface.
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A Comprehensive Analysis of Chronic Kidney Disease Prediction Through Machine Learning: Insights from Decision Tree Modeling

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Abstract
This study uses a multidimensional dataset to evaluate the possibility of Decision Tree modeling for predicting chronic kidney disease (CKD). The procedure entailed methodically assembling a dataset of patient demographics, clinical characteristics, and test results. This data was subsequently used to train the Decision Tree model, which identified important predictors of CKD. The results show that the model is effective in CKD prediction, with an accuracy of 0.85 (85%). Furthermore, Decision Trees gave a clear and understandable structure for comprehending the model's decision-making process. Serum creatinine levels, age, and blood pressure are all important predictors of CKD. These findings show that the model could be useful in clinical settings to help patients make decisions about their care. However, limits exist due to the dataset's size. To solve this and increase the model's generalizability, future research should focus on collecting larger datasets, studying more features, and experimenting with alternative AI techniques to improve prediction accuracy. Overall, this study advances CKD prediction by proving the potential of Decision Trees and underlining the need for interpretable models in healthcare applications. It lays the path for future research targeted at fine-tuning the model for real-world therapeutic applications.

Keywords: Chronic Kidney Disease, Artificial Intelligence, Decision Tree Modelling, Matrix Flow Chart, Healthcare applications, Model Hyperparameter tuning
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Effect of Niobium on Microstructural Evolution of Co-Cr-Mo Alloy During Aging Process at 850°C

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Abstract

The current research examined the influence of adding niobium on the microstructural transformations of a cobalt-chromium-molybdenum alloy (CCM) during heat treatment. The study utilized metallographic analysis, Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS), and hardness measurements to evaluate the alloy. The results showed that the transformation from the unstable face-centered cubic (FCC) phase to the hexagonal close-packed (HCP) phase during aging was highly sensitive to the heat treatment parameters. Furthermore, the hardness testing revealed increased hardness resulting from reduced grain size and the conversion of the dendritic morphology to an equiaxed structure with niobium addition. This was attributed to the increased formation of niobium carbide particles in the microstructure. Overall, the addition of niobium and resulting microstructural changes are expected to enhance the performance of this alloy for medical implant applications.

Keywords: cobalt-chromium-molybdenum alloy, Heat treatment, Niobium, Martensite phase.
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Structural, Electronic, Elastic, Magnetic and Optical Properties of $BaXN_3$(X=K, Rb) perovskites: An Ab-initio DFT Study

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Abstract

The full-potential linearized augmented plane waves (FP-LAPW) method, which is based entirely on functional density theory (DFT), is used to investigate the structural, electronic, magnetic, optical, and elastic properties of $BaXN_3$(X=K, Rb). This method also employs the Generalized Gradient Approximation (GGA) and a modified Beck Johnson TB-mBJ potential in the exchange correlation term. When the resulting structural properties were examined, the findings showed that our compounds are best stable when they are configured as ferromagnetic materials. The formation energy value demonstrated that these chemicals could be produced experimentally. Additionally, the estimated band structures show that $BaXN_3$(X=K, Rb) exhibits half-metallic behavior with an indirect band gap. The total and partial density of state curves were used to assess the contributions of the various bands. Additionally, we discovered that the total magnetic moment is an integer of 6 μB, confirming the half-metallic nature. The primary source of the magnetic moment is the spin-polarization of the p electrons in N atoms. 2 The mechanical stability of these compounds has been discovered. The elastic parameters are obtained, including the elastic constants, bulk modulus, anisotropy factor, Poisson's ratio, and Pugh's ratio. The optical spectra are calculated for the energy range of 0 to 30 eV, including the real and imaginary components of the dielectric function, extinction coefficient, and refractive index.

Keywords: Density Functional Theory, Structural Properties, Electronic Properties, Optical Properties and Elastic properties

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Numerical calculation of applied strain value in strain-induced martensitic transformation during rolling process in cobalt-chromium-molybdenum alloy

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Abstract

This research aimed to explore the effect of strain-induced martensitic transformation in the cobalt-chromium-molybdenum alloy during the cold rolling process. The strain applied during the rolling process was assessed and calculated by simulating the cold rolling process using Abacus software. The simulation results, which included thickness reductions of 10%, 20%, and 30%, indicated that a reduction of 30% was not feasible due to the emergence of cold cracks during the process. The findings suggest that the rolling process led to the martensitic transformation in the cobalt-chromium-molybdenum alloy. Consequently, the acceleration of this transformation could enhance the properties and applicability of this alloy.

Keywords: Co-Cr-Mo alloy, Strain-induced martensitic transformation, rolling process, abacus software.

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Evaluation of the Cumulative Energy and Temperature at the Interface in Dry Friction of a Couple Steel as a function of Hardness

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Abstract
This work consists of studying the determination of the temperature at the interface in the dry friction of a tribological couple in steel including the pin (fixed) in low alloy AISI 4140 steel against a steel disc (rotating) medium hard carbon AISI 1055. The parameters: Normal load applied, sliding speed, hardness of the material (ranges between 35 HRC and 50 HRC after undergoing tempering heat treatment at temperatures between 250 ºC and 550 ºC) and coefficient of friction resulting from the friction of the couple during the tests, play a very important role on the thermal effects of the surfaces. The Archard model was used to determine cumulative energy and the temperature at the interface of the tribological couple, using the parameters mentioned above. The coefficient of friction changes its value between 0,41 to 0,52 and the resulting contact temperature varies between 216 ºC and 313 ºC.
The results obtained showed that the contact temperature increase proportionally with the hardness of the pin material. The contact area between disc and pin is inversely proportional to the increase in the hardness of the pin.

Keywords: Steels, Hardness, Friction, Cumulative energy, Temperature of contact
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Computational determination of structural, electronic, magnetic and elastic properties of newly predicted O2XF (X=Ca, Sr and Ba) do full-Heusler alloys as potential spintronic materials

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Abstract

Structural, electronic, magnetic, elastic and optical characteristics of d^o full-Heusler alloys O_2XF (X=Ca, Sr and Ba) are investigated by using First-principles study based on density functional theory. Full-potential linearized augmented plane wave method is used to study these compounds in WIEN2k. The generalized gradient approximation that Perdew–Burke–Ernzerhof developed is used to deal with the exchange correlation function, The Trans-Blaha modified Becke-Johnson (TB-mBJ) approximation is employed to determine electronic properties with accuracy and precision. The results showed that the ground state of four compounds was the Hg_2CuTi-type structure in the ferromagnetic state. The elastic characteristics have been employed with the IRelast package, which is already included into WIEN2K. Band structure and density of states are used to describe electronic properties which indicate the half-metallic nature of these compounds. O_2BaF, O_2SrF and O_2CaF exhibit half-metallicity with band gaps of 10.56, 11.24 and 10.08eV respectively with mBJ-GGA-PBE in the spin-up channels whereas spin-dn channels are conducting. The total magnetic moments of O_2XF (X=Ca, Sr and Ba) compounds were obtained 3μB per formula unit at the equilibrium lattice parameter, which were in agreement with Slater–Pauling rule $M_{tot} = (24 - Z_{tot})\mu_B$. Our compounds are mechanically stable and reveal ductile nature. The obtained results reveal that our compounds are HM ferromagnets with perfect spin polarization in the absence of transition metals which make them promising candidates for spintronic devices.

Keywords: d^o Half-metals, First principles calculation, WIEN2k, Half-Heusler alloys; Half-metallic ferromagnetism, Electronic properties, Magnetic moments.

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Elaboration and characterization of sandcrete based on sand and fillers from demolition waste

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Abstract

The demolition of buildings produces a significant amount of waste, which poses a serious problem. Reusing the latter as a new construction material gives a second life to this type of material which fits perfectly into a circular economy. The objective of this work is to evaluate the influence of the recovery of demolition waste, such as sand and filler, on the physical and mechanical characteristics of sandcrete. The experimental study focused on the use of this waste as sand 0/5 (replacement of natural quarry sand with recycled sand) and as fillers. Two sands and two recycled fillers are used in this study: sand and filler of recycled concrete and sand and filler of recycled glass. The results obtained show that the properties of concrete in the fresh state (workability and density), the mechanical characteristics (resistance in compression and traction by flexion) as well as the transfer properties are affected by the use of sand and recycled fillers.

Keywords: sandcrete recycled sand, recycled filler, workability, mechanical characteristics.

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Structural and Thermal Stability of Nanocrystalline Stainless Steels: An Overview

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Abstract
The thermal stability and retention of the initial microstructure and mechanical properties are crucial for the consolidation of nanocrystalline stainless steel powders produced through the powder metallurgy route as well as for high-temperature structural applications of nanocrystalline bulk stainless steels. In this study, nanocrystalline stainless steels with nano-sized oxide additions (Y_2O_3) were synthesized using high-energy mechanical alloying. Microstructural evolutions as a function of annealing temperatures were investigated in detail. The dependence of hardness on the microstructural evolution was utilized to study the mechanical changes. The relative importance of nano-sized oxide additions was discussed in various temperature ranges with respect to grain growth.

Keywords: Nanocrystalline, Thermal stability, Grain growth, Stainless steel, Deformation induced martensite
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Creep Buckling Analysis of a Vertical Pressure Vessel During Post Weld Heat Treatment by Isochronous Stress Strain Curve

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Abstract
Abstract- Post weld heat treatment (PWHT) is a necessary method in the welded pressure vessels to increase the mechanical/metallurgical properties. In the current investigation, creep buckling analysis of a vertical pressure vessel made of SA-516 G70 during local post weld heat treatment at 650℃ by isochronous stress strain curve obtained by Omega method based on API 579-1/ASME FFS-1 is presented.

Keywords: PWHT, SA 516 G70, creep buckling, isochronous stress strain curve
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Influence of Copper on The Thermophysical Properties of a Green Mold

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Abstract
The aim of this work is to study the influence of copper on the thermophysical properties of a greensand mold during solidification of an A1100 pure aluminum casting. The silico-clay mold contains 4% water and 8% bentonite. Three mold conditions were studied: mold without copper, mold with two copper plates and mold with four copper plates. These plates, 1 mm thick and spaced 10 mm apart, are arranged in a plane perpendicular to the part's lateral faces. The study was limited to heat propagation in a single direction parallel to the plates, across the entire width of the mold. The instrumented molds were cast from pure aluminum at melting temperature. The thermophysical properties of each mold were calculated from the recorded temperature profiles, using the casting method. Temperature trends in the molds and comparative histograms of thermophysical properties were analyzed. Generally speaking, the results obtained show a fairly clear influence of copper on the mold's thermal behavior.

Keywords: Thermophysical properties, silico-clay mold, heat transfer.
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Correlation between hardness and mechanical characteristics of HDPE

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Abstract
The development of increasingly efficient materials is one of the concerns of manufacturers. The cost of the raw material, the ease of implementation shape of the parts, weight and recycling are also parameters to take account. Among the different families of materials, polymers take an important place because its properties can be adapted to the use by the incorporation of carbon black This work is a contribution to the development of a method simple to identify the properties of HDPE materials to respond to defects or incorrect behavior generated by the manufacturing process also allow easy and meaningful identification of parts defective. Our investigation focused on pure materials HDPE 5502 and HDPE TR144 produced by an Algerian polyamide company SP2K. First data exhaustive characterizing the rheological properties of HDPE materials which are systematic

Keywords: Black carbon 1, HDPE2, hardness3.
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Nokta Direnç Kaynağinda Oluşan Manyetik Alanin Farkli Malzemelerden Tasarlanan Kaynak Fikstürleri Üzerindeki Etkilerinin Sonlu Elemanlar Yöntemiyle Analizi

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Özet

Bu çalışmada otomotiv gövde ve şasi parçalarının üretiminde kullanılan alüminyum ve çelik malzemelerin, robotik nokta direnç kaynağı prosesinde kullanılan fikstürlerin birleştirme esnasında oluşan yüksek akımlar karşısında manyetik özellikleri araştırılmıştır. Bu amaçla, bilgisayar destekli tasarım programı ortamında, lineer ve non-lineer geometrilere sahip fikstür ekipmanları tasarlanmıştır. Fikstür materyali olarak st52-3 (yapısal çelik) ve yüksek manganezli manyetik özellik göstermeyen çelik seçilmiştir. Tasarlanan fikstür bilgisayar destekli analiz programında modellenerek 8000 amper değerinde akım uygulanmıştır. Bilgisayar ortamında modellenen fikstür sonlu elemanlar yöntemi kullanılarak magneto-statik olarak inclenmiştir. Analiz sonucunda, iki farklı materyale sahip fikstürler üzerinde oluşan manyetik alan şiddetleri, manyetik akı yoğunlukları ve manyetik akı yönelimleri elde edilmiştir. Analiz bulgularınca non-lineer geometriye sahip tasarımlarda daha fazla manyetik alan oluşumu gözlenmiştir. Yüksek mangenezli manyetik olmayan çelikte oluşan manyetik alan şiddetlerinin st52-3 (yapısal çelik) çeliğe göre daha az olduğu görülmüştür. Tasarlanan fikstürde karmaşık geometriye sahip olmayan bölgelerde daha az manyetik akı geçişi tespit edilmiştir. Fikstür ekipman üzerindeki boşluklu yapıların manyetik alan şiddetlerini arttırdığı gözlemlenmiştir.

Anahtar Kelimeler : Manyetik alan, Sonlu elemanlar analizi, st52, Yüksek manganezli manyetik olmayan çelik

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Investigation of the Hydration Mechanisms and Rheological Properties of Construction Chemicals Containing Unary, Binary and Ternary Binders

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Abstract
Cement-based construction chemicals contain fillers, additives, and mineral binders such as ordinary Portland cement (OPC), calcium aluminate cement (CAC) and calcium sulphate phases. Each raw material has a unique function, forming a holistic effect on the final product. The mineral binder systems used in construction chemicals can be unary, containing only OPC; binary, containing combinations of OPC, CAC, or calcium sulphate phases; or ternary, containing a combination of OPC, CAC, and calcium sulphate phases in varying ratios. For fast-setting applications, mostly CAC-contained systems are preferred, while for moderate-setting applications, mostly OPC-contained systems are favored. Calcium sulphate phases control the reaction rate. The performance of the product is based on its raw materials, determined by the mechanical properties of the formed structure after the reaction with water, a process called hydration. Although the properties of construction chemicals such as ceramic tile adhesive, self-leveling underlayment, and grout mortars differ depending on the usage area, they are expected to exhibit good adhesion, slip resistance, compressive properties, durability against extreme conditions, and adjusted rheological properties for user-friendly applications. Within the framework of the study, an investigation into the connection between the rheological profile of the products and the hydration response monitored by XRD and FT-IR was carried out. According to the results, increasing the ratio of CAC leads to an increase in viscosity due to differences in hydration compared to OPC. The inclusion of polymeric additives also alters the rheological profiles by decreasing viscosity, even in the presence of a high ratio of CAC.

Key Words : Cement, Hydration, Construction Chemicals, Rheology, XRD, FT-IR

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A356 Alüminyum Döküm Alaşımında Erbiyum Alaşım Elementi İlavesinin Akıcılığa Etkisinin İncelenmesi

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Özet

Alüminyum ve alaşımları dökülebilirlik, iletkenlik, korozyona karşı direnç, hafiflik ve diğer pek çok avantajlı özellikleri sayesinde otomotiv, havacılık, savunma, makine imalat endüstrisi gibi birçok alanda yaygınca kullanılan önemli bir mühendislik malzemesidir. Alüminyum döküm alaşımlarından kalite beklentisindeki artışa bağlı olarak farklı alaşım elementi ilaveleri ile alaşım özelliklerinin karakterizasyonuna yönelik çalışmalar devam etmektedir. Bu çalışmada A356 alüminyum döküm alaşımına %0,03, %0,06 ve %0,1 Erbiyum (Er) ilavesinin alaşımın akıcılığına etkisi kokil farklı kesit kalınlıklarına sahip dört kanallı akıcılık kalıbı ve spiral akıcılık kalıplara dökülmüştür. Sıvı metal temizliğinden kaynaklı hataların sonuçları etkilenmesinin önüne geçilmesi için sıvı metal döküm öncesi gaz giderme yöntemi ile temizleme işlemine tabi tutulmuştur. Kesit kalınlıklarının farklı olması dört kanallı akıcılık kalıbı değerlendirmesini zorlaştırdığından Akıcılık İndeksi ile değerlendirilmiştir. Elde edilen sonuçlarda Er ilavesinin artırılmasıyla alaşımın akışkanlığının azaldığı tespit edilmiştir.

Anahtar Kelimeler: A356 döküm alaşımı, Akıcılık, Akıcılık İndeksi, Erbiyum ilavesi, Sıvı metal temizliği

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Contribution to innovative concrete ovens for prefabrication

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Abstract
The prefabricated concrete industry using solar energy is one of the most complete materials available to the architect today to translate his vision of buildings and works.
Prefabrication has its advantages for the environment. Its durability helps to preserve natural resources, since it reduces the need for maintenance and reconstruction.
The objective is to solve two problems; the first is to accelerate the hardening of fresh concrete to reach mechanical resistance values, in a few hours, around 65 to 75% of the resistances at 28 days of normal hardening. The second is to use solar energy as a source of heat, non-polluting to the environment meeting the requirements of the sustainable development policy; this choice is justified by the abundance of renewable sources on the Algerian national territory.

Keywords: Precast concrete, Steaming, Solar energy, Mechanical resistance, Environment.
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Küresel Grafitli Dökme Demirlerin Özelliklerine Farklı Östemperleme Sıcaklıkların Etkisinin İncelenmesi

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Özet

Küresel grafitli dökme demirlerin mekanik ve mikroyapı özellikleri östemperleme olarak adlandırılan bir ısıl işlem ile iyileştirilebilmektedir. Östemperleme işlemi, parçanın kalınlığına bağlı olarak belirlenen bir süre boyunca, 240-400°C arasındaki sıcaklıklarda tuzlu su banyosunda bekletilerek gerçekleştirilir. Östemperlenmiş küresel grafitli dökme demirlerin mekanik ve mikroyapı özellikleri; döküm parçasına, tuzlu su banyosunda yapılan östemperleme sıcaklığı ve süresine bağlı olarak değişiklik göstermektedir. Tuzlu su banyosunda östemperlenme işlemi sonrasında ösferrit (iğnemsi ferrit) ve yüksek karbonlu östenit yapıları oluşmaktadır. Östemperleme sıcaklığı arttıkça, yüksek karbonlu östenit oranı artış göstermekte ve bu durum da malzemenin uzama değerlerini arttırmaktadır.

Bu çalışmada; bakırlı bir bileşim hazırlanarak sıvı metalin, kum kalıba dökülmesi yöntemi ile y-blok şeklinde küresel grafitli dökme demir numuneler üretilmiştir. Üretilen numuneler 900-950°C sıcaklığında 90-120 dakika östenitleme ile 335-365°C ve 245-275°C sıcaklığında 90-120 dakika östemperleme prosesine tabi tutularak östemperlenmiş küresel grafitli dökme demir malzemesi elde edilmiştir. Elde edilen ürünlerin akma mukavemeti, çekme mukavemeti ve uzama gibi mekanik özellikleri incelenirken ayrıca optik mikroskop ve taramalı elektron mikroskobu ile mikroyapı özellikleri de araştırılmıştır. X-ray diffraction (XRD) yöntemiyle hem as-cast hem de östemperlenme sonrası malzemelerde kristal fazların varlığı belirlenmiştir. Elde edilen sonuçlar bakırlı alaşımda düşük sıcaklıkta östemperlenme sonrası yüksek karbonlu östenit miktarında ve uzama değerlerinde bir düşüş olduğunu göstermiştir

Anahtar Kelimeler : Küresel Grafitli Dökme Demir, Östemperleme, ADI, Bakır,
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Structural and Morphological Analysis of Borided 2842 steel: The Effect of Boriding Temperature

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Abstract
2842 is a type of cold work tool steel featuring a balanced composition of elements such as chromium, tungsten, and manganese, designed for use at room temperature. Boriding is a surface hardening process that can be applied to many ferrous and non-ferrous alloys through a diffusion mechanism influenced by temperature. This process is typically conducted within a temperature range of 700 to 1400 °C, lasting from 1 to 16 hours [1]. One method of boriding, solid boriding, utilizes Ekabor II powders. In this method, Ekabor II is placed into a leak-proof stainless-steel box, with the samples to be borided positioned inside for the process [2]. In this study, 2842 cold work steel was borided at 900°C, 950°C, and 1000°C for 4 hours. To investigate the effect of boriding temperature on the structure and morphology of the 2842 steel, surface morphology analysis, structural analysis, and boriding thickness measurements were conducted using a X-ray diffraction (XRD), and scanning electron microscopy (SEM), respectively.
The boride layer thickness and structural characteristics of the steels were compared based on the boriding temperature. Therefore, it was observed that the boride layer thickness values increased with the increase of boriding temperature.

Keywords: 2842 steel, Boriding, Boriding Temperature, Thickness of the Borided Layer, Characterization
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Phy-X/PSD ve XCOM ile Bi_2O_3 katkısının bazalt camlarının radyasyon kalkanlama özellikleri üzerindeki etkisinin araştırılması

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Özet

Bu çalışmada, Bi_2O_3 katkısının bazalt camlarının gama ışını radyasyon kalkanlama özellikleri üzerindeki etkisi teorik olarak araştırılmıştır. Doğal volkanik kayaç bazalt bileşimine ağırlıkça % 10-50 oranında Bi_2O_3 ilave edilerek camlar üretilmiştir. Bi_2O_3 içermeyen Bi-0 numunesi 2,729 g/cm^3 ve ağırlıkça % 50 Bi_2O_3 içeren Bi-50 numunesi 4,018 g/cm^3 yoğunluk değerine sahiptir. Camların yoğunluk değerlerinde Bi_2O_3 katkı oranıyla lineer bir artış olduğu görülmüştür. Camların teorik kütle zayıflama katsayıları (μm, cm^2.g^{-1}) Phy-X/PSD yazılımı ve XCOM veri tabanı kullanılarak 0.015-15 MeV arasında ölçülmüştür. Ayrıca daha detaylı analiz yapılması amacıyla yarı-değer kalınlık (HVL), ortalama serbest yol (MFP), etkin atom numarası (Z_{etkin}), etkin elektron yoğunluğu (N_{etkin}) gibi radyasyon parametreleri de hesaplanmıştır. Cam bileşimine ilave edilen Bi_2O_3 oranındaki artışla radyasyon kalkanlama özelliklerinde bütün enerji seviyelerinde önemli iyileşmenin olduğu görülmüştür. Elde edilen bütün sonuçlar Bi_2O_3 katkısının bazalt camlarının radyasyon kalkanlama kabiliyetini arttırdığını ve bu camların radyasyon zırh alanında uygulama potansiyeline sahip olduğunu göstermiştir.

Anahtar Kelimeler: Bazalt, Bi_2O_3, Radyasyon Kalkanlama , Phy-X/PSD, XCOM
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Derin Öğrenme Tabanli Nesne Tespitinin Evrimi

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Özet

Günümüzde otonom sistemlerin daha ileri bir seviyeye ulaşabilmesi için yapay zekâ teknolojileri ile donatılmış sistemlere gereksinim duyulmaktadır. Geçmişte yapay zekâ da karar verme veya tahmin oluşturma süreçlerinde sadece makine öğrenmesi algoritmaları kullanılmıştır. Fakat günümüz teknolojisinde insan faktörüne olan bağlılık git gide azalmakta ve yerini derin öğrenme tabanlı sistemlere bırakmaktadır. Derin öğrenme yöntemleri, birçok araştırma ve uygulamada; görüntü işleme ve büyük miktardaki verileri başarılı bir şekilde yorumlama yeteneğine sahiptir. Özellikle görüntü işleme alanında, nesne tespiti son yıllarda üzerinde çalışılan popüler bir konu haline gelmiştir. Nesne tespiti, belirli bir sınıfa ait olan insanlar, hayvanlar veya arabalar gibi görsel nesnelerin dijital görüntülerde tespit edilmesiyle ilgilenen önemli bir bilgisayar görüşünün görevidir. Bu çalışmada nesne tespitinin tarihçesi ve evrimi konusunda bilgi verilmiştir ve nesne tespiti için güncel ve yaygın kullanılan derin öğrenme tabanlı yöntemler birbirleriyle karşılaştırılmıştır. Ayrıca nesne tespitinin uygumaları ve son yıllarda hangi alanlarda kullanılıyor konusu irdelenmiştir.

Anahtar Kelimeler : Yapay Zekâ, Derin Öğrenme, Görüntü İşleme, Nesne Tespiti.
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Use of Nanoclay-Containing Lid Packaging Film in Lavender Essential Oil Packaging

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Abstract
In this study, an environmentally friendly nanoclay-containing polymeric film (NPF) that can be used instead of environmentally damaging plastic lids used in food packaging was produced and its effect on the shelf life of lavender essential oil was examined by using it as a lid packaging film in the packaging of lavender essential oil.
For this purpose, lavender essential oil was covered with nanoclay-containing polymeric films and physicochemical analyzes were carried out in the control group, 2nd month, 4th month and 6th month. SEM analysis was applied to the produced nanoclay, and biodegradability, haze and FTIR analyzes were applied to the produced film. Then, acidity, peroxide, color, refractive index, viscosity and essential oil components analyzes were applied to the stored essential oil at specified intervals for 6 months.
As a result of these analyses, it was seen that the film showed a 31.74% deterioration in nature in the 6-month period, and the haze analysis result was determined as 87.17%. Acidity value (0.38%-0.68%), peroxide number (3.46-9.06), color results of lavender essential oil during storage *L (40.63-67.86), *a (-0 .89/-1.56), *b (3.92- 5.23), refractive index results (1.4578-1.4632) viscosity results (2.78-6.87 mPa) and dominant essential oil components linalyl acetate (27.04%-31.74%) and linalool (42.80%-46.6%), lavandulyl acetate (1.25%-1.35%), 1-8 cineole (3.44%-4.29%), camphor (4.07%-5.26%) and borneol (2.18%-2.89%). In line with these results; It has been determined that the nanoclay-containing polymeric films produced as lid packaging have as much protective effect as the plastic lid.

Key words: Biodegradable Film, *Lavandula Angustifolia,* Nanoclay, Pack, Physico-Chemical
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Manyetik Alan Azaltan Fırın Camı

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Özet

Bu çalışmada, beyaz eşya olarak her geçen gün kullanımı artan mikrodalga fırınların çalışma prensibi kaynaklı, kullanılması elzem olan ve magnetron tarafından üretilip, içerisinde bulunan besinlerin içerdiği su molekülleri ile etkileşim sonrasında sıcaklık artışı oluşturan elektromanyetik dalgaların fırın dışarısına etki etmesinin önlenmesi için kullanılan metal ızgarana yerine alternatif bir malzeme ile aynı işlevi ya da daha iyisini göstermesidir.

Mevcutta kullanılan metal ızgara, fırının iç yapısında metal çerçeveler ile oluşturulan faraday kafesinin bir yüzeyini oluşturmaktadır ancak bu ızgaranın metal sektörü ürünü olması kaynaklı karbon ayak izinin yüksek olması, üretim sonrasında montaj prosesinde işçilik, zaman ve malzeme kayıplarına neden olması kaynaklı faraday kafesinin bu ızgara tarafından oluşturulan yüzeyinin metal içerikli elektrik iletkenliğine sahip boya ile kaplanmış bir cam ile sağlanmasıdır. Kıstas olarak alınana ve EU bölgesinin standardı olan maksimum mikrodalgalar ölçüm yasal değeri 1.6 mW/cm²'dir. Proje nihai sonucu bu değerin altına inilmesidir.

Mevcut fırınlarda cam yüzey fırın iç haznesinin, son kullanıcı tarafında görünmesinin istenmesi sebebi ve temizlenmesin kolay olmasından dolayı tercih edilmektedir. Mevcutta kullanılan cam sadece bir baskı işlemi ile kullanılmaya devam edilecek ancak metal ızgaranın maliyet, üretim ve montaj zorluğu gibi olumsuz etkenlere sahip olmadan faraday kafesi prensibinden yararlanılmaya devam edilecektir.

Cam yüzeyine uygulanacak olan elektrik iletkenliğine ya da manyetik alan oluşturma özelliğine sahip baskı boyaları ile faraday kafesinin tamamlanması sağlanacaktır. Bu baskılarda kullanılacak olan boyalar gümüş, bakır, altın ve karbon içerikli olarak piyasada bulunmaktadır, yapılan literatür çalışmaları ve Yorglass firması deneyimlerinden dolayı organik içerikli boyaların cam yüzeyindeki mekanik ve fiziksel özelliklerinin istenilen seviyede olmamasında dolayı inorganik içerikli boyalar kullanılacaktır.

Kullanılacak boyanın belirlenmesi için gümüş, bakır, altın ve karbon içerikli boyalardan karbon içerikli boyalar organik içerikli olduğu için sadece değer karşılaştırması için kullanılmıştır. Gümüş, bakır ve altın içerikli boyalar ile yapılan denemelerde elektrik iletkenliği sıralaması Gümüş>Altın>Bakır şeklindedir, ölçümler voltmetre ile uçtan uca ölçüm ile yapılmıştır. Hem elektirik iletken seviyesi hem de maaliyet hesabı yapıldığında gümüş içerikli boyaların kullanımına karar verilmiştir.

Literatürde iletken boya, iletkenlik direnci 10-5 – 10-9 Ω.cm aralığında olan boyalar olarak tanımlanmaktadır. Deneme yapılan camlarda değer aralıkları bu değerleri karşılamaktadır.

Boyanın cam yüzeyine uygulanmasında serigrafi baskı yöntemi kullanılmıştır ve yöntem gereği kullanılacak olan ipeklerin boya geçirgenlik seviyelerine göre 3 farklı değerde ipek(77-90-120T), kullanılan boyaların % olarak içerdikleri metal içeriklerin, oranlarına göre 3 farklı değere sahip boya(40-50-60) ve farklı deseneler ile oluşturulan desen kalınlığı, baskı mikron kalınlığı gibi 3 farklı değer ile 27 farklı deneme sonucu değerlendirilmiştir ve optimum deneme sonucuna göre nihai ürün denemelerine geçilmiştir.

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Boyaların uygulandığı camların ölçümlerinde orta bölgelerinde elektromanyetik dalga çıkışının kabul edilebilir seviyede olduğu görülmüştür. (0,8-1,2 mW/cm²) Kapak kenar bölgelerinde ise camın kapak kenarlarına istenilen yakınlığın, kapak tasarımından dolayı yaklaşamadığı için manyetik dalga ölçümü 3-5 mW/cm² arasında ölçülmektedir. Kapak tasarımının değiştirilmesi ile cam kenarlarının fırın çeperine yakınlaşması sonrasında 0,8-1,2 mW/cm² değerlerine yaklaşılması hedeflenmektedir.

Anahtar Kelimeler: Mikrodalga Fırın, Faraday Kafesi, Gümüş İçerikli Boya, Elektrik İletkenliği, Manyetik Alan

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Obtaining Easy to Clean Oven Glasses Using the Sol-Gel Method

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Abstract
In this study, the effects of various parameters such as the type of glass after coating, chemical composition and concentration, temperature, duration, etc., on the mechanical resistance (particularly scratch resistance), optical properties, thermal durability, corrosion resistance, gloss value, oleophobicity, and hydrophobicity of easy-to-clean coated glass were analyzed for the white goods sector, which has high hygiene expectations. Two different solutions were prepared using tetraethyl orthosilicate (TEOS, 99%) and ethanol (EtOH, 99%), Titanium tetraisopropoxide (TTIP, 97%), methyltrimethoxysilane (MTMS, 95%), and hydrochloric acid (HCl) via the sol-gel method. Coatings were applied to the glass surface by the spray method and then dried. The contact angle measurements, which are crucial for easy cleanability after coating, were recorded as 102 degrees and 94 degrees. After subjecting the coated glasses to an annealing process at 350 degrees for 30 minutes, the contact angles were measured as 95 degrees and 90 degrees. To assess the functionality of the coatings, various substances such as milk, oil, ketchup, lemon, vinegar, and coffee were spilled onto the glasses with different coatings and left in an oven at 300 degrees for 30 minutes. After this process, contact angle measurements were taken for oil and water on the surfaces with stains, and the contact angles before and after the tests were compared to evaluate the functionality of the coating.

Keywords : Easy cleanability, Oleophobicity, Hydrophobicity,
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Kinetics of Dependent on Time the Cake Thickness Formation in Pressure and Non-Pressure (Slip) Ceramic Casting

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Abstract
Pressure and non-pressure (slip) ceramic casting methods are used to produce complex shaped ceramics by pouring casting slurry, which becomes fluid with the use of materials such as binders, deflocculating agents and water, into suitable casting molds prepared by creating models according to the desired product in industrial applications. The slurry can be fluidized by the defloculant agents in the solutions of high volume solids containing ceramic powders. Due to the absorpsing properties of the casting molds by capillary forces, the cake thicness is formed to are been filtered the water from the suspending to casting mold and a densely paced layer of particles to be deposited againt the mold wall. While In non-pressure casting, the separation of water from the the slurry to the casting mold obtains spontaneously depending on the absorption ability of the casting mold through capillary forces, In pressure casting, this separation mecanism obtains by externally applied to slurry pressure that activated the absorping properties of its.
In the present study, the cake thickness formation was obtained by applying non-pressure and pressure ceramic casting methods with using the slurry which specially prepared ceramic raw material compositions such as granulated ceramic powder, deflocculating agents and water in industrial applications. The kinetics of cake thichness formation from slurry was studied using two different methods. The kinetics of dependent on time the cake thickness formation with the effect of the pressure applied were evaluated. Accordingly, the values of the calculation and the values of the experimental measurements for the kinetics of cake formation mechanism were shown as parabolic graphs. Depending on the applied pressure, in pressure casting it has been observed that the cake thickness formation kinetics was to up 7 times faster and the green density was to obtain more than in non-pressure casting.

Key Words: Non-pressure (Slip) casting, Pressure casting, The kinetics of ceramic cake thichness formation, Casting time
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Investigation of the Effect of Heat-treatment on Charpy Impact Energy of 3D Printed Ti6Al4V Specimens

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Abstract
One of the inevitable problems in 3D printed specimens is the presence of porosities that leads to reduce the mechanical properties. In this research, 3D printed specimens made of Ti6Al4V alloy were produced utilizing SLM (Selective Laser Melting) process. By performing heat-treatment at 900°C, its effect on different porosity content and in particular, on Charpy impact energy at different temperatures was investigated. To determine the phases in the microstructure of the specimens, X-ray diffraction method (XRD) was used. Microstructural evaluation was carried out with elaborate investigations by optical and scanning electron microscope (SEM). The results show that in specimens without porosity, heat-treatment leads to microstructural improvement and as a result increasing in mechanical properties specially in impact energy. In contrast, in specimens with high porosity content the improvement of structure did not have even partial effect on impact energy. It illustrates that the high amount of porosity had adverse impact on the absorbed energy in Charpy impact test. So, high porosity content as a disadvantage overcome the microstructural improvement as an advantage in 3D printed specimens of Ti6Al4V alloy.

Keywords: 3D printed Ti6Al4V, Charpy impact test, Heat-treatment, Porosity.
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The Influence of Different Porosity Content on Charpy Impact Energy of Selective Laser-Melted Ti6Al4V Alloy

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Abstract
In the present study, additive manufactured specimens made of Ti6Al4V alloy were prepared utilizing SLM (Selective Laser Melting) process with different amounts of porosity including (without porosity, medium porosity and high porosity). Charpy impact test carried out in the range of room temperature to (- 60°C) to evaluate the effect of porosities characteristics on absorbed energy in Charpy impact test at different temperatures. Microstructural evaluation was carried out with elaborate investigations by optical and scanning electron microscope (SEM). To determine the phases in the microstructure of the specimens, X-ray diffraction method (XRD) was used. The results indicate that the amount of porosity had a significant effect on the absorbed energy in Charpy impact test. So that the impact resistance of 3D printed specimens of Ti6Al4V alloy without porosity showed extreme changes with temperature changes (reaching to higher upper shelf at room temperature). However, the impact resistance of mentioned specimens with high porosity amount did not depict a significant change between upper shelf and lower one.

Keywords: Additive manufacturing, Charpy impact test, Ti6Al4V, Porosity.
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LA-ICP-MS Analysis of Middle Age Glass Bracelets

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Abstract
The chemical characterization of ancient glass provide significant information of the glass production technologies and the development of the techniques in time. Yumuktepe Mound was located at the city centre of Mersin, the Mediterranean coast of Turkey. The characteristic Middle Age (10-13th) glass jewellery findings from Yumuktepe show the link between Islamic states of Western and Eastern Anatolia, Cyprus, Levantine and Mediterranean. In this study, 30 glass bracelet samples were analyzed by LA-ICP-MS to enlight the chemical composition of glass samples. The results show all samples were defined as soda-lime-silica type of glass. The colouring, decolouring and opacifying agents of different colours of glasses (blue, turquoise, green, red, amber and purple) were detected. Cobalt is responsible of the blue colour of blue glass bracelets. Turquoise hue from green to blue may caused by the variable contents of copper, lead and iron in samples. The high value of correlation calculation between Ba-Mn demonstrates the psilomelane ($(Ba,H_2O)_2Mn_5O_{10}$) contributed to glass as decolouring agent instead of pyrolusite (MnO_2) in all turquoise samples. Elevated quantities of iron in green glasses indicates the intentional addition of iron and the correlation coefficient between iron and chromium shows the chromite was contributed to the glass batch to colour the glass green. Divalent state of copper was found as the main opacifier and colourant of red opaque glasses. Pyrite (FeS) may added to the glass for amber colouring, however the element of S was not analyzed in this study. Calcium antimonate was determined as the opacifying agent for amber glass due to the positive correlation between calcium and antimony.

Key Words: LA-ICP-MS, Middle Age Glass Technology, Archaeometry.
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Endüstriyel Atıkların Radyasyon Zırh Camı Olarak Kullanılabilirliğinin Araştırılması

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Özet

Bu çalışmanın amacı, çeşitli endüstriyel atıkların radyasyon kalkanlama özelliğine sahip camların üretiminde kullanılabilirliğini teorik olarak incelemektir. Çalışmada, uçucu kül, Kümaş refrakter üretim atığı ve bor üretim atığı gibi endüstriyel atıkların radyasyon kalkanlama camı üretiminde kullanılabilirliği araştırılmıştır. Camların radyasyon kalkanlama parametreleri Phy-X/PSD yazılımı kullanılarak 0,08-1,33 MeV arasında hesaplanmış ve bazı teorik camlar ile karşılaştırılmıştır. Tüm atıklar için birbirine yakın sonuçlar elde edilmiştir. Hesaplamalara göre, düşük enerji seviyelerinde uçucu kül atığı nispeten daha iyi sonuçlar sergilerken, bor üretim atığı ve Kümaş refrakter üretim atığı yüksek enerji seviyelerinde daha iyi radyasyon kalkanlama özellikleri sergilemiştir. Atıkların teorik yarı değer kalınlıkları (HVL), bazı ticari radyasyon zırh camları ile kıyaslanmış ve kurşun içermeyen RS253, RS253-G18 ve RS323-G19 gibi bazı ticari camlara göre daha iyi sonuçlar göstermiştir. Tüm bu sonuçlar uçucu kül, bor üretim atığı ve Kümaş refrakter üretim atığının radyasyon zırh camı üretiminde kullanım potansiyelinin olabileceğini göstermektedir.

Anahtar Kelimeler: Radyasyon Kalkanlama, Atık, Phy-X/PSD
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Characterization and repairing defects analysis of MMC- HVOF coated rollers of roller screen used in iron ore pelletizing plants

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Abstract
In this research work, thickness and its deviation, microstructure homogeneity and porosity, surface interface alumina blasting and sublayer steel microstructure of tungsten carbide reinforced metal matrix composite (MMC) High Velocity Oxy-Fuel(HVOF) coated roller have been characterized. Repairing procedure of some superficial failed rolls microstructure included: surface polishing, compensating coating and finishing were examined. Scanning Electron Microscopy (SE and BSE) and Energy Dispersive Spectrometer (in point, window and map modes) have been employed for microstructural observation and evaluation. Feed powder, Hardness and wear behaviour also have been studied for precise examination of coatings. In every point of view, results have been showed that, presence of more than 200 micron of coating led to formation of micro-porosity colonies in upper 70 micron of coating due to hindered thermal transfer from coating along the thickness. This localized defect could act as crack initiation and propagation sensitization agent. So each stress source applied to coatings either in situ (at work) stresses or repair polishing could let to failure origination. At the other side, polishing of superficial failed sample for next compensating coating as preparation stage led to a smooth surface with very low roughness, so mechanical interlock probability between old coating and new coating (as repairing with 50micron thickness) were weakened significantly. Localized porosity and weak interlock led to fully detachment of repairing coating during surface finishing stage. So lower thickness of HVOF MMC coating and only 70-micron peeling (polishing or machining) were suggested to supplier for long lasting and reliable repairing of rollers.

Keywords: Surface polishing, thickness, microstructure, micro-porosity.
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Comprehensive failure analysis of rollers of roller screen used in iron ore pelletizing plants

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Abstract
In this research work, failure routes causes have been studied for three types of rollers used in Sirjan pelletizing plants includes: 304 ss steel, 1.4313 steel, hard chromium coated st52 steel. Macroscopic and statistical categorizing, metallography, hardness test, quantometer, Scanning Electron Microscopy and Energy Dispersive Spectrometer (in point, window, line and map modes) have been employed for rollers failures analysis.
Major and minor reasons of each type of rollers failures were determined based on examinations results as: low yield strength and low harness (201 HV) led to wear and mechanical deformation of 304 ss, pitting corrosion led to extra roughness of 1.4313c surface(lowering screening efficiency) and heterogeneous microstructure resulted in torsion of 1.4313 rollers, very thick (up to 200 micron) hard chromium coating on st 52 steel pipes acts as two independent un-coherent components that cracked separately at interface, during rotation and coated rolls failed due to local severe coating detachments. Some suggestions for modification and long-lasting of rolls fabrication and heat treatment stages have made the for-roll suppliers.

Keywords: 304 ss steel, 1.4313 steel, hard chromium coated st52, microstructure
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Controlling the Degradation Rate of Magnesium Alloys for Biomedical Applications

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Abstract
Metallic biomaterials are widely used in bone implants (bone fixation devices) due to their great mechanical properties. Stainless steels and titanium alloys are frequently used and deployed in the patients for several decades. Unfortunately, it has been reported that these alloys have some adverse effects on the human body (like the stress shielding effect, bio-inertness, the requirement of revised surgery, etc.). Therefore, engineers and scientists are continuously making efforts to find out the alternative options. "Magnesium alloys" has been the researcher's hotspot for last 20 years due to their excellent physical and mechanical properties. However, their fast degradation rate in the physiological environment limits them to be utilized as a bone implant material. Therefore, the aim of this project is to slow down the degradation rate of magnesium (Mg) alloy by applying a bio-ceramic layer on it. For this, "Micro Arc Oxidation" (MAO) coating process has been performed to modify the surface and control the degradation rate of Mg alloy. To achieve the necessary attributes, the coating parameters, including current density, voltage range, and oxidation time were properly adjusted and optimized. In addition to this, coating phases, morphology, and composition were investigated through different characterization techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDS). Moreover, the samples were immersed in the simulated body fluid (SBF) for several days to evaluate the apatite formation and eventually the In-vitro bioactivity. Further, the electrochemical degradation rate was analyzed via potentiodynamic polarization (PDP) and Electrochemical Impedance Spectroscopy (EIS). The overall results are encouraging and this effort provides important information for developing improved bone fixation / implantation solutions.

Keywords: Micro Arc Oxidation, Magnesium Alloy, In vitro Bioactivity, Electrochemical Impedance Spectroscopy
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Otomotiv Sektöründe Epoksi Toz Boya Öncesi Dönüşüm Kaplama İşlemlerinin Korozyon Dayanımına Etkisinin İncelenmesi

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Özet

Dönüşüm kaplamaları otomotiv sektöründe yaygın olarak kullanılmaktadır. Yüzeyin bir sonraki prosese hazırlanması ve korozyon dayanımına olumlu yönde etkisi olduğu bilinmektedir.

Bu çalışmada, demir fosfat ve zirkonyum esaslı dönüşüm kaplamaları kullanılmıştır. 6224 çelik üzerine kaplamalar yapılıp, elektro-statik toz boya ile boyandıktan sonra numuneler 400 saate kadar ISO 9227 Tuz testine ve 500 saate kadar VDA 233-102 Çevrimli Korozyon testinin döngülerine maruz bırakılmıştır. Korozyon testine tabi tutulan numuneler, sektörde kullanılan ISO görsel değerlendirme standardı, çapraz kesme testi, X Işınları Difraktometresi (XRD), Taramalı Elektron Mikroskobu (SEM), pin-on-disk aşınma testi ve boya kalınlık ölçümü gibi metotlar kullanılarak karakterize edilecektir.

Yapılan boya kalınlık ölçümünde zirkonyum esaslı nano seramik kaplamanın elektro-statik boyaya daha homojen tutunduğu ve numune üzerinde demir fosfat kaplamaya göre daha kalın boya kalınlığı oluşturduğu görülmüştür. Planlanan karakterizasyon teknikleri ile uygulanan testler sonucunda kaplamaların korozyon dayanımı üzerine kıyaslama yapılacaktır.

Anahtar Kelimeler : Dönüşüm Kaplama, Tuz Testi, Fosfatlama, Korozyon.
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Characterization of Etched and Functionalized Silicon Nanocrystals

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Abstract
Silicon remains the dominant material in photovoltaic (PV) technology. However, the high processing costs of monocrystalline and polycrystalline wafer technologies necessitate more economical alternatives. Silicon nanocrystals (Si-NCs) present a promising solution for cost-effective PV module production. In this work, free standing Si-NCs with a mean diameter of ≤50nm is utilized with a pretreatment process followed by functionalization. Silicon having strong affinity towards oxygen, develops an oxide envelop as exposed to air which make it electronically inert. Removal of oxide layer by an etching process is crucial as pretreatment process followed by attachment of styryl and 1-ethenyl-4-fluoro benzyl conjugate moieties on hydrogen-terminated Si-NCs via hydrosilylation of phenylacetylene and 1-ethynyl-4-fluoro benzene, respectively.
Characterization via scanning electron microscopic (SEM), high resolution transmission electron microscope (HRTEM), Fourier transformation infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopic (XPS) validated the etching and functionalization processes. However, electronic properties are validated by preparing thin-films of these functionalized Si-NCs with different thicknesses in a purposed device architecture at room temperature.

Keywords: Silicon Nanocrystals, Etching, Functionalization
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Comparison of Conventional Friction Stir Welding and Bobbin Friction Stir Welding for Joining Space Grade Aluminum Alloy 6061-T6

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Abstract
This Study aims to compare the properties attained by the butt joint of a common space grade Aluminum alloy 6061-T6, fabricated by the technique of Conventional friction stir welding and Bobbin friction stir welding in a cheapest possible way. The most common equipment or machinery, such as muffle furnace, conventional milling machine and lathe machine were utilized for the fabrication of tools and joints. The two out of four successful joints were fabricated in this study, which were found to contain the average tensile strength of 128Mpa along 65-97% of average base metal hardness.

Keywords: Friction Stir Welding, Pin tool, Bobbin tool, Design, 6061-T6, H13, Space grade
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Güneş Simülatöründe Ölçüm Belirsizliğinin Değerlendirilmesi

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Özet

Ölçüm belirsizliği analizinde kullanılan kılavuz (GUM), belirsizlik analizinin standartlaştırılması ve iyileştirilmesi konusunda büyük katkılar sağlayarak çeşitli endüstri ve araştırma alanlarında yaygın olarak uygulanmaktadır. Güneş enerjisi sektörünün hızla gelişmesiyle birlikte, fotovoltaik (PV) ölçümler gibi spesifik uygulamalar için detaylı belirsizlik analizlerinin gerçekleştirilmesi büyük önem kazanmaktadır. Fotovoltaik akım-gerilim (I-V) özelliklerinin ölçüm belirsizliği analizine yönelik olarak geliştirilmiş özel kılavuzlar bulunmaktadır. Bu kılavuzlar arasında Fraunhofer ISE 2013 modeli (Dirnberger Modeli) öne çıkmaktadır.

Bu çalışma, IEC 60904-1 standardına uygun olarak iki farklı referans modül ile Fraunhofer ISE 2013 modelinin uygulanmasını içermektedir. Çalışmada, etkin ışıma, modül yüzey sıcaklığı, I-V eğrisi ölçüm noktaları, standart test koşullarının doğrulanması, veri yerleştirme (fitting) ve tekrarlanabilirlik gibi faktörler dikkate alınmıştır. Bu faktörler ayrı ayrı değerlendirilerek, genel elektriksel parametrelerin (Isc, Impp, Voc, Vmpp, Pmpp, FF) ölçüm belirsizlikleri belirlenmiştir. Kalibrasyon modüllerinin ölçüm belirsizliğindeki azalmanın genel belirsizlik değerleri üzerindeki etkisi incelendiğinde, Isc, Impp, Voc, Vmpp, Pmpp ve FF değerlerinde sırasıyla 2.7, 1.9, 2.2, 1.3, 2.6 ve 2.8 kat iyileşme gözlenmiştir. Bu iyileşme, fotovoltaik ölçümlerde belirsizlik analizlerinin anlaşılması ve uygulanmasını geliştirerek sektördeki ölçüm güvenilirliğini artırmıştır.

Anahtar Kelimeler : Ölçüm Belirsizliği, Fotovoltaik Modül, Akım-Gerilim(I-V) Eğrisi
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Dissolution of Electric Arc Furnace Slag in Water: Effect of Temperature on Element Releases

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Abstract
Due to its sustainable approach, the green transition in steel manufacturing has increasingly favored using electric arc furnace (EAF) processing. Following EAF production, the origination of EAF slag, on the other hand, emerges as a significant challenge to the scientific community because of its accumulation in nature, which results in severe ecological hazards. Specifically, the complexity of EAF slag mineralogy is another difficulty that needs to be tackled when considering the utilization of these byproducts in various application areas. With these in mind, this study aimed to understand the dissolution of EAF slag in water media and examine the effect of temperature on elemental releases. After determining the specific surface area, chemical composition, and mineralogical phases of EAF slag, a solid-to-liquid ratio of 1:100 g/mL was considered in dissolution tests. The solutions were mixed separately using magnetic stirring at 22 and 60 °C temperatures for an hour. In the meantime, aliquot samples at 15, 30, and 60-minute intervals were collected to determine elemental releases via Inductively Coupled Plasma Optical Emission spectroscopy (ICP-OES). According to the ICP-OES results, the elemental releases were limited to only Al and Ca at 22 °C; however, the temperature increase enhanced Al and Ca releases and paved the way for the release of Si. Additional characterization techniques, such as Fourier transform infrared, X-ray photoelectron spectroscopy, and scanning electron microscopy, also revealed surface chemistry and morphology alterations. As a result, this study demonstrated that the intricate structure of EAF slag may restrict more elemental releases under ambient conditions; nevertheless, the temperature increase can aid in releasing more elements into the solution. Therefore, these findings may be exploited by alkali activation, resource recovery, and carbon mineralization fields to a greater extent.

Keywords: Electric arc furnace slag, Dissolution, Extraction, Resource recovery, Sustainability
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Alkali-Activated Stone Wool: A Non-Mechanically Processed Adsorbent for Dye Removal

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Abstract
This study examines the adsorption properties of stone wool activated through alkali treatment without mechanical processing. Mineral wool samples were immersed in a 1M alkali activator solution for 1 h, 5 h, and 24 h to investigate the effect of treatment duration on their adsorption capabilities. After 24 h of alkali activation, one sample was subjected to thermal treatment. The adsorption performance was evaluated through dye removal tests using 100 mg×L^{-1} dye concentration, 1 g/L adsorbent dose, 48 hours contact time, and pH of 7. The samples were characterized using Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD), and Scanning Electron Microscopy (SEM). 4.89 mg/g, 26.26 mg/g, 54.84 mg/g, 63.85 mg/g and 6.95 mg/g methylene blue adsorbed by raw stone wool, 1 h, 5 h, and 24 h activated and heat-treated stone wool, respectively. That shows adsorption capacity improved with alkali activation duration; however, the thermally treated sample exhibited a significant loss in adsorption capacity, showing similar properties to untreated stone wool. This suggests that the thermal treatment may have negated the effects of alkali activation, possibly by altering the surface reactivity or reducing the availability of functional groups responsible for adsorption, as indicated by FTIR analysis. XRD and SEM analyses further confirmed changes in crystalline structure and morphology that correlated with this decline in performance. The study underscores the need for careful optimization of processing conditions for alkali-activated mineral wool, as prolonged alkali treatment enhances adsorption, but thermal treatment can negate these benefits. The findings suggest that alkali-activated, non-milled mineral wool offers promising adsorption capacity, providing a sustainable and cost-effective alternative for cationic dye removal.

Key words : Adsorption, Alkali Activation, Methylene blue removal, Stone wool
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Effect of curing by Solar Energy on production, mechanical Strength and technology innovative concretes

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Abstract
The prefabricated concrete industry using solar energy is one of the most complete materials available to the architect today to translate his vision of buildings and works.
The objective of this study is to clarify the influence of atmospheric steam curing in a solar radiation (energy) curing chamber on the mechanical resistance of concretes. An experimental program was carried out to study the effect of the w/c ratio (0.4, 0.5 and 0.6), the influence of the type of cement and curing (water, air and curing at 29 °C and 45 °C). Six formulations of similar workability based on two cements (CEMI 42.5) and (CEM II/B 42.5). The results allow us to highlight the beneficial effect of the curing procedure to obtain maximum compressive strength, especially at early age. The solar energy steam curing technique is an effective technique to accelerate the curing of concretes, for good strength and great savings in electrical energy. The results obtained show a gain in concrete manufacturing times to achieve mechanical resistance at 28 days in service in the open air and this after a one-day drying and a 3-day extension of hardening in the open air.

Keywords: Prefabricated concrete, Steam curing, solar energy, Mechanical strength.
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Su Bazlı İç Cephe Boyalarda Çatlamayı Etkileyen Faktörlerin Belirlenmesi Ve Ürün Performansının Geliştirilmesi

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Özet

Su bazlı iç cephe boyaları, mekanları estetik olarak iyileştiren, koruyucu bir kaplama sağlayan ve çevre dostu bir seçenek sunan bir kaplama malzemesidir. Ancak su bazlı iç cephe boyalarında uzun süreli performansını etkileyen bazı sorunlar oluşabilir. Bu sorunlardan biri de çatlama problemidir. Çatlama problemi boyanın estetik görünümünü ve koruyucu performansını olumsuz etkileyen ciddi bir problemdir. Bu problemin oluşmasında yüzey hazırlığı, iklim koşulları, boya formülasyonu ve uygulama teknikleri bir çok faktör yer almaktadır. Bu sebeple, su bazlı iç cephe boyalarda çatlama problemini minimize etmek, ürün kalitesini arttırmak ve müşteri memnuniyetini sağlamak için büyük önem taşımaktadır. Bu çalışmada, su bazlı iç cephe boyalarında çatlama problemine yol açabilecek temel faktörler detaylı bir şekilde incelenmiştir. Çalışma kapsamında, yüzey hazırlığının çatlama üzerindeki etkisi, boyanın pigment hacim konsantrasyonunun (PVC) çatlamaya etkisi, bağlayıcı ve film oluşturucu ajanların farklı oranlarının malzeme performansına etkileri değerlendirilmiştir. Ayrıca, dolgu maddelerinin tanecik boyutlarının, boyanın çatlama direnci üzerindeki rolü ve bağlayıcının minimum film oluşturma sıcaklığının (MFFT) çatlama eğilimine olan etkisi sistematik olarak analiz edilmiştir. Bu çalışmada çatlamaya neden olan faktörler detaylı bir şekilde analiz edildikten sonra, elde edilen veriler ışığında, literatürde yer alan önceki çalışmalarla uyumlu ve 200 farklı boya örneği üzerinde yapılan deneylerle desteklenen yeni bir test metodu geliştirilmiştir. Yapılan literatür araştırmaları ve laboratuvar çalışmaları sonucunda, gerçek zemin uygulamalarının laboratuvar ortamında simülasyonunun daha kısa sürede gerçekleştirilebileceği bir test metodu geliştirilmiştir. Bu yeni test metodu, yüksek bir hassasiyetle çatlama performansını değerlendirebilmekte ve sonuçların tekrarlanabilirliğini artırmaktadır. Geliştirilen yeni test metodu kontrollü koşullar altında gerçekleştirildiği için dış etkenlerden bağımsız olarak daha tutarlı sonuçlar elde edilmesine olanak tanımaktadır. Ayrıca, bu yöntem, hem zamandan tasarruf sağlamakta hem de test süreçlerinin maliyetini önemli ölçüde azaltmaktadır. Bu sayede, su bazlı iç cephe boyalarının çatlama performansı daha hızlı, güvenilir ve ekonomik bir şekilde analiz edilebilmekte, ürün geliştirme süreçlerinde kritik bir araç olarak kullanılabilmektedir.

Anahtar Kelimeler : Su bazlı iç cephe boya, çatlama performansı, test metodları
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Average Friction-Drop Ratio Approach for Manifold Flow Hydraulics Based Uniform Outflow Profile

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Abstract
In this paper an analytical procedure taking into account "*uniform outflow profile*" for hydraulic analysis and design of multiple outlets pipelines, is presented. To determine friction head losses, the Darcy-Weisbach formula is used here; and the kinetic head change is considered whereas minor head losses are neglected. This method simulates pressure and outflow profiles along trickle and sprinkler irrigation laterals and manifolds, as well as gated pipes. The presented technique was applied to several computational examples to clarify its precision for trickle and sprinkler lateral design and, the analytical results were compared with those obtained using the numerical step-by-step method.

Keywords: Water pipelines; Steady-state analysis; Hydraulic networks; Uniform Outflow.
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4rd International Symposium on Characterization (ISC'24)
16-18 October 2024, Sakarya, Türkiye

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Analytical Relationships for Water Application Uniformity Parameters

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Abstract
An important objective of a micro-irrigation system is to determine the proper operating inlet pressure head which ensuring the desired level of water application uniformity as well as the allowable pressure head variation along the multi-outlet pipeline. In this analysis some mathematical expressions were deduced to relate three uniformity parameters; then the operating inlet pressure head is simply reformulated by taking into account a multiplying factor, α to the required average outlet pressure head, in terms of three uniformity parameters. Resulting, the influence of different uniform pipe slopes on the water application uniformity and the operating inlet pressure head for various emitter discharge exponents, was evaluated. In addition, to cover various design combinations an extensive comparison between the proposed equations and those of the previous studies was also presented.

Keywords: Water pipelines; Steady-state analysis; Hydraulic networks; Uniformity criteria.
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4rd International Symposium on Characterization (ISC'24)
16-18 October 2024, Sakarya, Türkiye

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Graphical Solution Based Design Curves for Outflow Uniformity Patterns

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Abstract
An important objective of a micro-irrigation system is to determine the proper operating inlet pressure head which ensuring the desired level of water application uniformity as well as the allowable pressure head variation along the multi-outlet pipeline. In this analysis some mathematical expressions were deduced to relate three uniformity parameters; then the operating inlet pressure head is simply reformulated by taking into account a multiplying factor, α to the required average outlet pressure head, in terms of three uniformity parameters. Resulting, the influence of different uniform pipe slopes on the water application uniformity and the operating inlet pressure head for various emitter discharge exponents, was evaluated. In addition, to cover various design combinations an extensive comparison between the proposed equations and those of the previous studies was also presented.

Keywords: Water pipelines; Steady-state analysis; Hydraulic networks; Uniformity criteria.
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Characterization of the Weldability of Steel Materials Used in Ship Building

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Abstract
In this study, we report the weldability of steel materials used in ship building. The effect of welding current on weld quality is examined. TIG and MIG welding methods are applied to 2,5 mm thick DIN EN 1.3964 austenitic stainless steel with different parameters. Tensile testing, hardness measurement and microstructure examination are performed on the specimen. According to the hardness test results, the highest hardness value is generally measured in the base metal. It is observed that the main material has a higher hardness than the HAZ(heat affected zone) and weld metal. According to the tensile test results of TIG welding samples, the fractures mostly occur in the base metal outside the HAZ zone. When the tensile test results of TIG welding samples are examined, ruptures mostly occur in the welding area. When the microstructure images are examined, it is observed that a small number of pores are formed in the weld areas and a columnar structure is formed at the grain boundaries. It is determined that the best parameter value for samples joined with TIG welding is 70 amper of current and 10 l/min of protective gas flow pressure, and the best parameter values of samples joined with MIG welding are 126 amperes of current and 22 volts of voltage.

Keywords: Stainless Steel, TIG, MIG, microstructure
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Comparison of Mechanical and Microstructural Properties of Dh36 Shipbuilding Steel using Different Welding Techniques

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Abstract
The effects of varying welding techniques on the microstructure and mechanical properties of DH36 steel are studied. When considering the use of different welding materials, it is evident that the choice directly affects the grain size and phase composition in the weld zone. The welding speed plays a critical role in determining the cooling rate, which affects the microstructural characteristics of the heat-affected zone (HAZ). A higher welding speed leads to a rapid cooling rate, promoting the formation of harder but more brittle martensitic structures, thereby affecting the ductility of DH36 steel. Furthermore, the interaction between welding speed and the thermal conductivity of the material can further complicate the microstructural evolution of the filler material, as higher conductivity can distribute heat more evenly across the weld area, mitigating some of the adverse effects of rapid cooling. Therefore, understanding the complex relationship between welding materials, speeds, and the resulting microstructure is critical for optimizing welding processes of DH36 steel to achieve desired mechanical properties and performance. In this study, the role of DH36 steel in marine engineering applications, including its mechanical and microstructural properties are investigated. This study, which analyzes the hardness distribution in the weld zone, heat affected zone (HAZ) and base material, provide information on the material properties of DH36 steel. Spectrometry analyzes are performed to better understand the welded areas of DH36 steel samples. Through this comprehensive review, it is aimed to contribute to the advancement of knowledge regarding the material and structural properties of DH36 steel.

Keywords: DH36 steel, welding, destructive testing, non-destructive testing, characterization
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Comparison of Surface Roughness Prediction in WEDM with Traditional Analysis Methods and ChatGPT

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Abstract
Artificial intelligence (AI) applications and use in output predictions in manufacturing are becoming increasingly widespread with Industry 4.0. Human-controlled mathematical calculations and coding are gradually being replaced by self-thinking, intelligent machines. This study investigates ChatGPT, the most widely used and known among AI applications, for output prediction in manufacturing. WEDM output predictions made with linear and full factorial regression models using ChatGPT were compared with traditional analysis methods. The inputs for WEDM studies are T_{on}, T_{off}, and voltage; the output to be predicted is surface roughness. Predictions made by traditional analysis methods Taguchi, ANOVA, and linear regression were compared with ChatGPT. ChatGPT was given only six experimental results instead of all experimental results and was asked to make predictions accordingly. In the error calculations, the Taguchi method gave the best result (0.85%), and the full factorial regression analysis performed by ChatGPT gave the worst result (2.89%). However, ChatGPT gave a better result in linear regression (1.79%). The study has shown that the AI model gives acceptable output prediction results even though very few experimental results are given for training compared to traditional methods and can be used for output predictions for manufacturing in the future.

Keywords: WEDM, Surface Roughness, Prediction, Taguchi, ANOVA, Regression, ChatGPT.
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Isıl Yaşlandırmaya Dayanıklı Poliamid 6 Kompozitlerin Geliştirilmesi ve Üretilmesi

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Özet

Gelişen elektrikli araçlar teknolojisi ve otomotiv sektöründe her geçen gün artan yenilikler ile kullanılan malzemelerin gereksinimlerini değiştirmiştir. Hafiflik, işleme kolaylığı, maliyet gibi önemli avantajlara sahip plastikler, metal ve çelikler gibi geleneksel malzemelerin yerini almıştır. Poliamid 6 (PA 6) polimeri genel olarak farklı katkıların eklenmesiyle kolay işlenebilirliği sayesinde elektrikli araçlar sektöründe de kullanılmaya başlamıştır. Bunun yanında, PA 6 kompozitlerinin yüksek sıcaklıklarda sürekli kullanımı sonrasında da özelliklerini koruması beklenmektedir. Bu çalışmada, PA 6 kompozitlerinin zamana bağlı olarak ısıl yaşlanma öncesi ve sonrası ısıl dayanım özellikleri test edilip incelenmiştir. Üretilen kompozitlerin mekanik özelliklerinde, 120-150 °C ve 2000-3000 saat ısıl yaşlandırma sonucunda %50'den daha az düşüş hedeflenmiştir. Genellikle orijinal parça üreticileri tarafından gelen talepler ışığında, bu değerler kabul edilebilir olarak değerlendirilmektedir. Yapılan literatür araştırmalarına göre, ısıl yaşlandırma süreci sadece mekanik özelliklerin değişmesine değil, aynı zamanda kimyasal yapıda bozulmaya da yol açmaktadır [1, 2]. Bu bozulmayı önlemek için geniş sıcaklık aralığında uzun vadeli koruma sağlayan antioksidanlar kullanılarak, polimer zincir yapısının güçlendirilmesi gerekmektedir [3]. Çalışmada, öncelikle ısıl yaşlandırmada dayanıklılık sağlayacak uygun antioksidan ve darbe değiştirici katkılar belirlenmiştir. Planlanan teorik reçetelere göre laboratuvar ölçekli ekstrüderde PA6 matrisli kompozitlerin üretimi gerçekleştirilmiştir. Mekanik testler için ejeksiyon kalıplama yöntemi ile 5B ISO standartlarına göre uygun test plakaları basılmıştır. Üretilen tüm örneklerin mekanik ve reolojik özellikleri belirlenmiştir. Kompozitler, 120 °C ve 150 °C sıcaklıkta şartlandırma etüvünde bekletilerek 500, 1000, 2000 ve 3000 saat sonunda çekme kopma, 3 nokta eğme ve darbe testleri yapılmıştır. Örneklerin yaşlandırma öncesi mekanik özellikleri yaşlandırma sonrası elde edilen değerleri ile kıyaslanmıştır. Sonuç olarak, mekanik özelliklerin maksimum %25 düştüğü gözlemlenmiştir.

Anahtar Kelimeler: Poliamidler, Yüksek Dayanım, Isıl Yaşlandırma, Kompozitler, PA6.
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Patentlenmiş ve Galvanizlenmiş Çelik Tellerde Soğuk Deformasyon Koşullarının Kırılma Moduna Etkisi

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Özet

Bu çalışmada, patentlenmiş ve galvanizlenmiş çelik tellerde değişken soğuk deformasyon koşullarının kırılma moduna etkisi incelenmiştir. Öncelikle endüstriyel pratiklikte 5.50 mm çaplı C70D kalite çelik filmaşinden çoklu redüksiyonlar ile 2.50 mm çapa indirgenme sağlanmıştır. Sonrasında patentlenmiş ve galvanizlenmiş ürünlerin kuru ve sulu çekim ortamlarında ve değişken hızlarda (4 ve 7 m/s) soğuk deformasyonu sağlanarak 0.90, 0.82 ve 0.75 mm çaplarında teller başarılı bir şekilde üretilmiştir. Teller üzerine yapılan metalurjik analizler, çelik matriksinde deformasyon boyunca uzamış perlit faz yapısının var olduğunu ortaya koymuştur. Mekanik karakterizasyon çalışmaları ise her iki ortam koşulunda da artan deformasyon hızına ve indirgenme çapına bağlı olarak kopma mukavemet değerlerinde bir artışa karşılık %-uzama değerlerinde bir azalmanın olduğunu göstermiştir. Kopma testleri sonrası tellerin kırılma yüzeyleri fraktografik etüdler ile karakterize edilmiş olup, deformasyon koşullarına ve sahip oldukları mikroyapısal bileşenlere bağlı olarak çelik esaslı tellerin kırılma davranışındaki değişim izlenebilmiştir. Fraktografik etüdler, her ne kadar çanak-koni tipi kırılma baskın olsa da proses koşuluna bağlı olarak kırılma kesitlerinde özellikle malzemenin plastik akışında değişimlerin olabileceğine işaret etmektedir.

Anahtar Kelimeler : Çelik tel, soğuk deformasyon, kırılma, karakterizasyon.
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Farklı Karbon İçeriklerine Sahip Çelik Tellerde Proses-Yapı-Özellik-Kırılma Karakterizasyonu

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Özet

Bu çalışmada, farklı karbon içeriğine sahip 1006, 1022 ve 1055 kalite çeliklerden indirgenmiş çaplarda tel üretimi sonrasında yapı-özellik-kırılma üzerine örnek incelemeler yapılmıştır. Endüstriyel pratiklikte eşdeğer koşullarda farklı karbon içeriğine sahip çelik filmaşinlerden tel üretimi yapılarak 5.50 mm çaptan 2.00 mm çapa indirgenme başarılı bir şekilde gerçekleştirilmiş olup, redüksiyon ara kademelerinde her bir tel malzemenin metalurjik ve mekanik karakterizasyonu yapılmıştır. Metalurjik analizler tellerin nihai mikroyapısında deformasyon boyunca uzamış perlitik yapıların var olduğunu ortaya koymuştur. Mekanik karakterizasyon çalışmaları, çapta sağlanan indirgenme ve çeliğin artan karbon içeriğine bağlı olarak mukavemet değerlerinde bir artışa karşılık ve %-uzama değerlerindeki bir azalmanın olduğunu ortaya koymuştur. Çekme testi sonrası hasarlanan tellerin kırılma kesitleri üzerine yapılan çalışmalar ise matriks içerisinde perlitik faz miktarına ve özellikle redüksiyon ile değişebilen perlit lamellararası mesafeye bağlı olarak kırılma modunun ne denli değişken olabileceğini ortaya koymuştur.

Anahtar Kelimeler: Çelik tel, mikroyapı, kırılma, karakterizasyon.
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Hidrotermal Yöntem ile Üretilen Bor Katkılı BNT-6BT Piezoseramik Tozların PVDF kompozitlerin Üretiminde Katkı Olarak Kullanılması ve Karakterizasyonu

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Özet

Piezoelektrik malzemeler, mekanik enerjiyi elektrik enerjisine ve tersine çevirebilme yetenekleri sayesinde otomotivden sağlık sektörüne kadar birçok alanda, sensörler, aktüatörler ve dönüştürücüler gibi uygulamalar için büyük ilgi görmektedir. Günümüzde çevre dostu ve yenilenebilir enerji üretiminin önemi arttıkça, yeni piezoelektrik malzemeler pek çok alanda ideal çözümler sunmaktadır. Nanomalzemeler ve karakterizasyon tekniklerindeki ilerlemeler, araştırmacılara yenilikçi çözümler geliştirme fırsatları sunmaktadır. Çevre bilincinin yükselmesiyle birlikte, kurşun (Pb) içeren malzemelere alternatif, benzer üstün özelliklere sahip malzemelerin geliştirilmesine yönelik araştırmalar önemli sonuçlar ortaya koymuştur. Bu doğrultuda, bu çalışmada, en yaygın kullanılan kurşun içeren PZT seramiklerle benzer yapı ve özelliklere sahip BNT-6BT piezoseramiklerin bor (B^{+3}) katkılı tozlarının üretilmesi ve bu tozların PVDF polimerinde kullanılmasıyla üstün nitelikli, hafif ve esnek kompozitlerin üretimi hedeflenmiştir. Hidrotermal yöntemle elde edilen piezoseramik tozların karakterizasyonu XRD ve SEM-EDX analizleri ile yapılmıştır. Piezoseramik tozlar, PVDF polimerine katkı maddesi olarak eklendikten sonra elektro-eğirme yöntemiyle fiber yapılar oluşturulmuştur. Fiberlerin morfolojisi SEM-EDX teknikleri ile incelenmiş, piezoelektrik özelliklerini sağlayan β fazındaki değişiklikler ise FTIR analizleri ile detaylandırılmıştır. Elde edilen bulgular, bor katkılı piezoseramik tozların PVDF polimerine eklenmesiyle piezoelektrik özelliklerde gelişmeler sağladığını ortaya koymuştur.

Anahtar Kelimeler: Hidrotermal Yöntem, PVDF Polimer, Bor Katkılı BNT-6BT, Kurşunsuz Piezoseramikler, Elektro-eğirme

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Effect of Bifilm Content on AlSi7Mg0.3 Alloy

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Özet
Al-Si alloys are used in many fields due to their superior castability, corrosion resistance, and high specific strength. Today, AlSi7Mg0.3 alloys are widely preferred in the automotive industry. It is mostly produced by casting methods. Most of the defects in aluminium casting are related to bifilms. Therefore, the effect of bifilms was investigated in this study. Degassing and liquid metal transfer processes were used to obtain different bifilm and density indices. Fluidity index, bifilm index, density index, porosity measurements, tensile test results and Charpy impact test results were performed in this study. Thus, the effect of bifilm content on different material properties was determined.

Keywords: Al-Si Alloy, Oxide, Liquid Metal Quality, Casting
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Mikro Alaşımlı Çelikte Farklı Miktarlarda Tellür İlavesinin MnS Morfolojisine Etkisi

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Özet

Tellür (Te) elementi, çeliklerde mangan sülfür (MnS) inklüzyonlarının morfolojisini kontrol etmek, mekanik anizotropiyi azaltmak ve otomat çelikleri, kalıp çelikleri, mikro alaşımlı çelikler gibi kükürt içeren çeliklerin işlenebilirliğini iyileştirmek için kullanılır. Yeniden kükürtlenmiş çeliklerde tellür, mangan tellür (MnTe) veya MnTe-MnS gibi kompozit inklüzyonlar şeklinde MnS içinde çözünerek MnS morfolojisini kontrol etmek için ilave edilir. MnS inklüzyonlarının en-boy oranı Te ilavesiyle önemli ölçüde azalır. Bununla birlikte, çelikteki Te içeriği aşırı olmamalıdır; aksi takdirde, kırılgan fazlar oluşur ve özellikle yüksek alaşımlı çeliklerde gevrekleşmeye neden olur. Bu nedenle, Te/S kütle oranı tellür ilavesi için önemli bir faktör olarak kabul edilir.

Bu çalışmada, Te miktarının düşük karbonlu mikro alaşımlı bir çelikteki MnS inklüzyonlarının morfolojisi ve en-boy oranı üzerindeki etkisi incelenmiştir. Yeniden kükürtlenmiş mikro alaşımlı çeliğe ark ergitme yoluyla 50-2000 ppm aralığında değişen miktarlarda Te eklenmiştir. Üretilen çeliklerin Te içeriği Optik emisyon spektroskopisi (OES) ile analiz edilmiştir. İnklüzyonların morfolojisi ve dağılımı optik mikroskop (OM), Taramalı elektron mikroskobu (SEM) ve enerji dağılımlı X-ışını spektroskopisi (EDS) teknikleri ile gözlemlenmiştir. Sonuçlar çelikteki Te/S oranı ile ilişkilendirilmiştir. Çalışma sonuçları incelendiğinde, çelikteki tellür miktarı belirli bir seviyeye ulaştığında, MnS inklüzyonlarının çevresinde artan miktarda MnTe bileşiği oluştuğu gözlemlenirken, Te/S oranının artmasıyla en-boy oranlarının azaldığı tespit edilmiştir.

Anahtar Kelimeler : Tellür, MnS İnklüzyonları, Morfoloji, En-boy oranı, Te/S oranı
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Investigation of Microstructural Changes of Scrap with Different Iron Content Depending on Solidification Time

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Abstract
The solidification process is one of the most important steps in casting. In addition, it is very important to use scrap aluminium resources to save energy and reduce carbon footprint. There are some difficulties in the use of scrap aluminium resources. The main ones are high Fe content and oxides. In this study, castings were performed on the step mould with varying cross-sections by mixing different ratios of machining chip and scrap aluminium scrap wheels. The effects of different solidification times and scrap content differences on the microstructure of the alloy due to cross-sectional changes in the mould were investigated. In addition, DAS and phase changes in the microstructure of alloys with different Fe ratios at different cooling rates were analysed.

Keywords: A356, Scrap, Microstructure, Fe content, Solidification.
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Contact Problem Between Functionally Graded Ortotropic Layer- Isotropic Half Plane System and Elastic Punch with Different Shapes

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Abstract
Functionally graded materials are advanced composite materials whose material properties can vary depending on function in one or more axes, developed by combining two or more materials in order to prevent stress concentrations in the contact areas of layered composite materials. FGMs are currently used in aerospace (rocket engine parts, spacecraft fuselage), electronic semiconductors, sensors), chemical (heat exchanger and tube, mud pump, reactor vessel), commercial (building materials, sports equipment, car body, window glass) biometals (implants, artificial skin) and nuclear energy (nuclear reactor parts, first wall of the junction reactor). Within the scope of this study, the contact problem between the functionally graded layer/homogeneous isotropic half-plane system and the elastic punch will be solved using the finite element method for parabolic, cylindrical, and rectangular punch profiles. In previous studies, it was accepted that the load-transferring punch was rigid and could not change shape. Since the analytical solution for the elastic punch has not been developed yet, there is no such study in the literature. Within the scope of this study, the problem will be solved by the finite element method, and the accuracy of the problem will be confirmed by comparing the special case of the punch being rigid with other studies in the literature. It is aimed to contribute to the literature on the design of contact elements in more realistic engineering problems by examining the effects of punch rigidity, material inhomogeneity, and geometric/material/load variables on contact lengths and contact stress distributions.

Keywords: Functionally Graded Materials, Contact Mechanics, Finite Element Method.
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Wear Performance Analysis and Characterization of B_4C Reinforced WC-Co Based HVOF Spray Coatings

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Abstract
High-speed oxygen-fuel spray (HVOF) coating process is one of the most important members of the thermal spray coating family, and is widely used for wear resistance as an alternative to hard chrome coatings in a wide variety of industrial surface engineering applications. The coating layer can be designed to provide protection against both corrosion and wear, depending on the required functions of the coating. In this experimental study, wear performance analysis and characterization of B_4C reinforced WC-Co based HVOF spray composite coatings was carried out. The effect of B_4C additive on wear performance was examined. The morphology and chemical composition of the coating were characterized by Scanning Electron Microstructure (SEM), electron dispersive spectrometer (EDS). The micro hardness test was carried out by using Vickers micro-hardness tester. The results were examined and evaluated comparatively.

Keywords : Surface Engineering, HVOF, Composite coating, Wear, Characterization
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Characterization of Hot Dip Plastisol Coating for Military Applications

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Abstract
Plastisol consists of a dispersion of fine vinyl resin particles in a plaslicizing oil. Vinyl dispersion describes the nature of the material and the process by which the liquid plastisol is made. Dip coating is a simple, low-cost, reliable and reproducible method which involves the deposition of a wet liquid film by immersion of the substrate into a solution containing hydrolysable metal compounds (or readily formed particles) and its withdrawal at constant speed into an atmosphere containing water vapor. After the coating process, final properties can be controlled by curing. The remarkable mechanical and chemical durability of plastisol coating makes it ideal for a wide variety of industrial applications, from the automotive industry to the military, agriculture and more. Plastisol can be applied thick or thin, depending on the part's application. Generally, the thickness achieved through a dip coating process ranges from 0.75mm to 2mm. The formulation and curing process can be adjusted to achieve hardness ratings between 5 Shore A and 80 Shore D. In this study, the structural properties of plastisol coatings at different mixing ratios were characterized.

Keywords : PVC, Hot Dip Coating, Mechanical Properties, Characterization
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Kalite Özellikleri İyileştirilmiş Sera Plastik örtü Malzemelerinin Bitkisel Üretime Katkıları

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Özet
Dünyada ve Türkiye de nüfus artışıyla birlikte kişi başına düşen tarımsal ürün tüketim miktarı da artmıştır. Farklı sebeplerden dolayı tarımsal üretim alanlarında meydana gelen azalma seracılığa olan ilgiyi arttırmıştır. Sera, bitkilerin büyümeleri ve gelişmeleri için uygun olmayan iklimlerde yetiştirilmesine olanak sağlayan çevresel faktörlerin kontrol edilebildiği bir sistemdir. Yetiştirilecek ürüne göre doğru teknikle kurulmuş seralar üretimin kalitesini ve verimini olumlu yönde etkilemektedir. Sera iskeletinde ve iç donanımında kullanılan malzemenin kalitesi kadar sera örtüsünün kalitesi de önemlidir. Sera örtü malzemesi seçiminde dikkate alınması gereken unsurlar vardır. Bunların başında ışık geçirgenliği gelmektedir; rüzgar, kar ve yağmur gibi hava etmenlerine karşı dayanım, yalıtım, ısı geçirgenliği, lekelenme durumu, UV geçirgenliği kimyasal etkiyle değişim, yoğuşma özelliği ise dikkat edilmesi gereken diğer unsurlardır. Sera ortamında yapılan yetiştiricilikte bitki büyüme ve gelişimi için ışık önemli bir faktördür. Gerekli miktarda ışığın sera içine nüfuz edebilmesi için seralar ışık geçirgenliği olan saydam malzeme ile örtülürler. Örtü materyalinin farklı dalga boyunda ki geçirgenlik seviyesi sera ortamında oluşan mikroklima alanını etkiler. Sera örtü malzemelerinin ışınım geçirgenliğini malzemenin yapısal özelliği belirlediği gibi çevresel faktörlerde etkilemektedir. Sera örtü malzemesi olarak ilk zamanlarda cam kullanılmaktayken ilerleyen teknolojiyle birlikte plastik malzemenin kalite ve çeşitliliğinin artması, sera kurulum aşamasında maliyet olarak cam malzemeye göre daha ucuz olması, herhangi bir tahribat durumunda tamirinin cama göre daha kolay olması plastik örtü kullanımını yaygınlaştırmıştır. Dünyada ve ülkemizde plastik sera alanları cam sera alanlarına nazaran daha fazladır. Bu çalışmada sera örtü malzemesi olarak kullanılan plastiğin içerisine ilave edilen katkı maddeleri ile kalite ve etkinliğinin arttırılması ile birlikte bu durumun bitkisel üretime olan etkileri ve katkıları hakkındaki mevcut bilgiyi iyileştirmek amaçlanmaktadır.

Anahtar Kelimeler: sera, plastik örtü malzemeleri, bitkisel üretim, kalite
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Corrosion investigation of quaternary magnesium alloys using a quasi-in situ approach

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Abstract

In this study, lean quaternary magnesium alloys (Mg-Zn-Mn-Ce, Mg-Zn-Ca-Ce, and Mg-Zn-Ca-Mn) were produced using direct chill casting and their corrosion behaviours were investigated via a quasi in-situ approach over 168 h of immersion in phosphate buffer saline (PBS) at 37 °C. Various techniques, including weight loss, hydrogen evolution, inductively coupled plasma optical emission spectroscopy (ICP-OES), potentiodynamic polarization, and electrochemical impedance spectroscopy (EIS). The obtained data was comparatively analysed to show the corrosion properties of magnesium alloys and the effectiveness of the different techniques. The results showed that the Mg-Zn-Mn-Ce alloy exhibited a fast dissolution during the initial immersion period while its corrosion resistance enhanced considerably after 24 h due to the formation of a protective surface film. The Mg-Zn-Ca-Mn alloy initially displayed better corrosion performance than the Mg-Zn-Ca-Ce alloy, but this decreased after 24 h due to a porous and cracked corrosion layer.

Anahtar Kelimeler : Magnesium alloy; biodegradable implants; microstructure; corrosion

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Mineral Katkılı Şekillendirilmiş Yapı Elemanı Üretimi ve Teknik Özellikleri

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Özet

Bu çalışmada, ülkemizdeki başka bir prosesin çıktısı olan bor varlığını avantaja çevirerek yeni bir ürün (örgü duvar elemanı) üretmeye yönelik çalışmalar yapılmıştır. Geçmişte yapılan çalışmalar da göz önünde bulundurularak, genleştirilmiş kil ve pomza gibi hafif agregaların düşük yoğunlukları, ısı ve yalıtkanlıkları, uygun basınç dayanımları gibi özelliklerinden yola çıkarak bu tür hammaddelerin, hafif yapı malzemesi olarak kullanılabilirliği araştırılmıştır. Bu çalışma, genleştirilmiş kil ve pomza gibi hafif agregaların çimento dışında uygun katkılar ile harmanlanarak karışım hazırlanması, şekillendirilmesi ve bu karışımın mekanik olarak preslenerek hafif, ısı yalıtkanı ve depreme dayanıklı bir malzeme üretilebilirliğinin araştırılmasını kapsamaktadır. Fiziksel ve mekanik testlerin yanında SEM, XRD, EDX ve TG-DTA analizleri gerçekleştirilmiştir. Ayrıca, ürünün muadili sektörel ürünler ile çeşitli yönlerden karşılaştırılmaları planlanmıştır.

Anahtar kelimeler: Bor Katkısı, Duvar elemanı, Genleştirilmiş kil, Pomza, Tinkal.
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Nano BN Katkılı Beton Harçlarının Mühendislik Özellikleri

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Özet

Bu çalışma kapsamında, ülkemizin en önemli kaynaklarından biri olan bor minerallerinden üretilen nanobor (bor nitrür) kullanılmıştır. Nanoborun beton malzemesi üzerindeki etkileri araştırılmış ve konvansiyonel beton ile karşılaştırılmıştır. Standart ve bor katkılı beton üretilerek küp kalıplara (15×15×15 cm) alınmış ve kür havuzunda bekletilmiştir. Söz konusu beton numuneler fiziksel ve mekanik testlere tabi tutulmuştur. Bu testlerin yanı sıra SEM, XRD, EDS ve DT-TG gibi ileri teknolojik deneyler de gerçekleştirilmiştir. Bu çalışma sonucunda, nanobor katkılı beton, konvansiyonel betona kıyasla basınç dayanımlarında artış, betonun çatlak yapısında azalma meydana getirerek yüksek durabiliteli ve düşük geçirgenliğe sahip yeni nesil bir beton üretilmiştir.

Anahtar kelimeler: Beton, Bor Katkısı, Çatlak, Durabilite.
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Silis Dumanı ve Hiper Akışkanlaştırıcı Katkılı KYB Betonun Performans Özellikleri

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Özet

Günümüzde dayanımı yüksek beton elde etmek için puzolanik veya bağlayıcı özellikteki mineral katkıların beton karışımında kullanılması giderek yaygınlaşmaktadır. Silis dumanı, bu amaçla kullanılan başlıca mineral katkılardan birisidir. Bu çalışmada hiper akınlaştırıcı ile silis dumanlı beton üretimi ve imal edilen betonların mühendislik özellikleri yapılan deneyler yardımıyla incelenmiştir. Referans betonla beraber farklı yüzdelerce (1,0-1,2-1,4-1,6) silis dumanı ikameli toplam 4 tip beton üretilmiştir. Her karışım tipi için 9'ar küp numune imal edilerek bu numuneler 7-28-60 günlük kür sürelerince ayrı ayrı deneylere tabi tutulmuştur.

Anahtar kelimeler: Beton, Çimento, Dayanım, Mineral katkı, Silis dumanı, Hiper akışkanlaştırıcı

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Soğuk Hava Koşullarında İnşa Edilen Betonarme Yapılarda Malzeme Seçimi

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Özet

Bu çalışma kapsamında; soğuk iklim şartlarına sahip olan bölge üzerinde iklimi dengelemede ne gibi sorunların oluştuğu ve çözüm önerilerinin neler olabileceğine değinilmiştir. Soğuk iklimde kullanılması gereken betonun özelliklerine ve yine aynı zamanda duvar yapımında kullanılacak malzeme seçimi üzerinde araştırmalar yapılmış; tuğla, bims, gazbeton ve perlit tuğla malzemelerinin özelliklerine yer verilmiş ve karşılıklı teknik analizleri yapılmıştır. Ardından yalıtım malzemelerine değinilmiş ve yaygın olarak kullanılan ısı yalıtım malzemelerinin teknik özelliklerinden bahsedilmiştir. Ardından proje tasarımının ve çizimin hangi programları kullanarak nasıl bir yöntem izlendiği anlatılmıştır.

Anahtar kelimeler: Soğuk iklim, Yapı malzemeleri, Yalıtım, İdeCAD, Yaklaşık maliyet,
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Yapı Malzemesi Üretiminde Kullanılan Bor Türevlerine Yönelik Çalışmaların Analizi

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Özet

Birlikte kullanıldığı malzemeye oldukça önemli nitelikler kazandıran ve bu nedenle de gün geçtikçe dünyadaki kullanımı hızla artan bor ve türevlerinin yapı malzemesindeki kullanım alanlarını araştırmak amacıyla yapılan bu çalışmada bor mineralleri ve kullanım alanları araştırılmıştır. Kullanım alanlarının öncelikle niteliği, sonra niceliği ön planda tutularak; cam sanayisinde, seramik sanayisinde, temizleme ve beyazlatmada, inşaat ve çimento sanayisinde, yanmayı önleyici/geciktirici olarak, nükleer uygulamalarda, enerjide, makine ve metalürjide, sağlıkta ve tarımda kullanımı anlatılarak borun önemi vurgulanmıştır. Daha sonra geniş kullanım alanına sahip borun, özellikle yapı malzemesi alanında kullanımı irdelenmiş, kategorilere ayrılmış ve kullanıldığı malzemeye kattığı pozitif özelliklere vurgu yapılmıştır. Üretiminde bor ve türevleri kullanılan yapı malzemeleri; çimento sanayisi, zemin ve duvar kaplama malzemeleri, ahşap ve ahşap kompozit malzemeler ve metal sanayisi olarak kategorilendirilmiştir. Her bir kategori içerisinde, literatürde yapılmış olan deneysel çalışmalar irdelenerek deney sonuçlarından faydalanılmış ve malzemenin bor katkısı ile kazandığı inovatif özelliklere vurgu yapılmıştır.

Anahtar kelimeler: Bor, Kullanım alanları, yapı malzemesi, kolemanit, boraks, üleksit.
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EVOH Katkılı Geri Dönüştürülebilir Aktif Ambalaj Filmlerinde Kalınlığın Mekanik Termal ve Bariyer Özelliklerine Etkisi

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Özet

Aktif ambalaj sınıfında bulunan bariyer filmler, paket içerisine gaz ve nem geçirgenliğini engelleyen aynı zamanda gıda ömrünü gıda katkı maddesi kullanmaksızın uzatan koruyucu materyallerdir. Bu filmler, genellikle gaz migrasyonunu önleyecek çok katmanlı film yapısıyla dizayn edilir ve ürünlerin tazeliği ile birlikte gıda kalitesini korumada etkin bir çözüm sunarlar [1]. Ambalaj sektöründe kullanılan ve esnek ambalaj üretmek için tercih edilen çok katmanlı filmlerde geleceği tehdit eden en önemli konulardan biri hammadde krizleri diğeri ise geri dönüşüm ve sürdürülebilirliktir. Ambalaj atıklarının tekrar kullanılması, hammadde tüketimlerinin azaltılması, tek tip malzeme ile yüksek kaliteli film oluşturulması gibi birçok sürdürülebilir çözümler üretilmeye başlanmıştır. Farklı polimer yapılarının koekstrüzyon gibi üretim teknikleri kullanılarak bir araya getirilmesi; mekanik, optik ve termal özelliklere katkı sağlarken aynı zamanda maliyeti de azaltmaktadır. Bariyer filmlerde yaygın olarak kullanılan Etilen-Vinil Alkol (EVOH), yapısındaki hidrojen bağları sayesinde oksijen geçişini etkin bir şekilde engeller ve üstün gaz bariyer özellikleriyle dikkat çeker. EVOH kopolimeri geri dönüştürülebilirliği ve şeffaf yapısı ile geri dönüşümü imkânsız olan lamineli alüminyum folyo ve metalize filmlere alternatif bir bariyer tabakası olarak görülmektedir [2]. Bu çalışma kapsamında; EVOH katkı oranı sabit tutularak (% ağırlıkça) farklı film kalınlıklarının oksijen geçirgenliğine ve filmin mekanik özelliklerine etkileri incelenmiştir. Blown (şişirme) ekstrüzyon tekniği ile bariyer özelliği geliştirilmiş 5 farklı (50, 60, 70, 75 ve 80 mikron) kalınlıkta filmler üretilmiştir. Bu filmler iç ve dış katları polietilen (PE), orta katı ise bariyer özellik kazandıran EVOH polimerinden oluşan koeks filmlerdir. Üretilen filmlerin mekanik özellikleri çekme-kopma testiyle, termal özellikleri diferansiyel taramalı kalorimetreyle (DSC) ve oksijen geçirgenliği için oksijen geçirgenlik hızı testi (OTR) ile karakterize edilmiştir. Filmde ölçülen pusluluk değerleri karşılaştırıldığında, film kalınlığının artmasıyla pusluluk değerinin arttığı görülmüştür. Yapılan OTR analizleri sonucunda 0.46 cc/m^2*gün ile 80 mikron film en iyi oksijen geçirgenliği değerini sergilemiştir. EVOH katkılı filmlerde en düşük erime sıcaklığı (T_m) 50 mikron filmde gözlenmiştir.

Anahtar kelimeler: Bariyer Film, Aktif Ambalaj, Oksijen Geçirgenliği, EVOH Kopolimer
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Thin Film and Surface Characterization with X-ray photoelectron spectroscopy (XPS)

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Abstract
XPS, or X-ray Photoelectron Spectroscopy, is a technique used to analyze the chemical composition, chemical state, and electronic state of elements present in a material with high sensitivity to the surface. It measures elemental composition at the parts-per-thousand range and is able to provide information about the oxidation state of materials. In an upcoming lecture, I will cover the working principles, advantages, limitations, and application areas of this widely-used method in the analysis of surface chemical structure. I will also present examples of chemical analysis on different surfaces, such as metal, metal oxide, and polymer, to provide a better understanding of the subject.

Keywords : XPS, thin film, characterization
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Investigation of abrasion properties of composites produced by alumina reinforcement to the matrix obtained from waste aluminium beverage cans

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Abstract
Aluminium is a widely utilised matrix material in the production of metal matrix composite materials, due to its favourable properties, including low weight and a low melting temperature. In order to enhance the characteristics of the matrix material, metal matrix composite materials are manufactured by incorporating a variety of reinforcing elements with superior properties. In this study, waste aluminium beverage cans were employed as the matrix material. Metal matrix composite materials were produced by the stir casting method, utilising alumina particles at concentrations of 0.5, 1 and 1.5 wt%. Wear and hardness tests were conducted on the produced metal matrix composite materials and the results were subjected to analysis. The results of the experiments demonstrated that the hardness value of the composite material reinforced with 0.5 wt% alumina particles was 124.83 Hv, while the highest hardness value, observed at 1.5 wt%, was 245.51 Hv. The minimum wear rate was 0.0000023 mm^3/Nm, and the lowest percentage weight loss was 1.60%, which was observed in the 1.5% alumina-reinforced composite material. The addition of Al_2O_3 reinforcement resulted in enhanced wear and hardness behaviours. The scanning electron microscope (SEM) images of the composites revealed an increase in particle distribution with elevated reinforcement ratios, indicating a homogeneous distribution of the reinforcement material.

Keywords : Waste aluminium, abrasion, hardness, composite material.
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Understanding the Relationship Between Dynamic Surface Tension and Viscosity, Shear Rate Behaviour of Water-Borne Systems

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Özet

Due to strict regulations on volatile organic compounds (VOCs) affecting health and the atmosphere around the world, environmentally friendly coatings are becoming popular and acceptable to meet increasing consumer demands. Among these low VOC technologies, solvent-free aqueous systems have become a popular option because water is an inexpensive, non-toxic, and environmentally solvent that can increase the efficiency of various organic reactions. However, the characterization of water-borne paint is different from solvent-borne paint in terms of rheology, flow properties, static surface tension (SST), and dynamic surface tension (DST).

DST measurement enables the characterization of formulation performance under conditions such as spraying and coating. Also, rheology measurements are useful to simulate the flow behaviors of paints and coatings under different processing and application conditions. In this study, dynamic surface tension and rheological properties of water-borne paints are investigated in terms of determining the most suitable surface age and method depending on the viscosity of the paints.

Keywords : Dynamic Surface Tension, Shear Rate, Rheology, Viscosity

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Investigation of Washburn Capillary Method for Powder Samples: Advantages and Disadvantages

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Özet

The wettability involves the interaction between the liquid phase, solid phase, and gas phase. The most common technique which is called the sessile drop technique for measuring the wettability of the sample is contact angle measurement. However, this technique is suitable for flat, smooth, and non-porous surfaces. Surface roughness, swelling, and liquid penetration into pores make it difficult to directly measure the contact angle of powders. As a result, some indirect methods have developed as the Washburn Capillary Rise Method.

In the Washburn Capillary Rise Method, powder that is in the special tube is immersed into the liquid and the amount of liquid absorbed into the powder is measured against the measurement time. In this study, different kinds of fillers were chosen to measure their material constant and the contact angle values. For this purpose, a force tensiometer was used with a special attachment for powder wettability measurements. Although heptane was the accepted wetting liquid in the literature, the effect of various organic solvents and packing characteristics were investigated. Additionally, the contact angles were measured by compressing the powders into the pellet form to compare two techniques. The results show that all the parameters would be helpful for optimization studies in similar cases.

Keywords: Contact Angle, Washburn, Wettability
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Investigation of the effect of different proportions of styrofoam additive on mechanical properties of concrete

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Abstract
In this study, the effect of different rates of styrofoam additives on the mechanical properties of concrete in lightweight concrete production was investigated. For this purpose, styrofoam additives were added to the concrete at rates of 2.5%, 5%, 7.5% and 10%. Physical and mechanical tests were performed on the produced concrete samples on the 7th and 28th days. Decreases in the mechanical properties of concrete were observed with the increase in the styrofoam additive rate.

Keywords: Styrofoam additive rate, Concrete, Compressive strength
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Effect of Colemanite addition on the strength of concrete

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Abstract
In this study, the effect of Colemanite addition on the strength properties of concrete was investigated. In our country, where the majority of the world reserves are located, the evaluation of boron, which is extracted as raw material, as a final product within the country is of great importance both in terms of enriching the raw material and benefiting from the positive properties it adds to the material performance. 15x15x15 cm concrete samples with colemanite additive were produced together with reference concrete with or without set accelerator additive. Samples were produced for each mixture type and these samples were subjected to compressive strength tests after 7 and 28 days of curing. As a result of the tests, the addition of colemanite to the samples increased the strength properties of concrete.

Keywords: Concrete, Colemanite, Compressive strength
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Investigation of mechanical properties of Borax pentahydrate added concretes

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Abstract
In this study, the effect of Borax pentahydrate on the strength properties of concrete was investigated. CEM I 42.5 R type cement supplied from AKÇANSA Cement Factory was used in the study. 15x15x15 cm concrete samples with 7% Borax Pentahydrate were produced together with reference concrete with or without set accelerator additives. Samples were produced for each mixture type and these samples were subjected to compressive strength tests after 7 and 28 days of curing. As a result of the tests, it was determined that borax pentahydrate additive caused some decreases in the strength properties of concrete in both 7 and 28 day samples.

Keywords: Concrete, Borax pentahydrate, Compressive strength
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Endüstriyel Atık Cam Fritlerden Elektronik Devre Altlıklarında Kullanılan Düşük Sıcaklıkta Sinterlenen Cam Seramik Kompozit Geliştirilmesi

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Özet

Bilgi teknolojisinin hızlı büyümesi, küçük, hafif ve çok işlevli elektronik bileşenler gerektirir. Düşük sıcaklıkta beraber sinterlenen (LTCC) gibi çok katmanlı seramikler, istenen özelliklere sahip 3 boyutlu kompakt yapıya devre entegre edilmesiyle yüksek yoğunluklu elektronik alt tabakaların üretilmesini sağlar. LTCC kompozitleri, Ag (961°C), Au (1063°C) ve Cu (1083°C) gibi düşük sıcaklıkta eriyen elektrotlar ile sinterlenebilmesi için sinterleme sıcaklığını 950°C'nin altına düşürmek için geliştirilmiştir. Akcoat firması, seramik karo sektöründe sırların hazırlanmasında kullanılan ve malzemeye istenilen özellikleri veren farklı bileşimlerde cam frit üretimi yapmaktadır. Bu cam fritlerin üretimi sırasında çöktürme havuzlarında cam frite göre çok daha ince tane boyutlu cam atıklar birikmektedir. Akcoat firması, yıllık ortalama 100 ton çıkan bu atığı hiçbir yerde değerlendirememektedir. Bu kapsamda bu projede, bu cam atığın geri kazanımı ile katma değeri yüksek nihai bir ürün oluşturulması, hammadde ve enerji tasarrufu sağlamak, geri dönüşüme katkıda bulunmak ve dışa bağımlılığın azaltılması amaçlanmıştır. Proje kapsamında düşük sıcaklıkta (<950°C) beraber sinterlenen seramik (LTCC) kompozitlerini üretmek amacıyla cam matriste bahsedilen atık ticari cam frit tozu, seramik matriste ise yapay oksit alümina (Al2O3) tozu kullanılmıştır. Şerit döküm yöntemiyle şekillendirilen numunelere yapılan karakterizasyon çalışmaları (XRD analizi, SEM analizi, dielektrik sabit ve kayıp, termal iletkenlik ve termal genleşme katsayısı, sertlik) sonucunda %80 atık cam frit tozu + %20alümina tozu içeren (C8A2) numunesinin optimum özelliğe sahip numune olduğu tespit edilmiştir. Böylece geliştirilen LTCC kompozit ile ticari LTCC kompozitlerin özellikleri kıyaslanabilmiştir.

Anahtar Kelimeler: Cam frit atığı, LTCC, cam seramik kompozit.
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Bor Atıklarının Çimento İkame Malzemesi Olarak İncelenmesi

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Özet

Bor mineralinin endüstride ve ileri teknolojide önemli bir yeri vardır. Türkiye, Dünya bor rezervlerinin % 73'üne sahiptir. Bu çalışmada, Türkiye'deki bor madeni işletmelerindeki dekapaj alanlarından alınan borlu atıkların çimentoya katkı malzemesi olarak ilave edilmesi ile fiziksel (ısı, su ve gaz geçirgenliği), kimyasal ve mekanik (basınç ve çekme dayanımı) özelliklerine etkisinin araştırılması hedeflenmiştir. Bu amaçla, Emet (Kütahya) bor yatağındaki Hisarcık ve Espey ocaklarına ait dekapaj alanlarından ve Bigadiç (Balıkesir) bor yatağının dekapaj alanından örnekler alınmıştır. Farklı üç alandan alınan örnekler, ilk önce, X-Işını Difraktometre (XRD) ve X-Işını Floresansı (XRF) analizleri için 100'er gram öğütülmüştür. Analizler sonucunda, Bigadiç dekapaj alanından alınan örneklerde kimyasal bileşen olarak başlıca CaO (%36.13), SiO_2 (%10.85), MgO (%8.81), B_2O_3 (%3.34) ve Al_2O_3 (%1.48) içerdiği tespit edilmiştir. Kızdırma kaybı ve uçucu madde oranı ise %36.73'tür. Bor atığı örnekleri, başlıca kalsit, dolomit ve çok az miktarda kolemanit ve kuvars içermektedir. Emet bor yatağına ait Espey ve Hisarcık dekapaj ocaklarından alınan örneklerde başlıca CaO (%53.22-55.16) tespit edilmiştir. Çok düşük SiO_2 (%0.30-1.69) ve B_2O_3 (<%0.5) içeriği belirlenmiştir. Kızdırma kaybı ve uçucu madde oranı ise %48.80'dir. Bor atığı örnekleri, başlıca kalsit minerallerinden oluşmaktadır. Çimento karışımlarına borlu atık oranı %1-10 arasında değişen oranlarda uygulanarak çeşitli harç reçeteleri hazırlanmıştır. Bu kapsamda, her bir reçete için çimento-karışım oranları, kullanılan borlu atık türleri ve oranları titizlikle belirlenerek karışımlar hazırlanmıştır. Elde edilen çimento karışımları yürürlükteki standartlara ve ilgili yönetmeliklere uygun olarak kürlenmeye tabi tutulmuştur. Kürleme işlemi, nem ve sıcaklık kontrollerinin titizlikle yapıldığı özel kür odalarında gerçekleştirilmiştir. Amaç, çimento karışımındaki borlu atık oranının optimum değerini belirlemektir. Analizler ve kıyaslamalar neticesinde elde edilecek verilerle borlu atıkların çimento karışımının dayanıklılığına olan katkısı değerlendirilecektir. Çalışmanın, hem yapı malzemeleri adına mühendislik uygulamalarına hem de stratejik önemi olan bor madeninin dekapaj alanlarından elde edilen malzemenin atık-çevresel yönetim açısından önemli bulgular sağlayacağı öngörülmektedir.

Anahtar Kelimeler : Borlu atık malzeme, çimento, kimyasal özellikler
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Preparation and Characterization of B_2O_3 Doped TiO_2 Thin Films

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Abstract

The sol-gel coating process is used to create thin films or coatings on a substrate through the transition of a solution (sol) into a solid (gel) phase. This process is widely used in various industries, including optics, electronics, and materials science, due to its ability to produce coatings with controlled thickness, composition, and properties. The process begins with preparing a sol, which is a colloidal suspension of solid particles in a liquid. In this study, sol was prepared by hydrolysis and condensation of Titanium and Boron alkoxides in an alcohol. Titanium and boron alkoxides were dissolved separately in alcohol homogenously. They were combined and mixed. After the sol is prepared, it was aged to allow the particles to grow and the solution to stabilize. It was coated on the glasses using the dipping method for coating. The coated glasses were dried at room temperature.

The surface of the coated glasses was characterized by a pencil hardness test, scanning electron microscope (SEM-EDX), and contact angle meter. Compared to uncoated glass, scratch resistance increased and contact angle decreased in B_2O_3-doped glasses.

Keywords : Sol-gel process, coating, Boron oxide, dip coating.

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Coating of TiO_2-doped Hydroxyapatite (HAp) on Ti6Al4V Alloy by HVOF Technique

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Abstract

Hydroxyapatite (HA) is a bioceramic belonging to the calcium phosphate family and is the main inorganic component of bone tissue. Its chemical formula is $Ca_{10}(PO_4)_6(OH)_2$ and is found naturally in bones and teeth. Hydroxyapatite is widely used in medical and dental applications due to its biocompatibility, bioactivity and excellent ability to blend with bone tissue. Surface coating with hydroxyapatite is an essential process in various biomedical applications. This coating process is especially done to improve the performance of metals, increase their biocompatibility, support the integration of implants with bone (osseointegration) and increase their corrosion resistance.

In this study, hydroxyapatite was prepared by sol-gel method. $Ca(NO_3)_2.4H_2O$ and H_3PO_4 were selected as starting chemicals. Separate aqueous solutions were prepared and combined. Ammonia was added until the solution pH was 9. Nano TiO_2 (P25) was added to this solution at 1%, 2% and 3% (by weight). It was kept at room temperature until dry. The dried mixture was calcined at 1100 °C for 4 hours. The obtained powders were ground below 60 µm in a jet mill. Ti6Al4V alloy with dimensions of 1.5x1.5 cm was coated with HVOF technique. Coated Ti6Al4V alloy was subjected to surface roughness, XRD, SEM-EDX analyses and bioactivity test.

Keywords : Bioceramic, HVOF, coating, sol-gel process.

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Yeşil Sentez ile Elde Edilen Gümüş Nanopartiküllerin Antimikrobiyal, Antioksidan Özelliklerinin İncelenmesi ve Bunlarla Seramik, Cam ve Polimer Yüzeylerin Kaplanması

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Özet

Karaçam kozalağı (*Pinus Nigra)* sulu ekstratından gümüş nanopartiküllerinin yeşil sentez yöntemi ile doğayı kirletmeden, kısa sürede, yüksek verimli, düşük maliyetli gümüş nanopartikül (AgNP) elde edilmiştir. AgNP'lerin antioksidan ve antimikrobiyal aktiviteleri değerlendirilmiştir. AgNP'ler ile seramik, cam ve polimer yüzeyler kaplanarak bu yüzeylere biyolojik özellikler kazandırılmıştır. Elde edilen gümüş nanopartiküllerin öncelikle kalitesi, morfolojisi ve boyutu çeşitli spektroskopik ve mikroskopik tekniklerle karakterize edilmiştir. Kozalak uçucu yağında ana bileşenin β –Caryophyllene olduğu tespit edilmiştir. Toplam fenolik ve flavonoid madde içeriği, elde edilen ektrelerde AgNP'lere göre daha yüksek tespit edilmiştir. KAgNP için 443 nm'de plazmon rezonans piki gösterdiği tespit edilmiştir. TEM analiz sonuçlarına göre KAgNP'lerin 22- 40 nm boyutta küresel nanopartikül olduğu görülmektedir. KAgNP'lerin 2,2-difenil-1-pikrilhidrazil (DPPH) süpürücü etkisi %56,19 olarak tespit edilmiştir. Bakır (II) indirgeyici antioksidan kapasite (CUPRAC) test sonuçlarına göre kozalak ekstresi 13,064±0,03 Eq µg mL $^{-1}$ Troloks, KAgNP için 6,277±0,301 Eq µg mL $^{-1}$ Troloks eşdeğeri olduğu belirlendi. Metal iyonu şelatlama aktivitesinin sonuçlarıa göre kozalak ektreleri (30,487±0,02 mg EDTA/g ekstra) KAgNP lere (20,243±0,45 mg EDTA/g ekstra) göre daha yüksek aktivite göstermişlerdir. Antibakteriyal çalışma sonuçlarına göre özellikle kozalak ektraktının *P. aeroginosa üzerindeki MIK değeri* 200µl/27mg iken KAgNP'nin 200µL/0,42mg olarak belirlenmesi KAgNP'nin *P. aeroginos*a üzerine yüksek antibakteriyal etki ye sahip olduğunu göstermektedir. Ag katkılı TiO_2 ince filmler seramik, cam ve polimer üzerine kaplanmıştır. KAgNP ile kaplanan Seramik, Cam, PC ve PMMA örneklerindeki biyofilm oluşumunun azaldığı belirlenmiştir

Anahtar Kelimeler : Yeşil sentez, Gümüş nanopartikül, Yüzey kaplama, Antioksidan kapasite, Antimikrobiyal, Çam kozalağı

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Açıkta ve Örtü Altı Sebze Yetiştiriciliğinde Kullanılan İnorganik Malçlama Malzemelerinin Verim ve Kalite Üzerine Etkileri

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Özet
Sebzeler içerdikleri vitamin, mineral maddeler, lif ve proteinler sayesinde insan beslenmesinde önemli rol oynamaktadırlar. Sebze yetiştiriciliği açıkta ve örtü altı yetiştiricilik olarak iki şekilde yapılabilmektedir. Her iki yetiştiricilik şeklinde de yüksek verim ve kalite de ürün elde etmek amaçlanmaktadır ve bu nedenle farklı uygulamalar ve yöntemler geliştirilmektedir. Sebze yetiştiriciliğinde ürün kaybına neden olan en önemli faktörler toprak kaynaklı hastalık ve zararlı etmenlerdir. En basit tanımıyla toprak yüzeyinin organik veya inorganik materyalle kaplanması olarak tarif edilen malçlama bu etmenlerle mücadelenin önemli bir ayağı olarak kabul edilmektedir. Bunun yanı sıra malçlama toprak sıcaklığının muhafazasını sağlar, su tutma kapasitesini arttırır ve üründe erkenciliği teşvik eder. Bu etmenlerin tümü üründe verim artışını olumlu yönde etkilemektedir. Malçlama saman, ağaç kabuğu vs. gibi organik malzemelerle yapılabildiği gibi plastik örtü gibi inorganik malzemelerle de yapılabilir. Her iki yöntemin de avantaj ve dezantajları olmakla birlikte son zamanlarda özellikle sebze yetiştiriciliğinde plastik örtü kullanımı oldukça yaygındır. Plastik örtü kullanımının etkinliğini arttırmak için ve girdi masraflarını azaltmak için yetiştirilecek ürüne ve yetiştirme mevsimine göre plastik örtünün kalınlığı ve rengi önemlidir. Plastik örtüler siyah, gümüş, kırmızı, mavi, sarı, yeşil gibi farklı renklerde üretilmektedir fakat en yaygın olarak siyah renkte plastik örtüler kullanılmaktadır. Bu çalışmada malçlamada kullanılan inorganik malzemelerin açık alanda ve örtü altı yetiştiricilikte sebze üretiminde verime ve kalite üzerine etkileri incelenmiştir.

Anahtar Kelimeler: sebze yetiştiriciliği, malçlama, inorganik malzeme, verim, kalite
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Elektroforetik Biriktirme (EPD) Yöntemi ile Ti6Al4V Levhaların Nano-HA Esaslı Malzemelerle Kaplanması ve Yüzey Özelliklerinin İncelenmesi

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Özet

Malzemelerin kullanımından kaynaklanan kırılma, yüzeylerinin bozulması gibi olumsuz etkenlerin ortadan kaldırılmasında kaplama yöntemleri önemlidir. Kaplama yöntemleriyle yeni malzemelerin alımına gerek kalmadan yüzey ve mekanik özelliklerinin iyileştirilmesinde gelişmeler olmaktadır. Bu yöntemler arasında Elektroforetik Biriktirme (EPD), en hızlı ve kolay kaplama yöntemleri arasında yer almaktadır. Yapılan çalışmada Ti6Al4V levhalar 20X20 mm ebatlarında kesilmiş, yüzeyleri kir, yağ, pisliklerden aseton ve etanolle temizlenmiştir. Ti6Al4V levhalar EPD yöntemi kullanılarak hazırlanan HA ve HA-Grafen çözeltiler ile 30-60V ve 90sn sürelerle kaplanmıştır. Kaplanan levhalara SEM-EDX ve XRD analizlerinin yanı sıra çizilme ve yüzey pürüzlülük testleri, temas açısı ölçümleri gerçekleştirilmiştir. XRD analiz sonuçlarında HA, Gr, Ti ve TiO_2 pikleri, SEM analizlerine göre 35-87 µm kalınlık değerleri ortaya çıkmıştır. Yapılan temas açısı ölçümleri sonucu kaplanan yüzeylerin hidrofilik olduğu ve çizilme test sonrasında ise 4B ve 3B çizgi kalınları bulunmuştur.

Anahtar Kelimeler: EPD, Ti6Al4V, temas açısı, kaplama
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Yüksek Oranda Filter Pres Kek Atığı İçeren Duvar Karosu Masse Üretimi ve Karakterizasyonu

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Özet

Seramik karo üretiminin değişik kademelerinde ortaya çıkan artık malzemeler ve yan ürünler arıtma süreci sonrası filter presten geçirilerek toplanmaktadır. Seramik karo sektöründe filter pres kek atığı olarak bilinen bu malzeme sürdürülebilir ve kabul edilebilir bir döngüde üretim süreçlerinde kısmen değerlendirilebilmektedir. Bileşiminde ağırlıklı olarak hem masse hem de sırlı bileşenlerden gelen içeriği barındıran bu toz malzeme değişik nedenlerden ötürü ancak belli miktarlarda üretim süreçlerinde tüketilmekte ve tüketilemeyen kısmı mevzuat gereği bertarafa gönderilmektedir. Bu çalışma kapsamında söz konusu filter pres kek atıklarının duvar karosu masse üretim sürecinde yüksek oranlarda kullanım olasılığı araştırılmıştır. Yapılan laboratuvar denemelerinde filter pres kek atığı duvar karosu masse granüllerine %50 ve %60 oranlarında ilave edilerek toz karışımları hazırlanmıştır. Elde edilen toz karışımları numune kalınlığının etkisini görmek amacıyla farklı gramajlarda sabit basınç altında dikdörtgen prizma geometrisinde preslenmiştir. Preslenen tabletler herhangi ilave bir işleme maruz bırakılmadan hızlı pişirim koşullarında iki farklı sıcaklıkta sinterlenmiştir. Elde edilen numunelerin mukavemet ve su emme değerleri başta olmak üzere temel karakterizasyonu yapılmış olup filter pres kek atığı içermeyen kontrol numuneleri ile karşılaştırması gerçekleştirilmiştir. Filter pres kek atığı katkısının mukavemet artışına yol açtığı ve numunelerin su emme değerlerini düşürdüğü tespit edilmiştir.

Anahtar Kelimeler : Seramik Duvar Karosu, Filter Pres Kek Atığı
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Savunma Sanayinde Araç Parçalarda Sarı Alodine Kaplamanın Önemi ve Faydaları

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Özet

Sarı alodine kaplama, genellikle alüminyum ve alüminyum alaşımlarının yüzeylerine uygulanan bir kimyasal kaplama yöntemidir. Alodine, korozyona karşı koruma sağlayan ve metallerin yüzeyini paslanmaz hale getiren bir kaplama türüdür. Kaplama işlemi sırasında metal yüzeyi, kromat bazlı bir solüsyonla kaplanarak oksidasyon ve korozyona karşı dirençli bir koruyucu tabaka oluşturur. "Sarı" terimi, kaplamanın uygulandıktan sonra genellikle sarımsı bir renk tonu kazanmasından gelir.Sarı alodine kaplama, alüminyumun yüzeyine uygulandığında, genellikle kromat bazlı kimyasal bileşikler içerir. Bu kaplama, metallerin yüzeyine ince bir kromat kaplama tabakası oluşturarak oksidasyonun önüne geçer. Bu kaplama işlemi, genellikle alüminyum alaşımlarının koruma amaçlı olarak kullanıldığı çeşitli endüstriyel uygulamalarda tercih edilir. Kaplama, metal yüzeylerde paslanmayı engellemek ve korozyon direncini artırmak için kullanılır.Savunma sanayinde kullanılan ekipmanlar ve araçlar, zorlu çevre koşulları ve savaş ortamlarına maruz kalır. Bu nedenle, malzemelerin korozyon ve oksidasyona karşı korunması büyük önem taşır. Sarı alodine kaplama, savunma sanayinde kullanılan metal parçaların ve yapıların ömrünü uzatır, bakım ihtiyacını azaltır ve ekipmanların performansını artırır. Ayrıca, kaplama, metal yüzeylerin boya ve diğer kaplama sistemlerine iyi bir aderans sağlar, bu da ek koruma sağlar.Türkiye'de savunma sanayinde sarı alodine kaplama kullanımı yaygındır, ancak kesin kullanım yüzdesi sektörel raporlar ve üretici firmalara göre değişkenlik gösterebilir. Türkiye'nin savunma sanayinde sarı alodine kaplamanın tercih edilmesi, metal yüzeylerin koruma ihtiyaçları ve uzun ömürlü performans gereksinimlerinden kaynaklanmaktadır. Kaplama, özellikle alüminyum alaşımlarının kullanıldığı askeri araç ve ekipmanlarda önemli bir yer tutar.Kaplamanın etkinliği üzerine yapılan araştırmalar, sarı alodine kaplamanın metallerin korozyona karşı dayanıklılığını önemli ölçüde artırdığını göstermektedir. Araştırmalar, kaplamanın çevresel faktörlere karşı koruma sağladığını ve metal yüzeylerin ömrünü uzattığını ortaya koymaktadır. Ayrıca, kaplamanın boya ve diğer kaplama sistemleri ile uyumlu olduğu ve bu uyumun ek koruma sağladığı da vurgulanmaktadır. Türkiye'de ve uluslararası alanda yapılan çeşitli çalışmalar, sarı alodine kaplamanın yüksek performanslı ve güvenilir bir koruma yöntemi olduğunu doğrulamaktadır.**Faydaları ve İstatistikler: Korozyon Direnci:** Sarı alodine kaplama, alüminyum ve diğer metallerin korozyona karşı dayanıklılığını artırır. **Uzun Ömür:** Kaplama, metal yüzeylerin ömrünü uzatarak bakım ve değiştirme maliyetlerini düşürür. **İyi Aderans:** Kaplama, boya ve diğer kaplama sistemleri ile mükemmel uyum sağlar. **Düşük Maliyet:** Kaplama işlemi, yüksek performanslı koruma sağlar ancak nispeten düşük maliyetli bir yöntemdir. Sonuç olarak; yapılan araştırmalar, sarı alodine kaplamanın, korozyon direnci testlerinde yüksek başarı gösterdiğini ve metallerin uzun süreli dayanıklılığını sağladığını ortaya koymaktadır. Sektörel raporlar, alüminyum alaşımlarında kullanılan sarı alodine kaplamanın, bakım ve onarım maliyetlerini önemli ölçüde azalttığını göstermektedir.

Anahtar Kelimeler : Sarı Alodine, kaplama, korozyon,
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Savunma Sanayinde Araç Parçalarinin Kompozit Olmasinin Önemi Ve Faydalari

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Özet

Savunma sanayinde araç parçalarının kompozit malzemelerden üretilmesi, modern askeri araçların performansını, güvenliğini ve verimliliğini önemli ölçüde artırmaktadır. Kompozit malzemelerin savunma araçlarında kullanılmasının başlıca nedenleri arasında hafiflik, yüksek dayanıklılık, korozyon direnci ve balistik koruma yetenekleri bulunmaktadır. Savunma sanayindeki kompozit malzeme kullanımı, ticari araçlara göre çok daha yaygındır ve spesifik gereksinimler doğrultusunda optimize edilmiştir. Örneğin, askeri araçların %60'ı, kritik parçalarında kompozit malzemeler kullanmaktadır. Bu oran, ticari araçlarda genellikle %10-20 civarındadır. Askeri araçlarda kompozitlerin bu denli yüksek oranda kullanılması, stratejik önem taşıyan performans ve güvenlik gereksinimlerinden kaynaklanmaktadır.

Anahtar Kelimeler : Kompozit, Verimlilik, Yüksek dayanıklılık,
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Savunma Sanayinde Araç Parçalarının Döküm Olmasının Önemi ve Faydaları

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Özet

Savunma sanayinde araç parçalarının döküm malzemelerden üretilmesi, askeri araçların performansını, dayanıklılığını ve maliyet etkinliğini artıran önemli bir yöntemdir. Döküm malzemeler, özellikle zırhlı araçlar ve askeri platformlarda kritik bileşenler olarak kullanılır. Bu malzemelerin kullanımının başlıca avantajları arasında yüksek dayanıklılık, tasarım esnekliği, üretim verimliliği ve maliyet etkinliği bulunmaktadır.

Yüksek Dayanıklılık ve Güç: Döküm malzemeler, yüksek mekanik dayanıklılık ve güç sağlar. Özellikle zırhlı araçlarda kullanılan dökme çelik ve dökme alüminyum parçalar, yüksek darbe direnci ve balistik koruma sunar. Örneğin, bir zırhlı aracın şasi ve süspansiyon elemanları genellikle dökme çelikten yapılır ve bu malzeme, geleneksel çeliklere göre %30 daha yüksek çekme dayanıklılığı sunar. **Tasarım Esnekliği:** Döküm teknolojisi, karmaşık geometrilere sahip parçaların üretimini mümkün kılar. Bu, askeri araçların tasarımında ve modifikasyonlarında büyük esneklik sağlar. Örneğin, bir tankın taretinde kullanılan dökme parçalar, çeşitli balistik koruma ve entegre sistemler için özelleştirilebilir.

Anahtar Kelimeler : Savunma sanayi, Döküm, Maliyet, Dayanıklık
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Sonochemically synthesized of Zinc Silicate ceramic nanoparticles

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Abstract

Willemite, an inorganic semiconductor material [1], is widely used in optoelectronic and electronic devices due to its unique properties [4]. It has attracted significant attention as a promising candidate for optoelectronic devices and gas sensor applications [2]. This research aims to develop a sonochemical synthesis technique to produce high-purity zinc silicate (willemite) nanopowders. Using a modified sonochemistry approach, zinc silicate hydrate nanoparticles were synthesized from zinc salts and waterglass under controlled pH conditions (pH 11–11.5) and Argon gas flow [3]. The resulting precipitate underwent heat treatment at various temperatures. Advanced characterization techniques, including TGA/DSC, X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), dispersive X-ray spectrometry (EDX), and N_2 gas adsorption, were employed to analyze phase transformations, morphological attributes, microstructures, and chemical composition. The findings revealed the formation of a well-crystalline willemite monophase at 890 °C, as confirmed by XRD analysis. The synthesized material exhibited high homogeneity and exceptional purity, as evidenced by EDX elemental mapping. Microscopic evaluations (SEM, TEM) validated its nanoscale characteristics. Importantly, this synthesis technique employs moderate temperatures, enhancing its cost-effectiveness for large-scale production. The resultant zinc silicate nanopowders hold potential for various industrial applications, including ceramics, paints, plastics, biomaterials, and composites, due to their high purity and homogeneity.

Although willemite is not conventionally used as a semiconductor material like silicon or gallium arsenide, its luminescent properties and potential for optoelectronic applications [2] position it as a material of interest in niche areas of electronics and photonics.

Keywords: Sonochemical synthesis, Willemite, nanopowders, Optoelectronic devices.

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Ultra-Flexible Ceramic-Based Coatings for Encapsulation of Organic Photovoltaics

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Abstract
Ceramic-based coatings such as silica is one of the most efficient gas barrier material, hence is widely used encapsulating material for electronic devices. In general, the processing of silica is carried out at high temperatures. Recently processing of silica has been carried out from a polymer called Perhydropolysilazane (PHPS). The PHPS reacts with environmental moisture or oxygen and yields pure silica. This material has attracted many researchers and has widely been used in many applications such as encapsulation of organic light emitting diodes (OLED) displays, semiconductor industries, and organic solar cells. One of the important reasons for using PHPS coating is its volume expansion, that is due to its rise of molecular weight while conversion from PHPS to silica, owing to its reaction with air and moisture, thus exhibiting very low susceptibility to crack formation and shrinkage. In this paper, we have demonstrated the process optimization of the conversion of the PHPS in terms of curing methods as well as curing environment. Various curing methods including exposing to dry heat, damp heat, deep UV and their combination under different environments were used to cure PHPS. FTIR analysis suggested that the quickest conversion method is the irradiation of PHPS with deep UV and simultaneous heating at 100^{o}C. Curing with this method yields water permeation rate of 10^{-3} g/(m^2·day^1) and oxygen permeation rate of less than 10^{-1} cm^3/(m^2.day.bar). Rapid curing at low temperature processing along with barrier properties make PHPS an ideal encapsulating material for organic solar cell devices and variety of similar applications.

Keywords: Silica coatings, polysilazane, thin films, room temperature cured PHPS, oxygen and moisture permeability
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Corrosion Behavior of 3D Printed Titanium and Magnesium Alloys in Biomedical Implants: A Review of Current Research and Case Studies

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Abstract
The advent of 3D printing technology has revolutionized the design and manufacturing of biomedical implants, enabling the creation of complex, patient-specific devices that were previously unattainable. Among the materials used, titanium and magnesium alloys have emerged as leading candidates for such implants due to their unique properties. Titanium alloys, particularly Ti6Al4V, are favored for their outstanding corrosion resistance and biocompatibility, making them ideal for long-term orthopedic and craniofacial implants. In contrast, magnesium alloys such as AZ31 and WE43 are gaining attention for their biodegradability, offering a novel solution for temporary implants that naturally resorb after fulfilling their function. However, the process of additive manufacturing introduces microstructural features that can significantly influence the corrosion behavior of these materials, impacting their long-term performance in biological environments.
This review synthesizes the current state of research on the corrosion behavior of 3D printed titanium and magnesium alloys in biomedical applications. It explores how the additive manufacturing process affects these materials' microstructures and, consequently, their corrosion resistance. The review also highlights real-world case studies where these materials have been implemented in clinical settings, providing insights into their practical performance and challenges. Additionally, the effectiveness of various coatings and surface treatments in enhancing corrosion resistance is critically examined. By identifying existing knowledge gaps and suggesting directions for future research, this review aims to contribute to the development of safer and more reliable 3D printed biomedical implants.

Keywords : 3D Printing, Biomedical Implants, Corrosion Behavior, Titanium and Magnesium Alloys.
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Borophene Production and Characterization

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Abstract
Research on graphene has guided researchers in the production of other two-dimensional materials. Borophene, the subject of this study, is a material with superior properties similar to graphene but has not been extensively studied. In this study, borophene was produced using an ultrasonic-assisted liquid phase exfoliation method. SEM, XPS, and Raman spectroscopy methods were used to determine the surface morphology and chemical composition of the produced material. As a result of the analyses, the characteristic bonding structure and chemical composition of the produced material were identified and compared with those found in previous studies in the literature.

Keywords: Grpahene, Borophene, XPS scans, Raman analysis, XRD analysis.
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Hydrophobic Coating on Ti6Al4V Alloy by Sol-gel Method

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Abstract
Titanium alloys, particularly Ti6Al4V, are widely recognized for their exceptional mechanical properties, including high strength-to-weight ratio and excellent corrosion resistance. These characteristics make Ti6Al4V a material of choice in critical applications ranging from aerospace to biomedical devices. However, enhancing its performance further through surface modification techniques, such as hydrophobic coatings, has garnered significant interest. Among various coating methods, sol-gel technology has emerged as a promising technique for imparting hydrophobic properties to Ti6Al4V surfaces. In this study, Ti6Al4V alloy was coated by sol-gel method using dip coating technique to obtain a surface with anti-corrosive and hydrophobic properties. Tetra ethyl ortho silicate (TEOS), Hepta deca fluoro-1-decanethiol was used for this purpose. Experimental results confirmed that sol-gel coating plays an important role in improving the properties of the surface. Water contact angle (WCA) measurement, pencil hardness tests were performed.

Keywords : Sol-gel, Ti6Al4V, coating, hydrophobic.
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Strontium Aluminate Epoxy Composites: Luminescent Materials for Novel Applications

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Abstract
Strontium aluminate-based materials have gained significant attention due to their excellent luminescent properties, including high brightness and long afterglow duration. These materials, often doped with rare-earth elements like europium and dysprosium, are widely used in various applications such as emergency signage, glow-in-the-dark products, and safety indicators. When combined with epoxy resins, strontium aluminate forms a composite that not only retains its luminescent properties but also benefits from the mechanical strength, adhesion, and chemical resistance of the epoxy matrix. This article explores the properties, preparation methods, and potential applications of strontium aluminate epoxy composites.

Keywords : Sol-gel, Luminescent, Epoxy, Composite.
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Uçucu Yağların Mikroenkapsülasyonu

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ÖZET

Bu çalışmada, koaservasyon ile kapsülleme, spesifik pH, sıcaklık veya bileşim altında aynı reaksiyon ortamında süspansiyon haline getirilmiş veya emülsifiye edilmiş aktif bileşen etrafında yeni oluşan koaservat fazın biriktirilmesini içerir. Kapsüllerin güçlendirilmesi için bir çapraz bağlayıcı gerektirebilir. Basit koaservasyon, jelatin veya etil selüloz gibi tek bir polimerin kullanımını içerir. Kompleks koaservasyon ise, iki zıt yüklü polimerin sulu çözeltide nötrleştirilmesini içerir. Yaygın olarak kullanılan yöntem, negatif yüklü Arap zamkı ile pozitif yüklü jelatin arasında nötralizasyondur.

Bu çalışmada uçucu selvi ve mür esansiyel yağları, duvar malzemesi olarak arap zamkı ve jelatin kullanılarak kompleks (karmaşık) koaservasyon metoduyla kapsüllendi. Metodolojide çapraz bağlama maddesi olarak glutaraldehit kullanılmıştır. Oluşturulan mikrokapsüller dijital mikroskop ile analiz edildi. Kullanılan esansiyel yağlar FT-IR, SEM ve EDX yöntemleri ile karakterize edildi. Çalışma sonucunda küresel formda mikrokapsüller oluşturulmuştur. Enkapsülasyon verimleri % 30-80 arasında elde edilmiştir.

Sonuç olarak, mikroenkapsüle edilmiş esansiyel yağlar, esansiyel yağların kullanımını daha etkili, uzun süreli ve özelleştirilmiş hale getiren bir teknoloji sunar. Bu avantajlar, birçok farklı endüstriye ve uygulamaya yönelik geniş bir kullanım yelpazesi sunarak yaygın etkisini ortaya çıkarmaktadır.

Anahtar Kelimeler: Enkapsülasyon, Kompleks Koaservasyon, Esansiyel yağlar.
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Earthquake resistant building

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Abstract
Earthquakes are natural disasters that can cause great damage and loss of life worldwide. In this context, designing and constructing earthquake-resistant buildings is of critical importance in terms of both safety and durability. Earthquake-resistant buildings are of critical importance to increase the safety and durability of structures. Design approaches, material selection and new technologies increase the performance of these buildings and protect against seismic risks. This study aims to provide a guide for the construction of safe and durable structures by presenting best practices and future developments in the field of earthquake engineering.

Keywords: Earthquake, Buildings, Durable materials,Applications
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Strategies for Preventing Damage to Machine Parts

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Abstract

Machine parts play a critical role in industrial processes. However, these parts are damaged due to various external factors and working conditions. This study focuses on the most common types of damage in machine parts and the precautions that can be taken to prevent these damages. Applicable strategies against damage types such as wear, fatigue, corrosion and cracking are discussed. It is known that preventing damages both increases machine efficiency and reduces maintenance costs.

Keywords: Machine, Damage types, Protection methods and techniques
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Low-Dissipation Electron Transfer in Bismuth Chalcogenides

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Abstract

Traditional electronics based on the transport, manipulation and storage of electrical charge have encountered fundamental physical limitations leading to rapidly increasing power consumption and heat generation. Spin electronics is an alternative technology for the development of electronics, since spin operations are characterized by low energy consumption and dissipation. Materials with low dissipation and with non-dissipation electron transfer are also related to the development of alternative energy and the development of new methods of energy conversion and reduction of losses during its transmission. The development of new materials for efficient energy conversion and transmission is also associated with the non-dissipative transport of charge carriers and the development of new high-temperature superconductors and technologies based on them. The development of superconducting technology is linked to the tasks of creating new and improved principles of cold generation and thermal energy transport, which requires the development of new types of thermoelectric materials. In bismuth chalcogenides, the strong spin-orbit interaction is caused by and depends on the state of the bond between the atoms of the heavy metal and the chalcogen (this affects the location of the point and the shape of the Dirac cone), which mainly determines the possibility of the dissipation-free passage of electrons along the trajectory of the half-orbits. For thermoelectric applications, the contribution of these states to efficiency is insufficient and limited by the temperature regime, since they exist only on the outer and back surfaces of the material at low temperatures. Proposals to increase the number of working surfaces were accompanied by the creation of heterostructures based on these materials, but an increase in efficiency has not yet been achieved, apparently due to the lack of an optimal ratio of the values of spin-orbit interaction and the energy barrier necessary for the appearance of these states, and a specific condition for the dielectric constant of the interface region. A better understanding of the interaction between the nature of the chemical bonding of these states and the unusual properties of collective excitations may help in creating multilayer materials with a large number of working surfaces, with the possibility of their practical application at room temperatures. The search for and obtaining of the required non-dissipative spin state in the near-surface region of materials with multilayer heterostructures and their practical use is expensive today. The production of multilayer materials with low dissipation during charge transfer may become more accessible by using the self-organization effect of nanostructures in technology. We have discovered oscillations of magnetoresistance at 249K and 273K in Bi_2Te_3 single crystals doped and intercalated with *Cu* and *Ni*, with quasi-two-dimensional layers separated by interlayer elements.

Keywords : Thermoelectrics, Topological Insulators, self-organization of nanostructures
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Properties Of Boron-Doped Bismuth Telluride

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Abstract
The processes of formation of nanoscale defects on van der Waals surfaces of layered Bi_2Te_3 crystals, as well as the formation of nanostructures containing boron on them, are of interest for thermoelectricity and tuning of the Dirac point of topological insulators. The results of the study of the volume and surface (0001) of Bi_2Te_3<B> (0.01 wt.%) are presented. The degree of defectiveness of the Bi2Te3 structure and its properties are largely determined by the technology of obtaining samples and affect the degree of anisotropy. The synthesis of Bi_2Te_3<B> was carried out in two stages. First, the components, taken in stoichiometric quantities, were slowly heated (10 K/min) to a temperature of 870 K, i.e. 10 K higher than the melting point of Bi_2Te_3, and held for 2 hours. Then the obtained samples were slowly cooled to room temperature. The sizes of nanostructures on the cleavage surface *(0001)* of Bi_2Te_3<B> crystals fluctuate within 3–7 nm, the largest number of them have a height of about 5 nm. As can be seen from the diffraction pattern, boron does not enter into chemical interaction on the van der Waals surface, unlike the volume, therefore the smallest sizes of nanostructures can contain the main amount of boron, this is confirmed by the practically unchanged appearance of Raman spectra from different parts of the crystal. The different sizes of interlayer nanostructures in defect cavities of the sample can be associated with different times of their formation and features of the defect structure of the Bi_2Te_3 surface. Boron doping leads to an increase in the thermo-emf and a decrease in the electrical conductivity of p-type Bi2Te3 single crystals, which is explained by an increase in the anisotropy of conductivity due to an increase in the gaps of defect cavities. The acceptor properties of boron are due to the tendency to complete the sp^2 configuration to a quasi-stable sp^3 configuration. In particular, when boron is doped in single-crystal samples of Bi_2Te_3<$CdCl_2$>, donor compensation occurs with a transition of the crystal conductivity from the n-type to the hole type. In this case, the thermo-EMF of the samples increases from 180 to 260 μV/K.

Keywords : Thermoelectrics, nanostructures, thermo-EMF
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Thermoelectric Features of Topological Insulator Bi_2Te_3<Fe>

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Abstract
Well known thermoelectric layered crystals bismuth chalcogenides also is a topological insulators. In topological insulators, the electrons in the near-surface region are not backscattered and are stable against perturbations as long as the perturbations are non-magnetic and time reversal symmetry (TRS), the basic principle of the existence of these states, is not broken. These stable surface states are promising for use in low-power electronic devices, in topological transistors that can be switched by an electric field, or in memory devices and logic cells controlled by spin current transfer. In these devices, contact with magnetic materials, in this case iron, can disrupt the TRS. The disruption of TRS by a transition metal can have practical applications, such as in magnetic topological insulators, using spin current transfer based on the quantum anomalous Hall effect. We conducted studies to identify the distribution of magnetic impurities in the matrix of layered bismuth chalcogenide crystals and their influence on the electrophysical properties. The facts of the introduction of *Fe* iron atoms into the interlayer space, the formation of nanostructures by them and their effect on the properties of Bi_2Te_3 were revealed. The obtained data show that *Fe* atoms not only replace *Bi* in the crystal matrix, but are also located in the van der Waals gap. The peculiarity of such processes is that nanoparticles are formed through successive physical and chemical processes, accompanied by a change in their composition and the emergence of nanowires. The influence of iron, which has a small atomic radius, on the morphology of the $Te^{(I)} - Te^{(I)}$ interlayer space, on the properties of Bi_2Te_3 and its solid solution $B_{2-x}Fe_xTe_3$ also affects the mechanical, thermoelectric and magnetic properties. X-ray diffractometric studies showed the presence of both free and chemically bound iron *FeTe* on the cleavage surface. Using AFM image studies, the size distribution functions of nanoparticles were determined, shapes, fractal dimensions of boundaries, and distribution of nanoparticles on the surface *(0001)* of the sample were analyzed. The presence of different groups of nanoparticles may be associated with different times and temperatures of their nucleation on the defective surface of Bi_2Te_3 and with the characteristics of crystallization processes on the defective surface (0001). Thermoelectric parameters coupled with mechanical strength had a peak in the middle of the percentage composition of the iron alloying impurity, a further increase in the amount of iron led to a sharp decrease in both parameters. Moreover, the best thermoelectric figure of merit of the most effective samples occurred due to a 12% reduction in thermal conductivity due to the scattering of phonons at the boundaries of nanoparticles and an increase in the interlayer distance of defective cavities.

Keywords : Thermoelectrics, Topological Insulators, nanoparticles
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Self-Organization of a Quantum Dots Array on The Surface of Selenium-Doped Bismuth Telluride

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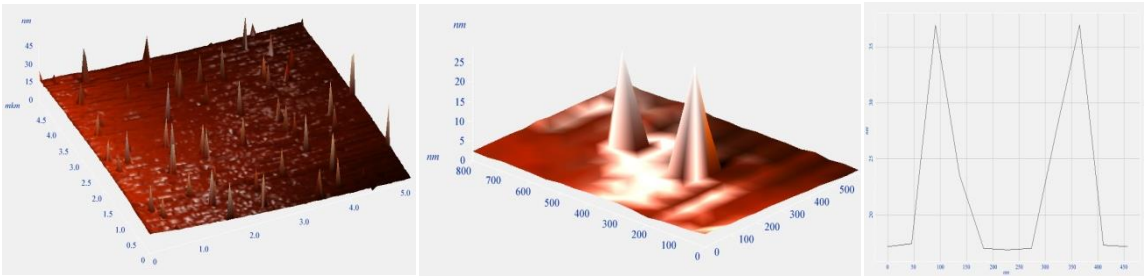
Abstract

Layered Bi_2Te_3 crystals are known as materials widely used in thermoelectricity and as topological insulators. Selenium-doped Bi_2Te_3 crystals with an array of nanoislands – quantum dots on the *(0001)* surface, formed on the basis of self-organization effects, are studied. Research into the properties of quantum dot arrays on the surface can be used to obtain sensors for a wide range of applications, heat and solar energy converters, and it is possible to achieve technological advances in obtaining topological insulators and controlling the Fermi level in their near-surface zone, to obtain high-speed connections for nanodevices and switches.



a) b) c)

Fig. 3D AFM image of an array of nanoislands on the surface of Bi_2Te_3<*Se*> – a); 3D-scale AFM image of a fragment of two Bi_2Te_3<*Se*> nanoislands – b); profiles of two nanoislands – c).

The results of the study indicate the formation of localized states on nanoislands, the transfer of charge carriers along the array is carried out by a phonon-activated hopping mechanism. The transition from diffusion to hopping transport is observed at nitrogen temperatures. It is shown that the value of hopping conductivity correlates with the level of thermalization of carriers localized on them. Apparently, a transition from unbound surface states to a bound surface-volume channel occurs during their hybridization under conditions of charge thermalization on long-range orbitals. Hopping conductivity can have several tunneling matrices depending on the energy level of localized states. Of practical interest is the type of tunneling that achieves the maximum charge transfer density with minimal scattering on phonons, which makes it possible to increase the thermoelectric figure of merit of the material by reducing thermal conductivity. A weak magnetic field promotes spin ordering and gradual charge pumping, which, reaching the level of the upper zones with long-range orbitals, creates spin shunting due to the formation of orbital order.

Keywords : Quantum Dots, thermoelectrics, nanostructures,
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Investigation of Mechanical Properties of 3D Fabricated Materials with Different Parameters

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Abstract
With the advancement of technology, the use of new production methods in the industry is becoming increasingly widespread. Instead of materials produced through long production processes in the past, materials produced more practically with 3D printers are preferred today. Due to the growing world population and the limited availability of raw materials, developing efficient production processes is crucial. For this purpose, using 3D printers with different materials and production parameters will significantly increase efficiency. To investigate this, the mechanical properties of materials produced with 3D printers using PLA polymer filaments manufactured under various parameters were studied. The parameters applied during production, such as temperature, production speed, and nozzle density, are quite influential. Additionally, the changes in mechanical properties observed in the studies were compared graphically.

Keywords: 3D printing, PLA, process parameter, mechanical behavior
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Characterization of Semi-Graphite using Micro-Raman Spectrometry and its Application on Paleotemperature Assumption

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Abstract

Micro-Raman spectrometry is a useful and non-destructive methodology for understanding the characterization of organic matter such as coal and coking coal, and graphite. Furthermore, it has importance on estimating the thermal metamorphism of organic matter in geosciences. In this study, we have for the first time applied micro-Raman spectrometry of semi-graphite samples from the Oysu mine (Western Türkiye) for characterization and palaeotemperature estimation. For this purpose, Raman band separation and D_1- and G-bands full width at half-maximum (FWHM) were applied from carbonaceous material in presentative semi-graphite samples. These results are correlated with T_{peak} temperatures calculated from vitrinite reflectance values (%vRo) from carbonaceous material, and XRD results. The mean %vRo values of semi-graphite samples are around 4.03%, whereas vRo eq% is 5.04% according to micro-Raman ID_1/IG ratios. Hence, the samples could be classified as semi-graphite. In agreement, a hump between 20-30 2Θ is detected in the XRD patterns. The micro-Raman spectroscope analyses show that the average position of the D_1-band is 1348 cm^{-1} and the average intensity of the D_1 band of the samples is 112 a.u., while the average position of the G-band is 1603 cm^{-1}, and the G-FWHM is 53 cm^{-1}. Besides, the D_2 band is not detected in first-order Raman spectra. According to micro-Raman spectrometry data, the calculated palaeotemperatures of the samples range from 336 to 349°C. This data is also close to calculated T_{peak} temperature (307-315˚C) and regional paleotemperature data from the literature. Furthermore, the G band positions in the first-order Raman spectra may suggest that the graphization degree of the studied samples is relatively low. Overall, the micro-Raman spectrometry data could be useful for characterization of carbonaceous matter-bearing metamorphic rocks and paleotemperature assumptions in combination with %vRo and regional geological data.

Keywords: Raman spectrometry, coal, graphite, thermal alteration.

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Optimization of the Laser Machining Parameters on Groove's Shape on S420MC Stainless Steel Surface Obtained with Fiber Laser

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Abstract
In this study, grooves were created on the high strength steel MC320 surface by using different parameters of a fiber laser. The obtained grooves were examined with a high-resolution optical microscope. As a result of the measurements made on the images obtained, the effects of the laser parameters used on the groove geometry were analyzed. Taguchi method was used in the optimization study. In the study, it was aimed to obtain the largest groove width/HAZ (heat affected zone) width. The maximum groove width/HAZ width was obtained with using power 60 W, laser scan speed 60 m/s, and laser frequency 50 kHz were used. The most effective laser parameter was also calculated as Laser Power with a ratio of 38.86 %. The least effective parameter on the groove geometry was calculated as Laser Frequency with a rate of 22.96 %.

Keywords : Laser Machining, S420MC Stainless Steel, Laser Ablation, Taguchi Optimization, Heat Affected Zone.
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Laser Surface Texturing of AA1050 Aluminum Alloy: Optimization of Geometric Patterns and Laser Parameters for Enhanced Surface Characteristics

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Abstract

This work focuses on the optimization of geometric patterns and laser parameters for the surface texturing of AA1050 aluminium alloy using fiber laser technology. Four different patterns were tested-square, diamond, hexagon, and circle-under changing powers of the laser (40-100 W) and theoretical area factors scanned by the laser beam (20-80%). In order to assess the effect of these parameters, the surface roughness was measured by an Sa profilometer, and the morphology was analysed by an optical microscope. The results showed that lower laser power and higher scanned area factors usually increase the roughness of the surface, while higher power decreases roughness by smoothing out the surface. In addition to the above, contact angle measurements were also carried out to study changes in wettability. The results have shown a good relationship between specific combinations of parameters of the laser treatment in light of changing properties of the surface, such as roughness or wettability. Optimal conditions were obtained at a power of 40 W and with an 80% value of the scanned area factor for square patterns, where clear texturing was observed with increasing surface roughness. These results will be useful in improving the functional properties of aluminium surfaces in various industrial applications.

Keywords : Laser Surface Texturing (LST), AA1050 alloy, Roughness, Laser Parameter Optimization, Contact angle.

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Additive Manufacturing of Energetic Materials

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Abstract
Additive manufacturing technologies are an innovative production method that stands out with its rapid prototyping convenience and enabling new production geometries that traditional methods do not allow. Energetic materials are metastable materials that have the potential to produce high and rapid gas release with stimuli. Due to the nature of those materials, energetic materials require quite different and relatively difficult production methods from other material groups. Moreover, the designs that can be produced by traditional methods are limited, and production time and cost increase due to using molds. On the other hand, additive manufacturing stands out as a fast, economical, and adaptable method and offers design freedom. R&D studies for rapid prototyping of energetic materials, characterization of new materials, and field testing require considerable financial and time-consuming efforts. While additive manufacturing eliminates these two disadvantages, additive manufacturing of energetic materials is currently a hot topic in the literature. However, since the research is generally kept as a commercial and military secret by the researchers, the studies that can be sourced are limited. Therefore, researchers need to acquire the know-how with the accumulation of their own work.

Keywords : Energetic Materials, Additive Manufacturing, Rapid Prototyping, Characterization
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New Generation of Energetic Materials

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Abstract
Energetic materials encompass a range of substances, including propellants, explosives, and pyrotechnics. The sensitivity of these materials is influenced by various factors such as their molecular structure, functional groups, particle size, surface area, surface morphology, and molecular stability. Currently, the most significant factor in the selection of ammunition is the availability of commercially produced energetic materials that exhibit reduced sensitivity to physical influences, including thermal effects, shock, friction, and static electricity. Research efforts are concentrated on developing high-performance explosives that introduce a new generation of energetic materials characterized by insensitivity at the molecular level, as documented in scientific literature. Nonetheless, the modeling, synthesis, and characterization of these advanced energetic materials at the molecular scale involve lengthy processes. Consequently, traditional nitramine-based energetic materials, such as RDX and HMX, remain among the most commonly utilized options. There is an ongoing demand for enhanced energetic materials. In the quest to create new energetic systems, it is essential to achieve optimal balances among energy content, safety, and cost. Therefore, it is advantageous to minimize trial and error in the development of new materials by accurately predicting the properties of energetic materials.

Keywords : Energetic Materials, Propellant, Ammunition, Defense Industry.
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Fe_3Al Alaşımının Düşük Karbonlu Çelik ile Nokta Direnç Kaynak Uygulamalarında Kaynak Akımının Etkisi

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Özet

Fe_3Al alaşımının birçok sektörde farklı malzemelerle kaynaklı birleştirme uygulamaları giderek daha fazla ilgi görmektedir. Bu alaşım, sahip olduğu mükemmel oksidasyon direnci, yüksek dayanım ve mekanik aşınmaya karşı üstün özellikleri sayesinde, kaynak bağlantılarda performansı artırma potansiyeline sahiptir. Nokta direnç kaynağı, birbirinden farklı veya birbirinin aynısı olan malzemelerin birleştirilmesi için kullanılan ve endüstride de oldukça yaygın olan bir yöntemdir. Bu çalışma, Fe_3Al alaşımı ile düşük karbonlu çelik malzemenin nokta direnç kaynağının uygulanabilirliği üzerine odaklanmıştır. Araştırmada kaynak akımı parametresi baz alınmış olup, bu iki malzeme arasında oluşan kaynak çekirdeğinin mekanik özellikleri, mikroyapı özellikleri ve görüntülenen olası zayıf noktaları incelenmesi hedeflemiştir. Yapılan testler ve analizler sonucunda, kaynakların kalitesi üzerinde kaynak akımının önemli bir rol oynadığı tespit edilmiştir. Sonuç olarak, Fe_3Al alaşımının düşük karbonlu çelikle nokta direnç kaynağında başarılı bir şekilde kullanılabilmiş ve optimum kaynak parametresinin 4,44 kA kaynak akımı olduğu görülmüştür.

Anahtar kelimeler: İntermetalik malzemeler, Fe_3Al, düşük karbonlu çelikler, nokta direnç kaynağı, kaynak akımı

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Modelling the formation kinetics of Fe_2B layers on DIN 12738 steel with a non linear model using Taylor expansion

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Abstract
This work aimed to model the growth kinetics of Fe_2B layers on the DIN 1.2738 steel by using a novel kinetic approach. The proposed model considered the transient diffusion regime of boron atoms through the surface of treated steel. The distribution of boron atoms across the Fe_2B layer was expressed as a Taylor expansion of second order. Afterwards, the boron activation energy in the Fe_2B layers was assessed as equal to 204.02 $kJmol^{-1}$ in the temperature range 1123-1223 K using the experimental results taken from the literature. Finally the present model has been validated experimentally by using additional boriding condition (1998 K for 4.5 h). The experimental Fe_2B layer thickness obtained at 1198 K for 4.5 h aligned with the predicted value provided by the model.

Keywords : Boriding, Iron boride, Diffusion model, Activation energy Diffusion.
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The Role of Biomaterials in Treating Hepatocellular Carcinoma (HCC)

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Abstract
One of the most common fatal malignancies worldwide is hepatocellular carcinoma (HCC). It is therefore crucial to develop new treatment options for patients. In this case, microscale biomaterials can improve the results of the treatment. HCC is becoming a leading cause of cancer-related mortality throughout the globe. Despite remarkable advances, HCC patients remain associated with poor prognosis. Unfortunately, the primary treatment in advanced-stage HCC is treating the symptoms and not curative. By using biomaterials, we can offer a better outcome in these patients. Microscale biomaterials are placed in the arteries feeding the tumor and suffocate the tumor, resulting in the death of cancer cells. These particles may also contain chemotherapeutic drugs. In this article, Transarterial chemoembolization (TACE), blank Transarterial embolization (TAE), conventional Transarterial chemoembolization (cTACE), TACE with drug-eluting beads (DEB- TACE), Transarterial radioembolization (TARE), and arterial embolization hyperthermia (AEH) are explained and reviewed

Keywords: hepatocellular carcinoma (HCC), embolization, embolic agent
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Investigation of Pitting Corrosion in The Superstructure Tank of Road Service Vehicles for Cleaning Purposes

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Abstract
Road service vehicles used for cleaning purposes on highways and airport runways require water systems due to their operating conditions. An integrated mechanism is used to supply and store water in the tanks located on the superstructure of the vehicles, and the necessary systemic lines are fed from these tanks. These tanks are made of stainless steel to protect them from external effects that will cause corrosion and all corrosive effects of the liquid inside due to its chemical structure. These manufactured metal tanks target longevity and are designed accordingly to provide efficient working conditions. However, some situations are inevitable and damage may occur to the tanks due to corrosion.
In this study, the causes of pitting corrosion occurring in a road service vehicle containing a water tank and its protective measures were examined. By analyzing the chemical structure of the water in the tank, it was determined that the tank suffered from pitting corrosion due to high chloride and sulfate.

Keywords: Stainless Steel, Pitting Corrosion, Chloride, Sulfate, Water Tank
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Fabrication of Si_3N_4 substituted 45S5 bioactive glass derived composites and their physical and in vitro biological characterizations

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Abstract
Silicon nitride (Si_3N_4) has recently been used as a dense, porous bioceramic or substitution for a bioglass due to its good biological effects. In this study, the effect of 10, 20 and 30 wt.% Si_3N_4 powder addition on the crystallization behavior and subsequent biological properties of 45S5 Bioglass® was assessed. Si_3N_4 incorporated 45S5 Bioglass® composite pellets were subjected to heat treatment at around 1000 ºC for 1h in an open-air furnace by following basic powder processes. It was seen that varying Si_3N_4 addition to the Bioglass significantly decreased the sintering temperature and hence affected the crystallization behavior of the Bioglass. The sintering temperature decreased by up to 150 ºC proportionally with the increase in silicon nitride content. Thus, a balance was achieved between decomposition and densification in the composites. Quantitative phase analysis (wt.%) of sintered composites calculated from XRD data revealed that with increasing Si_3N_4 fraction in the samples, the amorphous content of the samples increased and the amount of crystalize phases decreased. In vitro bioactivity tests pristine and 30 wt.% Si_3N_4 added Bioglass were carried out and characterized by FTIR, XRD and SEM. Due to Si_3N_4 being itself bioinert, it partially inhibited the formation of hydroxyapatite but exhibited different degradation characteristics. Moreover, cell biology and antibacterial studies of pristine and 30 wt. % Si_3N_4 added Bioglass were performed. Results showed that Si_3N_4 substitution in the Bioglass caused an increment in cell viability and antibacterial activity.

***Key words**: Si_3N_4, 45S5 Bioglass®, crystallization, biological properties*
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A study was conducted to examine the material properties of boron carbide-reinforced waste aluminium matrix composites

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Abstract
Boron carbide (B4C), which is composed of boron and carbon, has a multitude of applications and is employed in composite materials that require high hardness and wear resistance. In this study, metal matrix composite materials were produced by reinforcing B4C particles at 1, 3 and 6 wt% to an aluminium matrix obtained from the recycling of waste beverage cans. In the initial stage of the process, waste beverage cans were collected and subjected to a pre-melting procedure to remove any residual paint and impurities. There are numerous techniques for producing aluminium matrix composites, and the stir casting method was employed in this study. Specimens for tensile, flexural and hardness testing were prepared in accordance with ASTM standards. The tensile and flexural strengths of the specimens were determined using a universal testing machine. The densities of the specimens were determined using an Archimedes density apparatus, in accordance with the Archimedes principle. It was observed that the hardness values of the composite material increased in proportion to the ratio of hard B4C particles used for reinforcement. The highest hardness value of 86.08 Hv was obtained in a sample reinforced with 6% B4C. With an increase in the ratio of B4C particles used for reinforcement, it was observed that the mass wear amount decreased, and the wear resistance increased.

Keywords : Composite material, waste aluminium, boron carbide, hardness, wear.
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The importance of Kok-Tobe Tower in terms of Kazakhstan and Engineering

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Abstract
This study is about the engineering design and importance of Kok-Tobe Tower. Since Almaty is located in a region with high seismic activity, Kok-Tobe Tower was designed to be earthquake resistant. The tower is equipped with engineering solutions to withstand severe earthquakes. It is considered a symbol of the modernization process and technological progress of independent Kazakhstan, beyond being just a television tower. The tower has become a popular attraction for tourists while defining the city's silhouette. The tower, which was built between 1975-1983 using mostly steel and concrete, is 372 meters high and resistant to earthquakes of magnitude 10, and was built according to the most advanced engineering and technical standards of its time.

Keywords: Kok-Tobe, Concrete, Steel, Earthquake, Communication.
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Performance Optimization of Solar Chimney Systems: A Comparative Study of Thermal Energy Storage Solutions

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Abstract
Solar chimney power plants (SCPPs) are an emerging renewable energy technology that converts solar energy into electricity with low environmental impact. A key factor in improving the efficiency and reliability of SCPPs is the use of thermal energy storage (TES) systems, which allow for continuous power generation even when sunlight is not available. This paper presents a comparative study of different TES systems used in solar chimney technology, focusing on optimizing performance.
This study is primarily theoretical, aiming to determine the most beneficial TES system for solar chimney applications. The theoretical findings were validated using a small prototype previously built in the YEKARUM laboratory at Süleyman Demirel University (SDU) in Isparta, Turkey, where experimental results showed that crushed gravel was the most efficient TES material, with a collector efficiency of 89.73%. In this study, we extended the research theoretically by evaluating other materials, including rocks, refractory bricks, ceramics, concrete, and aluminum, to identify the optimal TES system for improving SCPP performance. These findings highlight the strengths and limitations of different TES materials, offering insights into the best strategies for optimizing SCPP performance. This work provides a foundation for future developments in solar chimney technology, emphasizing the importance of selecting the appropriate TES system to enhance energy output and system reliability.

Keywords: Solar Chimney Power Plant (SCPP), Thermal Energy Storage (TES), Solar Energy, Materials.
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Pack boriding modeling to study the growth kinetics of boride layers on an AISI 316 steel

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Abstract
The purpose of this work is to investigate the modelling of boriding kinetics of AISI 316 steel with in the temperature range 1123–1273 , using the integral diffusion model while considering the incubation periods of boride formation. This simulation model focus on the kinetics of formation of FeB, Fe2B and diffusion zone (DZ) layers formed on AISI 316 steel, icorporating the effect of boride incubation time.
This simulation model was established by solving the differential algebraic equations (DAE) resulting from the integral method in the temperature range 1123–1273 K. By using a particular solution of the obtained DAE system, the values of boron diffusivities in the FeB ,Fe2B and diffusion zone (DZ) layers were estimated. The estimated values of activation energies for boron diffusion in AISI 316 steel were respectively 210.26(FeB),193.80(Fe2B) and 140.55 (ZD)kJ mol^{-1} .
Finally, the results of this study provide a useful framework for simulating the boronizing kinetics of steels with FeB and Fe2B layer microstructures, taking into account key boriding parameters such as time and temperature. A good concordance was observed between the experimental and simulated results regarding the thicknesses of the layers.
Keywords: boriding / iron borides / incubation times / integral method / activation energies / DAE system /
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Electrochemical Reduction of Carbon-dioxide Using Metal Nano-particles Supported on Nano-Materials

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Abstract
Electrochemical reduction of CO_2 is an emerging and current issue for its conversion in to valuable product upon minimization of its atmospheric level for contribution of maintaining within the range of permissible limit. Among plenty of electro-catalysts gold and copper are efficient and effective catalysts, which are synthesized and applicable for this research work. The two metal catalysts were prepared in inert environment with different compositions through co-reduction process from their corresponding precursors and then by adding multi-walled carbon nano-tube as a supporter and enhanced the conductivity. The catalytic performance of CO_2 reduction for each composition was performed and resulted an outstanding catalytic activity with generation of high current density (70 mA/cm^2 at 0.91V vs. RHE) and relatively small onset potential. The catalytic performance, compositions, morphologies, structure and geometric arrangements were evaluated by electrochemical analysis (LSV, impedance, chronoamperometry & tafel plot), EDS, SEM and XAS respectively. The composite metals showed better selectivity of products and faradaic efficiencies due to the synergetic effects of the combined nano-particles in addition to the impact of grain size in reduction of CO_2. Carbon monoxide, hydrogen, formate and ethanol are the reduction products, which are detected and quantifiable by chromatographic techniques considering their physical state of each product.

Keywords: Carbondioxide, Faradiac Efficiency, Electrocatalyst, Current Density.
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The impact of artificial intelligence applications on construction costs

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Abstract
This study investigates the effects of artificial intelligence applications on the construction sector. Artificial intelligence (AI) is increasingly used in the construction sector and has significant effects on costs. These effects are directly related to both increased efficiency in the project process and optimization of material, labor and energy use. In addition, it is thought that it will provide savings by processing a lot of data such as the completion of the job on time, the amount and properties of materials to be used according to the nature of the job, and human-related errors, and by intervening in a timely manner.

Keywords: Artificial intelligence, materials, costs
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A study on traffic accidents and solutions

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Abstract
Traffic accidents are a significant problem worldwide. In this study, research has been conducted on the causes of traffic accidents and solution suggestions. Traffic accidents can be caused by the driver, the current condition of the road, mechanical or other malfunctions of the vehicles, and the situations of pedestrians and other living creatures getting in the way. Today, in order to solve traffic accidents, autonomous vehicles, support systems that relax the drivers, improving the condition of the roads, expanding the public transportation network, pedestrian and bicycle paths, underpasses and overpasses, increasing deterrent traffic fines and inspections are tried to minimize accidents.

Keywords: Traffic, vehicle, accident, solutions.
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Impact of Infrastructure on Transportation

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Abstract
This paper examines the effects of transportation infrastructure on social and economic development. The efficiency of modern transportation systems is directly related to infrastructure investments. This paper emphasizes that infrastructure improvements in various modes of transportation increase efficiency, promote economic growth and support sustainable development. It also discusses the contributions of infrastructure investments to reducing social inequalities, environmental sustainability and transportation safety. In both developed and developing countries, investments in transportation infrastructure contribute to social welfare and sustainable development in the long term. In this paper, the effects of infrastructure investments are discussed from various perspectives and the importance of future transportation projects is emphasized.

Keywords: Infrastructure, transportation, economic development, sustainability
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Synthesis of Metal-Organic Framework (MOF) for Electrocatalyst Applications and Evaluating Their Performances in Water Electrolysis

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Abstract
In today's world, limited resources of fossil fuels, dramatically increasing prices and negative effects on nature and people's health drive technology to seek alternative energy sources. Among all alternative sources, hydrogen is the most abundant fuel, and it has the highest specific energy content. Thus, it is crucial to use hydrogen to eliminate greenhouse gas emission. However, during synthesis of hydrogen from water, the water-splitting reaction faces high activation energy barriers, necessitating high-performance electrocatalysts. Metal-organic frameworks (MOFs) have gained significant attention for their diverse structures and potential in addressing these challenges.
In the scope of this study, different types of MOF structures (cobalt, nickel and iron) were synthesized with different linker options (benzene tricarboxylic acid and benzimidazole) using solvothermal method. Eventually, synthesized materials have been characterized to clearly understand structure of framework using SEM, XRD, Raman and FTIR methods. To find the most efficient MOF structure, performances on water splitting reactions have been investigated using LSV, cyclic voltammetry and other electrochemical techniques. At the end of this study, it is clarified that type of metal ion and organic linker have crucial impact on performance of MOF materials. So far, cobalt MOF synthesized with benzene tricarboxylic acid has the best performance results in water splitting reaction.

Keywords: Metal Organic Framework (MOF), Hydrogen Energy, Water Splitting Reactions
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Reactive Spark Plasma Sintering of Ultra-High Temperature Ceramics

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Abstract

ZrB_2-based composites were fabricated using Spark Plasma Sintering (SPS). The composites containing 25 vol% SiC particles were prepared by in situ reaction of $ZrSi_2$, B_4C and carbon black powders, which is a method to densify ZrB_2-based composites at low temperatures. Furthermore, rare-earth (RE) oxides were used to improve the mechanical properties of ZrB_2-SiC composites. The microstructures of the ZrB_2 based composites were characterized by X-Ray Diffraction and Scanning Electron Microscopy. Both the room temperature (hardness, strength, fracture toughness) and high temperature (ablation resistance) properties were investigated. The results showed that homogeneous microstructure and nearly fully dense ZrB_2-25vol.%SiC composites with a relative density above 99% were obtained after sintering at the temperature of 1600℃ under the pressure of 70 MPa for 10 min. During sintering, the additives were completely transformed into ZrB_2 and SiC particles, which were homogeneously distributed in the ZrB_2 matrix. The RE-based additives were also uniformly distributed at the grain boundaries of ZrB_2. The mechanical properties of ZrB_2-SiC composite, such as hardness, strength and fracture toughness, were slightly improved by the addition of RE oxides. Most importantly, the ablation resistance of ZrB_2-based materials was significantly improved by the addition of RE oxides, and further improved with their increasing amounts.

Keywords : UHTC, Reactive Spark Plasma Sintering, Ablation Test, Characterization

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Design and Fabrication of Flexible Hybrid Triboelectric Nanogenerators with Integrated Photovoltaic Effect for Enhanced Energy Harvesting

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Abstract

This study aimed to design and fabricate flexible single-electrode hybrid triboelectric nanogenerators (H-TENGs) incorporating photovoltaic effects, utilizing a composite of copper oxide (CuO) nanoparticles and citric acid in sanitary silicone rubber as the triboelectric negative material, and E-glass as the triboelectric positive material. Sanitary silicone rubber was selected for its flexibility, durability, and outstanding triboelectric performance, while E-glass was chosen for its strong triboelectric positive properties. By integrating these materials into a hybrid system, this research sought to develop a robust and efficient energy-harvesting device capable of simultaneously generating electrical energy from both mechanical and solar sources.

The fabricated device demonstrated a significant increase in open-circuit voltage, from 50V to 145V, as the concentration of CuO nanoparticles increased from 0.1% to 0.5% by weight under normal light conditions. In the absence of light, the voltage output ranged from 40V to 120V under the same conditions. These results underscore the synergistic potential of combining triboelectric nanogenerators with photovoltaic technologies through the integration of sanitary silicone rubber and E-glass.

This work advances the design of flexible, wearable energy-harvesting systems, offering promising applications in fields such as biomedical devices, wearable electronics, and environmental monitoring.

Keywords: Triboelectric nanogenerator, TENG, photovoltaic effect, copper oxide nanoparticle, citric acid, energy harvesting system, flexible, wearable

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Earthquake Resistance of Buildings in the African Continent and Solution Suggestions

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Abstract
In Africa, construction has gained great momentum, especially in recent years, with the acceleration of urbanization. However, this rapid growth has significant deficiencies and problems in terms of building earthquake-resistant structures. While some regions of Africa, especially along the East African Rift Valley, are at serious earthquake risk, buildings and infrastructures that are not prepared for earthquakes in these regions pose a serious danger. The difficulties experienced in earthquake resistance are based on various reasons such as inadequacies in construction technologies, lack of inspections and financial limitations. This study focuses on the causes of the earthquake resistance problem and solution suggestions to increase earthquake resistance.

Keywords: Buildings, Urbanization, Earthquake, Solution suggestions.
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Building designs for life

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Abstract
In the future, building designs are expected to be shaped by technological developments and sustainability. Energy sources such as solar panels, wind turbines, etc. that will be integrated into buildings will become more widespread, increasing energy efficiency and contributing to the economy, and depending on the increasing population, agriculture for food production will become widespread on the top floors of buildings, and rainwater harvesting will be carried out in thousands to protect water resources. It is expected that energy consumption, building safety, and people's quality of life and comfort will come to the forefront by providing artificial intelligence and IoT integration in buildings.

Keywords: Building design, Quality of life, Efficiency.
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Characterization and Structural Analysis of Historical Buildings in Lebanon and Their Transfer to Future Generations

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Abstract
Lebanon has hosted many civilizations throughout history and has an important cultural heritage that bears the traces of these civilizations. Traces of Phoenicians,Romans, Byzantines, Ottomans and many other cultures have survived to the present day in historical structures all over the country. The characterization and preservation of these structures are of great importance in terms of architecture, engineering and cultural heritage management. The characterization of historical structures in Lebanon is a process that must be handled meticulously from both structural and cultural perspectives and requires various methods for the sustainable preservation of these structures. In order to preserve, sustainably restore and pass on to future generations, environmental threats must be combated, financial resources must be provided and technical expertise must be developed. This paper aims to discuss the steps to be taken for the preservation of historical structures in Lebanon and the difficulties encountered in this process.

Keywords: Lebanon, Historical structure, Characterization, Conservation strategies
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Advantages and Industrial Applications of Boron Coating Methods

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Abstract
Boron coating technology has become increasingly important in the field of surface engineering in recent years. This method offers critical advantages such as hardness, wear resistance, corrosion resistance and resistance to high temperatures by improving the surface properties of materials. Boron coating involves the application of a hard layer containing boron element on metals and alloys. This process is usually carried out by chemical vapor deposition (CVD), physical vapor deposition (PVD) or thermal diffusion methods. Boron coatings are used in a wide range of industrial applications. While it is used on engine components, piston rings and transmission gears in the automotive industry, it is also preferred to increase the surface resistance of cutting tools and molds. In addition, boron coating technology is widely applied on parts requiring high temperature and wear resistance in the aviation and space industry. In this report, the advantages provided by boron coating technologies will be examined and the application areas of these coatings in different industries will be analyzed. The potential of boron element in surface engineering will be discussed together with its contributions to the development of high-tech materials.

Keywords: Surface engineering, Boron coating, high-tech materials.
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Use of Plasma Nitriding and Coating Technologies in Surface Engineering

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Abstract
Nowadays, advanced surface engineering techniques play an important role in order to increase the durability and performance of industrial materials. In this context, plasma technology, nitriding and coating methods are widely used to improve the mechanical, chemical and physical properties of materials. Plasma technology provides modification on the surface of the material by using high energy ionized gas. Coating and nitriding processes performed in plasma environment offer higher efficiency and sensitivity compared to traditional methods. In this study, the advantages of plasma-based nitriding and coating technologies in surface engineering will be examined and the effects of these technologies on different materials and their application areas will be discussed. The contribution of surface modification to industrial applications and innovations will be focused on.

Keywords: Surface engineering, Plasma technology, Nitriding and coating.
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Industrial Applications of Powder Metallurgy

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Abstract
Powder metallurgy is a production method based on the production and shaping of metals and alloys in the form of fine metal powders and then solidifying them by sintering. This technology has attracted great interest in industrial production in recent years due to its high precision and material efficiency. Powder metallurgy enables the production of parts using lower temperatures and energy compared to traditional casting and machining methods, while providing superior mechanical properties. In this paper, the basic principles, advantages and wide industrial application areas of powder metallurgy will be discussed. The cost and efficiency advantages offered by the method, improved material properties and environmental effects will be evaluated. Additionally, potential innovations that may emerge as this technology develops further are included.

Keywords: Powder metallurgy, Industrial application areas, Advantages of powder metallurgy.
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Sol-Gel Coatings: Technology, Advantages and Application Areas

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Abstract
Sol-gel coating technology stands out as an innovative method in the field of thin film coating. This method enables coating on various surfaces such as metal, glass, ceramic and polymer by providing precise film formation at low temperatures. The sol-gel method is based on the principle that metal alkoxides or organic-inorganic compounds dissolved in chemical solvents undergo gelation and drying stages to form a solid film. Sol-gel coatings provide a wide range of superior properties by providing nanostructured thin films. Sol-gel coatings have a wide range of industrial applications. Optical coatings (antireflective and UV protective), electronic circuits, biomedical devices, corrosion protection, and smart materials are the main areas where this method is used. Sol-gel technology has an important place especially in solar energy panels, photographic lenses and protective coatings of electronic devices. In addition, innovative solutions are developed using biocompatible sol-gel films in antibacterial coatings and biological applications. In this report, the basic principles, advantages and industrial applications of sol-gel coating technology will be discussed in detail. The contributions of sol-gel method in coating technology in terms of flexibility, surface improvement solutions and sustainability will be discussed.

Keywords: Sol-gel coating, Optical coatings, Antibacterial coatings, Surface improvement solutions.
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Use of Recycled Materials in Concrete and Its Effect on Its Performance

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Abstract
Environmental problems and resource depletion have brought sustainability-oriented approaches to the forefront in the construction sector. Concrete is the most widely used material in the construction sector, and its production consumes large amounts of natural resources and emits greenhouse gases. Therefore, the use of recycled materials in concrete production is seen as an important step in reducing environmental impacts and using resources efficiently. The effects of using recycled materials in concrete on both environmental benefits and structural performance are increasingly being researched and implemented. In this study, the use of recycled materials in concrete production, current developments in this field and application strategies will be discussed, and the dissemination of sustainable construction practices will contribute to both the solution of environmental problems and the increase in economic benefits.

Keywords: Recycled materials, Concrete, Construction industry, Economic efficiency.
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Properties of Nanomaterial Additive Concretes

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Abstract
Nanotechnology has great potential to improve the performance of construction materials and especially concrete. While traditional concrete offers high compressive strength and longevity, these features can be carried even further when improved with nanomaterials. Nanomaterials offer significant advantages in terms of strength, durability and sustainability by improving the microstructure of concrete. This report aims to provide information on the effects of nanomaterials on concrete, how these materials are used and the status of their application. Nanomaterials are materials that have the potential to revolutionize the construction sector by increasing the mechanical strength, durability and chemical resistance of concrete. While nanosilica, carbon nanotubes and other nanoadditives increase the performance of concrete and offer sustainable solutions that reduce environmental impacts, it is necessary to reduce costs and improve application techniques for the widespread use of these materials.

Keywords: Nano additives, Concrete, Mechanical and physical properties
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Development and Characterization of Ultra-High Temperature Ceramics

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Abstract

The present work reports the preparation, characterisation, and mechanical properties of novel diboride ceramics for extreme applications. It is divided into three parts. The first part will focus on the effect of various rare-earth (RE) oxides (2 – 10 wt.%) on the densification, microstructure, and mechanical properties of ZrB_2-25vol.%SiC composites. The ablation resistance of the RE-containing composites was significantly improved by 80 % when compared to RE-free diborides. In the second part, highly pure (Ti-Zr-Hf-Nb-Ta)B_2 high-entropy boride ceramics (HEBs) were produced by two-step spark plasma sintering, consisting of boro/carbothermal reduction of oxide precursors and pressure-assisted sintering. The room temperature mechanical properties of HEB continuously increased with the increasing amount of SiC up to 20 vol.%, while the dynamic oxidation rate of the materials significantly decreased. The third part will focus on the preparation of highly textured TiB_2 ceramics by slip casting an aqueous suspension in a magnetic field of 9 T, followed by sintering using SPS. The sintered material exhibited a Lotgering orientation factor of 0.90, with the c-axis of TiB_2 oriented parallel to the magnetic field and SPS pressing direction. The textured TiB_2 material exhibited a significant anisotropy in mechanical properties, such as hardness, elastic modulus and wear resistance.

Keywords : Ultra-high temperature ceramics, zirconium diboride, high-entropy ceramics, mechanical properties, ablation resistance

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Kardan Mili İstavroz Birim Parçasinda Kullanilan İki Farklı Düşük Alaşımlı Sementasyon Çeliğinin Statik Torsiyon Testi Performansının Karşılaştırılması

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Özet

Ağır ticari araç kardan millerinin torsiyonel yük taşıma kapasitelerinin tespit edilmesi amacı ile statik torsiyon testleri gerçekleştirilmektedir. Bu çalışma kapsamında ağır ticari araç kardan mili uygulamalarında kullanılan iki farklı düşük karbonlu yüzey sertleştirme çeliklerinin (20MnCr5 ve 20NiCrMo2-2) performansı karşılaştırılmıştır. Bu bağlamda malzeme bilimindeki üretim-yapı-özellik ve performans ilişkisine göre istavroz birim parçalarında statik torsiyon testi sırasında kırılan parçalarında; kimyasal kompozisyon, sertlik, mikroyapı ve makro görüntüleme gibi metalografi çalışmaları gerçekleştirilmiştir. Elde edilen sonuçlar karşılaştırıldığında, test edilen tüm istavroz gövdelerine ait geometrik tasarım aynı olmasına rağmen, test sonuçları malzeme kalitesine göre farklılık gösterdiği tespit edilmiştir. Özellikle istavroz birim parçasının çekirdek sertliğinin kardan milinin tork taşıma kapasitesi üzerinde etkili olduğu görülmüştür.

Anahtar Kelimeler : Kardan mili, istavroz, statik torsiyon testi, metalografi, sementasyon çeliği.

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Examining the Relationship between Electric Vehicle Designs and Battery Management Systems

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Abstract
In this study, the Relationships of Electric Vehicle Designs with Battery Management Systems were theoretically examined, and by monitoring the parameters such as safe use and life of the battery and various states (such as SoH and SoC) from scenarios constructed on equivalent battery models for different types of designs taken into consideration, secondary data was calculated, and these data were realized and compared in the Matlab/Simulink environment. The relationship between vehicle designs and the battery in terms of cell or battery pack was examined.

Keywords : Electric Vehicle, Battery Management Systems, SoH, SoC.
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Examination of Charging Methods and Charging Station Types of Electric Vehicles in Simulink Environment

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Abstract
With the global climate change problems of our age and developing technologies, there have been significant advances in electric vehicle technology. As a result of this advancement, electric vehicles have become widespread and the distance that can be covered and charging problems have emerged in vehicles. Manufacturers and users have resorted to various searches for the long-lasting slow charging problems in electric vehicles. In order to minimize these problems, various charging methods have been developed and different station types that charge these vehicles have emerged. In this study, charging methods and charging station types have been evaluated together, while the application principle and charging times have been taken into account. These charging methods, Mode1, Mode2 and Mode3; charging station types, AC Charging, DC Charging and Wireless Charging technologies have been simulated separately in the Matlab/Simulink digital environment and the findings obtained have been evaluated.

Keywords : DC, AC, Electric Vehicle, Charging Station, Charging Methods.
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Investigation and Comparison of Designs of Different Types of Motor Drives for Electric Vehicles

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Abstract
In parallel with the increasing energy prices in the world, the use of electric vehicles is becoming increasingly widespread. A power electronic intermediate circuit (inverter) that provides DC-AC conversion is used to control the electric motor used in electric vehicles. The most common method is to control the electric motor using a three-phase inverter circuit from a fixed high DC voltage busbar (such as 200-400Vdc). In this study, simulation studies were conducted and the efficiency increase obtained with the use of hybrid switches was demonstrated. In the next steps, a prototype inverter circuit using a 3-phase 7 kVA hybrid switch structure was experimentally established. The switching frequency used in real electric vehicles was examined by using 5kHz-10 kHz as the switching frequency in the designed circuit. The latest MOSFET switch based on SiC technology was used for the MOSFET switch in the proposed hybrid switch structure. A 3-phase asynchronous motor was driven with the inverter circuit and tests were performed for different driving profiles with the established dynamometer system, and the results were compared.

Keywords : electric vehicle, motor drives, asynchronous motor.
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The Construction Materials Industry

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Abstract
The construction materials industry plays a pivotal role in the construction of a vast array of structures, from residential homes to expansive highways. The production of essential materials such as cement, steel, sand, and special composites is a core aspect of this industry. Recently, there has been a notable shift towards the pursuit of more eco-friendly practices. This entails the utilisation of recycled materials and the development of products that are more energy-efficient. As urban areas continue to expand and the need for new buildings arises, this industry plays a pivotal role in facilitating growth and the construction of robust, sustainable structures. By embracing environmentally conscious methodologies, the industry is able to safeguard the natural environment while meeting the demands of modern construction.

Keywords: construction materials, structures, steel, cement,
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The Effect of Different Parameters on The Material Properties In Nitriding and Nitrocarburizing Processes Applied to Aisi 4340 Tempered Steel

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Abstract
In this study, the effects of gas nitriding and gas nitrocarburizing thermochemical surface hardening treatments applied to AISI 4340 tempered steel on the material's surface properties were investigated. The impact of these treatments, carried out experimentally using different temperatures, durations, and nitriding potential (K_N) values, on critical surface parameters such as surface hardness, white layer formation, and diffusion depth was examined. As a result of the nitriding process, a significant increase in surface hardness and the formation of a homogeneous white layer were observed. It was also found that similar results were obtained when the temperature was kept constant during nitriding while varying the duration and K_N values proportionally. On the other hand, in the nitrocarburizing process, surface hardness remained lower compared to nitriding and the white layer thickness was thinner. Additionally, it was determined that the white layer did not form homogeneously after the nitrocarburizing process. These results clearly demonstrate the different effects of the parameters used in both processes on the material's surface properties. This study highlights that the process parameters of nitriding and nitrocarburizing have a significant impact on the surface properties of the material and that these parameters must be carefully selected.

Keywords: Nitriding, Nitrocarburizing, Temperature, Duration, K_N
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A Research on Agricultural Hazelnut Spraying with Deep Convolutional Neural Network Method

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Abstract
In biology, hazelnut is one of the most widely cultivated hard-shelled fruits in the world, besides bearing the same common name of the shrub and tree species that make up the genus Corylus from the Betulaceae family of the Fagales team. The production base of hazelnut, which is grown in certain regions and special geographical areas in the world, is the sloping regions on the temperate and rainy Black Sea coasts in the north of Turkey. In these agricultural areas where mechanization is not developed enough, drones can be used for issues such as agricultural spraying, which is completely based on human power and is known to be harmful to health. In this study, it is aimed to detect hazelnut tree using Convolutional Neural Networks architectures and R-CNN algorithm. Alexnet and VGG-16 were used as Convolutional Neural Networks architectures. Images obtained from hazelnut trees in Giresun, Turkey formed the data set of the study. In the study carried out using the MATLAB programming language, the training data in the data set were trained and tested on the test data. While training with the Alexnet architecture is 89.65%, the accuracy result in training with the VGG-16 architecture is 87.41%. While the total accuracy of the hazelnut trees in the test images tested in the trained networks was 80.51% in the Alexnet architecture method, it was found as 78.65% in the VGG-16 architecture method. Although it is said that hazelnut trees are detected at a high rate in both methods, there is higher accuracy in hazelnut tree detection with Alexnet architecture.

Keywords: Hazelnut Tree; object detection; Alexnet; VGG-16; RCNN.
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Photovoltaic System Designs at Different Power Levels with Fuzzy Based Control Algorithm

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Abstract
In this paper, a detailed analysis of a photovoltaic energy production system (FS) is presented by utilizing solar energy, one of the renewable energy sources. The study deals with the system equipments in a designed FS and their selection and necessary calculations. The grid-connected and grid-independent analyses of seven different systems with power levels of 1kVA, 3kVA, 5kVA, 10kVA, 25kVA, 50kVA and 100kVA are examined. Fuzzy logic based control algorithms designed to ensure the energy continuity of the system against various changes in the generation source are proposed. Finally, the block diagrams and detailed wiring diagrams of the systems are examined and the cost analysis and exploration summary of the systems are presented.

Keywords: photovoltaic energy, fuzzy logic, control algorithm, SoH, SoC.
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Industrial Applications of Powder Metallurgy

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Abstract
Powder metallurgy is a production method based on the production and shaping of metals and alloys in the form of fine metal powders and then solidifying them by sintering. This technology has attracted great interest in industrial production in recent years due to its high precision and material efficiency. Powder metallurgy enables the production of parts using lower temperatures and energy compared to traditional casting and machining methods, while providing superior mechanical properties. In this paper, the basic principles, advantages and wide industrial application areas of powder metallurgy will be discussed. The cost and efficiency advantages offered by the method, improved material properties and environmental effects will be evaluated. Additionally, potential innovations that may emerge as this technology develops further are included.

Keywords: Powder metallurgy, Industrial application areas, Advantages of powder metallurgy.
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New Technologies in Electricity Generation

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Abstract
The rapid increase in energy demand in the world, global climate change and the limited resources of fossil fuels necessitate the development of new technologies in electricity generation. New electricity generation technologies that reduce dependency on traditional energy sources, minimize environmental impacts and offer more efficient and sustainable methods are of great interest in both developed and developing countries. This paper aims to address new technologies used in electricity generation that will shape the future energy transformation, the opportunities they offer and the challenges they face.

Keywords: Renewable energy and storage, Clean energy, Smart grids, Digital transformation.
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Humans and Future Automobiles

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Abstract
While technology is creating radical changes in every aspect of human life, the automotive sector has also become one of the biggest areas of influence of this transformation. The cars of the future are transforming the driver-centered transportation concept with artificial intelligence (AI), automation and electric vehicles, creating a completely new transportation ecosystem. Equipped with autonomous driving, artificial intelligence integration and sustainable energy solutions, these vehicles are redefining the relationship between humans and technology. This symposium paper will address this relationship between humans and future cars, the development of autonomous driving technologies, the role of artificial intelligence and sustainable transportation and solutions.

Keywords: Artificial intelligence, Autonomous vehicles, Sustainable transportation, Impacts on society.
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Effect of Laser Boriding Method on Steels

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Abstract
Laser boronizing is an innovative technology used to improve the surface properties of steel and other metals. This method injects boron element into the surface of the material using high-energy laser beams, thus increasing the hardness, wear resistance and overall performance of the material. This research aims to examine in detail the effects of laser boronizing methods on steel, process parameters, the obtained microstructure and application areas. This method provides significant advantages in industrial applications by increasing the mechanical properties of steel as well as corrosion resistance and thermal stability. Optimizing process parameters, reducing costs and controlling coating quality are critical to the future success of laser boronizing technology. This technology has wide application areas, especially in sectors such as automotive, energy and defense industries, and plays an important role in materials science and engineering.

Keywords: Laser boriding, Steel, Wear, Corrosion.
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Investigation of the Effect of Heat Treatments on Some Properties of Steels

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Abstract
Steel has a wide range of uses in industry and is a preferred material in applications requiring different mechanical and physical properties. One of the most commonly used methods for controlling and improving these properties is heat treatment applications. Heat treatment changes the microstructure of the steel, affecting the properties of the material such as hardness, durability, ductility and fatigue resistance. This study aims to examine the effects of heat treatment on steel, changes in the microstructure of the steel and performance parameters. Heat treatment optimizes the properties of steel such as phase transformations in the microstructure, distribution of carbides and stress relief, hardness, durability and toughness.

Keywords: Steel, Heat treatment, Microstructure, Strength.
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The Role of Polymer Materials in Aircraft

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Abstract
The materials used in the design of aircraft directly affect critical factors such as performance, fuel efficiency and safety. In this context, polymer materials have become an important material group that improves the structural and functional properties of aircraft. Thanks to their superior properties such as lightness, durability and flexibility, polymers are increasingly preferred in both military and civil aviation. This symposium paper aims to address the areas of use of polymer materials in aircraft, their advantages and future potential. These materials, which increase fuel efficiency, provide corrosion resistance and increase performance, play a critical role in both structural components and interior design of aircraft. However, the production costs, safety standards and certification processes of polymeric materials should be carefully considered for these technologies to be used on a wider scale.

Keywords: Smart polymers, Certification, Aerospace, Advantages.
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Thermal and spectroscopic studies of Sm^{3+}doped fluorophosphate glass

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Abstract

We have investigated the spectroscopic properties of Sm^{3+}- doped phosphate glass with the molar composition $40P_2O_5$ – 30ZnO-(15+x)LiCl-(15-y)BaF_2-z Sm_2O. Changes in the thermal behavior of glasses obtained were investigated by DTA/DSC method, thermal stability parameters were analyzed. It was found that the glass transition temperature is shifted towards higher temperatures with an increase in the Sm^{3+} ions content, while the range of vitreous state transformation (T_{g_endset} − T_{g_onset}) decreases. The ellipsometric data have provided a Sellmeier-type dispersion relation of the refractive index of the investigated glasses. The measured absorption spectra of both doped glasses reveal the presence of many absorption bands assigned to transitions from the $^6H_{5/2}$ ground state of Sm^{3+} ion to consecutive excited states. The absorption and fluorescence spectra, along with the photoluminescence decay of the 4G5/2 levels of the Sm^{3+} ion, have been analyzed within the Judd-Ofelt theory. It appears that the quantum efficiency of the $^4G_{5/2}$ – $^6H_{7/2}$ transition is very high 96% for the all glasses studied.

Keywords: phosphate glass, ellipsometric data, $40P_2O_5$ – 30ZnO-(15+x)LiCl-(15-y)BaF_2-z Sm_2O

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Evaluation of the tearing and wrinkling defects during deep drawing processes of CuZn30 alloy

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Abstract
Deep drawing is one of the most promptest forming process for manufacturing axisymmetric cup with significant forming depth. There are several defects such as tearing and wrinkling as the prominent ones leads to rejection of the components in metal forming procedures. This article investigates the roots of these defects during deep drawing process and its adverse effect on manufacturing at this stage. To address this problem, two kinds of common alloys of CuZn30 (b70) in sheet metal forming processes has been chosen. Mechanical testing and microstructural analyzing have been don. Microstructural evaluation was carried out with elaborate investigations by optical and scanning electron microscope (SEM). Extensive anisotropy Investigations indicated that anisotropic mechanical properties are responsible for these problems that can be prevented. The obtained observations indicates that tearing and wrinkling defects have direct relation with anisotropy. Investigations have shown that differences in anisotropy followed by differences in flexibility originates from the structures as presence of some elements in chemical composition and larger grain size cause the different structures in materials.

Keywords: Deep drawing, Anisotropy, Tearing and Wrinkling defect, Mechanical properties.
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Investigation of Fuzzy Logic and PID Based Speed Control of DC Motor Driven by Luo Converter

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Abstract
In this study, a method that provides the best dynamic performance for speed control of the DC motor driven by Fuzzy logic (FL) and PID control Luo converter has been applied. The experimental results are compared with a series of simulation results. The response of the driver behavior to the reference change was observed under PID and FL speed control of the DC motor by comparing the controller.

Keywords: DC Motor, Luo converter, Fuzzy logic, PID control, speed control.
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Wetting and joining of high entropy carbides by NiTa eutectic alloy

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Abstract

The wetting behaviour of molten pure Ni and NiTa alloys on the surface of (MoNbTaVW)C high entropy carbides (HEC) was investigated. The results showed a significant dissolution of the ceramic substrate in pure Ni when the wetting test was performed at 1480 °C. The interfacial reactions and dissolution of HEC substrates were suppressed after the addition of Ta into Ni and forming an eutectic alloy. Based on the wetting results, the NiTa eutectic alloy was selected for joining (brazing) of HEC ceramics to themselves. The pressure-less joining was performed in a field-assisted sintering machine (FAST) at 1480°C. The thickness of the interlayer was controlled by the weight of the alloy. The interfacial bonding between the HEC ceramics and the interlayer was investigated using scanning electron microscopy (SEM). The phase and microstructure analysis of the joints revealed that due to the formation of an interfacial layer along the interface, a strong joint with an apparent shear strength of 218 MPa was obtained.

Keywords : high entropy ceramics, joining, brazing, wettability, NiTa

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AB Initio prediction, sintering and mechanical properties of (HfNbTaTiZr)B_2 with different molar ratios of transition metals

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Abstract

High-entropy borides (HEB) are a new class of ultrahigh temperature ceramics. Until now, most of the research interest has been focused on the HEB materials with equimolar composition of transition metals. Among all of the HEB materials, (Ti-Zr-Hf-Nb-Ta)B_2 is one of the most investigated compositions. The present work was aimed at studying the effect of various molar ratios of five transition metals using density functional theory, with the compositional disorder being treated using the special quasi-random structures technique (SQS). Employing the Alloy Theoretic Automated Toolkit software, the SQS supercell (5×2×2) with 60 atoms was selected for the present calculations. The goal was to understand the effect of individual metal elements, different atomic positions and concentrations on the formation of the diboride structure. The individual HEB compositions were synthesized using boro/carbothermal reduction of oxide precursors at 1800°C, followed by Spark Plasma Sintering at the temperature of 2000°C. All materials with equimolar and non-equimolar compositions contained a single phase according to XRD analysis. The hardness (HV1) of the non-equimolar compositions significantly increased to ~ 23 GPa when compared to the equimolar structure (18.8 GPa). At the same time, the strength of the non-equimolar compositions were ~ 550 MPa, when compared to ~ 500 MPa for the equimolar composition. The present study clearly demonstrated that non-equimolar structures show superior mechanical properties when compared to their equimolar high-entropy counterparts.

Keywords : Ultra-high temperature ceramics, zirconium diboride, high-entropy ceramics, mechanical properties, ablation resistance

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Beta silicon nitride seeds as a reinforcement of the silicon nitride

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Abstract
Silicon nitride (Si_3N_4) has been recognized as a valuable structural material due to its exceptional thermal stability and very good mechanical properties, such as high flexural strength, high hardness and good value of fracture toughness. Recently, the properties of silicon nitride have attracted in the biomedical field, especially for orthopaedic implants and dental restorations. However, to make silicon nitride suitable for biomedical applications, it is necessary to improve its toughness. Crucial role in toughening play the shape (size and aspect ratio) of silicon nitride grains which may cause the toughening by crack deflection, crack bridging or crack branching. In this study, the different amount of the β-Si_3N_4 seeds is used as a reinforcement to identify optimal sintering conditions and amount of β-seeds to enhance toughness, making the material more suitable for biomedical applications. Silicon nitride-based ceramics were spark plasma sintered at 1750°C with different dwell time and the samples were subsequently evaluated using scanning electron microscopy and X-ray diffraction. Subsequent microstructural analysis and indentation fracture toughness revealed that the increasing dwell time increase the value of fracture toughness. Increasing amount of seeds has a positive effect on toughening only up to certain amount followed by a decrease in fracture toughness with a higher amount of β-seeds.

Keywords : Silicon nitride, β-Si_3N_4 seeds, toughness, spark plasma sintering
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Effect of Boron on Microstructure and Wear Resistance of a High Chromium Cast Iron Alloy

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Abstract
Applying hardfacing material through welding is a widely used method to protect surfaces from wear damage. In this study, two high chromium hardfacing alloys were utilized to create samples for the gas blasting erosion test. The erodent particles consisted of ferric oxide with a hardness of 657 HV and an average diameter of 260 µm. The impinging stream eroded the surface of the samples using a gas flow rate of 100 m/s at an angle of 30°, while the particle feed was varied from 140 to 630 g. The results demonstrated that the erosion resistance is primarily influenced by the bulk hardness of the hardfaced alloys. Furthermore, the sample that included boron (B) exhibited the lowest erosion rate, attributed to its highest bulk hardness compared to the other sample.

Keywords: Hardfacing; Flux-cored arc welding; Gas blasting erosion test; Microstructure; Primary carbide; Solid particle erosion.
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The Role of Process Parameters in the Production of Ti6Al4V Parts Fabricated by Selective Laser Melting (SLM)

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Abstract
Selective Laser Melting (SLM) is one of the additive manufacturing processes that is receiving a lot of attention today due to its application and unique features. The use of parts produced by this method depends on achieving the appropriate mechanical and metallurgical properties. Since the desirability of such properties depends on the correct determination of the process parameters, their effect on the porosity characteristics has been investigated in current research. The metallurgical investigations carried out in this research have shown that the improper setting of the parameters results in a variety of defects with detrimental properties. These defects appear in the form of porosity, cracking and balling and limit the use of this product. The optimum processing parameters, which resulted in appropriate porosity characteristics, were introduced.

Keywords: Selective Laser Melting (SLM), Ti6Al4V, Process Parameter, Defects, Porosity.
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Some Causes of Earthquakes in the World in Recent Years

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Abstract
Earthquakes occurring in the world attract attention with their increasing frequency and destructive effects. In recent years, research on the causes of earthquakes has also brought to the agenda the indirect effects of human activities and climate change. In this article, the geological and human-induced causes behind the major earthquakes in recent years are discussed and the indirect effects of plate tectonics, energy accumulation in fault lines, human activities triggering seismic activity and climate change are evaluated. Earthquakes are the result of complex interactions of both geological and human-induced factors. In order to understand the causes of earthquakes and reduce seismic risks, plate tectonics, the effects of human activities and indirect contributions of climate change must be carefully evaluated.

Keywords: Earthquakes, Plate tectonics, Energy accumulation, Climate change
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Design and Simulation of a Sample Rooftop Solar Power Plant with 100 kWp Capacity

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Abstract
As it is known, increasing the share of green energy production is a priority for all countries. One of the most important green energy sources, solar, offers great opportunities for humanity due to its almost environmentally friendly effect and easy installation through photovoltaic (PV) plants. In addition, it also offers an economic investment opportunity with some incentives offered by countries. The amount of energy produced from solar power plants in Turkey is increasing exponentially every year and this increasing trend is expected to continue. In addition, by the end of 2023, the installed power exceeded 12 thousand MW and became 12 thousand 425 MW. In this study; The design and simulation application of a roof-type, grid-connected distributed solar power plant with a capacity of 100 kWp was presented through the PVsyst program. In the study, it was seen that the panel slope, the correct PV module and inverter selection are extremely important. The annual amount of energy that can be given to the grid was obtained as 130 MWh. In the simulation studies, it was emphasized that such a facility, compared to a power plant with equivalent energy production, would not emit 1500 tons of $Co2$ and would contribute positively to the climate change effect. It was observed that approximately 30,000 USD income could be obtained from such a newly established facility with a fixed fee purchase guarantee together with local contribution for the first ten years. Considering that the life of the plant will be 30 years, it can be said that the facility investment would be extremely advantageous even without public support.

Keywords: electric vehicle, motor drives, asynchronous motor.
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Extraction of Copper/Max Recovery of Copper from Low-Grade Ore

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Abstract
Due to the lower concentration of copper and the presence of higher levels of impurities, extracting copper from low-grade ores is challenging. Conventional extraction methods, such as pyrometallurgy, are unsuitable for low-grade ores because they result in significant material waste and have a negative impact on the environment. That's why advanced copper extraction techniques from low-grade ores are examined and reviewed like hydrometallurgical techniques such as solvent extraction electrowinning (SX-EW) and bioleaching. Bioleaching is considered more economical and environmentally friendly than any other traditional technique by utilizing microorganisms to intensify copper solubilization. To produce high-purity copper cathodes, the SX-EW process leaches copper into a solution first, and then selective solvent extraction and electrowinning are performed. Recent developments in waste management, process optimization, and reagent development have increased the effectiveness of these approaches and try to make them more environmentally friendly by reducing their negative effects on the environment. The potential of adopting these new technologies to improve the economic efficiency and sustainability of copper extraction from low-grade ores is emphasized. This also contributes to the broader objective of resource conservation and environmental protection hat also contributes to the enhanced objective of resource conservation and protection of the environment.

Keywords: Batteries, pyrometallurgy, bioleaching
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Development of Nanofibers for Batteries as a Separator

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Abstract
The development in the field of batteries plays a magnificent role in different high-performance applications, such as electronic devices and cars with alternative power sources. It is observed that this study relates to the use of nanofibers using TiO_2(titanium dioxide) and PVP(polyvinylpyrrolidone) for optimizing the battery performance. TiO_2 was chosen because of its exceptional electrochemical stability and PVP was used as a binder to support the mechanical strength of the fibers. Ethanol is used as a solvent to dissolve and homogenize the TiO2 and PVP mixture. The process starts with the complete dispersion of the TiO_2 powder into the PVP solution for which phase purity and crystallinity of the TiO_2 were evaluated by the X-ray diffraction (XRD) technique. During the electrospinning process, it is expected that the nanofiber threads formed well, to contain uniform and continuous fibers. The materials obtained in the above process of TiO_2/PVP nanofibers show high porosity and large surface area which is a characterizing factor for battery separators to ensure effective ion transport and uptake of the electrolyte. These nanofiber separators have been developed to improve the effectiveness and the safety of batteries and also to increase the life span of the batteries for this kind of application. This type of approach in battery separator innovation would be a more promising approach for the future of energy storage technologies serving as a basis for the future progress in the technological development of consumer electronic devices and energy systems based on renewable sources.

Keywords: batteries, TiO_2, PVP, separator
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A hybrid energy production system model for electric vehicles in Giresun province and energy production projection for 2030

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Abstract
Renewable energy sources are increasingly gaining interest due to their environmentally friendly features and sustainability. This interest is increasing with the awareness of the environmental damage and depletion possibilities of fossil fuels, which are currently used intensively. However, discontinuity, which is a significant disadvantage of renewable energy sources, is seen as a factor limiting the development of this field. In this study, a study focusing on a hybrid energy system that combines solar and wind energy with biogas sources was conducted. The inability to provide solar energy production at night, the fluctuation of wind energy production due to changing weather conditions, and the variability in energy production of biogas systems depending on the raw material are the factors affecting the design of this hybrid system. In this study, discontinuity in renewable energy production was minimized with the hybrid system. Hybrid systems integrate solar, wind and biogas energy sources, ensuring that the energy obtained from these sources balances each other. In this way, even in cases such as adverse weather conditions or night hours, the fluctuation in energy production is reduced and a continuous and stable energy source is obtained. With the widespread use of electric vehicles, energy demand is expected to increase even more. A sample design proposal has been made in order to meet this increasing energy need from clean and sustainable sources. In addition, in this study, a system has been proposed for the future reference of Turkey's energy need for electric vehicle charging stations, for a time estimate over a location determined in Giresun province and for this need to be met with clean energy. The design of the system was carried out through the HOMER PRO program.

Keywords: hybrid energy, electric vehicle, solar and wind energy, HOMER PRO.
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Investigation of the Possibilities of Using Kütahya Region Kaolines in The Ceramic Industry

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Abstract
When preparing ceramic wall tile bodies, clay, kaolin, calcite and feldspar are used. The technical properties of the tiles (water absorption, total shrinkage, dry firing strength, fracture strength) and the desired physical properties (L, a, b, surface smoothness) vary depending on the raw material content in the recipe. Rheological parameters play a critical role during the formulation development stages, as they help prevent production issues and ensure that the final product meets the performance criteria. Consequently, parameters such as density, viscosity, and particle size distribution (sieve analysis) were incorporated into the formulation process to optimize these outcomes. Providing raw materials from regions close to ceramic production facilities facilitates production. It increases competitiveness as transportation costs will decrease. At the same time, the short distance will reduce greenhouse gas emissions released into the air during the transportation of raw materials. In this study, instead of the clays used from Afyon region, ceramic body composition studies were carried out with Kütahya region kaolins at the rates of 2%, 4%, 6% and 8%. These compositions were sintered at NG Kütahya Seramik at 1130-1150 ^{o}C firing cycle. As a result of the studies, it was found appropriate to use 2% of the Kütahya region kaolins in the wall tile body composition. Exceeding this proportion results in increased water absorption and decreased in dry strength, thus compromising the technical performance of the tiles.

Keywords: Characterization, Kütahya Region Kaolins, Wall Tile, Alternative Raw Material.
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Synthesis of Hydroxyapatite from Bovine Bone for Medical Applications

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Abstract
Hydroxyapatite (HAp) synthesized from bovine bone have recently gained attention due to their outstanding properties. HAp is prepared at a controlled calcination procedure at temperatures of 750°C, 850°C, and 950°C for 5 hours. The produced materials were fully evaluated using X-ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy (SEM) to examine their crystallinity, phase composition, and microstructural characteristics.
FTIR analysis revealed that three important peaks in the calcined samples matched the standard values, demonstrating the preservation of functional groups characteristic of hydroxyapatite. XRD examination indicated a monoclinic crystal structure across all samples, comparable with normal hydroxyapatite. SEM imaging indicated that when the calcination temperature increased, the crystallinity, density, and transmittance of the samples likewise improved, while porosity reduced.
The results emphasize that regulating calcination temperature is critical in increasing the structural and optical properties of hydroxyapatite, making it a suitable candidate for biomedical applications. This study proposes a sustainable strategy to generating high-purity hydroxyapatite from genuine bovine bone, leading to cost-effective methodologies in material synthesis.

Keywords: Hydroxyapatite, Bovine Bone, Calcination, Crystallinity, Biomedical Applications
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Development of Antifungal Patch with Natural Extracts Embedded onto Silver Nanoparticles for Diabetic Patients

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Abstract
Recent data shows that the illnesses caused by antibiotic-resistant bacteria in the European Union and European Economic Area (EEA) match the combined impact of HIV, influenza, and tuberculosis. Infection control plays a key role in wound care and forms a global industry worth billions. Most amputations from diabetic sores and ulcers stem from infections, which affect more and more older people. The main hurdle to healing is the biofilm a well-organized group of bacteria wrapped in a substance they make themselves, which resists standard treatments. We need new antimicrobial drugs and ways to fight biofilms. In this context silver nanotechnology has caught a lot of attention for better healthcare. Silver nanoparticles offer new ways to control infections in wound healing because of their natural healing properties and ability to kill many types of microbes. This review aims to give readers an overview of the latest advances in silver nanotechnology focusing on how silver helps wounds heal.

Keywords: Silver, Diabetic, biofilm
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Comparison of Some Coatings Applied to Steel Surface

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Abstract
Steel is a widely used material in many industries, but due to its sensitivity to corrosion and wear, the application of protective coatings is of great importance. This study examined the application of different types of coatings to the steel surface and their effects on corrosion resistance, mechanical strength and other important properties. Various methods such as epoxy, polyurethane, galvanized, and ceramic coatings were compared.

Keywords: Steel, Epoxy, polyurethane, galvanized and ceramic coatings
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Electromagnetic Properties of Polyaniline Composites for Shielding Applications

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Abstract
This work is a contribution to the study of the electrical and magnetic properties of polymer composite materials made up of polyaniline (PANI), polyisoprene (PI) and polyamide (PA), each of these materials providing a specific property allowing to use this type of composites in various applications such as in electromagnetic shielding or absorption of microwave signals. In this context, the electron paramagnetic resonance (EPR) technique was used to characterize samples of PI/PANI and PI/PA12@PANI having different structures in comparison with pure polyaniline. The effect of the structure on the electrical properties of the samples was verified. The sample containing polyamide was found to be more conductive and containing the highest concentration of paramagnetic centers. The same sample exhibits the lowest microwave penetration depth and reflective shielding efficiency suggesting its potential use as a microwave absorber. The study of the RPE signal as a function of temperature allowed to determine the activation energy of spin movements estimated to be of 18 meV.

Keywords : EPR, Composite, Polymers, Electrical properties.
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Transforming Scrap into High-Performance Al-7075 With Comprehensive Property Analysis and Material Characterization

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Abstract

The 7xxx series Aluminum alloys more specifically the grade AL-7075 is highly demanded for aircraft and defense applications as the Aluminum grade 7075 is light in weight, malleable, heat and fire resistant as well as capable of conducting electricity. It shows corrosion resistant behavior as it swiftly forms passivation layer of aluminum oxide and interacts efficiently with other chemical components, particularly oxygen. The 7xxx series alloys more specifically 7075 are on competitive level with the higher strength and light in weight gives it advantage over titanium and steel alloys as these are heavy and does not suit for better weight to strength ratio for commercial and military applications. The cryogenic properties of Al-7075 keep it on the top in Aluminum alloys as these are not embrittled at low temperature and become even stronger as the temperature is decreased. It is perfect for cryogenic fuel tanks for rockets and launch vehicles without suffering major ductility losses. Maintaining the composition of 7 series Aluminum specially Al-7075 is very typical task for the production of Aluminum grade 7075 that is the reason that Aluminum alloy grade 7075, is not being produced in Pakistan and imported from other countries for essential needs. Whereas, Al-7075 first time locally produced in Pakistan at a bulk form. The composition is confirmed by spark spectroscopy, whereas characterization is carried out by Optical Microscopy and mechanical properties are observed by Tensile strength, yield strength, hardness and physical properties are observed by density. Microstructure and mechanical properties of Al-7075 were described by spectrometer, optical microscopy, universal tensile testing machine and density manually. Scrap is source of production and cost of local production is the half. It will increase economic stability by reduction in cost of import.

Keywords: Aluminum, properties, scrap

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Predictive Modelling of the Boronizing Process Using Neural Networks

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Abstract
Boronizing is a thermochemical surface treatment designed to enhance the wear and corrosion resistance of metals by diffusing boron atoms into their surface, leading to the formation of hard boride layers. This paper explores the application of neural networks (NNs) as a predictive modeling tool for the boronizing process. By training the model with experimental data, it effectively estimates key outcomes such as layer thickness and boron concentration in the treated material. The findings demonstrate that neural networks offer a robust and efficient alternative to conventional empirical approaches for process prediction and optimization.

Keywords: Boronizing, Neural networks, Modelling, Simulation, Process optimization
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PVDF-BaTiO3 Nanocomposite Scaffolds for Biomaterials applications; Synthesis and Characterization

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Abstract
PVDF and PVDF/BaTiO3 nanocomposite scaffolds are studied in the present work. BaTiO3 (BTO) nanoparticles have been synthesized using a cost-effective ball-mill method, while free-standing PVDF/BaTiO3 nanocomposite scaffolds with varying BaTiO3 content have been prepared using solution extrusion modeling 3D printing technique. Phase identification has been carried out using the X-ray diffraction technique. The results showed that the PVDF/BTO 3D printed scaffolds had a highly porous structure with interconnected pores. Adding BTO nanoparticles to the PVDF matrix improved the piezoelectric properties of the scaffolds. Also, increasing the percentage of BTO in the PVDF matrix increased the piezoelectric response and made them more suitable for bone tissue engineering applications. The scanning electron microscope (SEM) has been used to characterize the morphology of samples. For increasing the hydrophilic properties of PVDF, cold plasma treatment was used. In vitro cell culture studies using MSC cells showed that the PVDF/BTO 3D-printed scaffolds supported cell adhesion and proliferation, indicating their biocompatibility. The findings of this study demonstrate the potential of PVDF/BTO 3D-printed scaffolds as a promising biomaterial for bone tissue engineering applications due to their favorable structural and biocompatibility properties.

Key words: Polyvinylidene fluoride (PVDF), Barium titanate (BTO), 3D printing, Scaffold, Piezoelectric.
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Boosting piezoelectricity of PVDF fibers fabricated by electrospinning process using submicron sized BaTiO3 particles reinforces

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Abstract
Piezoelectricity involves the formation of an electricicity in response to mechanical force, and vice versa, in a certain group of materials. This distinctive attribute has garnered numerous applications, including energy harvesters, sensors, actuators, and others. Ceramics, polymers, and their composites make up different groups of piezoelectric materials. Piezo-ceramics, such as PZT, ZnO, and BaTiO3, are known for their high piezoelectricity. However, their brittleness limits their applications. In contrast, piezo-polymers, like PVDF, offer flexibility and ease of processing. Despite these benefits, their piezoelectric properties are considerably lower than piezo-ceramics. Combining the strengths of both, results in piezo-composites that exhibit enhanced electromechanical properties and mechanical flexibility, suitable for a wide range of applications, including wearable energy harvesters. Recently, fabricating piezo-composites in the form of fibers, since having wide applications in wearable electronics, has observed so much attention. Therefore, we investigated the enhancement of the piezoelectricity in PVDF fibers by adding BaTiO3. PVDF powder and submicron sized BaTiO3 particles were dispersed in DMFand placed in an ultrasonic bath for 20 minutes to prevent agglomeration. Eventually, the prepared solution was fabricated as nanofibers by electrospinning process. FE-SEM reduction (362 nm). FTIR resulted in increase of -phase from 58.90% to 65.01%. Piezoelectric property of the nanofibers were measured as their output voltage response by applying them an external 2.6 N force with frequency of 5 Hz. It was observed that addition of submicron sized BaTiO3 particles to the PVDF fibers, reinforces its piezoelectricity, but not considerably high (17 µV), since the size of the particles may cause in improper dispersion of them. In conclusion, piezoelectricity of PVDF nanofibers increases as BaTiO3 is added to its matrix, but the increase depends on the BaTiO3

Keywords : Piezoelectricity, Polyvinylidene fluoride, Barium titanate, Electrospinning, Nanofiber, N, N-dimethylformamide.
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Review of new cemented tungsten carbide sintering methods and binders

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Abstract

Hard metal composites are widely used in various industries due to their unique combination of hardness, toughness, and strength, especially tungsten carbide cemented. They're used for manufacturing cutting tools, woodworking, dental applications, mini drill bits, and other wear-resistant components. The sintering techniques and binder selection significantly impact the performance of these materials. In conventional sintering methods, like liquid or solid-phase sintering, the lengthy processing time leads to undesirable grain growth in tungsten carbide, which reduces mechanical strength and hardness. We know that fine-grained structures enhance mechanical properties and, in turn, increasing the useful life of products. However, modern sintering methods that reduce either the sintering temperature or time, such as plasma and microwave spark synthesis, as well as simultaneous heat and pressure methods like hot isostatic pressing, prevent this undesirable grain growth and yield a final product with improved mechanical properties. New sintering approaches have influenced the selection of binders for tungsten carbide cemented materials, which have traditionally been made with cobalt. While cobalt offers high wettability and improved toughness, it has drawbacks like a low melting point that can lead to sticky wear, along with poor resistance to corrosion and oxidation at high temperatures. Alternatives like nickel and iron have been introduced, but innovative methods like plasma spark synthesis now allow for the use of ceramic binders such as alumina, enabling high-temperature sintering without the need for a binder. These advancements lead to the production of tungsten carbide with high hardness, strength, and density, encouraging researchers to explore new sintering methods.

Key words: Spark plasma sintering, Binder, Cemented tungsten carbide, Microwave sintering

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Investigating the possibility of recycled zirconia blocks with combining gel casting and cold isostatic press

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Abstract

Zirconia-based ceramics are importance in dentistry, due to their favorable mechanical properties and aesthetic appearance. These ceramics are employed in the fabrication of dental veneers. Accordingly, zirconia blocks are machined by CAD-CAM in accordance with the prepared plan. It is typical for a considerable quantity of zirconia ceramic to be left over from the original block, which is unsuitable for use with the CAD-CAM machine. Furthermore, a portion of the block is also unsuitable as chips resulting from the machining process. The objective of this research is to recycle the remaining zirconia from the blocks by gel casting and cold isostatic pressing. In order to achieve this, samples of specific dimensions were prepared using the gel casting method, after which the samples were subjected to cold isostatic pressing at varying pressures. Subsequently, the samples were subjected to a heat treatment in furnaces designed for the baking of zirconia. An examination of the strength and density of the samples following heat treatment revealed that those prepared in two stages (gel casting and pressing) exhibited greater density and strength than samples prepared in a single stage (only gel casting). This phenomenon can be attributed to the lower porosity of two method samples in comparison to single method samples. Furthermore, the similarity in strength between the recycled samples and dental blocks demonstrates the efficacy of recycling these costly materials.

Keywords: zirconia, recycling, gel casting, cold isostatic press (CIP).

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Piezoelectric Nanoparticle as Reinforcement Used in 3D-printed Bone Scaffolds

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Abstract
Bone defects and injuries which can be originated from fractures, trauma, aging, osteoporosis, tumor resection, etc., are a challenging health problem worldwide Autografts and allografts have been used as the ideal materials for bone treatment, but due to their limited availability, risk of inflammation, and immune system responses, new and efficient alternatives was needed. Nowadays, scaffolds are playing an important role in tissue engineering (TE) especially in bone tissue regeneration. Bone scaffolds can be fabricated through different methods like 3D-printing, electrospinning, etc., using various types of materials based on the desired functionality. On the other hand, electrical stimulation has shown its considerable efficiency in regenerative medicine, neuroscience and cancer treatment. Using well designed bone scaffolds with suitable mechanical properties and electrical stimulation at the same time, leads to bone regeneration. This electrical stimulation influences the bio-electric signaling pathways and promotes bone growth. Electrical stimulation can generate from piezoelectric nanomaterials as reinforcements in bone scaffolds, which can be activated by mechanical pressure of body activities or even ultrasound waves (US). In this way, we don't need an external power source or invasive percutaneous electrodes. In this study, we will discuss about different piezoelectric materials that can be used as nanoparticle reinforcements such as ZnO, BaTiO3, etc., in 3D-printed bone scaffolds.

Keywords: Bone defects, electrospinning, ZnO, BaTiO3.
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Fabrication and Characterization of an Ultra-High Current Electromagnetic Nanogenerator for Enhanced Energy Harvesting and Wireless Power Applications

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Abstract

Electromagnetic Nanogenerator is one of the prominent candidates for harvesting renewable energy, exhibiting significant advantages. This type of nanogenerator can effectively convert energy from rotational movement to electricity based on electromagnetic induction. Herein, the fabrication of an Ultra-High Current Electromagnetic Nanogenerator (UHC-EMG) is reported and the electrical characterization results are fully investigated. The nanogenerator consists of 4 NdFeB magnets and coils to provide a high magnetic field. Under 1000 RPM the UHC-EMG can produce the output power of 348 W/m^2(140 mW), an open circuit voltage of 2.9 V (Peak to Peak), and a high short circuit current of 424 mA. Also, the nanogenerator performance for charging different capacitors (1, 10, 22, and 33μF) is analyzed. Furthermore, in this paper, the ability of the nanogenerator for wireless power transmission is investigated which represents the eligibility of the UHC-EMG applications for the power supply of low-power electronic devices in different conditions.

Keywords: Electromagnetic nanogenerator, High Current, Energy Harvesting, Electromagnetic Induction.

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Optimization of Balsa Wood's Triboelectric Properties through Chemical and Conductive Modifications for Self-Powered Sports Sensors

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Abstract

Wood-based triboelectric nanogenerators (W-TENGs) have achieved significant attention due to their sustainability, abundance, and mechanical flexibility. Specifically, Balsa wood offers an excellent platform for use in sports application because of its lightweight nature and unique cellular structure. In this paper, the improvement of Balsa wood's properties through a detailed step-by-step chemical treatment is investigated. Since wood is available as a natural material in most regions, harvesting energy from it and fabricating self-powered sensors based on it requires enhancement in its physical properties so that it can be used as a triboelectric material. Furthermore, to boost electrical performance, a thin conductive layer of Cu is deposited using a sputtering method, and its improvement on the triboelectric output is thoroughly analyzed. The microstructure of the chemically treated Balsa wood is characterized using Scanning Electron Microscopy (SEM). The microstructure of the chemically treated Balsa wood is characterized using SEM, revealing that after treatment, the empty spaces inside the wood are filled, and the cracks are sealed, resulting in enhanced flexibility and mechanical strength. Furthermore, the sputtering of a thin copper layer transforms the Balsa wood from a non- conductive to a hypo-conductive material, resulting in improving the electrical performance of the TENG. The output voltage of $2\times2cm^2$ W-TENG, under a force of 5N with 1Hz frequence is about 1.5V. The results show improvements in impact, energy harvesting efficiency, and great application of high sensing precision in sports wearable sensors.

Keywords: Triboelectric Nanogenerator, Balsa, sputtering, Sensors, Energy Harvesting

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Basınç Destekli Sinterleme ile Üretilen Kompozisyonel Derecelelendirilmiş Grafit Takviyeli Ti6Al4V Metal Matris Kompozitlerin Mikroyapısal Karakterizasyonu

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Özet

Bu çalışmada, basınç destekli sinterleme ile üretilen kompozisyonel derecelendirilmiş grafit takviyeli Ti6Al4V metal matris kompozitlerin mikroyapısal özellikleri incelenmiştir. Ti6Al4V alaşımı ve grafit tozlar (100 µm altı) bilyalı değirmende karıştırılarak kütlece %10 grafit içeren Ti6Al4V kompozit tozlar hazırlanmıştır. Hazırlanan Ti6Al4V/grafit kompozit tozlar ile 1000 µm kalınlığında üst katman ve Ti6Al4V tozlar kullanılarak 3000 µm kalınlığında alt katman olmak üzere kompozisyonel derecelendirilmiş grafit takviyeli Ti6Al4V metal matris kompozit numuneler, vakum ortamında, 45 MPa basınç altında, 950°C sıcaklıkta ve 45 dakikada sinterlenerek üretilmiştir. Optik mikroskop ve geçirimli elektron mikroskobu çalışmaları sonucunda mikron ve mikron altı boyutlarda grafit partiküllerin Ti6Al4V metal matrisi içerisinde yüksek oranda homojen olarak dağıldığı görülmüştür. Mikroyapıda yüksek oranda α fazı ve düşük oranda β fazının bulunduğu, grafit partiküllerin özellikle Ti6Al4V matris partikülleri sınırlarında yer aldığı gözlenmiştir. Matris ve grafit arasında 50 nm altı tane boyutlarında TiC fazının varlığı, matris ile grafit arasında kuvvetli metalürjik bağ oluşumunu göstermiştir.

Anahtar kelimeler: Grafit, Ti6Al4V, Titanyum Karbür, Titanyum Matris Kompozit

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Advancements and Properties of Chitosan-based Nanoparticles for Osteosarcoma Treatment: A General Review

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Abstract
Osteosarcoma (OS) is a type of cancer originating from bone that develops in osteoblast cells. It is the most common primary bone cancer that afflicts children and adolescents. Chemotherapy, as a common primary treatment for osteosarcoma, can cause both short-term and long-term side effects for the patients and affects the immune system, such as hair loss, loss of appetite, fatigue, cardiotoxicity, etc. Recent advances in drug delivery nanoparticles have received increased interest and offer novel therapeutic solutions with minimum side effects. Chitosan-based nanoparticles nowadays play an important role in treating osteosarcoma due to their antibacterial properties, biocompatibility, and ability to encapsulate drugs. As a result of their properties, chitosan-based nanoparticles can provide a prolonged release of therapeutic compounds that effectively target osteosarcoma cells; likewise, they can allow the controlled release of drugs, leading to improved therapeutic outcomes. They can also be engineered to target bone cells and tissues, which can result in the promotion of osteogenesis and bone repair, making them more appropriate for bone-related cancer treatments. This review highlights the recent advances of chitosan-based nanoparticles as drug delivery systems, which play a promising role in osteosarcoma treatment.

Keywords: Osteosarcoma, bone cancer, drug
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A Review on Different Structures of Silicon for Next-Generation Lithium-Ion Battery Anodes

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Abstract

High energy density and high specific power and energy have made Lithium-ion batteries pivotal for portable electronic devices. However, demand for higher energies and powers always arises and researchers endeavor to provide. Since Silicon offers high theorical specific capacity (almost 11 times that of Graphite), it is being considered as a potential and suitable candidate for anode material of next- generation Lithium-ion batteries. However, Silicon's capacity fades after a few cycles due to its drastic volume change during lithuation/delithuation, which hinders its commercialization. Low electrical conductivity and high reactivity of Silicon which results in an unstable solid electrolyte interphase (SEI) are other serious challenges that Silicon as anode faces. Different structures of Silicon, particularly its nanostructure forms, illustrate different properties that have the potential to conquer the challenges. Many structures such as nanoparticles, nanowires, thin films, porous Silicon, etc. have been fabricated by researchers and their performance has been investigated. By reviewing various fabrication methods and evaluating the performance of these Silicon structures, this paper aims to provide a comprehensive understanding of their advantages and limitations, offering insights into their potential for overcoming the hurdles associated with Silicon anodes in Lithium-ion batteries. The discussion is critical for advancing research and development in this area, bringing us closer to realizing commercially viable, high-performance Silicon-based anodes for next-generation batteries.

Keywords: Lithium-ion batteries, Silicon, Anode, Nanostructures.

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Nanocarbides formation in Co-28Cr-5Mo-0.3C implant alloy during martensite transformation

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Abstract
The precipitation of nanoscale M23C6 carbides in a Co–28Cr–5Mo–0.3C implant alloy during tungsten inert gas (TIG) welding has been subjected to a comprehensive and systematic investigation. The nanoscale M23C6 carbides precipitated at hcp-fcc interfaces, with an observed range of 10-100 nm. Furthermore, X-ray diffraction analysis demonstrated that a greater quantity of athermal ε-martensitic transformation (approximately twofold that observed in the solution-treated sample) was attained following the welding process. Evidently, the formation of nanoscale M23C6 carbides was markedly enhanced by the development of athermal martensite transformation. Additionally, these particles impart a remarkably high hardness of approximately 850 HVN to the alloy.

Keywords: Co-Cr-Mo alloy; athermal martensite; nanoscale carbides.
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Impact of barium oxide on the structure and surface properties of glass-crystalline glazes

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Abstract
The impact of barium oxide addition onto glazes from the SiO2-Al2O3-CaO-MgO-K2O system was investigated. Samples were prepared with 0, 2.5, 5 and 7.5 wt% of barium oxide added to this system. The glazes were fired at 1240°C with 1h holding at maximum temperature. The analyses of phase composition (XRD), surface properties (color and roughness), structural mid-infrared analysis, and microstructure were performed.
Diopside and Hyalophane crystals were observed. Mid-infrared studies confirm that the appearance of crystalline phases ordered the structure of the glazes. Still, the amorphous phase increased its disorder related to the higher amount of modifying barium cations. The addition of barium oxide did not significantly affect the color of the surface but caused an increase in roughness due to surface crystallization. Based on Hv measurements and EDS chemical analysis, the microhardness increased with an increased amount of barium in the amorphous phase.

Keywords: barium oxide, SiO2-Al2O3-CaO-MgO-K2O, EDS
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Reactive Sintering of Ultra-High Temperature Ceramic Materials from B_4C and MAX Phases

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Abstract

In this work, the influence of three MAX phases (Ti_3SiC_2, Ti_2AlC, and Cr_2AlC) on the densification and final properties of dense composites from Ultra-High Temperature Ceramics (UHTC) family was studied. Addition of the MAX phases resulted in the formation of secondary boride phases due to chemical reactions between boron carbide and MAX phase. Mentioned phases were utilized for reduction of sintering temperature of the final composite material. It decreased the sintering temperature up to 800 °C when compared to pure B_4C. Additionally, the phase composition and derivative mechanical properties were investigated to evaluate differences between final composites materials. All obtained materials remarkably increased their fracture resistance (K_{IC}) from 33 to 100%. The mechanical properties of B_4C were either retained (Ti_3SiC_2) or decreased in terms of Vickers hardness and Young's Modulus (Ti_2AlC and Cr_2AlC). Systems with Ti_3SiC_2 appeared to possess significant potential for application

Keywords: MAX phases, Ultra-High Temperature Ceramics (UHTC), Boron carbide (B_4C)
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Reactive Sintering of Ultra High Temperature Ceramics (UHTCs) for Cutting Tools

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Abstract
Composites incorporating boron carbide (B4C) have garnered significant research interest due to their superior physical and chemical properties. This study employed boron carbide, carbon, and intermetallic compounds from the Ti-Si and Ti-Al systems to create a composite consisting of over 99% TiB_2, TiC, and SiC. It investigated three densification methods: pressureless sintering (PS), hot-pressing (HP), and spark plasma sintering (SPS), with consolidation temperatures of PS 1650-1750°C, HP 1500-1550°C, and SPS 1400-1450°C. The type of intermetallic compound used affected the reaction mechanisms, and using intermetallic phases like TiSi, $TiSi_2$, and Ti_5Si_3 with appropriate molar ratios of B_4C and C produced a dense composite with a simplified phase composition, eliminating free carbon from the final material. The high-temperature refractory TiB_2-TiC-SiC composite demonstrated high mechanical strength and fracture toughness. The sintering process was highly efficient, decomposing nearly 99% of initial phases to form new TiB_2 and SiC phases, well-densified at relatively low temperatures. The TiC phase formed only in the absence of boron, but a small amount appeared with Ti_5Si_3 and sufficient Ti. Composites were sintered at 1000-1700°C. The study also evaluated the ablation resistance of TiB_2-TiC-SiC composites made from B_4C, C, and intermetallic compounds through reactive sintering using the SPS technique, involving intermetallics from Ti-Si (TiSi, $TiSi_2$, Ti_5Si_3) and Ti-Al (Ti_3Al, TiAl, $TiAl_3$) systems. Density was measured using Archimedes' method. Phase compositions were analyzed with a Panalytical/Philips X'Pert Pro MD XRD diffractometer, and X-ray absorption spectroscopy (XAS) at the PIRX beamline of Solaris National Synchrotron Radiation Center, Krakow, Poland. Ablation resistance was tested with an oxyacetylene flame at 1800°C for 60 seconds, and ablated surfaces were examined using a confocal microscope (Lext OLS 3100, Olympus) to measure ablation depth. Linear ablation rates were calculated, and the microstructure and chemical composition of ablated surfaces were analyzed using SEM/EDS (Thermo Scientific Scios 2). The composites exhibited good ablation resistance, often surpassing commercially available materials.

Keywords: boron carbide (B_4C), intermetallics, Ultra High Temperature Ceramics (UHTCs),
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New materials for wood structure joints and their fire protection

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Abstract

Due to earthquake and difficult surrounding conditions influencing wood construction joining, there is a need to develop of new adhesives and their protection against fire. The work concerns analysis of new mixtures of flexible and rigid polyurethanes, which role is to ensure adequate mechanical strength of the connection, dampening vibrations and resistance to external conditions such as fire, moisture, mold or fungi. Such adhesives should show good thermal stability, low gas release during fire situations, good and stable thermophysical behavior and connection shape stability. That is why this part of research concerned structural thermal analysis of PU and finding new fire protection coating for adhesive wooden structure joints. These two kinds of materials were investigated by means of phase composition and their correlation to thermal stability. The PU showed the stability above 200°C and low nitrogen oxides release quantity. The revealed gases were analyzed in air flow by DSC-TG-DTG thermal analysis with mass spectroscopy. The thermal stability of PU was also visualized, on selected sample compositions, by hot stage microscopy. The new PU were also examined by mechanical thermal analysis and the value of storage Young modulus (E'), inelastic E'' and loss tangent were determined.

The second part of the research concerns the optimization of hydrogel mixtures that can be used in two ways - as a fire extinguishing fluid, among others, for wooden structures, and also as a wood protection impregnant. Five-, six- and seven-component mixtures containing potassium sulfate, potassium dihydrogen phosphate and a system of three selected salts in various proportions were proposed, where the hydrogel base was sodium alginate. Thermal analysis allowed us to estimate the thermal stability of the fluids. In order to verify the extinguishing properties, fire and extinguishing tests using wooden samples were carried out. Scanning Electron Microscopy was used to analyze the particles remaining after the combustion reaction of samples extinguished with selected types of the designed fluids. The conducted test fires allowed us to check how the selected fluids behave in real fire conditions. As a result of the initiation of a fire in pine beams (test fire 3A), it was determined that the best extinguishing efficiency was achieved by a fluid based on a 0.25% sodium alginate

solution with a $KHCO_3/(NH_4)_2CO_3/CO(NH_2)_2$ salt system. The fire was completely extinguished and did not re-ignite.

In case of polyurethane adhesives, research was funded by the National Science Centre, Poland under the OPUS call in the Weave Programme [No 2021 43 /I/ST 8 00554]. The other, concerning hydrogel, were supported by subvention of the Polish State Ministry of Education and Science for AGH University of Krakow under project 16.16.160.557.

Keywords : PU, FPU, RPU, thermal analysis, fire tests, coatings, adhesives, extinguishing fluid.
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Mikrodalga Destekli Yöntemle VNi_2S_4 Üçlü Metal Sülfür Nanoparçacıklarının Sentezi ve Yapısal Karakterizasyonu

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Özet

Metal sülfürler yüksek özgül kapasitesi ve benzersiz özellikler sayesinde enerji depolama birimleri için kullanılmada büyük ilgi görmektedir. Metal sülfür bileşikleri, geniş bir yelpazede kimyasal, fiziksel ve elektronik özelliklere sahip olup, malzeme bilimleri ve mühendislikte büyük bir öneme sahiptir. Bu bileşikler, özellikle enerji depolama, kataliz, elektronik cihazlar ve sensör teknolojilerinde önemli uygulamalara sahiptir. Metal sülfürler, genellikle yüksek iletkenlik, düşük bant aralığı ve yüksek termal stabilite gibi özellikler gösterirler. Bu özellikleri sayesinde, özellikle batarya elektrot malzemeleri ve güneş pilleri gibi enerji dönüşüm ve depolama cihazlarında kullanılırlar. Ayrıca, çevre dostu ve bol bulunan elementlerden elde edilebilmeleri, sürdürülebilir malzeme arayışlarında metal sülfürleri öne çıkarmaktadır. Bu derleme, metal sülfürlerin sentezi, yapısal özellikleri ve çeşitli ileri teknolojilerdeki potansiyel uygulamaları üzerine odaklanmaktadır.

Bu çalışmada VNi_2S_4 metal sülfürün farklı süre ve güç optimizasyonlarında sentezlenmiştir. Mikrodalga sentez yöntemi geleneksel yöntemlere göre enerji, zaman ve verim gibi özellikler için büyük avantaj sağlamaktadır. Bu çalışmada mikrodalga sentezi kullanıldı. Karakterizasyon işlemleri için X ışını kırınımı, Taramalı Elektron Mikroskobu ve Geçirimli Elektron Mikroskobu analizleri gerçekleştirilmiştir.

Anahtar Kelimeler: Metal Sülfürler, Enerji Depolama

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$CoNi_2S_4$ Üçlü Metal Sülfür Nanoparçacıklarının Yenilikçi Bir yaklaşımla Sentezi ve Morfolojik Analizleri

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Özet

Son yıllarda, hızlı modernleşme, sanayileşme ve küresel nüfus artışı, çevresel bozulmaya ve fosil kaynaklarının tükenmesine neden olmuştur. Yenilebilir enerji kaynakları enerji kaynakları alternatifler sunarken, bu kaynaklardan üretilen enerjiyi etkin bir şekilde depolayabilecek iyi bir enerji depolama sistemine ihtiyaç duyulmaktadır. Kükürt doğal olarak bol bulunması, petrol ve gaz endüstrisinin bir yan ürünü olarak büyük ölçekli üretilmesi ve uygun maliyetli olması gibi önemli özellikler taşımaktadır. Kükürt bazlı elektrotlar, yüksek şarj depolama kapasiteleri ve düşük maliyetleri nedeniyle yüksek kapasiteli enerji depolama sistemleri için umut verici bir seçenek sunmaktadır. Bu çalışmada, CoNiS4 kompoziti hızlı, basit ve düşük maliyetli olan mikrodalga yöntemi ile elde edilerek etkili bir elektrot malzemesi geliştirildi. Elde edilen numuneler SEM, TEM ve XRD kullanılarak analiz edildi. Bu sonuçlara dayanarak, mikrodalga yöntemi ile bu malzeme üretimi gelecekte enerji depolama sistemlerinin üretilmesi için umut verici görünmektedir.

Anahtar Kelimeler: Metal sülfür, Nanoparçacık, Mikrodalga
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Hızlı ve Ekonomik Bir Yöntemle $CdNi_2S_4$ Nanoparçacıklarının Sentez Optimizasyonu ve Karakterizasyonu

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Özet

Fosil yakıtların giderek tükenmesi ve karbon dioksit salınımı, termal kirlilik ve asit yağmuru gibi çevresel sorunların artışı, temiz ve yenilenebilir enerji kaynaklarına olan ihtiyacı acil hale getirmiştir. Bununla birlikte, yenilenebilir enerji kaynaklarından elde edilen enerjinin arazi, hava durumu ve günün saati gibi doğal etkenler nedeniyle istikrarsız olması, verimli enerji depolama sistemlerinin geliştirilmesini zorunlu kılmaktadır. Gelişmiş nanomalzemeler, özellikle geçiş metali bileşikleri, bu enerji depolama zorluklarını ele almakta büyük potansiyel göstermektedir. Geçiş metali oksitleri geniş çapta kullanılsa da, metal sülfürleri daha yüksek iletkenlik, daha düşük bant aralığı ve geliştirilmiş iyon difüzyonu özellikleri sayesinde daha umut verici alternatifler olarak öne çıkmaktadır. Bu çalışma, hızlı, enerji tasarruflu ve ölçeklenebilir bir süreç olan mikrodalga destekli bir yöntem kullanılarak $CdNi_2S_4$ nanopartiküllerinin sentezine odaklanmaktadır. Mikrodalga sentez tekniği, çevresel etkileri en aza indirirken homojen nanopartiküllerin üretilmesini sağlamaktadır. Araştırmanın amacı, $CdNi_2S_4$'ün sentezini optimize etmek ve üstün yapısal ve elektrokimyasal özelliklerinden yararlanarak enerji depolama uygulamalarındaki potansiyelini araştırmaktır.

Anahtar Kelimeler: Metal sülfür, Nanomalzeme, Enerji
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Farklı Ambalajlarda Depolanan Ayçiçek Yağının Bazı Fizikokimyasal Özelliklerinin Zamana Bağlı Değişimi

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Özet

Bu araştırma kapsamında, farklı ambalajlarda depolanan ayçiçek yağının bazı fizikokimyasal özelliklerinin değişimi incelenmiştir. Bu doğrultuda, cam, plastik ve teneke ambalajlarda 6 ay süresince depolanan ayçiçek yağının, serbest yağ asitliği, peroksit, kırılma indisi, iyot sayısı, yağ asitleri kompozisyonu ve oksidatif stabilite değerleri belirlenmiştir. Elde edilen sonuçlar sırasıyla, serbest yağ asitliği yönünden (% 0,08-0,10), peroksit sayısı (0,12-2,30), iyot saysı (126,90-128,06), oksidatif stabilite (4,52-3,65) aralıklarında değişmiş olup, yağ asitleri kompozisyonu açısından baskın doymuş yağ asitleri palmitik, stearik, doymamış yağ asitleri ise oleik ve linoleik yağ asitleri olmuştur. Bu sonuçlar doğrultusunda ayçiçek yağının bazı fiziko kimyasal özelliklerinin farklı ambalaj çeşidine göre depolama süresince değişim gösterdiği belirlenmiştir.

Anahtar Kelimeler : Ayçiçek yağı, cam, teneke, plastik, ambalaj, fizikokimyasal özellikler.
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Nano Bentonit İçerikli Polilaktik Asit (PLA) Kapak Ambalaj Filminin Zeytinyağının Fizikokimyasal Özellikleri Üzerine Etkisi

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Özet

Bu araştırma kapsamında, nano bentonit içerikli polilaktik asit kapak ambalaj filminin (BPLAKAF) natürel sızma zeytinyağının fizikokimyasal özellikleri üzerindeki etkisi incelenmiştir. Çevre dostu ve biyobozunur özellikleri ile dikkat çeken BPLAKAF, zeytinyağının depolama süresi boyunca kalite ve tazeliğini koruma potansiyeli açısından değerlendirilmiştir. Araştırma, nano bentonit üretimi, BPLAKAF üretimi ve bu filminzeytinyağı depolamasında kapak ambalajı olarak kullanımı olmak üzere üç aşamada gerçekleştirilmiştir. Yapılan analizler sonucunda, nano bentonitin XRF analizi ile baskın bileşenleri %65,53 SiO_2, % 16,63 Al_2O_3 ve % 4,21 Fe_2O_3 olarak tespit edilmiştir. BPLAKAF'ın kalınlığı 200 mikrometre olarak belirlenmiş ve Enerji Dağılımı X-Işını Analizi sonucunda baskın elementler karbon, oksijen, silisyum ve alüminyum olarak tespit edilmiştir. Ayrıca, BPLAKAF'ın görünür yağ sızdırmadığı gözlenmiştir. Sonuç olarak, üretilen BPLAKAF ile ambalajlanmış natural sızma zeytinyağının, fizikokimyasal özelliklerini ve oksidatif stabilitesini koruduğu, serbest yağ asitliği ve peroksit sayısı değerlerinin gıda olarak tüketilebilirlik kriterlerine uygun olduğu ve sürdürülebilir, doğa dostu özellikleri ile zeytinyağı teknolojisinde kapak ambalaj filmi olarak kullanılabilir olduğu belirlenmiş olup, kapak ambalaj yerine ileriki çalışmalarda tüm amabalajın bu malzemeden üretilip kullanılabilirliğinin araştırılmasıda tavsiye edilmektedir.

Anahtar Kelimeler : Polilaktik asit, nano bentonit, nanoteknoloji, zeytinyağı, fizikokimyasal özellikler.

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Impact of Zirconia Nanoparticles on the Corrosion behaviour of Plasma Electrolytic Oxidation Coatings on AZ31 Magnesium Alloys

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Abstract
Magnesium is one of the lightest engineering alloys, widely used across various industries. However, magnesium and its alloys are considered chemically active materials due to their poor corrosion resistance. One effective solution to mitigate this issue is the application of surface modification processes, such as plasma electrolytic oxidation (PEO). The PEO process generates a thick, porous, and protective coating on the surface that improve corrosion and wear resistance. Additionally, incorporating nanoparticles, such as ZrO_2, into the electrolyte can effectively reduce the porosity of the PEO coating and enhance its properties. This study investigated the role of PEO coatings on surface properties, both with and without incorporation of zirconia nanoparticles. The results of Electrochemical corrosion tests revealed that PEO coatings and PEO coating modified with zirconia nanoparticles reduced corrosion current density by 3.9 and 7.6 times, respectively, compared to the uncoated sample.

Keywords: AZ31, Corrosion Behaviour, Plasma Electrolytic Oxidation, ZrO2 Nanoparticles,
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Road to Quantum Metrology, Information Science and Technology: It's all about Materials Engineering

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Abstract
Overcoming conventional paradigms, quantum information science and technology, or QIST, is in the forefront of revolutionary advances in information processing, communication, and computation. Quantum technology market is expected to reach a global market size of 1 billion Dollars in 2025 and exceed 3 billion Dollars by 2035. This market not only consists of front-end high technology sensing and computing platforms, but also of supporting materials supply chains for example microwave components, super condcting wires, etc.
As the Quantum Metrology Lab of National Metrology Institute, UME, we explore the horizons of quantum devices, namely sensors and metrological standards. These devices utilize Quantum properties of matter such as quantum states of atoms and electrons, fluorescence, wave properties of electrons, quantum tunneling and various effects such as Spin Hall Effect and Quantum Anomalous Hall Effect. First step to study these systems is to successfully engineer the materials properties and to measure them correctly. As part of an institute dedicated to measurement accuracy and traceability, the Quantum Metrology Lab focuses on nano-dimensional metrology, standardizing nano-electrical measurements in the DC and microwave ranges, in micro-probe stations or in scanning probe microscopy systems. Our Lab's activities also include developing of voltage reference standards, new reference resistance materials and dimensional standards. In this talk we dive into successful components in manufacturing Quantum Devices, importance of characterization techniques and other key factors in Quantum Technologies.

Keywords: quantum, metrology, information science
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SnO_2/ İlmenit Katalizörünün Fotokatalitik Özelliklerinin İyileştirilmesi

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Özet
İlmenit, kimyasal formülü $FeTiO_3$ olan bir mineral türüdür. Genellikle siyah veya koyu gri renkte olup, yüksek yoğunluğa sahiptir. İlmenit, titanyum metalinin ve titanyum dioksitin (TiO_2) üretiminde önemli bir kaynak olarak kullanılmaktadır. Dünya genelinde yaygın olarak bulunması sebebiyle ilmenit, düşük maliyetlidir.
SnO_2, yüksek elektron tutuculuğu, düşük maliyeti ve optiksel şeffaflık gibi özellikleriyle gelecek vadeden bir malzemedir. TiO_2 ise UV ışığını absorbe edebilmesi, yüksek oksidasyon potansiyeli, bolluğu, yüksek kararlılığı ve toksik olmaması gibi çekici özelliklerinden dolayı en önemli fotokatalizörlerden biri olarak kabul edilir. Ancak TiO_2'nin geniş bant aralığı (3–3.2 eV) ve yüksek maliyeti, bu malzemenin dezavantajlarıdır. Bu nedenle, alternatif olarak ilmenit minerali kullanılarak SnO_2/TiO_2 katalizörünün üretilmesi ve karakterizasyonu önem taşımaktadır.
Bu çalışmada ilmenit kullanılarak SnO_2/İlmenit katalizörleri, H_2SO_4'ün farklı derişimleri kullanılarak hazırlanıp karakterizasyonlarının incelenmesi ve karşılaştırılması amaçlanmıştır. Karışım 120 °C'de 40 dakika süreyle ısıtılmış ve çözelti oda sıcaklığında soğutulmuştur. Karışım, filtre kağıdı ve bir vakum pompası kullanılarak süzülmüştür. Süzüntü, beyaz bir çökelti oluşana kadar su eklenerek ısıtılmış; sonrasında asit çözeltisinden ayırmak için santrifüje verilmiştir. Ortaya çıkan çökelti yıkanmış ve 500 °C'de 7 saat süreyle kalsine edilmiştir. Oluşan ürün XRD ile analiz edilerek sonuçları incelenmiştir. Bu çalışma Kocaeli Üniveristesi BAP birimi tarafından FYL-2024-3615 numaralı proje ile desteklenmiştir.

Anahtar Kelimeler: Fotokatalizör, SnO_2/TiO_2, ilmenit
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The Role of Optical Sorters in Raw Material Characterization and Performance Analysis

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Abstract
Optical sorters are critical tools that enable the separation and analysis of components by utilizing the interactions of materials with light. Raw material characterization determines a material's physical, chemical and optical properties and is essential, especially in industrial processes. Optical sorters are used to identify the components of materials by separating light beams of different wavelengths. This method is quite effective in determining the homogeneity and purity of materials, detecting impurities and analyzing component ratios.In this study, the effects of different types of optical sorters and various wavelength ranges on the characterization of calcite and dolomite raw materials were examined in detail; in addition, the contributions of these sorters to the performances in production processes were evaluated. The findings reveal that optical sorters are essential in determining susceptible material components. These techniques used in the study are widespread, especially in quality control, material research, and production processes. The findings of this research show that optical sorters have significant potential for broader applications in materials science.

Keywords : Optical sorters, characterization, Calcite, Dolomite, Wavelength analysis
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Investigating the effect of the Accumulative Roll Bonding process on the mechanical properties and microstructure of pure copper

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Abstract

In recent years, there has been a lot of focus on processing metallic materials with grain sizes smaller than 1 µm, also known as ultrafine-grained structures. Severe plastic deformation (SPD) methods have been identified as effective techniques for producing these materials. Accumulative Roll Bonding (ARB) is a sub-method of severe plastic deformation that can produce materials with ultrafine structures and induce specific deformations in the material's structure. This study investigates the mechanical properties and the microstructure of pure copper samples undergoing the ARB process at room temperature over two passes. Uniaxial tensile tests and Vickers microhardness tests were carried out on the samples. The results showed that the yield strength and tensile strength of the samples processed by the ARB process increased by 249% and 51% respectively with an increase in the number of cycles. However, the elongation, which measures ductility, decreased by 96.7% with an increase in the number of ARB cycles. On the contrary, the analysis of the sample's microstructure revealed a reduction in grain size.

Keywords: Accumulative roll-bonding (ARB), Pure copper, Ultrafine-grained (UFG), Mechanical properties, Severe plastic deformation (SPD)

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Effect of aluminum addition on microstructural features of nitrided SiW-xAl ductile cast irons

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Abstract

Lightweight non-ferrous alloys commonly used in high-temperature applications, such as engine and exhaust system components, often lack sufficient mechanical stability and oxidation resistance. To overcome these limitations, SiW-xAl ductile cast irons have been engineered with aluminum additions, which promote the formation of a protective oxide layer, thereby significantly improving the oxidation resistance of the alloy. This aluminum-rich oxide layer provides significant improvement, however, oxidation continues to penetrate the matrix through graphite nodules. To mitigate this, coating the surface of the graphite nodules that are in contact with the atmosphere will block oxygen exposure, preventing oxidation from progressing through the graphite nodules. The nitriding surface treatment is an effective method for forming a protective layer on iron-based alloys. This process results in iron-rich nitride phases on the surface and a nitrogen-enriched diffusion zone beneath the surface. Taking consideration of aluminum affinity for nitrogen, it is expected that in aluminum-alloyed cast iron, the nitriding process will lead to the formation of aluminum-rich nitride precipitates both on the surface and in the sub-surface region. This study aims to investigate the effect of aluminum present in the cast iron composition on the surface and sub-surface components obtained through the nitriding process. In this study, SiW and SiW-4Al ductile cast irons were subjected to gas nitriding at 510°C for 32 hours, and the effect of aluminum on the nitriding process was analyzed. After nitriding process, surface characterizations were conducted using X-ray diffraction with Cu-Kα radiation and a scanning speed of 1.0°/min. Light microscopy and scanning electron microscopy were employed to examine the surfaces and cross-sections of SiW and SiW-4Al ductile cast irons. The characterization revealed the formation of a nitrogen-rich white layer on the surface, which was observed to grow in accordance with the stoichiometry of the ε phase and coated the graphite nodules. Cross-sectional analysis indicated the development of the γ' phase in the diffusion zone with increasing aluminum content, alongside the precipitation of aluminum nitride.

Key words: SiW-xAl ductile cast iron, nitriding, characterization.

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Metallurgical characterization of nitrided novel SiW ductile cast iron

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Abstract
In high-temperature applications like exhaust manifolds, there is a demand for materials that offer both high thermal and mechanical stability. While stainless steels and Ni-resist alloys are capable of meeting these requirements, their high cost and challenges in casting limit their widespread use. Ferritic ductile cast irons, such as the SiMo alloy, offer a more affordable and easily cast alternative but are restricted by their inability to perform above 800°C. Therefore, the development of new alloys, such as SiW-based ductile cast irons, is necessary to provide improved high-temperature properties at lower costs, making them more suitable for demanding environments. Considering the high-temperature applications, the oxidation resistance of cast iron becomes crucial. Both the oxidation of iron in the solid solution and the high oxygen affinity of carbon in graphite increase the oxidation of cast iron. The oxidation resistance of cast iron can be enhanced by preventing the contact of both the iron in the solid solution and the graphite with oxygen on the surface. For this purpose, nitriding which is a surface treatment effective for iron-based alloys can slow down the diffusion of oxygen beneath the surface due to the nitride compounds formed. In this study, the primary aim is to metallurgically characterize the surface components formed by applying the nitriding process to SiW ductile cast iron for varying durations. In this study, SiW ductile cast irons are subjected to gas nitriding at 510°C for 12 and 40 hours. In order to reveal microstructural features obtained during different durations of nitriding processes, both surface and cross-sectional examinations were performed on the nitrided SiW ductile cast irons. For the surface characterizations, X-ray diffraction with Cu-Kα radiation and a scanning speed of 1.0°/min. was used, and cross-sectional characterizations were done by using scanning electron microscope and energy dispersive x-ray spectrometer. Characterization studies have shown that (i) a compound zone dominated by the ε phase formed on the surface for both nitriding durations, (ii) the thickness of the compound zone increased with longer nitriding times, (iii) the γ' phase became more pronounced beneath the ε phase with increased duration, and iron nitride precipitates in the diffusion layer increased, (iv) the surfaces of the graphite nodules were more effectively covered by the compound zone as the nitriding duration increased.

Key words: SiW-xAl ductile cast iron, nitriding, characterization.
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New achievements in Polymer-coated quantum dots (QDs), a mini review

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Abstract

The development of quantum dots and the use of quantum materials have attracted the attention of researchers today. Due to their unique properties, quantum materials can be used for various applications such as biomedicine, pharmaceuticals and drug delivery materials, electronics and food industries when combined with polymers in the form of polymer-coated quantum dots. The development of these materials can play an effective role in the development of the roadmap of quantum materials. In the current research, in the form of a mini review, the latest achievements in this field have been examined in order to provide suggestions for future research for researchers. In this research, CdSe, folic acid and graphene quantum dots have been investigated. Graphene is of particular importance in medical applications as well as drug delivery due to its high biocompatibility. The use of mentioned substances such as folic acid is also used in this research to detect cancer cells. Also, more attention should be paid to electronic industries.

Keywords: Quantum Dots, Polymer-coated, Quantum Science, food industries, biomedical.
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Investigation of the Effects of Permittivity of Soda-Lime-Silica Glass on Transparent Frequency Selective Surface Design for 5G Technology

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Abstract
This study focuses on the electromagnetic characterization of Frequency Selective Surface (FSS) with Soda-Lime-Silica glass substrate, which transmit electromagnetic waves by enhancing them at a critical frequency range for 5G technologies at Ka band. Low emissivity coatings on soda lime silica glass prevent the transmission of signals at 5G frequencies, especially in the 26-28 GHz frequency band. In order to solve this problem, a circular slot frequency selective surface (FSS) was designed by removing out some part of the coatings.
In this context, permittivity of glasses with different thicknesses and cut from various locations were measured using the waveguide and Free Space methods. The "fast method" was used for waveguide measurements, while the "Transmission Mode" Free Space method was applied inside the anechoic chamber. Additionally, significant insights were gained regarding the behavior of glass material during the permittivity calculations.
After electromagnetic material characterization of different soda lime silica glass samples, the effect of different permittivies on resonance tranmission frequency of the designed the frequency selective surface based on circular slot geometry were observed by simulating via CST Microwave Studio. The results show that the glass with lower permittivity value leads to better transmission at higher 5G frequencies.

Keywords: glass, permittivity, Ka band, 5G technology
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Evaluation of the Biocompatibility of Carbon/Carbon Composites Manufactured via CVD/CVI Techniques

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Abstract
The aim of this study is to create a pyrolytic carbon matrix around carbon fiber preforms with a three-dimensional (3D) orthogonal weave structure using the CVI process, and then to coat the resulting C/C composites with SiC through chemical vapor deposition (CVD). The study will examine the structural, thermal, mechanical, and biocompatibility properties of both types of composite materials obtained. In this study as well, carbon/carbon composite structures were obtained by creating a pyrolytic carbon matrix around three-dimensional woven carbon fiber preforms using the Chemical Vapor Deposition-Infiltration (CVD-CVI) method.
Subsequently, the produced C/C composites were divided into two groups, with one group being coated with SiC (silicon carbide) using the CVD method. In this study, carbon/carbon (C/C) composite structures were produced by depositing a pyrolytic carbon matrix around carbon fibers found in a three-dimensional (3D) preform using the Chemical Vapor Deposition-Infiltration (CVD/CVI) method. The preforms used as starting materials were in orthogonal fiber geometry and 3D carbon fiber knitting structure. The CVI process performed in the CVD device was carried out at 1250 ℃, under vacuum, with a methane gas flow, for a total period of 312 hours gradually applied in an inert atmosphere consisting of argon and nitrogen gases. The produced block piece was processed to obtain small test samples; tensile and three-point bending tests were applied to the pieces, and their densities were measured. Samples were subjected to in-vitro biodegradation tests in 0.9 % isotonic sodium chloride solution by weight at 37 °C for a total of 21 days. The density and the apparent porosity of the produced samples were measured to be 1.4 g/cm³ and 13.424%, respectively. The tensile strength and bending strength of the produced C/C composites were determined to be 252.5±6.20 MPa and 236.6±25.7 MPa, respectively. At the end of 21 days, the biodegradation ratio of C/C composites was calculated as 0.0095%.

Keywords : C/C Composites, 3D carbon fiber fabrics, chemical vapor infiltration (CVI), pyrolitic carbon, biocompatibility, biodegregation
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Examining The Effect of Hexagonal Boron Nitride on Morphological, Chemical Properties of Biopolymers using Dual-Beam Methodologies

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Abstract
Interest in biopolymers has been considerably increasing due to their excellent biocompatibility, biodegradability and renewability. The growing deficiency of petroleum resources is another significant reason for the attraction in biodegradable materials. Biopolymers, including PLA and PCL, have a wide range of applications, such as; drug delivery systems, implants, automotive, biomedical applications, and the packaging industry. In this study, the effects of hBN (Hexagonal Boron Nitride) addition on the chemical, and morphological distribution in PLA/AgNWs (Acetone) and PCL/AgNWs (Chloroform) nanocomposites prepared by the drop-casting method were analyzed through cross-sectional analysis using a dual-beam system. The results were be compared to the previous studies performed on PLA/AgNWs/hBN (Chloroform) nanocomposites. Thus, the effect of the same additives on morphological and chemical properties depending on the solvent (acetone, chloroform) was also investigated.
Focused Ion Beam-Scanning Electron Microscope (FIB-SEM) is a dual beam platform that consist of ion and electron columns, equipped with several components, such as; gas injection system(s) (GIS), Energy Dispersive X-ray Spectroscopy (EDS) detector, and micromanipulator systems [1].
To reveal the subsurface properties of biopolymer nanocomposites, micron or nano-scale cross-sections were taken from the sample precisely using gallium ion milling. Thanks to the simultaneous high-resolution imaging provided by SEM, the subsurface morphology of the samples were examined in detail, via the cross-sectional analyses. In addition to morphological examinations, elemental analysis of the sample was also carried out using the Energy Dispersive Spectral (EDS) analyses.
The results indicate that the addition of hBN improves the dispersion of AgNWs in both PLA and PCL matrices. In the PLA matrix, this effect is more pronounced in the chloroform-based system. PLA/AgNWs/hBN nanocomposites prepared in chloroform exhibit a more uniform nanowire distribution, resulting in higher mechanical strength and thermal stability compared to those prepared in acetone.

Keywords: Biodegradable Biocompatible Polymers, Dual Beam Processing, Hexagonal Boron Nitride.
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Kür Çevriminin Karbon Fiber Takviyeli Polimer Kompozitin Mekanik Özellikleri Üzerindeki Etkisi

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Özet

Günümüz havacılık sektöründe hava aracı yapısalı üretiminde karbon fiber takviyeli polimer kompozit(CFRP) malzemeler yüksek özgül mukavemeti ve özgül modülünden dolayı sıklıkla kullanılmaktadır. Otoklav prosesleri yüksek ilk yatırım maliyeti ve uzun işlem süreleri gerektirdiğinden, diğer endüstriyel alanlarda uygulanması ekonomik olarak pratik değildir. Öte yandan ıslak serim elle yatırma yöntemi, maliyet açısından etkili ve basit bir işlem olmaya devam etmektedir. Klasik ıslak serim yöntemine kıyasla ıslak serim/vakum torbalama yöntemiyle daha üstün mekanik özelliklere sahip kompozit parçalar imal edilebilmektedir. Üretilecek parçanın kalitesi büyük ölçüde kürlenme koşullarına bağlıdır. Bu çalışmada kür çevrimi parametrelerinden kür sıcaklığı, bekleme süresi ve ısıtma hızındaki değişimin, 2x2 twill dokuma karbon fiber kumaş ve epoksi reçine kullanılarak ıslak serim/vakum torbalama yöntemiyle üretilmiş kompozit plakaların basma dayanımı üzerindeki etkileri incelenmiştir. EN 2850 standardına göre hazırlanmış iki uçtan tab uygulanmış numuneler, her kür çevrimi setinde en az beş tekrar basma testine tabii tutulmuştur. Test sonuçları Minitab™ istatistiksel analiz programında analiz edilmiştir. Koşulan tek yönlü ANOVA testleri neticesinde 85°C'de bekleme süresinin değişimi(5, 10 ve 15 saat) ile mekanik dayanımın kısmen değişmesine rağmen kür çevrimleri arasında istatistiksel olarak anlamlı bir farklılık olmamıştır. Isıtma hızındaki değişim(0,5°C/dk, 1°C/dk, 2°C/dk) ile de basma dayanımında istatistiksel olarak anlamlı bir fark görülmemiştir. Kür sıcaklığındaki değişim(65°C, 85°C ve 105°C) ise istatistiksel olarak anlamlı bir farklılığa neden olmuştur. En yüksek basma mukavemeti değerleri 65°C'de kürlenen numunelerde elde edilmiştir. Mekanik davranıştaki bu değişim geçmiş çalışmalar da dikkate alınarak reçine ve fiber arayüz bağlanmasının 65°C' de daha güçlü olmasına atfedilmiştir.

Anahtar Kelimeler: CFRP, ıslak serim, vakum torbalama, kür çevrimi, basma testi
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The synthesis of composites based on hafnium diboride and their application as electrode materials in supercapacitors

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Over the past several years, boron-based compounds have garnered growing interest as possible materials for energy storage applications due to their numerous desirable features. Research concerning the potential application of hafnium diboride (HfB_2) as an electrode for supercapacitor systems is limited. However, there is extensive literature on the physical and mechanical characteristics of transition metal diborides, particularly HfB_2. Within this article, we evaluate the electrochemical properties of HfB_2 and its blends (for example, HfB_2-HfC) as the electrode for all-in-one symmetric and asymmetric supercapacitor devices. Mechanical activation-assisted direct synthesis techniques produced HfB_2 particles and their HfC-containing composite materials. Using electron paramagnetic resonance (EPR) spectroscopy, the chemical and materials perspectives were used to determine the origin and place of point defects in the produced materials' surfaces. The correlation between the number of defects and the enhanced supercapacitor performances was elucidated by utilizing various structural, electronic, and electrochemical characterization techniques, including electrostatic electrochemical impedance spectroscopy, cyclic voltammetry, galvanostatic cycling with potential limitations, and other similar methods. Depending on the synthesis conditions, conductivity, energy, power density, and capacity may be adjusted, allowing high-performance supercapacitor devices to be manufactured. It has been found that composite materials based on HfB_2 and HfB_2-HfC have high energy density and high-capacity values, which indicates that these materials have the potential to be helpful for energy storage purposes.

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Defects study of h-BN performance in supercapacitor devices

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Abstract

h-BN as a 2D material attracted a major interest in research due to its outstanding properties such as high surface area to volume ratio, and high thermal stability. However, it suffers in electrochemical applications due to its low electrical conductivity. In this study, we demonstrate utilizing the defective structure of h-BN intrinsically through high-energy ball milling, and extrinsically through developing a core-shell model of h-BN as the core and ZnO as the shell for the purpose of increasing the specific capacitance oh h-BN as an electrode material for supercapacitor devices up to values as high as 600 F/g, with low electrical resistance.

Keywords :

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Kontrollü İlaç Salım Uygulamaları İçin İlaç Yüklü Mikro Parçacık Üretimi

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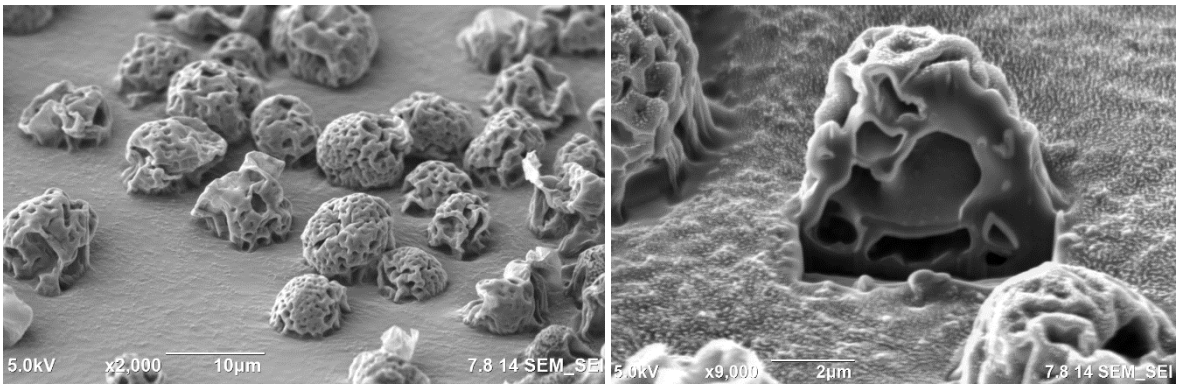
Özet

İlaç taşıyıcı sistemler, farmasötik ve biyoteknolojik alanlarda, tedavi edici ajanların hedef bölgeye iletilmesinde temel bir çözüm sunmaktadır [1]. Bu sistemler, terapötik etkiyi sağlayacak ilaçların vücuda farklı yollarla alımını içermekte olup, geleneksel dozlama yöntemlerine kıyasla ilaç konsantrasyonundaki dalgalanmaların ve yan etkilerin azaltılmasını hedeflemektedir [2]. Ancak, bu sistemler genellikle tekrarlı dozlamalar gerektirdiğinden kandaki ilaç seviyelerinde ani değişikliklere ve toksik etkilere yol açabilmektedir. Bu gibi dezavantajlar nedeniyle alternatif ilaç salım sistemlerinin geliştirilmesi önem kazanmıştır. Kontrollü ilaç salım sistemleri, ilaç salım miktarını ve süresini düzenleyerek tedavi etkinliğini artırmayı ve yan etkileri en aza indirmeyi amaçlamaktadır.

Bu çalışma ile, mikroelektro-mekanik sistemler (MEMS) teknolojisi ve ultrasonik dalgalar kullanarak olabildiğince tekrarlanabilir özelliklerde ve boyutlarda mikropartikül üretimi yapılmıştır. Araştırma kapsamında poli(laktik-ko-glikolik asit) (PLGA) tabanlı mikropartiküller üretilmiş ve FIB-SEM (Odaklanmış İyon Demeti- Taramalı Elektron Mikroskobu) sistem kullanılarak yan kesit alındıktan sonra yüzey ve iç morfolojik analizleri gerçekleştirilmiştir.



Üretilen mikropartiküllere ait yüzey (sol) ve iç morfolojiyi (sağ) gösteren SEM görüntüleri

1-Vasir J.K, Labhasetwar V. Targeted drug delivery in cancer therapy, Technology in Cancer Research and Treatment, 2005; 4(4), 363-374.
2-Tiwari, G., et al. Drug delivery systems: An updated review. Int. J. Pharm. Investig. 2012; 2(2).

Anahtar Kelimeler : Mikropartikül, Kontrollü ilaç salınımı, MEMS

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A review of carbon nanotubes as a reinforcing agent in the composites manufactured by powder metallurgy

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Abstract

Carbon nanotube (CNT)-reinforced composites have garnered significant attention in the field of materials science and engineering due to their potential to enhance the mechanical, electrical, and thermal properties of traditional materials. This review article provides a comprehensive overview of the synthesis, properties, challenges, and future prospects of CNT composites, with a focus on their application in powder metallurgy. Key findings include the remarkable improvements in mechanical strength, hardness, and toughness, as well as enhanced electrical and thermal conductivity, wear resistance, and corrosion resistance achieved through the incorporation of CNTs into various matrix materials. Despite these advancements, challenges such as achieving uniform dispersion of CNTs, ensuring strong interfacial bonding, scalability of production, high cost, and safety concerns remain significant barriers to widespread adoption. Future research directions are discussed, including innovative approaches to overcome these challenges, collaboration between academia, industry, and government agencies, and the development of standardized regulations for the responsible use of CNT composites. Overall, this review highlights the immense potential of CNT-reinforced composites in revolutionizing diverse industries and underscores the importance of continued research and development efforts to unlock their full capabilities.

Keywords: Carbon nanotube, composite, mechanical properties, microstructure,
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Investigation of Mechanical Properties of Oil Tempered Wires used in Automotive Industry

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ABSTRACT

The basic requirements for springs are not only the desired spring properties, but also long-term durability and reliability, especially against breakage and sagging. Oil tempered spring wires, especially with their excellent elasticity properties, have attracted a lot of attention in the automotive industry in recent years and are widely used in important components such as clutch, suspension, engine, etc. In this study, oil tempered wires, which are not produced in our country and widely used in the automotive industry, were mechanically analyzed and compared with high carbon (0.83C) tempered steel wires. The mechanical properties of 2 mm and 3 mm diameter oil-tempered wires and patented spring wires were investigated and tensile strength, % elongation, modulus of elasticity and shear strength test results were evaluated.

Keywords : Automotive industry, Oil tempered spring wires, Mechanical properties

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Investigation of the Compact Surface of Core Reinforced Plastic Coated Compact Steel Wire Rope Core

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Abstract

In applications requiring high strength, steel ropes must be used. Steel ropes are formed by the combination of many steel wires due to their structure. Each wire plays a major role in the strength of the rope, and there are many complex problems brought about by the structure of steel ropes consisting of many wires. The most important of these is the wear of the wires under repeated loads over time due to lateral friction and friction under load. In order to reduce the wear surfaces, a plastic interface coating is made to cut the friction between each other, this surface reduces the friction between the core wires and the wires outside the rope. In addition to this wear-resistant rope design, a feature that increases the strength of the ropes is the compaction of the outer wires of the rope. These wires, compressed under high pressures, have higher strength properties than other ropes of the same diameter. At the same time, it provides a great increase in rope fatigue performance. While the ropes are fatigued, they provide a number of cycles on the same line under a certain load, increasing this number of cycles prolongs the rope's disassembly period and therefore the time the compacted rope is released to nature is extended and reduces the scrap cost. In this study, the surfaces and strengths of the compacted wires were examined, the increased metallic cross-sectional area resulting from the compression of the rope wires was examined and compared with the uncompacted wires.

Keyword : Compact steel wire, Steel rope, Plastic Coated ,Compact Wires .

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Nano Surface Modification of Wood Materials with Hydrophobic and Hydrophilic Characteristics

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Abstract

Surface modification of wood materials are processes and techniques applied to improve the performance, durability, aesthetics and lifetime of wood. Wood surface modification is important for both indoor and outdoor use and is applied in many areas such as furniture, building materials and decoration. Hydrophobic (water repellent) liquid coatings can be applied to wood surfaces using nanotechnology. The application of modified nanoparticles to the surface can prevent the penetration of water into the wood, prolong the life of the wood and provide protection against staining.

In this study, three different nanocoating solutions (AS-54, HL-31 and SH-5) were developed to improve the hydrophobic properties of wood surfaces and applied to Yellow Pine (Pinus sylvestris L.), Eastern Beech (Fagus orientalis Lipsky) and Cedar (Cedrus libani) species. The wood samples were prepared according to ISO 3129 standard and subjected to surface modification in accordance with ASTM-D 3023. Contact angle measurements were carried out with the sessile drop method, the behavior of the nano-coatings on the wood surface was observed and recorded for 10 seconds and the wettability properties of the surfaces were examined.

The results revealed that SH-5 coating provided the highest contact angle (103.52°) on Eastern beech, while HL-31 coating provided the lowest contact angle (66°) on Yellow pine. The results of the contact angle measurements in the control groups were hydrophilic due to the water-absorbing properties of the woods used. On the coated surfaces, SH-5 was found to provide the best hydrophobic and stain-resistant properties. This study shows that hydrophobic coatings significantly prevent water penetration, extend the life of wood and provide more stain-resistant surfaces on nanotechnology-modified wood surfaces.

Keywords : Wood Material, Wettability, Nano Technology, Nano Coatings, Contact Angle.

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Kinetic of dissolution of γ' precipitates in IN738LC nickel base superalloy using arc heat treatment

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Abstract

Nickel base superalloy IN738LC is widely used in power plant industry and gas turbine blade manufacturing. The main strengthening mechanism of this alloy is the precipitation hardness caused by γ' precipitates. These precipitates play an important role in determining the mechanical properties of this alloy and their amount and morphology changes under heat treatment. In this research, in order to investigate the evolution of γ' precipitates during heat treatment, a number of solution annealed samples were subjected to arc heat treatment. In this heat treatment, by applying heat caused by a static arc, a temperature ranges from the ambient temperature to above the melting point is created in the sample. Using this process, samples with 100 amp currents were heat treated for 1, 2 and 15 minutes. Electron microscope, image processing and transient heat transfer model with axial symmetry were used for experimental and mathematical investigations. In the following, using the experimental and numerical results simultaneously, a mathematical model for the dissolution kinetics of γ' precipitates in the heat-affected zone of these welds was presented. The results of electron microscopy showed that the dissolution rate and shape of γ' precipitates are strongly influenced by the distance from the heat source. The activation energy of dissolution of γ' precipitates increased with increasing time and its value was between 40 and 80 kJ/mol.

Keywords : Superalloy IN738LC, arc heat treatment, dissolution kinetics of **γ'**, finite element model.

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Synthesis and Characterization of Activated Carbon from Walnut Shells and Olive Leaves for Supercapacitor Applications

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Abstract

In this work, activated carbon was synthesized from agricultural wastes like walnut shells and olive leaves and then characterized for application as supercapacitor electrodes. The conversion involves a two-step process: carbonization and chemical activation using KOH and ZnCl2, yielding a highly porous structure suitable for energy storage. These results are proof that walnut shells and olive leaves could act as economically feasible precursors and that their activation with KOH is far better compared to the activation developed by ZnCl2. Most importantly, KOH-treated activated walnut shells reached a maximum of about 2500 m^2/g surface area, corresponding to about 5205% for raw walnut shells. The enhanced surface area is helpful in better charge storing capability; hence, these materials are quite suitable for supercapacitor applications. In this work, there is tackling of environmental challenges linked to agricultural waste, contributing toward sustainable production methods which could reduce feedstock costs in industrial applications

Key Words : Activated Carbon, Agricultural Waste, Supercapacitors, Sustainability

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