ISC'23

3rd International Symposium on Characterization

# ABSTRACT BOOK

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# 3rd

**INTERNATIONAL SYMPOSIUM ON CHARACTERIZATION**
06-08 SEPTEMBER 2023, TURKEY

# Abstract Book

EDITOR

Prof. Dr. Atilla Evcin

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# PREFACE


3rd International Symposium on Characterization (ISC'23) has been hosted by academics and researchers belonging to different scientific areas of the University of Afyon Kocatepe, University of Giresun, NED University of Engineering and Technology (The Materials Engineering Department), Khaje Nasir Toosi University of Technology, Sabancı University Nanotechnology Research and Application Center (SUNUM) and TUBITAK Marmara Research Center at Istanbul/Türkiye from 6 to 8 September 2023.

We invited valuable scientists from different countries of the world to our symposium. Our 13 invited speakers shared the latest technology and their experiences with our participants. I would like to thank them for their participation in our third symposium.
A magnitude 7.7 earthquake occurred in Pazarcik, Kahramanmaraş Türkiye at 04.17 hours on February 6, 2023 followed by an earthquake of 7.6 in Elbistan, Kahramanmaraş occurred the following day in the same region. This was the largest disaster of the century. We have determined this year's 2023 theme of our summit as "Kahramanmaraş Earthquake".
The symposium included 4 parallel face to face section and 3 parallel online sessions in which there were invaluable presentations by both national and international presenters. We would like to thank our moderators, authors, academics, researchers, students, professionals and all participants, and also to each of our organizing committee members.
Nearly 150 oral, online oral and poster presentations from different countries were successfully presented. This is a great success for a third symposium. Another achievement of ours is to enable our academic participants to benefit from the academic incentive regulation by providing 53% of foreigners.
The book covers the abstracts and full papers in English or Turkish as the authors submitted to the summit. All submissions have been evaluated through a review process. Hoping the online book will be enjoyable and useful to all who are interested in research and studies and applications in the field of Engineering and Technology.

Best regards
Prof. Dr. Atilla Evcin
On behalf of the Organizing Committee
Symposium Chair

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- Dr. Recep Kurtuluş, Afyon Kocatepe University, Türkiye

## INVITED SPEAKERS

**Prof. Ian M. Reaney** joined the Department of Materials Science and Engineering in 1994 first as a PDRA, then as a Lecturer from 1995, followed by promotion to a personal chair in 2007, followed by becoming the Dyson Chair in Ceramics in 2016.
He attained his PhD from the University of Manchester in 1989 and worked as a post-doctoral researcher at the University of Essex before joining the group of Professor Setter at the Laboratoire de Ceramique, Ecole Polytechnique Federale de Lausanne in Switzerland in 1991.
He is the European site director for the NSF funded Centre for Dielectrics and Piezoelectrics and the Director of Research and Innovation in MSE.

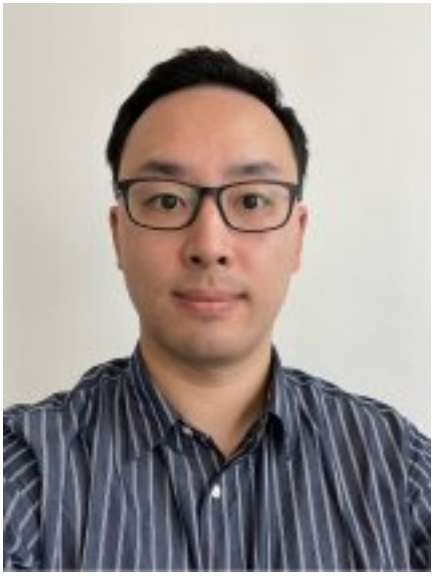
**Adil Ahmed Alshoaibi,** Department of Physics, College of Science, King Faisal University, Al Ahsa, Saudi Arabia, 00966506933370, adshoaibi@kfu.edu.sa Dr. Al Shoaibi is a Sheffield graduate, The General Supervisor of KFU Central laboratories, Chairman, Department of physics & Mathematics and Statistics. He has 5 patents. He has published 111 ISI/Scopus-indexed articles. He has participated in conferences in France, Poland, Spain, US, & UK.

Adil's research is a blend of the Chemistry, Physics and Engineering of Inorganic Materials, especially oxides, which focuses on materials with interesting and/or useful electrical properties, especially ionic conductors, mixed ionic/electronic conductors, semiconductors, ferro- and di-electrics.

Mehmet Ali Gülgün is a graduate of Bogazici University Mechanical Engineering Department. He finished his MSc at Michigan State University at the Metallurgy, Mechanics, and Materials Science Department under the supervision of Prof. Dr Eldon Case. In 1996 he received his PhD degree in Ceramic Engineering from UIUC Materials Science and Engineering Department. His PhD advisor is Prof. Dr. Trudy M Kriven. ALer a 6 months stay in Japan at TIT with Prof. DR. Masahiro Yoshimura, he was a research scienQst at Max Planck InsTute in StuTgart in Prof. Dr. Manfred Ruhle's group unQl he joined Sabanci University Engineering Faculty in 2000. He is currently a professor of Ceramics at SU, enjoying teaching and research with his research group composed of undergraduate and graduate students and postdocs.

**Dr. Zhilun Lu** is a Lecturer (Assistant Professor) at the University of Leeds. Dr. Lu has successfully secured multiple grants from both the Royal Society and the Royal Society of Chemistry. His research group focuses on the structure-composition-property relations of a broad spectrum of advanced functional materials and the translation of novel materials into prototype devices.
He is a member of IOM3, the Royal Society of Chemistry, and the American Chemical Society. He serves as a peer reviewer for esteemed journals like Nature Physics, Nature Communications, Advanced Functional Materials, and Physical Review Letters. With over 60 journal publications (H-index=27), he received a Hot Article award from Energy & Environmental Science, ranking his paper in the top 10%.

**Dr Lawan Umar Grema** is currently the head of department mechanical engineering Ramat polytechnic Maiduguri, Borno state Nigeria. He is a materials engineer with specialization in sealing glasses for solid oxide fuel cell applications. During his PhD he studied thermal, mechanical and electrical properties of these glasses.



**Dr Ge Wang** graduated BSc in Materials Science and Engineering (2011) from the Shandong University (China) and MSc in Advanced Engineering Materials (2012) from the University of Manchester. Then he obtained his PhD in Electroceramics (2016) from the University of Manchester, followed by a 7-month industrial internship in a university spin-out company, Ionix Advanced Technologies, as a ceramic engineer. He joined the Functional Materials and Devices group at the University of Sheffield as a Research Associate in 2017 and recently was awarded Dame Kathleen Ollerenshaw Fellowships at the Department of Materials, University of Manchester. His planned research at Manchester sits between the Department of Materials and Henry Royce institute focusing on developing sustainable materials and manufacturing next-generation of energy storage devices, including energy-density multilayer ceramic capacitors, all solid-state battery and energy harvesting devices.

**Dr. Ahmad Azmin Mohamad** is an associate professor for School of Materials & Mineral Resources Engineering at University Sains Malaysia. He started this job since 2004. He obtained his doctoral degree in the field of Advanced Materials at Physics Department, University Malaya. He studied alkaline solid polymer electrolytes for nickel-metal hydride (NiMH) bateries for his PhD. His current research focuses on bateries, supercapacitors, and corrosion. He had published more than 100 papers in high impact journals. His undergraduate and master's level courses cover crystallography, materials characteriztion, corrosion engineering, and many others. Dr. Azmin's work includes serving as an editor or board editor for multiple journals, among them the renowned International Journal of Energy Research (Wiley-Hindawi), which holds a Q1 ranking.

**Reza Bahrami** has been working as a metallurgical lab director and laboratory lecturer in Amirkabir University of Technology for 20 years. He graduated from Amirkabir University of Technology in masters program of materials science and engineering. His research interests are advanced materials, powder metallurgy, metal forming, additive manufacturing, and biomaterials. He has published several papers in prestigious journals such as, Alloys & Compounds, and Materials & Design.

Dr. Mert Akel graduated from Sabancı University Materials Science and Engineering in 2005. He licensed a dirt-repellent material which he developed in a university project and sold it to a ceramic company. he has carried out more than 20 innovative projects including hydrogen technologies, alternative energy and chemical process technologies by making important activities and achievements in Turkey's entrepreneurship ecosystem. He got his PhD. on PEM Type Fuel Cells at Gebze Technical University. He took part in the establishment of Turkey's first boron carbide plant, TRBOR A.Ş. as the R&D Manager. He has been working as Tübitak MAM Vice President in Material Technologies since October 2022, and besides his METU MEMs Board Membership, he carries out technical support and mentoring activities for entrepreneurs on different platforms. He is married and has a child.

**Mehdi Khodaei** received his Bachelor degree in 2005 and Master degree in 2008 from the Department of Materials Engineering, Isfahan University of Technology, Iran. In 2014 he obtained his PhD degree from University of Tehran, Iran in Nanotechnology-Materials Science. He was visiting researcher at Pohang University of Science and Technology (POSTECH), Korea, (March 2012-June 2013) working at Ferroelectric Nano Materials Lab. under supervision of Prof. Sunggi Baik as well as Pohang Accelerator Laboratory (Korea Synchrotron facilities). He was joined to K.N. Toosi University of Technology, Iran in Sep. 2014 and he is currently working as Dean of Faculty Materials Science and Engineering. During last years, he was PI of several project such as “Functional Nanocoatings by suspension thermal spray technique” in Silk Road Science Foundation between Chinese Academy of Science and Iran.

He was born in 1972 in Clausthal, Germany. He completed his primary and secondary school in Elazığ, Turkey. He graduated from the Civil Engineering Department in Fırat University (Turkey) between 1988 to 1992. He has started my MSC at Construction Education Department in Fırat University 1993. He has started to work as a research assistant at Construction Education Department in Technical Education Faculty in 1994. He graduated his MSC in 1996 and started to his PhD study in the same year. He graduated his PhD degree in 2002. He has got the Assistant Professor position at Civil Engineering Department in Kocaeli University in 2004. He went for research to Columbia University in USA in 2012. He had stayed for 8 months and he worked with Prof. Dr. Christian Meyer as a researcher on internal curing of concrete with recycled aggregate. He has been working at Kocaeli University as Associate Professor since March 2017. He worked as Vice Dean at Engineering Faculty in Kocaeli University between 2018-2020.

**Çağatay Alp ARSLAN** completed his B.Sc. and M.Sc. at Hacettepe University Geological Engineering Department. He is studying for his PhD thesis on Low Carbon Cements at Gazi University Civil Engineering Department now. He worked at TurkishCement R&D Institute as the Head of Mineralogy Laboratory and Lead Engineer of R&D&I department between 2016-2020. During his working at TurkishCement, he was the member of CEMBUREAU Product Standards and Regulations Committee. Since 2020, he has been working as Group R&D&I Chief of Vicat Group Turkey.

Uğur Akkaya graduated from Marmara University Faculty of Communication Journalism Department in 1997. He had worked at the National Journal and Agents for 3 years. He has taken training of Theatre and Stage Technique. In 1999 he has been worked at TUBITAK Metrology Institute. Currently, he is working as a Institutional communicatıon responsıble at tübitak metrology ınstıtute.

# The effect of the marine environment on the mechanical behavior of the concretes of the Keddara Dam (Algeria)

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**Abstract**
The study presented deals with the mechanical consequences and the degradations caused by the external attack of sulphates from the marine environment on the prefabricated concretes of the spillway and the dyke of the Keddara dam in Boumèrdes (Algeria). Three different external sulphate attack protocols were applied for three types of concrete based on crushed aggregates (dry concrete at 45°C, ordinary concrete (28 days) and water-hardened concrete at 28 days, the samples are immersed in a 5% $H_2SO_4$ solution at 20°C.
The results show that the impact of the age of the material on its degradation in contact with the sulfuric acid solution was highlighted, visual observations then a rapid and brutal degradation on the surface then in depth towards the core then a loss of mass and cracking and finally the ruin of the material.

Keywords: Precast concrete, External sulphate attack, Degradation.

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# Structural analysis of $Cu(OH)_2$-rGO-CuO nanocomposite

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**Abstract**
In this work, three mass ratios were used: (1:2) (1:3) (1:4); (Graphite: potassium permanganate), during the primary step of synthesis, graphene oxide was reduced and decorated with copper hydroxide and copper oxide under thermal treatment by refluxation at 100°C during 2h. The XRD results confirm reduction and decoration of GO and formation of Cu(OH)2-rGO-CuO nanocomposite, this result was confirmed by the appearance of diffraction peaks related to Cu(OH)2 and CuO. XPS shows peaks of C1s, O1s and Cu2p orbitals, their deconvolution gives more information about chemical composition of our nano-composite. XPS results confirm once again XRD results by proving reduction and decoration of GO with Cu(OH) and CuO.

**Keywords :** $Cu(OH)_2$-rGO-CuO nanocomposite, XRD, XPS

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# Study of the effect of $Alq_3$ molecules on the structural and optical properties of dip-coated titanium dioxide ($TiO_2$) films processed by sol-gel method

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## Abstract

In this work, we prepared thin layers of undoped titanium dioxide ($TiO_2$) and doped with ($Alq_3$) molecules in different content 0.1 at.% and 0.5 at.% using sol-gel method by applying dip-coating technique. Four layers is the number of every film. The last was withdrawing with the speed of 0.86 cm/min and then annealed at 450°C during 1h. The variation of doping content affects the structural and the optical properties of prepared films. X-ray diffraction (XRD) shown that the obtained samples crystallize into anatase phase only. The roughness mean surface (RMS), recorded by the atomic force microscopy (AFM) analysis, augments from 0.994 to 2.573 nm corresponding to undoped $TiO_2$ and 0.1 at% $Alq_3$ doped $TiO_2$, respectively. This result is in good agreement with the growth of the grain size (D) since it increases from 13.08 to 16.88 nm. Further, the elevation of $Alq_3$ doping content from 0.1 at.% to 0.5 at.% decreases the roughness mean surface (RMS) from 2.573 to 1.232 nm and diminishes the grain size (D) from 16.88 to 9.93 nm. This agreement emphasizes the relationship between XRD and AFM analysis techniques. Corresponding to undoped $TiO_2$ and 0.1 at.% $Alq_3$:$TiO_2$, UV-Vis and M-lines spectroscopy techniques indicate the decrease of the refractive index (n) from 2.55 to 2.43 and the increase of the film thickness (d) from 251.46 to 341.92 nm. As far as the content of ($Alq_3$) increases from 0.1 at.% to 0.5 at.%, refractive index (n) increases from 2.43 to 2.64 and the thickness (d) decreases from 341.92 to 235.58 nm. Consequently, we conclude that 0.5 at.% $Alq_3$ doped $TiO_2$ improves the structural and optical properties of titanium dioxide ($TiO_2$). It is worthy to mention that 0.5 at.% $Alq_3$:$TiO_2$ enhances the electric polarization mode ($TE_0$).

**Keywords :** Sol-gel , Anatase , $Alq_3$ , $TiO_2$ , m-lines.

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# Characterization of aluminum alloys with advanced transmission electron microscopy techniques

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**Abstract**
In this study, detailed transmission electron microscopy (TEM) techniques such as selected area electron diffraction (SAED), energy dispersive spectrometry (EDS), high resolution transmission electron microscopy (HRTEM) and precession electron diffraction (PED) were used to investigate the microstructure, second phases and precipitates in aluminum alloys. Size, type and morphologies of second phases and precipitates were investigated with the help of advanced transmission electron microscopy techniques. X-ray diffraction (XRD), optical microscopy (OM) and scanning electron microscopy (SEM) studies were also performed on aluminum alloy samples.

Keywords : Aluminum Alloys, HRTEM, EDS, SAED.

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# Contribution to the study of mesoporous materials and their application in organic synthesis

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**Abstract**:
This masters Works is divided into two parts : The first part is a contribution to the study of mesoporous materials presenting a potential mainly in the field of catalysis.Ag/SBA15 mesoporous materials were synthesized under acidic condition using the copolymer triblock (pluronic123) as template and tetraethoxysilane (TEOS) as the source of silica.heteroatoms such as silver have been incorporated by the post-synthesis pathway within the porosity of mesoporous materials to modify the latter of hexagonal structure and specific surface area. powder XRD ,N2 adsorption ,FTIR Fourier transform Infrared techniques were used for characterization of catalysts and study of relationships with catalytic activity The second part concerns the application of catalysts in the esterification of fatty acids we studied the influence of reaction parameters on the activity and selectivity of prepared catalysts and their applications in the production of biodiesel , for their many environmental and economic benefits. Biodiesel is a product obtained by esterification in wich the fatty acid is raected with an alcohol in the presence of a mesoporous catalyst. The esterification process is influenced by the reaction mode the molare ratio of the alcohol to the fatty acide , the type of alcohol, the nature and amount of the catalysts ,the reaction time,the content of the reaction metal,and temperature.

**Keyword :** Ag/SBA15 ;post-synthesis ,fatty acid , biofuel biodiesel.

# Numerical simulation of the detection of the contact stress between roller and tire of a cement rotary kiln

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**Abstract**
Kilns are machines widely used in the industry, especially that of cement. They are often subject to high mechanical and thermal stresses. The rotation of these ovens is made by a control which is a geared motor assembled with a pinion, meshed with the toothed wheel which is welded to the circular shell of the oven. Given the length of the oven which exceeds 80 meters, this control needs other elements to allow the rotation of the oven, which are the bearing stations and which play a second role, as a support. Our kiln has three stations, each consisting of a carrier shell, a bandage and two rollers.
Our work presents an analysis of the distribution of the stresses of the contact of the outer surfaces of the tire and roller of the rotary cement kiln. During this work using two methods of study; the first is an analytical study of mathematical formulations, using the fortran programming language. The second is a finite element numerical simulation with the ABAQUS software. The total stress is obtained by a combination of bending and contact stresses. To obtain a bending stress, the furnace is considered an indeterminate thick tube subjected to static and symmetrical loads using Castigliano's theorem. All results are in excellent agreement with the validation model. In addition, a more realistic model of the tire subjected to all loads simultaneously is also simulated, with the effect of varying the thickness of the tire and the effect of varying the angle of the roller-tyre position.

**Keywords :** Four rotatif, Contrainte de flexion, Contact, bandage, galet, méthode analytique, simulation numérique.

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# Yumurta kabuğu/kitosan /alümina esaslı biyokompozitlerin üretilebilirliği ve karakterizasyonu

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## Özet

Biyokompozit, biyomalzemelerin alt grupları arasında yer alıp, kompozit yapısında en az bir doğal kökenli malzeme kullanılması durumunda elde edilen malzemedir. Deneysel çalışma kapsamında yumurta kabuğu, kitosan (chitosan) ve alümina kullanılmıştır. Bilindiği üzere Yumurta kabuğu yaklaşık olarak %85-95 kalsiyum karbonat, %1,4 magnezyum karbonat, %0,76 fosfat, %4 organik maddeden oluşmaktadır. Yumurta kabuğunun çevre üzerinde oluşturduğu olumsuz etkiyi azaltmak için çeşitli uygulamalar geliştirilmiştir. Bu uygulamalarda yumurta kabuğu, katkı maddesi veya hammadde olarak kullanılmıştır.
Kitin $(C_8H_{13}O_5N)_n$ doğal olarak birçok yerde bulunan, bir glikoz türevi olan N-asetilglikozaminin uzun zincirli polimeridir. Kitinin en önemli türevlerinden biri olan kitosan ise kitinin alkali ortamda kısmen ya da tamamen deasetilasyonu (organik bir bileşikten asetil fonksiyonel grubunun çıkarılması) ile elde edilen polikatyonik özellikte bir biyopolimerdir. Deneysel çalışmada; 10 farklı biyokompozit reçetesi tasarlanarak karışımlar hazırlanmıştır. Reçeteler kapsamında; alümina ($Al_2O_3$), kitosan, yumurta kabuğu, selüloz, β-trikalsiyum fosfat (TCP) kullanılmıştır. Hazırlanan karışımlar değirmende 15 saat boyunca karıştırılmış, değirmende karıştırıldıktan sonra elde edilen karışımlar hidrolik preste 30 bar basınç altında preslenerek pelet haline getirilmiştir. Tüm reçeteler içinde ham mukavemet açısından yumurta kabuğu, kitosan ve alumina içeren ES-03 kodlu reçeteye ait numuneler en iyi sonucu vermiştir. Akabinde ES-03 kodlu reçetesine ait numunelere 5 farklı sıcaklıkta (1350°C-1400°C- 1425°C-1450°C-1475°C) sinterleme prosesi uygulanmış olup, bu numunelere XRD, SEM analizi, yoğunluk, porozite ve su emme testleri yapılarak biyokompozit numuneler karakterize edilmiştir.

Anahtar Kelimeler: Yumurta Kabuğu (Tozu), Biyokompozit, Biyomalzeme, Sinterleme, Karakterizasyon

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# Effect of quenching wheel speed in planar flow casting process on the structure and magnetic properties of $Fe_{82}Si_5B_{13}$ wide-width ribbons

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## Abstract
Improving energy efficiency is one of the most cost-effective measures countries can take. Fe-based amorphous/nanocrystalline based core transformers with high-Bs and low coercivity and core loss are an alternative to conventional transformers (electrical steels) to improve energy savings and reduce the $CO_2$ emissions. In this work, an attempt is made to study the effect of various quenching wheel speeds (20-30 m/s) on the surface quality, structure (degree of amorphicity) and soft magnetic properties of wide-width $Fe_{82}Si_5B_{13}$ ribbons produced by planar flow casting (PFC) method. X-ray diffraction (XRD), filed emission scanning electron microscope (FESEM), differential scanning calorimeter (DSC), vibrating sample magnetometer (VSM) and B-H loop tracer (1-100 Hz) were conducted on the as-spun samples to investigates their structure, thermal behavior and soft magnetic properties. Based on the results obtained, it was shown that the trends of thickness variations of the as-spun ribbons with the increase of wheel speed are in good agreement with Bernoulli equation for the PFC process. Besides, scanning electron microscope micrographs of the ribbons revealed that the surface quality y of the prepared ribbon improved by increasing the wheel speed. Further, it was seen that wheel speed plays an important role in the control of the level of amorphicity and of magnetic properties of the as-spun samples. It was indicated that the higher was quenching wheel speed, the higher was the degree of amorphicity giving rise to a lower coercivity and core loss for the ribbons prepared.

Keywords: amorphous alloys, planar flow casting (PFC) process, magnetic properties

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# Electrodeposition and characterization of nickel based coatings on zincated aluminum substrates

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**Abstract**
Aluminum has a wide variety of use in the industry owing to its outstanding properties, however; in most cases, it requires a protective coating to enhance corrosion resistance. Besides that, direct coating methods are not practical for Al alloys due to the formation of nonuniform oxides. Zincating is a solution-based method to cover Al-based substrates with a zinc layer to prevent oxidation during coating processes. In this study, Al substrates were coated with different zincating steps to obtain the uniform Zn layer before Ni electrodeposition. A custom-made solution was optimized for the zincating processes where sing and double zincating were applied. Ni-based coatings were electrochemically deposited as a function of applied current density from a Watts-based electrolyte. The characterization of the coatings was performed via scanning electron microscope, energy dispersive spectroscopy, X-ray diffraction, Vickers hardness, and Raman spectroscopy. Lastly, Ni-based alloys were examined for corrosion resistance. It has been found that a single zincating process formed via a custom-made zincating solution has a more uniform layer compared to a double zincating process. Besides that, the applied current density affected the morphology and the Ni-based phases. The most homogenous Ni coated was obtained with 30 mA/cm$^2$ applied direct current density on the single zincated Al substrates.

Keywords : Zincating, Electrodeposition, Nickel Based Coatings, Al Substrate.

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# Hybrid PA11/PLA composites reinforced with carbon fiber and graphene nanoplatelets: mechanical, thermal, electrical, and EMI shielding performances

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**Abstract**
Carbon fiber (CF) reinforced polymer composites are widely used in various industries thanks to their superior properties such as low density, good mechanical, and thermal properties, and ease of processing. CF-reinforced polyamide 11 (PA11)/poly (lactic acid) (PLA) composites were fabricated and characterized by us. The results demonstrated that the thermal and mechanical properties of the PA11/PLA blend were improved by the addition of CF. In addition to the fact that CF-reinforced thermoplastics are widely used and well-known, research is still underway to expand their applications and add new functional properties. Various methods have been attempted to improve the final characteristics of the composites. In this context, the preparation of hybrid composites using multi-scale (micro/nano) fillers has been quite promising in improving composites properties. Therefore, the focus of this study was to investigate the effects of micro-scale CF and nano-scale graphene nanoplatelets (GNP) on the properties of 60/40 wt% of PA11/PLA blend. The hybrid composites were prepared by adding 0.5-1-3-5 wt% GNP to PA11/PLA composites containing 20 wt% CF (20CF) via melt blending technique. The effects of GNPs increasing amount on the mechanical, thermal, morphological, electrical, dielectric, and electromagnetic interference shielding (EMI SE) performances of the PA11/PLA/CF composites were examined. The mechanical and thermal tests showed the synergistic effect of CF and GNP. A similar synergistic effect was also observed for the AC conductivity values. Hybrid composites containing 0.5-1-5 wt% GNP have $\sigma_{AC}$ values at 0.01 Hz of 0.14, 0.45 and 0.69 S/m, respectively. EMI shielding efficiency (EMI SE) measurements also showed the synergistic effects of hybrid fillers and the highest EMI SE in X-band was measured as 35 dB. Reflection was found to be the dominant shielding mechanism for both 20CF and CF/GNP hybrid composites.

Keywords: Graphene nanoplatelets, Carbon fiber, Hybrid polymer composites, EMI shielding

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# Characterization of graphene doped carbon nanotube/epoxy based functional nanocomposites for aerospace applications

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## Abstract

Composites are called "Nanocomposites" when one of the components that make up their structure is used in sizes below 100nm. The graphene used in this study has a very high flexibility and lightness and also stands out with its conductivity in the electrical field. Carbon nanotubes, on the other hand, can be single-walled or multi-walled, as well as show extraordinary resistance to compression effects parallel to their structure, and their optical properties are indisputable. These nanomaterials can also be preferred in military aviation and space studies, thanks to their many superior properties. In the study, the nanopowder mixture consisting of graphene doped carbon nanotube was added to the resin in many different ratios and productions were performed. All preparation and casting processes were carried out in the most accurate and sensitive way. No additives other than resin, hardener and nano-powders were used in manufacturing part. The 32% graphene doped CNT powder introduced into the resin and dispersed in there for 30 – 45 minutes via dual mixing process. Afterwards, air bubble removal was applied in drying-oven environment and the hardening component was added. The casting of samples was conducted after 5 minutes of mixing. The prepared samples were kept in the mold for 2 days and outside the mold for 5 days for complete curing. The tensile test results of composites contained 0.05% wt. and 0.0125% wt. graphene doped CNT were compared with neat epoxy. The fractographic images of samples were also examined by SEM and XRD analyzes after tensile test.

Keywords : Nanocomposites, Graphene, Carbon Nanotubes, Space and Aviation, Polymer Technologies.

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# Laboratory evaluation of incorporating waste ceramic materials into cement mortar

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**Abstract**
Green and sustainable concrete and cement mortar have received significant attention from the construction industry and researchers since they were proposed. Ceramic waste is one of the most active areas of research, encompassing several disciplines, including civil engineering and building materials. Ceramic waste is a source of pollution for the environment, making the recycling of ceramic waste urgent and important. For this purpose, in this study, cementitious mortar samples produced with ground sintered and unsintered ceramic waste were analyzed for their fresh state workability, 28-day compressive strength, unit weight, water absorption, and capillarity. To achieve this, specific percentages of sand used in the mortar were replaced with ground ceramic waste.

Keywords: The cementitious mortar, ground sintered and unsintered ceramic waste, the workability, compressive strength, unit weight, water absorption, and capillarity

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# Development and characterization of an adsorbent in graphitic structure for sampling air quality

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**Abstract**
Spherical Graphitic Carbon Structure is an important material used for adsorbing Volatile Organic Compounds (VOCs), which are one of the main causes of air pollution. This study, aiming to enhance this material, is a continuation of our previous work where effective parameters such as pressure and time were determined in GPC production.
Initially, cross-linked polymeric microspheres were synthesized using the suspension polymerization method. The obtained polymeric microspheres were carbonized up to 700 °C and then activated with steam at 830 °C to produce spherical PAC. When the PAC produced by this method was measured with a BET device for surface area and average pore diameter, it was determined that they were 1929.65 m²/g and 35.054 Å, respectively. The same PAC underwent microstructure examinations using SEM and chemical structure characterization using RAMAN microscope. Based on all these characterization studies, it was determined that the produced PAC possessed the desired characteristics, namely a spherical structure and a heterogeneous (micro-meso) pore distribution.
In the second stage, different grafitization experiments were conducted on the PAC samples at various temperatures (1750, 1500, 1250, and 1000 °C) under inert 20 mbar vacuum and with a 10 L/min Argon flow for 5 hours. As a result, with an increase in temperature, the surface areas of the obtained GPC samples decreased, while the average pore diameters increased. The decrease in BET surface areas of the GPC samples was attributed to a reduction in the number of crystallite edges on the surface due to prolonged exposure to high temperatures. Additionally, SEM and Raman characterization results for the same products showed that the GPC51750 sample obtained at a high temperature (1750 °C) exhibited a more orderly structure and higher graphitization compared to other samples, as evidenced by the broader G band.

**Keywords:** Spherical Polymeric Activated Carbon, Graphitization, Graphitic Carbon, BET, Raman, SEM, VOC adsorption, Thermal Desorber-GCMS.

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# Experiment of boride layer on Ti−6Al−4V alloy

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**Abstract**
Pack boriding conditions boriding Ti-6Al-4V alloy in the temperature range of 950 to 1050 °C, the effects of pack boriding conditions on the boride layers were investigated. The experimental findings demonstrate that the boride layers were made up of a thick inner layer of TiB with whisker- or needle-like morphologies extending into the substrate, and a continuous thin outside layer of $TiB_2$. When the boriding temperatures were 950–1050 °C and the treatment time was greater than 8 h, thick and compact boride layers were produced. The growth kinetics of the boride layers were characterized by a parabolic curve, and the depth of the boride layer rose with boriding temperature and time. The growth kinetics of the boride layers, including both $TiB_2$ and TiB layers. Activation energy estimated of 200.11 and 233.33 kJ/mol of boron in the $TiB_2$ and TiB layers, respectively.

Keywords : boride layer, characterization, Ti−6Al−4V alloy.

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# Effect of homogenization process on the microstructure of triple melted nickel based superalloys

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## Abstract

In this study, the microstructural evolution of the nickel-base superalloy in terms of eutectic and precipitate formation is investigated starting from solidification (VIM+ESR+VAR) through homogenization. To get better insight for the microstructure evolution, precipitation of γ′, formation of (γ+γ′) eutectic phases, metal carbides (MC, $M_{23}C_6$ etc.), metal borides and other intermetallic existing in the microstructure were characterized by optical, electron microscopy and XRD techniques. Formation of these phases are significant for the post-heat treatment and forging processes since they dominate the final strengthening features in the service conditions. Furthermore, the influence of various homogenization heat treatment conditions on the kinetics of γ′ dissolution was studied. Process parameters were designated through DSC-DTA analysis and thermodynamic calculations of Thermo-Calc software. Solid solubility of γ/γ′ eutectics and their effect on high temperature mechanical properties were closely characterized after high temperature strain-controlled compression tests. A correlation was observed for the phase stability and morphological transition of *γ/γ′ eutectics → primary γ′ → secondary γ′* formation via optical and electron microscopy techniques.

Keywords: Nickel based superalloy, Triple melting, Microstructure, Homogenization Heat treatment.

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# Magnetic waterborne polyurethane nanomicelles for enhanced breast cancer tumor imaging and therapy

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## Abstract
A magnetic targeted drug delivery system was prepared by encapsulating hydrophobic doxorubicin (DOX) and oleic acid-modified $Fe_3O_4$ nanoparticles (SPION-OA) into the hydrophobic core of waterborne polyurethane nanomicelles (CPUM) using the solvent evaporation method. The drug-loaded magnetomicelles (CPUM-DOX-SPION) had a spherical shape with an average size of 158 nm. The magnetomicelles showed superparamagnetic properties with excellent magnetic resonance imaging (MRI) contrast effects and T2 relaxation in vitro. In the absence and presence of a magnetic field, the cytocompatibility and cellular uptake of the samples were evaluated by MTT assay and flow cytometry, respectively, and the cells were visualized under a confocal microscope. Application of the magnetic field increased cellular cytotoxicity and cellular uptake in association with improved DOX delivery. The in vivo monitoring of tumor volume showed that tumor growth of the mice group treated with CPUM-DOX-SPION in the presence of an external magnetic field was significantly retarded, with no apparent loss of body weight, compared with the same magnetomicelles in the absence of the magnetic field and with free DOX at the same dose. The in vivo MRI experiment indicated the potential of these magnetomicelles as a probe in MRI diagnosis for tumor targeting, and the results showed that magnetically guided delivery of CPUM-SPION magnetomicelles into tumors could significantly improve the targeting efficacy. The outcome of this study suggested that the prepared magnetomicelles were applicable as theranostic systems for effective magnetically guided delivery of chemotherapeutic agents and image-guided personalized medicine.

Keywords: magnetomicelles, theranostic, waterborne polyurethane, doxorubicin.

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# EMOPSO algorithm for solving TSP and multi-objective multi-modal routing problem in Tehran transportation network: a comparative approach with NSGA-II algorithm

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**Abstract**
In this study, solving the traveling salesman problem (TSP) using Enhanced Multi-Objective Particle Swarm Optimization (HMOPSO) and non-Dominated Sorting Genetic Algorithm (NSGA-II) is discussed. Then, multi-modal and multi- objective routing problem in Tehran metropolis is implemented; for the problem walking, metro, and BRT modes and length, traffic, and convenience objectives are assumed. The traveling salesman problem is inherently a discrete problem. MOPSO algorithm is also an algorithm for solving continuous multi-objective problems. Therefore, to solve the discrete TSP problem, the enhanced of multi-objective particle swarm optimization algorithm (EMOPSO) has been used. In the proposed algorithm, instead of using the random velocity vector, the previous position of the particle is used and the random velocity vector is removed. Also, instead of coefficients related to inertial movements, gbest and pbest, integer values are used. For the traveling salesman problem, two objective functions of length and traffic are considered, which need to be minimized. The results of the algorithms show that the enhanced algorithm finds a better path in less time and fewer generations than the NSGA-II algorithm. Also, the Pareto solution fronts obtained from the DMOPSO algorithm have more expansion in the goal space and are closer to the ideal point.
Keywords: Multi-objective particle mass optimization algorithm, NSGA-II algorithm, Traveling salesman, Optimization and Pareto solution front.

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# The role of Ti6Al4V powder characteristics on quality of laser powder bed fusion (l-pbf) process parts: porosity and microstructure

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**Abstract**
Critical porosities are one of the essential factors in reducing the mechanical properties of parts produced by the laser powder bed fusion (L-PBF) process, which may have various sources. The partial source of these porosity is related to the process parameters such as laser speed and laser power during production, which can be optimized and reduced. However, despite controlling the aforementioned factors to eliminate porosity, the powder used in making 3D printed parts can itself be an unavoidable source of porosity entering the parts. Results of the current study showed that these porosities can have both spherical and irregular shape depending on the reason for its creation and grows when entering the final part. The intrinsically characteristics of the powder (microstructure, density, porosity , ….) have been investigated using different methods such as X-ray diffraction (XRD) and field emission scanning electron microscopy (FESEM).

Keywords: Laser powder bed fusion (L-PBF), Ti6Al4V powder, porosity, microstructure.

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# Formation of carbon nanomaterial/magnetite nanosheets composite in gray cast iron blackening by eco-friendly solution

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**Abstract**
In this research, cast iron blackening was carried out utilizing hydrothermal treatment with eco-Friendly compounds which led to the formation of carbon nanomaterial/Magnetite Nanosheets Composite. The characteristics and quality of the layer was evaluated by X-ray diffraction (XRD), field emission scanning electron microscope (FESEM), oxalic acid spot test and corrosion tests including open circuit potential (OCP), potentiodynamic polarization and electrochemical impedance spectroscopy (EIS). The results showed that magnetite nanosheets as the only phase present on the surface were uniformly dispersed throughout the heterogeneous surface of cast iron containing two phases of graphite and iron, which ultimately led to an increase in the corrosion resistance of cast iron.

Keywords: Magnetite nanosheets, Hydrothermal, Eco-Friendly compounds, Cast Iron, Corrosion resistance.

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# The effect of heat treatment on microstructure and mechanical properties of 3D printed Ti6Al4V specimens oriented in different directions

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## Abstract
In the current study, 3D printed parts made of Ti6Al4V material were prepared utilizing SLM (Selective Laser Melting) process in two horizontal (X) and vertical (Z) directions. By performing heat treatment at 900 °C, its effect on microstructure, porosity characteristics and especially on mechanical properties was investigated. Microstructural evolutions were carried out with detailed investigations by light and electron microscopes (FE-SEM), radiography and Archimedes test. Investigations of phase transformations were done by XRD test and their effect on mechanical properties such as tensile behavior and hardness was evaluated.
The results indicate that heat treatment had remarkably favorable effect on microstructural characteristics and mechanical properties of Ti6Al4V 3D printed parts. In such a way that the mechanical properties, especially the tensile and yield strength as well as the ductility of heat treated parts increased significantly compared with that of as received ones. Also, the manner of these changes in the specimens oriented in the X and Z directions showed significant differences, which was depicted using microstructural images and radiography.

Keywords: 3D printing, Ti6Al4V, heat treatment, microstructure, mechanical behavior.
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# Porosity in 3D printed parts produced in horizontal and vertical directions and its performance on tensile and fatigue loadings

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**Abstract**
Porosity as an inevitable parameter in the parts produced by the additive manufacturing process have significant effects on mechanical properties. In this research, by using Ti6Al4V parts produced by additive manufacturing process in horizontal (X) and vertical (Z) orientations, the effect of porosity characteristics (content, morphology and distribution) on mechanical properties has been investigated using tensile and fatigue tests.
Interestingly, the results indicated dissimilar behavior of porosity in different loadings as well as different orientations. Despite the dissimilar porosity characteristics in the specimens oriented in different X and Z directions, the tensile properties of both directions showed similar behaviours. However, in the case of fatigue tests, completely different results were observed which is expressed in more details in the manuscript. These findings can be taken into consideration in the computational and experimental design and optimization of additive manufacturing parts from Ti6Al4V alloy.

Keywords: 3D printing, Ti6Al4V, porosity, tensile, fatigue.
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# Bakır çok telli tel çekme makineleri giriş rölelerinde aşınma kaynaklı hasarın önlenmesi ve tel çekim kalitesinin iyileştirilmesi

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## Özet

Bakır çoktelli tel çekme makinelerinde, giriş malzemesi olarak kullanılan tel, makara ya da sepetlerden çözülür ve yönlendirme avare makaraları vasıtasıyla makinaya doğru iletilir. Kollektörde toplanan teller, makine çekim grubuna gelmeden metal giriş rölesinden geçirilir. Tellerin yük altında giriş rölesine baskı uygulaması ve sürtünme etkisiyle röle yüzeyinde aşınmalar meydana gelebilmektedir.

Aşınan giriş rölesi yüzeyleri, tele sürterek tel yüzeyinde mekanik deformasyona neden olabilmektedir. Kaplamalı tellerde kaplamanın bozulması ya da tel yüzeyinde tozuma hasarları gibi yüzey kusurları karşılaşılan mekanik deformasyon hasarlarına örnektir. Giriş rölesinden kopan küçük metalik partiküllerin tel yüzeyine batması sonucunda tel kopması problemleri ile karşılaşılabilmektedir.

Çalışmanın amacı, çoktelli tel çekme makinelerinde alternatif malzemeler ve aşınmaya dayanıklı kaplamalar kullanılarak imal edilmiş giriş rölelerinin denenmesidir. Yüzeyi WC-NiCr kaplanmış 1.0503 çelik, 1.2080 çelik, yüzeyi $CrO_2$ kaplanmış 1.2080 çelik, 1.2436 çelik, yüzeyi $Cr_3C_2$-NiCr kaplanmış 1.2436 çelik kullanılarak üretilen röleler kimyasal kompozisyon, sertlik, yüzey karakteristiği bakımından kıyaslanmıştır. Ayrıca belirlenen rölelerin çoktelli makinesinde uzun süreli kullanım sonucunda, üzerinden geçen tel miktarı ve tel metrajına bağlı olarak aşınma seviyesi karşılaştırmalı olarak incelenmiştir.

Anahtar Kelimeler: Bakır ve bakır alaşımları, Çoktelli, Tel çekme, Aşınma, Röle

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# Characterization of tunable zirconium nitride thin films deposited with different Ar: $N_2$ ratios

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## Abstract
Transition metal nitrides are highly promising materials for their exceptional thermal, electrical, optical, and catalytic characteristics. Extensive research has centred on the Zr-N compound due to its outstanding properties, rendering it suitable for diverse industrial applications. These encompass its use as robust coatings and diffusion barriers in semiconductor technology, as well as in optical setups such as heat mirrors and decorative coatings. Notably, the composition of nitrogen significantly influences the optical properties of zirconium nitride (ZrN). Therefore, the current study investigates the effects of an increased nitrogen flow rate on the various characteristics of deposited ZrN films. A comprehensive analysis was carried out to determine the optimised stoichiometry of ZrN thin film by thoroughly assessing the structure and optical properties of the fabricated ZrN thin films as a function of stoichiometry. The forthcoming pursuits will be dedicated to understanding the behavior of ZrN thin films in the realm of refractometric sensing applications through a customised micro-spectrometry setup.

Keywords: Refractory transition metal nitrides; zirconium nitride; sputtering; thin film; optical properties

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# Nanomechanical transition behavior of top and bond layer in TBC

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**Abstract**
Thermal barrier coatings (TBC) have been developed to reduce the surface temperature of hot components in gas turbine engines. In order to get superior oxidation and mechanical properties , "Yttria Stabilized Zirconia (YSZ)" top coat and β-NiAl bond coat is preferred. Chemical Vapor Deposition (CVD) is utilized for bond coat and Electron Beam Physical Vapor Deposition (EBPVD) is applied for the top coat. In this study, mechanical properties of each coating layer is analyzed by nanoindentation technique. Compositional change and phase formation is characterized through coating region to substrate by SEM-EDS analysis and XRD techniques, respectively. The results of this study has revealed significant difference in microstructural and nanomechanical properties on each coating layer.

Keywords : Thermal barrier coating, Aluminide coating, EBPVD-YSZ coating, Nanoindentation, Microstructure

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# An overview of correlation between microstructure and hardness of FeCoCrNi high entropy alloys

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**Abstract**
High energy mechanical alloying (HEMA) is one of the well-known production routes to obtain nanocrystalline structures of metals and alloys with remarkable benefits. Additionally, this attained enhanced properties may be further increased with the addition of dopants which triggers the formation of second phases upon temperature exposures. However, compaction of nanocrystalline powders at high temperatures introduces a prominent problem due to the grain coarsening tendency of nanocrystalline structures. In this work, FeCoCrNi high entropy alloys (HEAs) with the addition of dopants were nanostructured by HEMA revealing face centered cubic crystal structure. Subsequently, the as-milled HEAs were cold compacted followed by a presureless sintering at different temperatures up to 1100 °C in a protective gas atmosphere. The attained microstructures and hardness of HEAs were examined by X-ray diffraction (XRD), focused ion beam microscopy (FIB), and microhardness test. The results revealed the existence of regions surrounded with abnormally grown grains appeared particularly at elevated sintering temperatures, along with increased hardness.

Keywords: high entropy alloys, high energy mechanical alloying, hardness, dopant additives, heat treatment

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# Actual evapotranspiration estimation using ssebop approach with landsat 8 images

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**Abstract**
Practically calculating evapotranspiration has some limitations, such as the inability to estimate evapotranspiration at large scales, high costs, the inability to calculate evapotranspiration for different land cover types, etc. Therefore, remote sensing can compensate for these drawbacks. The Surface Energy Balance Algorithm for Land (SEBAL) algorithm is a well-known method for calculating evapotranspiration using hot and cold pixels in satellite images. However, it has its complexities and is considered an older approach. To address these complexities, simplified methods like Operational Simplified Surface Energy Balance (SSEBop) have been proposed, which do not require calculating certain energy balance parameters such as sensible heat flux and consider zero value for ground heat flux. All evapotranspiration calculations were performed using the SSEBop method in the Google Earth Engine (GEE) environment. 8-day Landsat 8 images are used to estimate evapotranspiration using the SSEBop method. Parameters such as Normalized Difference Vegetation Index (NDVI), air temperature (Ta), surface albedo, and land surface temperature(LST) significantly influenced the calculations, and the accuracy of the images was also taken into consideration. Actual evapotranspiration was calculated using this method for a specific period where we have practical evapotranspiration data. C factor has an essential role in the calculation. The k value is considered 1.15 by G.Senay 2013 recommendation Actual evapotranspiration data were measured using a scintillometer in a well-irrigated piece of land within the Zayandeh Rood basin in the Isfahan region. Our data is measured for the hottest pixel in the specified area of interest by 8.5448 on August 18th, 2016.

Keywords: Evapotranspiration, Google Earth Engine, SSEBop, Landsat8

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# Hydraulic performance of morning glory spillway with two orifices

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**Abstract**
In recent years, the construction of high reservoir dams for water storage has increased. Dams are consisting of various components, including spillways as one of the most important structures which are used to discharge the excess extreme entering floods to the reservoirs. Failure to do so can result in significant damage to the dam and may lead to destructive effects. Morning glory is one of the distinctive spillways, which are used in particular geometrical conditions. Hydraulic flow parameters, including pressure and velocity at different locations of the spillway, are required to design such structures. Due to the high complexity of geometry and flow conditions, simple hydraulic relationships for accurate assessments of its behaviors are not suitable. Recently Morning glories are accompanied by one or more orifices. This paper investigates the numerical behavior of flow over a Morning Glory spillway with adjusted orifices. The study is based on a three-dimensional model by Flow 3D. The results indicate that the spillway along with the orifices leads to an increase in flow rate. Pressure distribution and flow velocity are also provided and compared with the condition without orifices.

Keywords : Morning Glory spillway, Flow 3D, Numerical Modeling, Flow Discharge.

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# Free vibration analysis of a beam resting on winkler elastic foundation through the sumudu transform method

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**Abstract**
In the article are determined the free vibration characteristics of a beam lying on a Winkler elastic foundation. This well-known problem is solved by employing the Sumudu transform method to convert the fourth-order partial differential equation for the beam's natural vibrations into an algebraic equation. The solution assumes that the beam's free vibrations are harmonic. The obtained results are compared with those obtained using the finite element method.

Keywords: Sumudu transform method, Free vibration, Winkler elastic foundation, vibration characteristics.

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# Dual ceramics (LATP-LLTO) composed by functional polymer electrolyte for dendritic-free and robust lithium metal batteries

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## Abstract

Lithium-metal batteries (LiMBs) are promising energy storage devices due to the high capacity and minimum negative electrochemical potential. Nevertheless, their concrete applications remain disturbed by unbalanced electrolyte-electrode interfaces, limited electrochemical window, and high-risk. Herein, a novel strategy to obtain dual ceramic-based electrolytes that possess great potential in energy storage due to their higher level of energy densities in LiMBs. Dual-ceramic (LATP-LLTO) gel polymer electrolyte (DCGPE) film developed via the curable system, aimed to prepare flexible $Li^+$ interpenetrating network film to integrate the two ceramic structures with polyethylene oxide (PEO) to yield the free-standing electrolytes film for better battery safety and desired interfacial stability. The DCGPEs films presented a satisfactory electrochemical performance, including, good ionic conductivity, large transference number, and wide electrochemical stability window (ESW) at room temperature. Most importantly, the fundamental function of LATP and LLTO is to support building a stable solid-electrolyte-interphase (SEI) and limits the growth of dendrites. Thus, prepared dual ceramic-based electrolytes effectively renders to inhibit lithium dendrite growth in a symmetrical cell Li//PEO+10% LATP+15% LLTO//Li test during charge/discharge at a current density of 2 $mA/cm^2$ and 0.25 $mA/cm^2$ above 2400 h without short-circuiting occurrence at room temperature. Besides, the battery assembled of $LiFePO_4$/PEO+10% LATP+20% LLTO/Li exhibits superior cyclic stability with high Coulombic efficiency. This study recommends that the binary network structures of Li-ion conductor help to design a prime solution of promising electrolyte for high-performance LiMBs applications.

**Keywords:** LATP, LLTO, PEO, PVP, lithium-metal batteries, Li-dendrites.

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# Modifiye edilmiş fiber takviyeli betonarme kompozitlerin üretimi ve mekanik özelliklerinin iyileştirilmesi

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## Özet

Artan dünya nüfusu ve yaşam şartlarının önemli ölçüde değişmesi nedeniyle yapılarda kullanılan malzeme türleri önemli ölçüde değişmektedir. Hem yorulma, rijitlik ve mukavemet gibi mekanik özelliklerinin iyileştirilmesi hem de hafiflik ve maliyet gibi özelliklerin geliştirilmesi son dönemlerde sıklıkla araştırılmaktadır. Bu faydaların sağlanması amacıyla yapılarda kullanılmakta olunan betonarme yapıların içerisine farklı takviye malzemeleriyle özelliklerini geliştirmek mümkündür, bu bağlamda özellikle fiber takviyesiyle üretilen beton esaslı kompozit malzemeler bu ihtiyaca önemli katkı sağlamaktadır. Fiber takviyeli kompozit malzemelerin kullanılmasıyla birçok mekanik özelliklerde iyileştirmeler sağlanarak yüksek maliyetli konstrüksiyonların yerine kullanılması sağlanacaktır. Ancak fiberlerin bu kullanımlarında genellikle matris içerisinde topaklanmak problemiyle karşılaşılmakta ve homojen olmayan bu yapısal sorunun giderilmesi için farklı yöntemler kullanılmaktadır. Bu olumsuzluğun giderilmesinde kullanılan fiber yüzeylerinin farklı işlemlerle yüzey yapısının geliştirilerek matris malzemesi içerisinde daha düzenli bir yapının elde edilmesi mümkündür. Bu çalışmada farklı türde fiberler çevre dostu bir yöntem olan kimyasal buhar biriktirme yöntemiyle (CVD) düşük yüzey enerjili polimerik ince filmlerle kaplanmıştır. Çalışma kapsamında polimerik ince filmlerin üretimindeki kullanılan gerekli CVD parametreleri belirlenmiştir. Hem kaplanmış hem de kaplanmamış fiberler kullanılarak kompozit malzemeler hazırlanmış ve mekanik özellikleri incelenmiştir. Yapılan değerlendirmelerde kaplanmamış referans malzemelere kıyasla basma mukavemetinde iyileştirme sağlanmıştır.

Anahtar Kelimeler: Fiber, CVD, betonarme kompozitler, mekanik davranışlar

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# Mechanical, thermomechanical and mechanofluorochromic characterızation of methyl orange doped polymer medium

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## Abstract
Smart materials are capable of exhibiting one or more properties that can be intentionally altered in response to external stimuli such as voltage, temperature, humidity, pH, electricity, magnetic fields, or mechanical forces. Among the various effects used to control the properties of smart materials, the mechanical effect holds a significant role. Smart materials display a response to external mechanical stimuli, including stretching, bending, pressing, and grinding, and this particular characteristic is referred to as mechanochromism. The term 'mechanofluorochromic' is used to describe the ability of a material to change its emission wavelength or intensity when subjected to an applied external mechanical force. Mechanofluorochromic behavior is the outcome of a physical or chemical change that occurs within the molecule due to mechanical influences. It is hypothesized that the manipulation of this characteristic can enable the regulation of stress distribution, thereby mitigating potential undesired defects such as microcracks and inclusions.
In the context of this study, the mechanofluorochromic behavior of polypropylene (PP) film samples was investigated under tensile forces by incorporating a fluorophore molecule (Methyl Orange (MO)) and thermomechanical characterization was carried out with dynamic mechanical analyses (DMA). Additionally, the mechanical behaviors occurring in epoxy medium of the samples were also revealed by flexural and tensile tests. The optical properties of these polymer films have also been investigated using UV-vis absorption and fluorescence measurements in PP and PMMA. The study revealed a decrease in emission intensity, some chromic shifts in emission wavelength and an increase in storage modulus after the application of the mechanical force.

**Keywords:** Smart Materials, Mechanofluorochromism, Reducing Aggragation Effect.

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# Enhanced singlet oxygen generation through novel diaxial silicon phthalocyanine sensitizer: synergistic effect of light and ultrasound

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**Abstract**
Photodynamic therapy (PDT) is a therapeutic procedure that involves the application and activation of a photosensitizer by light with an appropriate wavelength [1]. Among these therapy strategies, sonodynamic therapy (SDT) has been extensively investigated for cancer treatment in clinical researches during the past several years [2]. The cytotoxicity of ultrasound coupled with a sensitizing substance is also evaluated in association with photodynamic therapy (SPDT) [3]. Although many photosensitizers exist, phthalocyanine derivatives are those most commonly used as cancer treatment[4]. In this study, to contribute to the development of SPDT, a promising sensitizer was synthesized, characterized, and its photophysico-chemical properties were analyzed. Afterwards, the singlet oxygen quantum yield of the sensitizer was calculated by both photochemical and sono-photochemical studies.

Keywords: Photodynamic therapy, Sonodynamic therapy, Silicon Phthalocyanine, Singlet oxygen.

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# Effect of PdO doping on Cobalt-oxide and Cobalt-selenide: An activity for electrocatalytic performance toward water splitting

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## Abstract

Environmental pollution and clean energy resources are an important part of our civilization. There has been considerable progress in the development of metal oxides and metal chalcogenides based electrocatalysts in recent years. Nonetheless, recently reported materials suffer from limitations in their electrocatalytic activity due to various factors such as a large onset potential, poor electrical conductivity, and a low density of catalytic centers. In this research, we present a novel approach involving the use of ultraviolet (UV) light to facilitate the doping of PdO onto cobalt oxide and cobalt selenide nanostructures. As a result, the PdONPs@$Co_3O_4$ nanocomposites exhibit a significantly higher density of active sites, improved electrical conductivity, and enhanced durability for oxygen evolution reaction (OER) activity compared to PdONPs@$CoSe_2$ nanostructures. The Co and Pd ions at the interface of this composite system synergistically influence the adsorption energy of reaction intermediates, thereby enabling the reaction to proceed with lower energy consumption.

Keywords: Cobalt oxide; Cobalt Selenide; PdO doping; Oxygen Evolution Reaction; Water splitting;

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# Nano montmorillonit içeren kapak ambalaj filminin tereyağı depolanmasında fizikokimyasal özellikleri üzerine etkisi

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## Özet
Bu araştırma kapsamında çevre kirliliğine neden olan petrol türevli ambalaj malzemelerine alternatif olarak nano içerikli ambalaj filmi üretilmiştir. Nano montmorillonit içeren gıda ambalaj filmi tereyağı depolanmasında kapak ambalajı olarak kullanılmıştır ve depolanma esnasındaki fizikokimyasal özellikleri üzerine etkileri 0-2-4 ve 6 aylık bir zamana bağlı olarak incelenmiştir. Üretilen biyofilme oksijen geçirgenliği, yağ sızdırmazlığı analizleri ve depolanan tereyağına ise serbest yağ asitliği, peroksit sayısı, renk, yağ asitleri kompozisyonu, viskozite, kırılma indisi, psikrofilik mikroorganizma ve toplam maya ve küf analizleri yapılmıştır. Bu doğrultuda 6 aylık periyotda, nanofilmin yağı sızdırmadığı, oksijen geçiş hızının 4485 cc/$m^2$/gün, tereyağının, serbest yağ asitliği (%) (0,62-1,07), peroksit sayısı (0-1,798 meq/kg), renk L*(79,99-97,74), a*( -0,07)-( 4,18), b* (26,09-29,77), kırılma indisi değerleri (1,4367-1,472 $n_D$), baskın yağ asitleri, doymuş yağ asitlerinden bütirik asit ve miristik asit, doymamış yağ asitlerinden de oleik asit belirlenmiş olup psikrofilik mikroorganizma, toplam maya ve küf değerleri tespit edilmiştir. Sonuç olarak; üretilen filmin tereyağını fiziko-kimyasal açıdan koruduğu, mikrobiyolojik açıdan ise hijyen koşullarına dikkat edilerek geliştirilmesi gerektiği belirlenmiştir.

Anahtar Kelimeler: Nano montmorillonit, ambalaj, terayağı, fiziko-kimyasal, depolama.

## Abstract
Within the scope of this research, nano-containing packaging film was produced as an alternative to petroleum-derived packaging materials that cause environmental pollution. Food packaging film containing nano montmorillonite was used as a cover packaging in butter storage and its effects on physicochemical properties during storage were investigated over a period of 0-2-4 and 6 months. Oxygen permeability and oil tightness analyzes were performed on the produced biofilm and on the stored butter free fatty acidity, peroxide number, color, fatty acid composition, viscosity, refractive index, psychrophilic microorganism and total yeast and mold analyzes. Accordingly, in a 6-month period, the nanofilm does not leak oil, the oxygen transmission rate is 4485 cc/m2/day, the free fatty acidity (%) of butter (0.62-1.07), the peroxide number (0-1.798 meq/kg), the color L*(79.99-97.74), a*( -0.07)-(4.18), b* (26.09-29.77), refractive index values (1.4367-1.472 nD) , dominant fatty acids, butyric acid and myristic acid from saturated fatty acids, and oleic acid from unsaturated fatty acids were determined. In addition, psychrophilic microorganism, total yeast and mold values were examined. In conclusion; It was determined that the film produced protects the butter in terms of physico-chemical aspects, and in terms of microbiology, it should be developed by paying attention to hygiene conditions.

Keywords: Nano montmorillonit, butter, physico-chemical, storage.

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# Synthesis of barium, strontium and barium-strontium hexaferrites by co-precipitation method

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## Abstract

In present study, magnetic nanoparticles of Barium Hexaferrite, Strontium Hexaferrite and Barium-Strontium Hexaferrite were synthesized by co-precipitation method and thereupon X-ray diffraction (XRD) and Vibrating-Sample Magnetometer (VSM) were used to characterize the powders. Synthesis parameters, such as materials, equipment, lab condition, temperature and solvents were chosen equally, therefore comparison status for products was fully provided. In order to synthesize Barium Hexaferrite, Iron chloride and Barium chloride with a Fe/Ba molar ratio of 11 were utilized. To synthesize Strontium Hexaferrite, Iron chloride and Strontium chloride with the Fe/Sr ratio of 12 were used. At last, for synthesizing Barium-Strontium Hexaferrite, the identical chlorides were applied in which the Fa/Ba and Fa/Sr ratio of 24 was selected. Mixture of Water and Ethanol with the ratio of 1 and 3 (respectively) as solvent and NaOH (which the ratio of OH/Cl was 2) as precipitator at room temperature were used. Samples dried at 80˚C for 24 hours, afterwards, toward the diffusion of $Ba^{2+}$ and $Sr^{2+}$ into Iron oxide and formation of Hexaferrite phase, they were calcined at 950˚C for 1 hour. **In the following, XRD technique was hired to observe the formed phases and study crystalline parameters. By means of VSM technique, magnetic properties of the powders were determined in which the Barium-Strontium Hexaferrite was superior.**

**Keywords**: Strontium, Barium, Synthesis, Co-precipitation, Magnetic nanoparticles

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# Investigation of piezoelectric and dielectric properties of bone cements with BCT-BZT additives

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## Abstract

The origin of this study is based on the production of piezoelectric bone cement, and the investigation of the dielectric and piezoelectric properties of the produced bone cement. Firstly, barium calcium zirconium titanate (BCZT) piezoelectric powder was produced via a sol-gel process. Then it was mixed with the bone cement consisting of calcium phosphate cement (CPC), and magnesium phosphate cement (MPC) at different weight ratios (0%, 20%, 30%, 40%). CPC-MPC bone cement was prepared by mixing an equivalent weight ratio of CPC and MPC. The structural phase analyses were carried out by X-ray diffraction (XRD). The morphological structure of the samples was investigated by scanning electron microscopy (SEM). The piezoelectric bone cement powders are compacted in the form of a pellet and then sintered for electrical characterizations. The samples were exposed to corona poling before piezoelectric coefficient ($d_{33}$) measurement by using a piezoelectric-$d_{33}$meter. The dielectric behavior of the samples was measured by LCRmeter. According to the results, the piezoelectric and dielectric properties of the samples were enhanced with an increasing BCT-BZT ratio. As charges generated by the piezoelectric property of bone contribute to the activity of bone resorption and bone-forming cells, it can be said that the produced piezoelectric bone cement is a promising material for bone tissue engineering applications.

Keywords: Bone cements, Piezoelectric properties, Dielectric properties, BCT-BZT

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# Numerical approach of the influence of the pressure in a cavity intended for the tribo-electrostatic separation of fine particles

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**Abstract**
In the field of recycling, several tribo-electrostatic separators use the injection of air, in order to ensure a tribo-electrification which in turn allows the loading of the particles for a possible dry separation, which depends on the application of a strong electric field. This work concerns a dynamic numerical study of the behavior of a fluid composed of air and particles in a cavity which represents a separation chamber of an aero-tribo-electrostatic separator. It is a question of studying the influence and the impact of the parameters of the air injection speed and the speed of rotation of the two electrodes called "rotors" on the pressure inside a cavity in plexiglass. The numerical simulation was carefully processed by the ANSYS CFX (CFD) software, using the k-ε model. However, we can see that the pressure inside the cavity which represents the aero-tribo-electric separation chamber is not influenced by the rotation of the "rotors" electrodes but, rather, it is affected by the speed of d entrainment of the fluid (air plus particles).

**Keywords:** Flows, numerical simulation, CFD. Aero-tribo-electrostatic separators

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# Metal organik kafes yapılarının quartz crystal microbalance sensör üzerinde uygulamaları

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## Özet

İlk olarak 1990'larda geliştirilen Metal Organik Yapılar/Kafesler (MOF), moleküllerin kendiliğinden bir araya gelip bağ oluşturmasıyla hem organik hem de inorganik moleküllerden oluşan kristal hibrit malzemelerdir. MOF'lar gözenekli, yüksek yüzey alanına sahip, gözenek boyutu ve topolojisi ayarlanabilir bir grup olarak birçok alanda istenen kullanıma uygun tasarım çalışmaları olan bir yapıdır. Bu nedenle MOF'ların birçok alanda uygulaması bulunmaktadır. Bunlar; gaz ayrımı, kataliz, karbondioksit yakalama, su adsorpsiyon ve desorpsiyonu olarak sıralanabilmektedir. MOF'lar kimyasal sensörlerin performanslarının artırılmasında anahtar rol oynayan algılayıcı arayüzey malzemeler, sensör duyarlılığı ve seçiciliği üzerinde önemli bir etkiye sahiptir. MOF'lar, gazlar ve buharlarla yüksek etkileşim yetenekleri, gaz molekülleri için kolay erişilebilir katmanlar oluşturma, yüksek kararlılık ve sağlamlık gibi birçok özelliğe sahiptir. Günümüzde Quartz Crystal Microbalance (QCM) sensörler kimyasal tanı alanlarında kullanılmaktadırlar. Kimyasal sensörler Uçucu Organik Bileşikler (UOB) başta olmak üzere çeşitli toksik bileşikleri algılamada sensör olarak kullanılmaktadır. Böylelikle seçilmiş farklı MOF yapılı bileşiklerin QCM üzerinde UOB 'lere karşı sensör özellikleri incelenmiştir. Bu çalışma, MOF'ların QCM esaslı sensör yüzeylerine uygun kaplama yönteminin geliştirilmesini, kaplama karakterizasyonunu, seçilmiş UOB'lere (12 adet analit)karşı sensör testlerini, sensör performans karakterizasyonunu ve son olarak performans değerlendirmesini kapsamaktadır. Ölçümler kapsamında kimyasal sensörlerin data analizi, sensör tepkisi, duyarlılık, tepki zamanı sabiti, kararlılık, tersinirlik, tekrarlanabilirlik çalışmaları yapılmıştır. Sensörün kararlılığı, daha uzun zaman aralıklarında yapılacak olan tekrarlanan ölçümlerle test edilmiştir. Bu şekilde, test edilen tüm MOF'lar, algılama malzemeleri olarak performanslarında tam olarak karakterize edilmiştir. Ölçüm sonucunda QCM'ler kuru havada yüksek tepki verirken, nemli havada da yüksek tepki vermişlerdir. 12 adet analit içinden QCM üzerine kaplanan MOF yapıya en iyi tepkiyi veren asetonitril ve metanol analitleri olmuştur (850-1000 MHz arasında değişmektedir). İlk sonuçlar MOF yapılı maddelerin QCM sensör üzerinde kullanımı için oldukça ümit verici olmuştur. Böylelikle MOF yapıların QCM sensör üzerinde çalışmaları hakkında şimdiye kadar az veri bulunan sensörler için yeni bir arayüzey malzeme olmuştur.

Anahtar Kelimeler: Sensör, Metal Organik Kafes, Quartz Crystal Microbalance, Uçucu Organik Bileşikler.

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# High-performance copper oxide-based heterojunction bipolar transistor: design, modeling, and performance analysis

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## Abstract
The goal of this study is to elucidate the step-by-step process of incorporation of a $Cu_2O$ confinement layer in an oxide semiconductor-based heterojunction bipolar to explore its impact on gain enhancement. The emitter and collector layers have consisted of CuO. The material of the base layer is silicon, with a confinement layer with $Cu_2O$ added between the emitter and base regions. The transistor is designed as a PNP structure and used the inherent characteristics of copper oxide as a p-type, which means ion-implant is a high-temperature process, so removing it and fabricating the organic subtract will be conceivable. The research involved the simulation of transistors with and without a $Cu_2O$ confinement layer using state-of-the-art semiconductor processing techniques. Simulation results exemplify that proposed the potential barrier caused by the confinement layer prevents the electrons from moving from the base to the emitter layer. The improve on injection efficiency caused the increase in DC gain. In SILVACO, device parameters, such as doping profile, dimensions, and material properties, were considered and modeled. Finally, the result was as the AC gain escalated to 52dB, the cut-off frequency achieved was12 GHz, and by considering a wide range of base-emitter voltages the DC gain became >1000. This transistor with an AC gain of 52dB has applications as an audio and radio frequency amplifier and oscillator that generates a periodic waveform, it is useful in signal processing circuits, communication systems and sensors application to utilized in sensor circuits to amplify signals from sensors.

**Keywords:** Copper Oxide-based Heterojunction Bipolar Junction Transistor, confinement layer, Injection efficiencyz

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# Photodiode characteristics of pentacene/cuo thin film structures

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**Abstract**
Pentacene organic semiconductor thin film was grown by thermal evaporation method on the CuO thin film produced by one-step electrochemical method. Then, point Ag contacts were placed on both layers and Ag/Pentacene/CuO/Ag device was produced. The basic electrical properties of the device were investigated at ±0.5 V application potential in the dark and at 20, 40 mW.cm$^{-2}$ light intensities. The basic diode parameters of the device were determined according to the ideality factor ($n$), barrier height ($\phi_b$) and reverse saturation current ($I_0$) thermionic emission theory. Accordingly, at dark, 20 and 40 mW.cm$^{-2}$ $n$ values, respectively; 6.42, 1.74, 13.34, $\phi_b$ values; 0.38, 0.47, 0.16 eV, $I_0$ values; It is designated as 1.69x10$^{-7}$, 4.10x10$^{-9}$, 7.87x10$^{-4}$ A. The high barrier height brought the diode closer to the ideal and reduced the reverse saturation current. The reason why the ideal diode value of the Pentacene/CuO photodiode is greater than 1 can be explained by the inhomogeneous charge distribution and undesirable impurities. Basic photodiode parameters of Pentacene/CuO photodiode; photocurrent ($I_{ph}=I_{ill}-I_{dark}$), photoconductive responsivity ($R_{ph}=I_{ph}/P_{inc}.A$), photosensitivity ($PS\%=(I_{ph}-I_{dark})x100/I_{dark}$) and specific detectivity ($D^*=(R_{ph}.A^{1/2})/2qI_{dark}^{1/2}$) values were determined at 20 and 40 mW.cm$^{-2}$ light intensities. In 20 mW.cm$^{-2}$ light intensity and at -0.5 V, $I_{ph}$, $R_{ph}$, $PS\%$ and $D^*$ values are 1.3x10$^{-6}$ A, 1.01x10$^{-4}$ A.W$^{-1}$, 30% and 1.43x10$^{8}$ Jones, respectively, while at 0.5 V these values are 1.8x10$^{-6}$ A, 1.4x10$^{-4}$ A.W$^{-1}$ are 190% and 1.4x10$^{8}$ Jones. At 40 mW.cm$^{-2}$ light intensity and at -0.5 V, $I_{ph}$, $R_{ph}$, $PS\%$ and $D^*$ values are 2.33x10$^{-3}$ A, 9.05x10$^{-2}$ A.W-1, 2.33x10$^{5}$ % and 1.28x10$^{11}$ Jones, respectively, while at 0.5 V values are 2.82x10$^{-3}$ A, 1.1x10$^{-1}$ A.W$^{-1}$, 1.41x10$^{5}$ % and 1.1x10$^{11}$ Jones. As a result of these results, it is seen that the photodiode parameters of the Pentacene/CuO photodiode, especially at 40 mW.cm$^{-2}$ light intensity, are quite high compared to the literature and offer an alternative to thin film based optoelectronic applications.

Anahtar Kelimeler: CuO1, Pentacene2, photodiode3, high photo sensivity4.

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# Fabrication of piezoelectric PVDF-ZnO composite nanofibers by electrospinning technique

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## Abstract
Piezoelectricity is the phenomenon in which a certain group of materials exhibit the generation of electric charge in response to mechanical stress or pressure, and vice versa. This unique property has found tremendous applications among a variety of devices including energy harvesters, sensors, actuators, etc. Among the different piezoelectric materials, polyvinylidene fluoride (PVDF) nanofibers fabricated by electrospinning process, when combined with other piezoelectric materials like zinc oxide (ZnO), show enhanced piezoelectric properties. Based on previous studies, incorporating the ZnO nanoparticles into the PVDF nanofibers improved the piezoelectric properties of samples compared to PVDF samples. Following these researches, we investigated the effect of adding ZnO nano-powder to PVDF nanofibers on its piezoelectricity property. ZnO particles were dissolved in N, N-dimethylformamide (DMF) and placed in an ultrasonic bath for 10 minutes to prevent agglomeration. Then they were added to the PVDF and DMF solution and placed on a hot plate magnetic stirrer for 25 minutes at a temperature of 60°C with a speed of 400rpm. Finally, the prepared solution was placed in the electrospinning machine and nanofibers were produced out of them under this situation: Feeding rate = 5cc/h, Collector speed = 1500rpm, and Nozzle distance = 15cm. The voltages applied ranged between 17-20V. Scanning electron microscope was used to check the structure of the samples. Piezoelectricity property of the nanofiber was measured by applying a 2.6N force with 5Hz frequency. It was observed that by adding 0.3g (wt%15) ZnO to the PVDF matrix, the piezoelectric property experienced a 3-time increase, compared to pure PVDF nanofibers.

Keywords : Piezoelectricity, Polyvinylidene fluoride, Zinc oxide, electrospinning, nanofiber .

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# Doğal kauçuk/epokside doğal kauçuk esaslı kuşingam hamurlarında reçine ilavesinin fiziko-mekanik ve yapışma performansına etkisi

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## Özet

Faydalı ömrünü tamamladığı belirlenerek araçtan sökülen araç lastikleri "atık lastik" ya da ömrünü tamamlamış lastik (ÖTL) olarak tanımlanmaktadır. Ömrünü tamamlamış atık lastikler ciddi çevre kirliliğine neden olmakla birlikte sürdürülebilir ekonomi için de önemli bir kayıptır. Bu atıkların miktarını azaltabilmek için en uygun yöntem, ömrünü tamamlamış lastiklerin, teknik olarak mümkün olduğuna karar verildikten sonra kaplanarak tekrar kullanılmasıdır. Lastik kaplama teknolojisi, uzun yıllardır hem lastik sektörü hem de bilim dünyasının üzerinde çalıştığı bir konudur. Ömrünü tamamlamış lastik karkası ve kaplanan sırt kısmı arasındaki yapışmayı sağlayan kuşingam (cushion gum) hamuru, lastik kaplama sürecinin performansını etkileyen en önemli bileşenler arasındadır. Kuşingam hamuru, iki adet pişmiş kauçuğu (karkas ve yeni sırt) yeniden vulkanizasyon sırasında birbirine kimyasal yolla bağlayan, yapışma performansı yüksek, dinamik çalışma koşullarında çatlamaya neden olmaya, çevresel şartlara karşı dayanıklı ve yüksek mekanik dayanıma sahip bir bileşime sahip olması beklenen bir hamurdur. Bu çalışmada, doğal kauçuk (NR)/epokside doğal kauçuk (ENR) esaslı hamurlarda alkil fenolik reçine (SP 1045), bromlanmış oktil fenol-formaldehit reçine (SP1055) ve oktil fenol-formaldehit reçinesi (SP 1045) olmak üzere farklı tip reçineler ve N,N-m-fenilendimaleimid (HVA-2) kullanımının kuşingam hamurunun reolojik, fiziko-mekanik ve ısıl dayanım özellikleri üzerindeki etkileri incelenmiştir. Yapışma karakterizasyonunda T-yapışma kuvveti ve teorik termodinamik yapışma işi yaklaşımları kullanılmış, bulgular karşılaştırmalı olarak değerlendirilmiştir. Uygun reçine sisteminin kullanılması ile karkas ile kuşingam arasındaki arayüzey etkileşimini önemli ölçüde geliştirilebildiği sonucuna varılmıştır.

Anahtar Kelimeler: Doğal kauçuk, Epokside doğal kauçuk, Kuşingam hamuru, Reçine

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# Hiper akışkanlaştırıcı ve mineral katkılı harçların performans özellikleri

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## Özet
Bu çalışmada hiper akınlaştırıcı (HA) ile mineral katkı(SD) katkılı 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 4 tip beton olmak üzere 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. Karışımda hiper akınlaştırıcı ve farklı oranlarda mineral katkı kullanılmıştır. Böylece SD oranı arttıkça yüksek dayanımlı betonlar daha ekonomik olarak imal edilebilir. Karışımdaki silis dumanı miktarı arttıkça normal betona göre 7-28-60 günlük dayanım değerlerinin orantılı bir şekilde arttığı gözlemlenmiştir. Normal(RFR) betona göre kullanılan katkılar sayesinde su ihtiyacı azalmıştır.

**Anahtar kelimeler**: Beton, Çimento, Hacim ağırlık, Kompasite, Schmidt darbe dayanımı, Hiper akışkanlaştırıcı

# Performance characteristics of hyper plasticizer and mineral additive concrete

## Abstract
In this study, the production of silica fume concrete with hyper-accumulator and the engineering properties of the produced concretes were investigated with the help of experiments. Together with the reference concrete, a total of 4 types of concrete were produced, including 4 types of concrete with different percentages of silica fume (1.0-1.2-1.4-1.6). For each mixture type, 9 cube samples were produced and these samples were subjected to separate tests during the curing period of 7-28-60 days. In the mixture, a hyper-accumulating agent and different proportions of silica fume were used. Thus, as the silica fume ratio increases, high-strength concrete can be produced more economically. It was observed that as the amount of silica fume in the mixture increased, the strength values of 7-28-60 days increased proportionally compared to the RFR concrete. Thanks to the additives used compared to RFR concrete, the need for water has decreased

**Keywords:** Cement, Concrete, Bulk weight, Compactness, Schmidt impact strength, Hyperplasticizer

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# Bor katkılı alüminyum alaşımının fiziksel ve kimsayal özellikleri

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## Özet
Bu çalışmada, alüminyum malzemesinin mukavemet değerlerini bor ve borkarbür gibi malzemeler ile alaşımlandırarak yeni bir kompozit malzeme sentezlenmiştir. Yeni oluşan malzemenin mukavemet değerlerini bir kaç farklı deney ile kıyaslanarak özellikleri araştırılmıştır. Alüminyum hemen hemen birçok sektörde kullanılan bir malzeme durumundadır. Birçok sektöre hitap etmektedir. Alüminyumun fizikomekanik değerlerini daha yüksek değerlere taşımayı planlayıp, hizmet verdiği sektörlerde daha kullanışlı hale getirmek hedeflenmiştir. Bu hedefler doğrultusunda; bor malzemesinden %10 ve alüminyumdan %90 eklenerek bir alaşım sentezlenmiş, borkarbür malzemesinden %10 ve alüminyumdan %90 eklenerek bir alaşım sentezlenmiş, borkarbür %5 ve bor %5 malzemeleri ile başka bir alaşım ve son olarak borkarbür malzemesinden %5 ve alüminyumdan %95 eklenerek yeni bir alaşım elde edilmiştir. Çalışmaların sonucunda, en yüksek mukavemeti borkarbür malzemesinden %10 ve alüminyumdan %90 eklenerek test edilen numune ile elde edilebilmiştir.

**Anahtar kelimeler**: Alaşım, bor, borkarbür, alüminyum, kompozit malzemeler.

# Physical and chemical properties of boron doup aluminum alloy

## Abstract
In this study, a new composite material was synthesized by alloying the strength values of aluminum material with materials such as boron and borcarbure. By comparing the strength values of the newly formed material with several different experiments, its physicomechanical properties were investigated. Aluminum is a material used in almost many industries. It caters to many sectors. It is aimed to carry the physicomechanical values of aluminum to higher values and to make it more useful in the sectors it serves. In line with these goals; the material boron 10% aluminium and 90% of the Alloy by adding synthesized from the material borkarbur 10% aluminium and 90% of the alloy synthesized by adding, borkarbur 5% and boron 5% of an alloy material with other materials borkarbur and finally 5%, and aluminum up to 95% was obtained by adding a new alloy. As a result of the studies, the highest strength could be obtained with the tested sample by adding 10% from boroncarbide material and 90% from aluminum.

Keywords: Alloy, boron, borcarbide, aluminum, composite materials.

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# Silis dumanı katkılı betonların mekanik özellikleri

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## Özet
Bu çalışmada silis dumanı ile beton üretimi ve imal edilen betonların mühendislik özellikleri yapılan deneyler yardımıyla incelenmiştir. Referans betonla beraber farklı yüzdelerce (5-10-15-20-25) silis dumanı ikameli 5 tip beton olmak üzere toplam 6 tip beton üretilmiştir. Her karışım tipi için 9'ar küp numune imal edilerek bu numuneler 7-14-28 günlük kür sürelerince ayrı ayrı deneylere tabi tutulmuştur. Tüm beton tiplerinde basınç dayanımı arttıkça yarmada çekme dayanımı, eğilme dayanımı ve kesme dayanımı artmıştır. İmal edilen bütün betonlar arasında en yüksek dayanım değerleri, 28 günlük SD10 tip betonda görülmüştür. Karışım tiplerinin tamamında silis dumanı ilavesi %10'a kadar arttıkça basınç dayanımı, çekme dayanımı ve eğilme dayanımlarının da arttığı gözlenmiştir.

**Anahtar kelimeler**: Beton, Çimento, Dayanım, Deney, Silis dumanı, Süper akışkanlaştırıcı

# Mechanical properties of Silica fume added concrete

## Abstract
In this study; silica fume, concrete production and engineering properties of manufactured concrete was examined with the assist of tests. With the reference concrete, substituted silica fume variety percentages (5-10-15-20-25) as 5 types concretes, totally 6 types of concretes was producted. For each type of mix, specimens were separately subjected to tests for (7-14-28) days during cure by producted 9 each of cubes specimen. When compressive strength increase, splitting tensile strength, flexural strength and shear strength increase as well in all types of concretes. Nonetheless, increase rate of splitting tensile strength, flexural strength, shear strength is lower than one of compressive strength. Among the all manufactured concretes, highest strength values have been seen in the concrete type of SD10 for 28 day. It was observed that when substituon of silica fume increase up to 10%, compressive strength, tensile strength and flexural strength also go up in all types of mix.

**Keywords:** Cement, Concrete, Silica fume, Strenght, Super plasticizer

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# Hafif beton üretimi ve mühendislik özellikleri

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## Özet
Beton, bir bağlayıcı tarafından aglomere edilmiş agregalardan oluşan kompozit yapı malzemesi için kullanılan genel bir terimdir. Hafif beton ise kısmen veya tamamen hafif agregalardan, hidrolik bağlayıcılardan veya sentetik reçinelerden oluşur. Hafif agregalarla hafif beton (HB) üretilmesindeki en büyük sorunlardan biri, agregaların farklı elek gruplarında farklı ve büyük su emme oranlarına sahip olmalarıdır. Bunun yanında da hafif agreganın doğru oranda kullanılmasıdır. Bu çalışmada; pomza agregasını farklı oranda katkı agregası olarak kullanarak katkılı ve katkısız betonun arasındaki farkı, hafif beton üretimi ve mühendislik özellikleri incelenmiştir.Dört farklı karışım oranı (%0, %10, %20 ve %30 pomza katkı oranı) her bir karışımdan 9 adet, toplamda 36 adet 15x15x15 cm boyutlu hafif beton üretilmiştir. Üretilen örnekler 7, 14, 28 günlük fizikomekanik özellikleri belirlenmiştir.

**Anahtar kelimeler**: Alaşım, bor, borkarbür, alüminyum, kompozit malzemeler.

# Lightweight concrete production and engineering properties

## Abstract
Concrete is a general term for a composite building material consisting of aggregates agglomerated by a binder. Lightweight concrete, on the other hand, consists partially or completely of lightweight aggregates, hydraulic binders or synthetic resins. One of the biggest problems in producing lightweight concrete (HB) with lightweight aggregates is that the aggregates have different and large water absorption rates in different sieve groups. In addition, it is the use of light aggregate in the right ratio. In this study; By using pumice aggregate in different ratios as additive aggregate, the difference between concrete with and without additives, lightweight concrete production and engineering properties were investigated. Four different mixing ratios (0, 10%, 20% and 30% pumice additive ratio) were 9 of each mixture, in total. 36 pieces of 15x15x15 cm lightweight concrete were produced. The physicomechanical properties of the produced samples at 7, 14, and 28 days were determined.

**Keywords:** Alloy, boron, borcarbide, aluminum, composite materials.

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# Köpük beton üretimi ve fizikomekanik özellikleri

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## Özet
Bu çalışmada, ısı ve ses yalıtımı sayesinde enerji ve çevre koruma özelliği öne çıkan yapı malzemesi olarak kullanılabilen ve özellikle binaların dış duvarlarında kullanılabilmeye uygun olan köpük beton üretilmiştir. Numuneler, portland çimentosu, uçucu kül, ince kum, hidrojen peroksit kullanılarak hazırlanmıştır. Hazırlanan numunelerin mekanik özellikleri bakımından beton üretiminde kullanılabilirliği araştırılmıştır. Karışıma uçucu kül sırasıyla % 20-30-40 oranlarında ilave edilmiştir. Uçucu kül katkısının köpük beton örneklerinin mukavemet değerlerini artırıcı etki yaptığı ve birim ağırlık değerleri ile doğru orantılı olarak basınç mukavemeti değerlerinde artış kaydedildiği gözlenmiştir. Örneklerin akış değerleri incelendiğinde örneklerde düzenli akış gerçekleşmiştir. Akış süreleri azaldıkça kalıba daha düzenli yerleşme ve homojen bir karşım sağlanması sonucu mukavemet gelişimi olumlu etkilenmiştir.

**Anahtar kelimeler**: Köpük beton, gözeneklilik, mukavemet, uçucu kül, köpük ajanı.

# Foam concrete production and physiochechanical properties

## Abstract
In this study, foam concrete was produced, which can be used as a building material with a prominent energy and environmental protection feature thanks to thermal and sound insulation and is especially suitable for use on the outer walls of buildings. Samples were prepared using portland cement, fly ash, fine sand, hydrogen peroxide. The usability of the prepared samples in the production of concrete in terms of its mechanical properties has been investigated. Fly ash was added to the mixture at a rate of 20-30-40%, respectively. It has been observed that the fly ash additive has an effect on increasing the strength values of foam concrete samples and an increase in the compressive strength values has been recorded in direct proportion to the unit weight values. When the flow values of the samples were examined, regular flow was realized in the samples. As the flow times decreased, the strength development was positively affected as a result of more regular placement of the mold and providing a homogeneous response.

**Keywords:** Foam concrete, porosity, strength, fly ash, foaming agent

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# Examination of the morphological and antibacterial characteristics of Ti-Cu powders prepared by mechanical alloying

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**Abstract**

Titanium alloys have been extensively utilized in a range of fields, with a particular emphasis on the medical and dental sectors, owing to their exceptional characteristics. These alloys have gained significant popularity due to their unique properties, which make them highly suitable for applications. Ti alloyed with Cu has been documented to exhibit distinctive characteristics, including favorable mechanical performance, excellent biocompatibility, satisfactory corrosion resistance, and a comparatively lower melting point. In this study, the Ti-Cu alloy has been synthesized using elemental Ti and Cu powders through the process of high-energy ball milling. Then, the Ti-Cu alloys were characterized using various techniques including Scanning Electron Microscopy (SEM), X-ray diffraction (XRD), and antibacterial test. The objective of the study was to investigate the impact of copper (Cu) addition on the antimicrobial properties of mechanically alloyed titanium-copper (Ti-Cu) alloys against *Staphylococcus aureus*. The findings indicated that Ti-Cu alloys exhibited a reduction in bacterial count.

**Keywords:** Ti-Cu alloys, antibacterial, mechanical alloying, ball milling

**Acknowledgments:** This research was supported by Necmettin Erbakan University - BAP under grant number 221315006.

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# Grapheneoxide (GO) katkılı içi boş nanolif yapıların üretimi ve karakterizasyonu

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## Özet

Günümüzde, biyomedikal, elektronik, kompozit, film, metal, elektrot, pil, sensör, ilaç ve gen teknolojisi, güneş enerjisi ve enerji depolama sistemleri gibi çeşitli endüstrilerde geniş uygulama alanına sahip, nano boyutta grafen oksit (GO) içeren yeni tip malzemelerin geliştirilmesi üzerine kapsamlı araştırmalar yapılmaktadır [1-3]. Bu çalışmada ise eş-zamanlı elektroçekim yöntemi ile GO katkılı ve katkısız içi boş Polibütilen Süksinat (PBS)/Termoplastik Poliüretan (TPU) nanolif matlarının üretimi ve analizi yapılmıştır. Üretilen iki-bileşenli nanoliflerin iç yapısında saf PVP, dış yapısında ise GO eklenmiş PBS/TPU polimer karışımı bulunmaktadır. PBS/TPU (60/40 w/w) çözelti karışımlarına kütlece farklı yüzde oranlarında (0,5; 1; 5) GO eklenerek uygun parametrelerde çözünme işlemi gerçekleştirilmiş, ardından elde edilen çözeltiler elektroçekim sürecinde kullanılmıştır. GO katkılı nanolif matları üretildikten sonra, etanol ile iç yapıdaki PVP'nin çözünmesi sağlanarak, yapıdan uzaklaştırılmıştır. Böylece, içi boş PBS/TPU bazlı nanolifler elde edilmiştir. Üretilen matların karakterizasyonu için Taramalı Elektron Mikroskobu (SEM), Diferansiyel Taramalı Kalorimetri (DSC), mekanik analiz ve Sitotoksisite testleri yapılmıştır. SEM yüzey görüntülerinde içi boş nanoliflerin genel olarak pürüzsüz bir yapı ile bazı bölgelerde kısmen boncuklu yapılar içerdiği gözlenmiştir. DSC sonuçlarından, tüm nanoliflerin çekirdeğindeki PVP'nin uzaklaştırıldığı belirlenmiştir. Çekme testi sonuçlarına göre, karışımlarda GO oranı artırıldığında elekrospun matların mekanik özelliklerin iyileştiği belirlenmiştir. Hücre canlılığı testleri ile 24.saat sonuçlarında, içi boş nanoliflerin toksik olmadığı kanıtlanmıştır. Nanoteknoloji ürünü olarak katma değeri yüksek biyomedikal uygulamalar için PBS/TPU/GO bileşimi önerilmektedir.

Anahtar Kelimeler: Polimer nanolif, eş-eksenli elektroçekim, grafen oksit, biyomedikal.

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# Farklı iklim parametrelerine bağlı insan vücudunun karakterizasyonu ve termal stres

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## Özet

İnsan vücudu genel olarak; iç organlar, kemik, kas, yağ tabakası, doku, derialtı, cilt, üst deri ve deriden oluşmaktadır. İnsan vücudu içinde bulunduğu ortamın iklim parametrelerine bağlı olarak hissettiği sıcaklıklara ile farklı özellikler göstermektedir. Bu iklim parametreleri genel olarak; sıcaklık, nem, rüzgâr, bulutsuzluk, su buharı basıncı ve güneş radyasyonudur. Bu parametrelerin ikili, üçlü ve dördü birlikte dikkate alınarak insan vücudunun hissettiği sıcaklığa bağlı farklı tepkiler vermektedir. Çalışmada, sıcaklık ve neme bağlı hesaplanan Konforsuzluk İndeksi (DI), rüzgâr hızına ve sıcaklığa bağlı hesaplanan Rüzgâr Etkili Eşdeğer Sıcaklık (WCET), su buharı basıncı ve sıcaklığa bağlı hesaplanan Bağıl Basınç İndeksi (RSI), rüzgar hızına, bağıl neme ve sıcaklığa bağlı hesaplanan Efektif Sıcaklık İndeksi (TE); sıcaklık ve neme bağlı hesaplanan Soğutma Güç İndeksi (CP); sıcaklık ve bağıl neme bağlı hesaplanan Isı İndeksi (HI); yaz için sıcaklık ve neme bağlı hesaplanan Yaz Sıcaklık İndeksi (SSI); su buharı basıncına, bağıl neme ve sıcaklığa bağlı hesaplanan Eşdeğer Sıcaklık İndeksi (TeK) ve toprak üstü sıcaklığa, çevrenin bulutsuzluk oranına, su buhar basıncına ve sıcaklığa bağlı olarak hesaplanan Universal Termal İklim İndeksi (UTCI), gibi dokuz farklı indeks için insan vücudunun tepkisi ve özelliği incelenmiştir. Bu incelemeler için ülkemizdeki sıcak iklim özelliği gösteren İzmir ili ve soğuk iklim özelliği gösteren Ağrı ili kabul edilmiştir. Bu illerin farklı iklim parametrelerine bağlı hesaplanan İndeksler için insan vücudu davranışı araştırılmıştır. Bu indekslere bağlı olarak insan vücudu; aşırı soğuk, soğuk, serin, sıcak, aşırı sıcak gibi algılamalar yapmaktadır. Bu algılamalara bağlı olarak çok stresli, az stresli, stressiz veya çok rahat davranışlar göstermektedir.

Anahtar Kelimeler: İnsan vücut yapısı, Vücut özelliği, Meteorolojik parametreler, Termal stres.

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# High energy ball milling synthesis of titanium niobium oxides as an anode for lithium-ion batteries

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## Abstract
Lithium-ion batteriesare rechargeable batteries that are mainly used as a power source for many portable electronic devices, especially mobile phones, personal computers, and electric vehicles. $TiNb_2O_7$ (TNO) is a promising anode material for lithium-ion batteries due to its high capacity, stable cycle performance, and safety. But high charging speeds are their significant challenge. $TiNb_2O_7$ nanoparticles have been synthesized by mechanochemical method and post-annealing as an anode material for lithium-ion batteries. In this study, the nanostructured $TiNb_2O_7$ has been synthesized by ball milling of $TiO_2$ and $Nb_2O_5$ raw materials and subsequent heat treatment. The synthesized nanoparticles were characterized by XRD, SEM, and EDS analysis, and the electrochemical properties of the nanoparticles were measured by cyclic voltammetry and charge-discharge rate tests. The capacity of the lithium-ion battery at 1 C was measured at 245 mAh/g and after 200 cycles it was measured at about 140 mAh/g.

Keywords: TNO, mechanical alloying, anode materials, Li-ion batteries.

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# Synthesis and characterization of tinb$_2$0$_7$ nanostructures using hard and soft templating methods in the sol-gel approach

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## Abstract
The demand for energy storage has led to significant research efforts focused on developing secondary batteries with higher energy density and faster charging and discharging capabilities. Titanium-based oxides, specifically lithium titanate (LTO), have been identified as promising materials for replacing carbonous anodes in lithium-ion batteries. However, these materials have lower energy density, which is a critical disadvantage for applications such as electric vehicles. To address this issue, monoclinic $TiNb_2O_7$ (TNO) was proposed over a decade ago as an alternative to LTO by Goodenough. TNO offers five possible redox reactions in its crystal structure, enabling a theoretical capacity of 387 $mAhg^{-1}$, slightly higher than graphite. As a result, TNO has been extensively studied for anode development in both academia and industry. In the current study, the researchers employed various strategies within the sol-gel approach to enhance the rate capacity and cycling performance of TNO. The materials were characterized using electrochemical techniques like charge/discharge tests and electrochemical impedance spectroscopy (EIS). Additionally, electron microscopy techniques were used to study the morphology and elemental mapping, while powder X-ray diffraction (XRD) was employed for phase analysis and studying preferential growth in the direction of lithium-ion transport. Rietveld refinement of X-ray diffractograms was further utilized to determine the phase content of the samples. The results showed low-rate capacities of up to 300 $mAhg^{-1}$, 1C capacities of up to 200 $mAhg^{-1}$, and high-rate capacities of up to 130 $mAhg^{-1}$. Furthermore, capacity retention rate of up to 80% after 200 cycles at a 1C rate was observed. These findings demonstrate the great potential of nanostructured TNO as a high-performance anode material for lithium-ion batteries.

Keywords: Li-ion battery, Electrochemical Characterization, Rietveld Refinement, Electron Microscopy.

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# Piezoelectric characterization of polylactic acid (pla) nanofiber synthesized by electrospinning

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## Abstract
Polylactic acid nanofibers have gained significant interest in various fields due to their unique biocompatibility, biodegradability, and mechanical strength. Moreover, PLA nanofibers can exhibit piezoelectricity, putting them among potential candidates for numerous applications such as energy harvesting, sensors, and actuators. Furthermore, the PLA may present in all three primary crystalline phases (α, β, and γ) according to their structure in spirals and symmetries of different lattices. These forms appear under thermal or location limitations. Phase β is the most common phase because it is the only phase that can provide a strong piezoelectric response in PLA. In this research, polylactic acid (PLA) procedures were prepared in binary solvent solutions in different ranges, and subjected to electrospinning to produce nanofibers, during which the parameters control different processes. The most optimal of which is (DCM/DMF, 60/40). After the production of nanofibers, tests of FTIR, SEM, and piezoelectric properties were performed to determine the structural characteristics of the produced nanofibers.

Keywords: Polylactic acid, Piezoelectricity, Electrospinning, Nanofibers

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# Investigation of two-phase flow stability in single and multi-boiling channels- stability limit and criteria

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## Abstract
In this paper, the steady-state characteristic curve of fluid flow boiling pressure drop in a heated channel versus mass velocity variations is obtained by presenting an integrated model based on new dimensionless quantities. According to the analytical solution, the different forms of this curve, based on the variation of parameters, are investigated. The required conditions for pressure drop instability occurrence are evaluated. The results show that the sub-cooling and frictional numbers are directly affected by this condition. Two non-linear ODEs are obtained from the present model under the unsteady condition. The numerical solutions are determined by an appreciate scheme of mono-implicit Rung Kutta method. By using Lyapunov stability analysis, conditions in which instability occurs are identified. The effects of parameters on pressure drop diagram versus mass velocity are investigated and the existence of extremum is discussed. The oscillations form varies according to the value of the basic oscillations damping parameter from an elliptical orbit to a quadrilateral, corresponding to the pressure drop curve. In addition, by non-linear analysis, variations of the oscillation periodic time and amplitude are examined and their dependency on the parameters of systems is investigated. The range and stability conditions for one and more parallel channels have been investigated and determined. The results show that the form of presentation of dimensionless variables based on redefined characteristics reduces the multiplicity of parameters involved and facilitates modeling the process for more channels.

Keywords: Pressure Drop Oscillations, Two Phase Flow, Linear Stability Analysis, Nonlinear Stability Analysis, Dimensionless Quantities, Instability Control.

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# Optimized design of a hydrogen production reactor by development and application of a novel pod-based computational method

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## Abstract

For decades, hydrogen has been discussed as a possible energy carrier for achieving a low-carbon energy-based economy. Hydrogen has long piqued the curiosity of scientists, and several studies into its generation have been done to date. The incomplete methane combustion process in porous media can be considered a suitable method for hydrogen production, especially in the case of designing the optimized required system. Due to the complexity and nonlinear nature of combustion, the scaled output of a sample system, in general, is not true. For this reason, achieving an optimized design requires numerical analysis for any case again. This paper aims to find the optimal system design based on dimensionless input parameters. Using a numerical solution and empirical tests, a suitable data set is generated for the process outputs in terms of design parameters. By presenting a novel POD-based hybrid Intelligence method involving the use of discrete orthogonal polynomials as well as the Tikhonov normalization method, the relationship between the output data and the design parameters is established. Due to the closed form of the presented prediction functions for desired results, the extremum and conditions to achieve these optimized results could be obtained by conventional methods.

Keywords: Optimization, POD, Orthogonal Polynomials, Partial Oxidation of Methane.

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# Sensitivity analysis of wrf model to precıpitation forecase (case study: north-west of Iran)

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## Abstract
In this research, the assessment of selecting appropriate physical configurations for northwestern region of Iran is provided through a sensitivity analysis of the Weather Research and Forecasting (WRF) model. The paper focuses on physical parameters by 14 microphysical schemes in the context of rainfall forecasting. Various schemas associated with the aforementioned parameters are employed to enhance the model's performance with two spatial resolutions of 12 and 4 kilometers. The initial and boundary conditions are derived from FNL-GDAS data, covering 16 precipitation events occurring between 2008 and 2017. Evaluation of simulation outcomes is performed by utilizing data from rain gauge stations within the research area. The effectiveness of each distinct physical configuration is evaluated using several metrics, including the Kling-Gupta Efficiency (KGE), Pearson correlation coefficient, Nash-Sutcliffe efficiency (NSE), and relative error (RE). The selection of microphysics schemes is based on satisfactory precipitation predictions to enhance forecast accuracy. The results shows that the Kessler, CAM, and WSM3 microphysics schemes are the most effective schemes in predicting rainfall across the northwest of Iran. Therefore, the integration of these outlined methodologies is recommended for the development of rainfall forecasting systems tailored to this region.

Keywords: WRF Model, Precipitation Forecasting, Physical Parameterization, Northwest of Iran, Sensitivity Analysis

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# Performance and geometry study of silicon nanowire-based field effect diodes (FED)

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**Abstract**
In this study, the integration of the side-contacted field effect diode(S-FED) with the Si nanowire concept is pursued to create a device that maintains a substantial aspect ratio while delivering suitable execution. The nanowire side-contacted FED (NW-SFED), referred to as this apparatus, exhibits the capability to achieve an exceptionally high on/off current ratio, allowing for efficient switching between on and off states. An evaluation of NW-SFED's performance is conducted to explore how variations in channel length, device width, as well as the dimensions of the $n^+$ and $p^+$ doped regions in the source and drain, respectively, influence its operational characteristics. The impact of the channel length and device width on NW-SFED fabrication turned out to be negligible, whereas the thickness of doped regions emerged as the critical parameter in the fabrication process.

**Keywords:** Side-contacted Field Effect Diode, Nanowire, On/Off Current ratio

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# Modified drain side impurity concentration to improve electronics characteristic of carbon nanotube field effect transistors

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**Abstract**
In this paper a modified doping profile is presented for carbon nanotube field effect transistors (CNTFETs) to improve the device characteristics. The drain region doping profile is engineered to manage the conduction and valance bands and band to band tunneling by two different impurity densities. Drain side is doped by heavy and light concentration sections to increase the horizontal distance between bands and consequently lower leakage current. By applying this doping profile, the device electronics characteristics such as capacitances, leakage current, saturation current, current ratio, delay, the power delay product(PDP), and cut-off frequency experience improvements. Self-consistent solution of Poisson and Schrödinger equations is done at non-equilibrium Green's function. The proposed doping profile can be considered for devices at higher speeds and more reliable demands.

Keywords : CNTFET, Doping profile, Device characteristics, Green's function, Speed, Capacitance.

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# Investigation of the post-processing heat treatments on the microstructure and hot tensile properties of additively manufactured inconel 939 superalloy

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## Abstract

In recent years, Selective Laser Melting (SLM) process has become focus of research due to its wide range of benefits and easy fabrication advantageous in mass production of nickel-based superalloys. However, the mechanical properties of additively manufactured nickel-based superalloys are not sufficient enough for service conditions. Therefore, heat treatment studies are necessary to achieve desired microstructures for better mechanical properties. In this concept, it is aimed to replace melt pool boundaries and to obtain more equiaxed fine grain boundaries via heat treatment studies. This study deals with the effect of post-heat treatment studies on the microstructure and mechanical properties of selectively laser-melted Inconel 939 superalloy. As-built and heat-treated (hot isostatic pressing and vacuum heat treatment, HIP&VHT) samples were characterized via optical and electron microscopy techniques. Transition temperatures and phases were analyzed using X-ray diffraction (XRD), differential scanning calorimetry (DSC), and Thermo-Calc simulation techniques. Finally, the effect of hot tensile test on gamma prime (γ′) formation and morphology in the microstructure was investigated. Overall, the study tried to provide an insight whether the post-processes are necessary for modifying microstructure and achieving optimal mechanical properties. It was observed that both HIP and VHT had a beneficial impact on the %Elongation after hot tensile tests in comparison to the as-built conditions. However, there was no noticeable differences were achieved in UTS and yield stress.

Keywords: IN939, Additive Manufacturing, SLM, HIP, Vacuum Heat Treatment

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# Ti6Al4V levhalar üzerine elektroforetik yöntem ile HA-Zn katkılı malzemelerin kaplanması

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## Özet
Ortopedik implant cerrahisinde karşılaşılan en önemli sorunlardan birisi implantasyon bölgesinde oluşan enfeksiyondur. İmplant bölgesinde enfeksiyona sebep olan bakteriler (E. coli ve S. Aureus) antibiyotik tedavisine karşı çok büyük direnç göstermekte, bu durum da hücre yenilenmesinin olumsuz sonuçlanmasına ve implantın kaymasına neden olmaktadır. İmplantasyon bölgesinde oluşan enfeksiyon, operasyonun yenilenmesini gerekli kılmakta ve bununla birlikte her operasyonda da implantın enfekte olma riski katlanarak artmaktadır. Bu çalışmada implant yüzeyinin antibakteriyel ve biyouyumluluk özelliklerinin artırılması hedeflenmiş ve bu kapsamda Ti6Al4V levha yüzeyleri elektroforetik kaplama (EPD) yöntemi ile hidroksiapatit (HA) katkılandırılmış Zn elementi ile farklı voltaj ve sürelerde kaplama işlemine tabii tutulmuştur. HA yüksek biyouyumluluğu nedeniyle Zn elementi ise antibakteriyel etkinin artırılması için tercih edilmiştir. Ti6Al4V levhalar sırasıyla 100-1200 grid zımpara kağıtlarıyla zımparalandıktan sonra vakum pompasıyla silis kumu kullanılarak yüzeylerine kumlama işlemi gerçekleştirilmiştir. Kumlama işleminden sonra yüzeydeki artefaktların temizlenmesi için asetonlu ultrasonik banyoda yıkandıktan sonra asit çözeltisinde bekletilmiştir. Bu işlemler sonrasında EPD için uygun hale getirilen levhalar hem nano boyutta HA ile hem de HA-Zn karışımları ile kaplanmıştır. Gerçekleşen XRD analizleri sonucunda HA piklerinin yanı sıra Ti pikleri de ortaya çıkmıştır. Yapılan SEM-EDX analizleri ile en iyi sonuçlar 90 V ve 90 sn parametreleri sonrası ortaya çıkmış ve kaplama kalınlığı 500X yakınlaştırmada 30 µ olarak ölçülmüştür.

Anahtar Kelimeler: İmplant, Elektroforetik Kaplama, Biyouyumluluk, Ti6Al4V, HA

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# Characterization of PVDF/$BaTiO_3$ free standing scaffold for bone regeneration prepared by 3D printing

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## Abstract
This study focuses on the development of 3D-printed scaffolds using polyvinylidene fluoride (PVDF) and barium titanate (BTO) nanoparticles for bone regeneration applications. The scaffolds were fabricated using a solution extrusion modeling 3D printing technique and were characterized for their structural properties. The results showed that the PVDF/BTO 3D-printed scaffolds had a highly porous structure with interconnected pores and an average pore size of ~500 µm. The addition of BTO nanoparticles to the PVDF matrix improved the piezoelectric properties of the scaffolds, making them more suitable for bone tissue engineering applications. The scanning electron microscope (SEM) has been used to characterize the morphology of samples. 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. Further investigations are needed to evaluate their in vivo performance for bone regeneration purposes.

Key words: Polyvinylidene fluoride (PVDF), Barium titanate (BTO), 3D printing, Scaffold, Piezoelectric.

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# Phytochemical and biological investigation of anogeissus dhofarica a. j. scott

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**Abstract**

In the current study, methanol (ADAM) extracts and their fractions, including chloroform (ADAC), ethyl acetate (ADAE), n-hexane (ADAH), and aqueous (ADAA) fractions, were prepared from aerial parts of *Anogeissus dhofarica* and evaluated for phytochemical assessment, high-resolution electrospray ionization mass spectrometry (HR-ESI-MS) analysis, isolation, and in vitro bioassays. The qualitative analysis determined that, except alkaloids, all the representative groups were found to be present in the analyzed samples. Samples under quantitative study displayed the highest amount of total phenolic contents in the ADAE fraction, while total flavonoid contents were highest in the ADAM extract. The ADAM extract was subjected to HR-ESI-MS to identify the chemical constituents that presented twenty-two bioactive ingredients, outlined for the first time from A. dhofarica, mainly contributed by sub-class flavanones. In the case of antimicrobial activity, the ADAE extract revealed an effective zone of inhibition (ZOI) against the Gram-positive bacterial strain (Staphylococcus aureus) with an MIC value of 0.78 ± 0.3 mg/mL, while the ADAA extract exhibited higher ZOI (34 ± 0.12 mm) against the fungal strain Candida kruzei with an MIC of 0.78 mg/mL. In the DPPH (2,2-diphenyl-1-picrylhydrazyl) analysis, the ADAE extract exhibited a maximum scavenging potential with an $IC_{50}$ of 9.8 ± 1.2 µg/mL, succeeded by the ADAM extract with an $IC_{50}$ of 17.4 ± 0.4 µg/mL free radical scavenging capability. In the antidiabetic assessment, the ADAE extract was the most effective, with an $IC_{50}$ of 6.40 ± 0.1 µg/mL, while the same extract demonstrated prominent activity with 30.8% viability and an $IC_{50}$ of 6.2 ± 0.3 µg/mL against breast cancer cell lines. The brine shrimp lethality assay demonstrated a correlation with the in vitro cytotoxicity assay, showing the ADAE extract as the most active, with a 70% mortality rate and an $LC_{50}$ of 300.1 µg/mL. Furthermore, gioassay guided isolation of n-hexane and EtOAc fractions of the understudy plant species afforded one new natural product (lupeyl butyl ether, 1) along with sixteen known metabolites (2-17) reported from this source for the first time. In conclusion, all the tested samples, especially the ADAE and ADAM extracts, have significant capabilities for the investigated activities that could be due to the presence of the bioactive compounds.

Keywords: *Anogeissus dhofarica* A. J. Scott; cytotoxicity; antimicrobial; HR-ESI-MS; antidiabetic; phytochemical analysis; antioxidant

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# Effect of Cu on photocatalytic degradation of methylene blue by ZnO/5 wt.%g-C3N4 nanocomposite

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## Abstract

In this research, the synthesis and characterization of a photocatalyst used for the degradation of methylene blue (MB) under visible light irradiation was investigated. The photocatalyst was prepared through a co-precipitation method, incorporating 5 wt. % of graphitic carbon nitride (g-C3N4) within zinc oxide (ZnO) matrices. To further enhance the photocatalytic activity, Cu was introduced into the ZnO/5 wt. % g-C3N4 photocatalyst utilizing the same co-precipitation approach. This novel modification led to the formation of a Cu-doped ZnO/g-C3N4 nanocomposite. The impact of copper incorporation on the photocatalytic performance was systematically investigated. The resultant Cu-doped nanocomposite exhibited remarkable potential for efficient MB degradation under visible light irradiation. The photocatalysts' structural and optical properties were assessed using XRD, field emission scanning electron microscopy (FESEM), and UV-Vis spectroscopy. XRD analysis confirmed well-defined crystalline structures of all samples, while FESEM revealed unique flaky morphologies with high specific surface areas in g-C3N4 nanosheets and a transition from hexagonal of pure ZnO to the spherical shape of nanoparticles with the addition of g-C3N4 and Cu doping. The DRS analysis indicated that the introduction of Cu facilitated improved visible light absorption by the nanocomposite, extending its photocatalytic activity into the visible spectrum. Additionally, the analysis unveiled a reduction in the bandgap energy within the Cu-doped nanocomposite, measuring 2.9 eV, whereas the bandgap energy of pure ZnO stands at 3.2 eV. The photocatalytic activities of each nanocomposite were evaluated by observing the degradation of MB under visible light exposure. Out of all the nanocomposites studied, the Cu-doped nanocomposite displayed the most rapid degradation rate. It achieved an impressive 84% removal of MB in just 180 minutes of exposure to visible light, surpassing the performance of the ZnO/g-C3N4 nanocomposite. The latter achieved a 73% removal of MB within the same timeframe. These findings suggest that ZnO/g-C3N4 photocatalysts hold significant potential for breaking down organic pollutants, and the inclusion of Cu as a dopant further enhances their efficiency under visible light. This research contributes to the advancement of photocatalytic materials, which could find valuable applications in environmental remediation and wastewater treatment.

**Keywords:** ZnO/g-C3N4, Nanocomposites, Cu doping, Photocatalyst, Methylene Blue.

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# The effect of boriding time on the structural and morphological properties of ramor 500 steel

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**Abstract**
Ramor 500 armor steel is classified as a high-strength ballistic protection steel with hardness ranging from 490 to 560 HV and thicknesses of 2-30 mm. It is designed to withstand high-velocity impacts. In this study, a thermo-chemical coating method called box boriding was employed to perform boriding on Ramor 500 armor steel using Ekabor II boron powder at 950°C for durations of 2, 4, and 6 hours. The structural and morphological properties were investigated using scanning electron microscopy (SEM), X-ray diffraction (XRD), and profilometry.

The surface roughness, boride layer thicknesses, and structural characteristics of the steels were compared based on the boriding duration. Consequently, an increase in boriding duration led to higher surface roughness values for the steel and thicker boride layers were obtained.

**Keywords:** Ramor 500, boriding, boriding duration, thickness of the boride layer

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# Effect of TA addition on high temperature oxidatıon resistance of nickel-based superalloy

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**Abstract**
Ni-based superalloys have wide range of applications due to their superior properties such as high temperature strength, creep resistance, oxidation resistance, etc. During the high temperature oxidation of Ni-based superalloys, a continuous and dense oxide film ($Cr_2O_3$ and $Al_2O_3$) on the surface of the alloy, which have a protective effect, is formed. In the scope of this study, a novel Ni-based superalloy with good high temperature oxidation resistance was designed and produced. Moreover, the change of oxidation resistance with the addition of refractory Ta element was investigated. The alloy system, which was designed with thermodynamic calculations using ThermoCalc software, was produced by vacuum arc melting (VAM). Phase analyzes were performed with x-ray diffraction (XRD) techniques, while scanning electron microscopy (SEM) was used for microstructural characterization. High temperature oxidation tests were conducted at 1000ºC for prolonged time periods and weight gains were measured. Furthermore, the oxide layers formed on the surface were examined comparatively.

**Keywords:** Oxidation Resistance, Elevated Temperature, Scanning Electron Microscopy, Superalloy, XRD.

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# Manganese oxide as an artificial photosynthetic catalyst

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## Abstract

Manganese oxide ($Mn_3O_4$) is a potential catalyst for water splitting application. Its performance can be improved by doping and composition alteration. In this study, $Mn_3O_4$-based nanoparticles were doped with calcium, and some composited with porphyrin. The composition and phase purity, and morphology of the obtained nanoparticles were studied using X-ray diffraction (XRD) and field emission scanning electron microscope (FESEM), respectively. Their photoelectrocatalytic behaviors were evaluated by linear sweep voltammetry (LSV) and chronoamperometry analysis during water splitting process in neutral conditions. The highest photoelectrochemical (PEC) activity was observed in porphyrin/Ca-doped $Mn_3O_4$ nanocatalyst whose stability was confirmed by chronoamperometry.

**Keywords :** Water splitting; Manganese oxide; Calcium dopant; Porphyrin.

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# Mikrodalga etkisiyle çimento hammaddelerinin öğütülmesi: verimlilik ve enerji tasarrufu potansiyeli

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## Özet

Bu çalışma, geleneksel öğütme yöntemleri alternatif olabilecek mikrodalga enerjisinin çimento hammaddelerinin öğütülmesindeki potansiyelini incelemektedir. Mikrodalgaların çimento üretiminde enerji verimliliği ve öğütme süreçlerinde iyileştirmeler sağlayabileceği konusu giderek daha fazla ilgi çekmektedir. Geleneksel öğütme yöntemleri, genellikle yüksek enerji tüketimine neden olan mekanik güç gerektirmektedir. Mikrodalga enerjisi, malzeme içindeki su moleküllerini hızla ısıtarak mekanik süreçlere kıyasla daha hızlı bir öğütme sağlayabilmektedir. Mikrodalga öğütme, malzeme içindeki mikrodalga emilim özellikleri göz önüne alındığında seçici bir şekilde ısıtma sağlayarak enerji kayıplarını minimize edebilmektedir. Bu çalışma, mikrodalga enerjisinin çimento hammaddelerinin öğütülmesinde daha düşük enerji tüketimi, daha hızlı öğütme hızı ve daha ince tane boyutu da dahil olmak üzere çeşitli avantajlar sunduğunu göstermektedir. Bu avantajlar hem çevresel sürdürülebilirlik hem de üretim verimliliği açısından önemlidir. Ayrıca, mikrodalga öğütme sürecinin geleneksel öğütme yöntemleriyle kolayca entegre edilebileceği ve mevcut üretim tesislerine adapte edilebileceği sonucuna varılmıştır. Mikrodalga enerjisi çimento hammaddelerinin öğütülmesinde alternatif ve etkili bir yaklaşım olarak görülmüştür.

**Anahtar Kelimeler:** Çimento, Mikrodalga, Enerji, Öğütme

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# Mikrodalga enerjisinin çimento harcının hidrolik ve mekanik özellikleri üzerindeki etkisi

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## Özet

Bu çalışma, mikrodalga enerjisinin çimento harcının hidrolik ve mekanik özellikleri üzerindeki etkisini araştırmaktadır. Mikrodalga enerjisinin çimento harcının hidrolik, mekanik ve diğer önemli özelliklere etkisi, yenilikçi bir bakış açısı sunmaktadır. Geleneksel çimento üretimi yöntemleri, çimento harcının mekanik özelliklerini belirlemede kritik bir rol oynasa da yeni teknolojilerin çimento özelliklerini geliştirmek için kullanılabilirliği ve etkisi araştırılmaya devam etmektedir. Bu çalışmada, mikrodalga enerjisinin çimento harcı üzerindeki etkileri ayrıntılı olarak incelenmiş ve SEM (Taramalı Elektron Mikroskobu) ve XRD (X-ışını Kırınımı) gibi yöntemler kullanılarak çimento harcının mikro yapı karakteristikleri değerlendirilmiştir. Mikrodalga enerjisinin çimento harcına uygulanması, su moleküllerinin hızla ısınmasını ve hidratasyon reaksiyonlarının hızlanmasını sağlayabilmektedir. Bu hızlı hidratasyon, çimento harcının daha kısa sürede dayanım geliştirmesine neden olmaktadır. Mikrodalga etkisi çimento harcının iç yapısını etkileyerek daha kompakt ve homojen bir yapı oluşmasına ve çimento harcının mekanik dayanımını artmasına katkı sağlamıştır. Mikrodalga enerjisinin çimento harcının iç yapısındaki hidratasyon ürünlerinin miktarını ve dağılımını olumlu yönde etkilemiştir. Mikrodalga enerjisinin çimento harcının mekanik özellikleri üzerindeki etkisi, çimento üretiminde ve inşaat uygulamalarında yeni fırsatlar sunabileceği görülmüştür.

**Anahtar Kelimeler:** Mikrodalga enerjisi, Çimento harcı, Mikro yapı, Hidrolik özellikler, Dayanım

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# Investigating the effect of adding molybdenum to biocompatible titanium-zirconium alloy: a simulation-based investigation

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**Abstract**
Today, titanium alloys are highly regarded in all kinds of parts, including hip joints, dental implants, and skull covers due to their high biocompatibility, corrosion resistance, high strength and hardness, and favorable fatigue behavior. Meanwhile, Ti-6Al-4V alloy, due to the presence of aluminum and vanadium elements, leads to Alzheimer's disease and accumulation in the lungs, which has led to the development of new titanium alloys. In this research with the help of JMatPro material properties analysis software, new Titanium Zirconium alloy and the effect of adding Molybdenum as a beta stabilizing element have been analyzed. The results showed that with the presence of Zirconium and Molybdenum elements, the strength of the alloy will be equal to the conventional Ti-6Al-4V alloy. Also, by increasing the weight percentage of Molybdenum up to 10% by weight, the elastic modulus decreases up to 16%, which will play an effective role in reducing pain in patients.

Keywords: Software Simulation, Titanium Alloy, JMatPro, Ti-6Al-4V

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# Development and characterization of pain killer cream containing boron and herbal extract

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## Abstract
Developments in nanotechnology have brought up the issues of toxicity and side effects mediated by nano-sized systems. Particularly, particle size, particle shape and surface properties affect the pharmacokinetics and bio distribution of particles. From a therapeutic point of view, the benefit-risk ratio and its relationship to dose and frequency of dosing should be considered.

In this study, the oils obtained by purifying Ginger, Turmeric, Juniper and Sycamore leaves by extraction method were characterized by FTIR, GC-MS and mixed with Vaseline and turned into cream. In order to improve its pain-relieving properties boron-containing oxide were added, which is one of the popular raw material of recent years. For this purpose, the effects of each herbal extract were evaluated by individual groups on rats and in combinations where they were used alone or together.

Keywords: Boron, Painkiller, oil mixture

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# Fabricaton, characterization and evaluation of antibacterial activities of PAN/GO nanocomposite fibers incorporated with thymus vulgaris leaf extract

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**Abstract**
In this study, nanocomposite fibers of polyacrylonitrile/graphenoxide (PAN/GO) incorporated with Thymus vulgaris leaf extract were successfully fabricated using electrospinning technique for antibacterial applications. Firstly, commercial graphene oxide (GO) was added into nanoscale polyacrylonitrile (PAN) fibers. Fourier Transform Infrared spectroscopy (FT-IR) and contact angle measuring device were used to reveal the chemical structures of the prepared PAN/GO nanofiber samples and examine their wetting behavior. The surface morphology of the obtained fibrous composite materials was observed by Field Emission Scanning Electron microscopy (FE-SEM) and the average fiber diameter dimensions of fibers were measured with the ImageJ software system. Structural analysis results confirmed that the prepared composites consisted of both PHB and PLA fibers. Morphological analysis results showed that GO additive reduced the mean fiber diameter of PAN nanofibers. It was determined that the PAN/GO working solution could produce homogeneous and bead-free fibers under the conditions of 1 mL/h feed rate, 18 kV power and 15 cm needle tip to collector distance. Moreover, the hydrophilic GO loaded to the PAN fibers led to a reduction in the water contact angle of the resulting composite nanofiber surfaces, offering a useful property for a variety of antibacterial applications. Later, the prepared Thymus vulgaris leaf extract was applied to PAN/GO nanofiber surfaces via spray coating to impart antibacterial properties. The antibacterial activity of PAN/GO fibers containing the extract was tested against *Staphylococcus aureus*, a gram-positive bacteria. The higher extract content in the nanofibers resulted in a decrease in bacterial colony formation. The results displayed that PAN/GO nanocomposite fibers loaded with Thymus vulgaris leaf extract could be a promising material for various antibacterial applications.

Keywords: PAN, GO, Thymus vulgaris leaf extract, Nanocomposite fibers, Antibacterial activity.

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# Investigating the corrosive inhibiting properties of cigarette butts extract on AISI 4140

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**Abstract**
Utilizing recycled cigarette butts as a corrosion inhibitor for AISI 4140 immersed in a 10% HCl solution could be a game-changer. The aim of the current investigation is to explore the feasibility of employing recycled cigarette butts as a corrosion inhibitor for AISI 4140 that is immersed in a 10% HCl solution. To accomplish this goal, we investigated the impacts of aqueous extracts derived from cigarette butts with varying concentrations (ranging from 2% to 10%) on three distinct heat treatment conditions of steel (as received, oil quenched, and annealed). The chemical composition of the unprocessed extracts was determined using spectrometric techniques. The efficacy of cigarette butt extract as an inhibitor on AISI 4140 was evaluated using potentiodynamic polarization analysis in a 10% HCl solution. The investigation revealed that the most effective inhibitor concentrations for all heat treatment forms, including as received, annealed, and oil quenched, were achieved at 8%, resulting in efficiencies of 99%, 75%, and 96%, respectively. Furthermore, at an 8% inhibitor concentration, the corrosion rate was significantly reduced for all heat treatment types including as received, annealed and oil quenched, with reductions of 1.219 mm/yr, 4.95 mm/yr, and 1.20 mm/yr respectively. The surface analysis was conducted using a high-powered stereo Leica microscope.
Keywords: AISI 4140, corrosıon inhibitor, heat treatment, potentiodynamic polarization

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# The influence of alumina-zircon fibers on the mechanical and chemical properties of silica-based ceramic cores

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**Abstract**
Silica-based ceramic cores are significantly used in the investment casting process. For this purpose, they must exhibit sufficient flexural strength and thermal resistance. In this study, the effect of zircon-alumina fibers on the mechanical and chemical properties of the ceramic cores was evaluated. Samples were produced by injection molding under 12 kPa pressure and at 115 °C temperature. Samples were prepared with 0, 1 and 2 Wt% Alumina-Zircon fibers as an additive. MOR, XRD, SEM and leachability characterization analysis were performed. The results show that the fibers increase the MOR and the leachability of the core up to 43%, and 44% respectively.

Keywords : ceramic cores, injection molding, fused silica, Alumina-Zircon fibers.

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# Finite element analysis of AISI 316LN & AISI 304 stainless steel for automotive axle shafts: a simulation-based investigation

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## Abstract
The automotive axle shaft is a critical component in the drivetrain system, transferring the torque from the differential to the wheels and enduring significant mechanical stresses. Material selection for axle shafts directly impacts vehicle performance and durability. In this study, we performed finite element analysis on two stainless steel materials: "Stainless steel, austenitic, AISI 316LN, annealed, wrought" and "Stainless steel, austenitic, AISI 304, 1/2 hard, wrought." The axle shafts were subjected to loading conditions representing real-world scenarios. One end of the shaft was fixed, while a 1000 N.m bending moment in the opposite y-direction and a constant 500 N.m axial force were applied, simulating acceleration, cornering, and vehicle weight. We evaluated stress distribution, deformation, and failure potential. Our analysis revealed that under the specified loading conditions, "Stainless steel, austenitic, AISI 316LN, annealed, wrought," exhibited failure, while "Stainless steel, austenitic, AISI 304, 1/2 hard, wrought," displayed superior resilience without immediate signs of failure. These findings suggest that AISI 304 is a more suitable material for automotive axle shafts in demanding driving scenarios. This study contributes to the selection of materials for automotive components, enhancing overall vehicle performance and safety.

**Keywords:** Automotive Axle Shaft, Software Simulation, Ansys, Materials Science

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# Impact of kerogen matrix roughness on methane and ethane adsorption: a molecular simulation study

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## Abstract
Understanding the adsorption capacity of kerogen, the predominant organic component in shale gas reservoirs, is crucial. However, the limitations associated with experimental investigations have thus far hindered a comprehensive exploration of the influence of kerogen surface roughness on adsorption capacity. Given these constraints, the present study employs molecular simulation techniques to delve into the implications of surface roughness within the kerogen matrix confined within a 4 nm slit pore. For this purpose, the adsorption behavior of methane and ethane fluids was scrutinized at a temperature of 363.15 K and pressure of up to 50 MPa. The Langmuir adsorption model was used to convert excess adsorption to absolute adsorption. The results of this study revealed that the adsorption amount increases with roughness, thereby serving as a significant parameter for quantifying adsorption and estimating gas in place. Furthermore, the impact of roughness on the absolute adsorption of methane fluid was more pronounced than that of the ethane fluid.

Keywords: Shale gas, Adsorption, Roughness, Kerogen, Molecular simulations.

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# Mikroalg aracılı mikrobiyal yakıt hücrelerinin potansiyeli ve uygulamaları

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## Özet

Enerji kaynaklarının giderek sınırlı hale geldiği çağımızda, sürdürülebilir ve yenilenebilir enerji üretimi arayışı ön plana çıkmıştır. Mikrobiyal yakıt hücreleri bu arayışın sonucunda ortaya çıkmış ve son yıllarda önem kazanmıştır. Bu hücreler, mikroorganizmaların biyokimyasal reaksiyonları yoluyla organik maddeleri doğrudan elektriğe dönüştürebilirler. Bu çalışmada hücrenin anot bölmesinde at gübresi atık suyu ve kuru mikroalg biyokütlesi substrat olarak, katot bölmesinde ise *Chlamydomonas sp.* mikroalg türü elektron alıcısı olarak kullanılmıştır. Her iki bölmede de grafit keçe elektrot kullanılmıştır. Bu sistemde gerçekleştirilen deneyler sonucunda 29,93 mW/m$^2$'lik maksimum güç yoğunluğu ve 599 mv açık devre voltajı kaydedilmiştir. Aynı zamanda atık suda % 49,35 KOİ giderimi elde edilmiştir. Bu çalışma, atık su ve mikroalglerin kullanıldığı çift odacıklı mikrobiyal yakıt hücresinin enerji üretim potansiyelini vurgulamaktadır. *Chlamydomonas sp.* mikroalglerinin katot bölgesinde kullanılması, fotosentetik aktivite sonucu üretilen oksijenin elektron transferinde kullanılabileceğini göstermektedir. Bu yöntem, atık yönetimi ile yenilenebilir enerji üretimini bir araya getirerek çevresel sürdürülebilirliğe katkı sağlamaktadır.

Anahtar Kelimeler: Atıksu Arıtımı, Mikrobiyal Yakıt Hücresi, Yenilenebilir Enerji

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# Experimental study of the mechanical performance and approaches related to the durability of expanded polystyrene concrete

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## Abstract

This paper is devoted to the experimental study of lightweight cement composites made from the valorization of dune sand, corrected by crushed sand following the application of the Abrams method. Lightness is achieved by the partial substitution of the corrected sand by expanded polystyrene beads. The latter is characterized by its thermal and acoustic insulation power as well as its lightness. Our main objective is to investigate experimentally the influence of the increased PSE bead content in the concrete mix. This investigation is based on the physico-mechanical behavior and the durability of the expanded polystyrene concrete. A series of this composite are produced by incorporating expanded polystyrene (EPS) beads at volumetric contents ranging from 0; 15; 25; 35; 45; 75 and 100% EPS, as a substitute for the corrected dune sand.

Experimental results revealed that the increase in the partial substitution of corrected dune sand by PSE beads in the concrete mass positively decreased the density and negatively decreased the mechanical properties (the mechanical compressive strength (Rc) and the dynamic modulus of elasticity (Ed)). Moreover, the presence of PSE beads in concrete contributes significantly to the improvement of the durability properties.

**Keywords:** lightweight concrete, Expanded polystyrene (EPS), Transport properties, Durability.

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# BNT-BKT-BT piezoelektrik seramiklerde çeşitli katkıların elektriksel özelliklere etkilerinin incelenmesi

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## Özet

Bu çalışmada, $0{,}854(Bi_{0,5}Na_{0,5}TiO_3)$-$0{,}12(Bi_{0,5}K_{0,5}TiO_3)$-$0{,}026(BaTiO_3)$ (BNT-BKT-BT) seramikler katı-hal yöntemi kullanılarak, katkısız, %1 mol $B^{+3}$ ve %1 mol $B^{+3}$ ile birlikte %1 mol farklı $D^{+n}$ ($D^{+n}$: $Al^{+3}$, $Li^{+1}$, $Mn^{+3}$ ve $Nb^{+5}$) katkıları kullanılarak üretilmiştir. Yüksek saflıktaki oksit ve karbonat hammaddeler öğütme ve karıştırma işlemlerinin ardından kalsine edildikten sonra $B_2O_3$ tozu stokiyometriye uygun olarak eklenmiştir. Üretilen tozlar pelet şekline getirilerek bağlayıcı giderme işleminin ardından 1150°C sıcaklıkta 12 saat boyunca sinterlenmiştir. Arşimet yöntemi ile yoğunlukları belirlenen sinterlenmiş numunelerde X-ışınları kırınımı (XRD) analizi ile kristal yapı, taramalı elektron mikroskobu (SEM) ile kırık yüzey mikroyapı karakterizasyonları gerçekleştirilmiştir. Karşılıklı yüzeyleri parlatılmış ve elektrotlanmış numunelerin dielektrik ($\varepsilon_r$ ve tanδ), piezoelektrik ($d_{33}$) ve ferroelektrik histeresiz (P-E) ölçümleri alınmıştır. Elde edilen bulgular ışığında tekil olarak bor veya bor ile ikili katkılamanın yapı ve elektriksel özellikler üzerindeki etkileri irdelenecektir.

Anahtar Kelimeler: Kurşunsuz piezoelektrik, BNT-BKT-BT, Bor, Katkılama, Ferroelektrik, Dielektrik.

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# Kinetics of pack boriding of EN-GJL-250 lamellar gray cast iron

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## Abstract
In the present study, the lamaller gray cast iron (EN-GJL-250) was hardened by pack-boriding in the powders mixture of 50%B4C, 49.5%$Al_2O_3$ and 0.5%$AlF_3$ at 800, 900 and 1000 °C for 2, 4, 6 and 8 h. The produced borided layers were characterized by scanning electron microscopy (SEM) and XRD analysis. The boriding kinetics of EN-GJL-250 lamaller gray cast iron was also investigated. Based on empirical relationship relating the time dependence of total boride layer thichness. The activation energy for boron diffusion was calculated as equal to 169.66 kJ $mol^{-1}$ for the EN-GJL-250 cast iron. The experimengal values of total boride layer thichness are in agreement with the results from the empirical relation.

**Keywords:** Pack-Boriding, Diffusion, Borided layer, Kinetics, Activation energy

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# Green synthesis of nano graphite materials from lemon and orange peel: a sustainable approach

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**Abstract**
The presented research is focused on waste to wealth phenomenon, where Nanographite materials (NGMs) from lemon and orange peel powders were synthesized by pyrolysis technique. The prepared NGMs were analyzed using X-Ray Diffractometer (XRD) and Fourier Transform Infrared Spectroscopy (FTIR) for structural and compositional properties. The XRD study validated the crystalline character and size (13 and 15 nm, respectively) of the NGMs obtained from lemon and orange peels, while the FTIR examination revealed information regarding the functional groups contained in the materials. The fabricated NGMs from lemon and orange waste have the potential to be used in a variety of scientific and engineering applications, including energy storage and water purification systems.

Keywords: waste to wealth, pyrolysis, lemon and orange peel, X-RD.

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# The effect of anhydrous boric acid on the strength of concrete

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**Abstract**
In this study, the effect of anhydrous boric acid on the strength properties of concrete was investigated. 15x15x15 cm samples of concrete with 2% and 4% anhydrous boric acid additive were produced, together with reference concrete with or without setting accelerator additives. Three cube samples were produced for each mixture type and these samples were subjected to compressive strength tests after curing periods of 7, 14 and 28 days. While better results were obtained in the strength values of the concrete samples using the setting accelerator, it was determined that the strength values of the concrete decreased with the increase of the anhydrous boric acid additive ratio.

Keywords: Concrete, Anhydrous boric acid, Compressive strength

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# The effect of granular styrofoam additive on mechanical strength of concrete

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**Abstract**
In this study, 1% granular Styrofoam additive was used to make the porous concrete, which has the largest share among the building components, lighter and more useful, and some tests were carried out to measure the compressive strength. In order to improve the physical and mechanical properties of the concrete, 1.5% hyper plasticizer was added to the mixing water together with the cement. Physical and mechanical tests were carried out on the produced concrete samples on the 7th and 28th days. As a result, it has been seen that the unit volume weight and specific gravity values of the granular Styrofoam additive are lower than the crushed stone aggregates, the water absorption rate is high, and the compressive strength values are close to the strength values.

Keywords: Granular styrofoam, Concrete, Mechanical Strength,

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# The effect of foam additive in concrete on the mechanical strength of concrete

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**Abstract**
In recent years, studies have been carried out on the effects of foam concrete applications, which are widely used in our country, on concrete strength. In this study, the strength properties of concretes with 1.8 and 2.4% foaming agents were investigated. The positive and negative effects of the strength of the foaming agent on the concrete were investigated. Cement, crushed sand and water and foaming agent were used as raw materials. Cube samples of 15x15x15 cm dimensions were prepared and subjected to 7 and 28-day compressive strength tests. As a result of the experiment, decreases were observed in the compressive strength values with the increase in the foaming agent additive ratio.

Keywords: Foam Concrete, Foaming Agent, Mechanical Strength,

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# The effect of barium on structural and thermophysical behaviour of aluminoborosilicate sealing glasses for sofcs applications

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**Abstract**

Structure property relationships in a series of barium oxide silica swapped glasses of BaO-ZnO-$La_2O_3$-$Al_2O_3$-$B_2O_3$-$SiO_2$ have been investigated to assess their suitability for use as a potential sealing material in solid oxide fuel cell (SOFC) applications. Density, mechanical properties, thermal and electrical properties have been characterised as a function of composition. Raman and Fourier transform infra-red spectroscopies were undertaken to understand glass structural changes. The $T_g$s of these glasses fall between 580 to 662$^o$C which 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:** barium oxide, glass-ceramics, SOFC

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# Nanomaterial and its application in wastewater treatment: a multicriteria decision-making approach

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## Abstract

Due to the special physicochemical properties and characteristics of nanomaterials, nanotechnology is widely chosen as one of the most suitable solutions for wastewater treatment. However, choosing the best nanomaterial for a given wastewater treatment application involves making a difficult judgment call based on several factors. The use of a Multicriteria Decision Making (MCDM) methodology to choose the best options among several nanomaterials for wastewater treatment is thoroughly examined in this research work. Alternatives of nanomaterials and a variety of criteria, such as efficiency, concentration, crystallographic properties, absorption capacity, and contact time, are associated together to perform an MCDM selection. To compile information on the characteristics of nanomaterials and how well they function in applications for wastewater treatment, a thorough literature research is carried out. To avoid techniques that are based on comparing criteria with subjective and purely factual bases, in this research work, Entropy - SAW & TOPSIS methods were used in the model to compute the importance of criterion in terms of weights and to associate them with nanomaterial alternatives. An example case study involving the selection of nanomaterials for heavy metal removal from industrial wastewater was used to illustrate the suggested MCDM technique. This study provides experts in the wastewater treatment sectors with the most adequate nanomaterial substitute, in order to reduce process cost and gain faster absorption time. An objective technique is applied to strengthen the general understanding of wastewater treatment preferring the optimal nanomaterial options, taking into account many different factors including material properties and empirical data.

**Keywords:** Nanomaterial, Nanotechnology, Wastewater treatment, MCDM, Entropy – SAW, Entropy – TOPSIS.

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# Providing a new computational algorithm in optimal design of airfoil based on the adjoint method

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## Abstract

The current study demonstrates a new procedure for designing the optimal shape of a two-dimensional airfoil which has been exposed to uniform flow with the attack angle of α. In this procedure, in order to increase the precision, using the conformal mapping, every panel is mapped to the new coordinate system. With the aim of simplicity in integration process, the equation of the curve has been estimated by polynomials that are based on summation operator. Shape design problem being based on the difference between the calculated minimum pressure distributions with the favorite pressure distribution has been discussed as a target function. Adjoint method is used for the inverse problem analysis. The minimizing of the mentioned target function versus the orthogonal polynomials parameters lead to solve a system of equations. In order to avoid ill-posed condition of the equations, the Tikhonov regularization has been applied. In addition to a computational algorithm provision, a typical pressure distribution has been used and obtained the profile of the airfoil while the accuracy of the calculation is presented. The Advantage of this method is the facility of its application in the shape design problems.

Keywords: Optimization; Orthogonal Polynomials; Shape Design; Tikhonov Regularization

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# Using $Co_2$ laser, the effect of laser power and laser exposure time for cavity formation on $Al_2O_3$ ceramic surface

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## Abstract

$Al_2O_3$ ceramic materials have many industrial applications, especially because they have wear resistant. In this study, dimples of different sizes were formed on the surface of ceramic plates with a $CO_2$ laser. The effects of laser power and laser exposure time on the dimensions of the cavity were investigated. For this purpose, laser powers of 40, 52, 65, 78, 91 and 105 W were applied to the ceramic material for 10 seconds. In addition, 80 W laser power was kept constant and the laser beam was sent to the material for 1, 5, 10, 15, 15, 20, 25 and 30 seconds. High-resolution images of the resulting cavities were taken with an optical microscope. Using the images, the dimensions of the cavities were measured and the effects of laser power and laser exposure time on the cavity geometry were observed.

Keywords: $Al_2O_3$ ceramic, Laser machining, Laser parameters, Surface texture, $CO_2$ laser.

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# Hidrotermal yöntem ile $TiO_2$-nano partikül tozu kullanılarak üretilen bor katkılı BNT-BT kurşunsuz piezoelektrik seramik tozunun morfoloji karakterizasyonu

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## Özet

Bu çalışmanın amacı; $TiO_2$ Nano Partikül tozu kullanarak bor ($B^{+3}$) katkılı 0,94($Bi_{0,5}Na_{0,5}TiO_3$-0,06$BaTiO_3$ (BNT-BT+B) çevre dostu ve kurşunsuz piezoelektrik özelliğe sahip tozların hidrotermal yöntem ile üretilmesi ve karakterizasyonudur. Böylece literatürde çokça çalışılan çevre ve insan sağlığına zararlı Pb katkılı piezoelektrik malzemelerin yerini alabilecek özellik ve performansı sağlayan alternatif kurşunsuz, doğa ve çevre dostu, polimer malzemelere katkılı olarak kullanılabilecek piezoelektrik toz üretiminin gelişim sürecine katkı yapmak hedeflenmektedir. Bu hedef doğrultusunda morfotropik faz yapılı 0,94($Bi_{0,5}Na_{0,5}$ $TiO_3$-0,06$BaTiO_3$) (BNT-BT) piezoelektrik kristallerinin üretimi %1 mol Bor ($B^{+3}$) katkısıyla düşük sıcaklıkta hidrotermal yöntem ile gerçekleştirilmiştir. Hidrotermal reaksiyon için sıcaklık 200°C ve süre 48 saat olarak belirlenmiştir ve BNT-BT+1mol B tozların üretimi gerçekleştirilmiştir. Üretim aşamasında sodyum kaynağı olarak kullanılan NaOH konsantrasyonu farklı molar oranlarda, diğer bileşenler için ise tuzlar, hidroksitler ve oksitler kullanılmıştır. Farklı NaOH molar oranlarının ve $TiO_2$ Nano Partikül tozu kullanımının üretilen piezoseramik toz sisteminde morfolojik oluşumlar üzerindeki etkilerinin incelenmesi amaçlanmıştır. Bu çerçevede istenen üstün özellikleri sağlayan morfolojinin ve boyutun elde edilebilmesi önemlidir. Üretilen piezoseramik tozlara yapısal karakterizasyon için XRD, SEM ve EDX analizleri yapılmıştır. Yapısal ve faz analizleri ışığında uygun görülen kristalin tozların piezoelektrik PVDF polimer malzemelere kompozit malzeme üretimi için katkı olarak kullanılması ile üstün piezoelektrik özellikli esnek piezokompozit malzemelerin geliştirilmesi çalışmanın nihai hedefidir.

Anahtar Kelimeler : Hidrotermal yöntem, $TiO_2$ Nano Patikül, BNT-BT+%1 mol B, Morfoloji, Esnek Piezoelektrik, Kompozit

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# A review on properties and applications of ferrites

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**Abstract**
For many years, the name of magnetic materials has been mentioned as one of the most widely used and important materials. We have been familiar with the phenomenon of magnetism through the compass for about 4000 years. More than 150 years ago, a great scientist named Maxwell taught us the relationship between magnetism and electricity and formulated it. I call this course “the spring of life in the world of ferrites”. Maxwell's equations were like the seeds that Maxwell planted and then the first buds have appeared in Heinrich Hertz period. The existence of electromagnetic waves was proved.
About 15 years after Hertz, the first study on magnetic ferrites was done by Hilpert. In the Forestier period, we saw the first leafs, then with great discoveries from Kato and Takei we saw the blossom! The years 1935 to 1970 are known as the golden age of ferrites. This period was “The summer of life in the world of ferrites”, In my idea! Because researches were seen in production and commercialization of ferrite materials. The buds have grown due to technology and experience, and we encountered many fruits and ferrites. In this article, we tried to have an overview of the history of ferrites, their properties, applications.

Keywords: Ferromagnetic materials, Ferrites, Ceramics.

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# Karbon lif katkılı kompozitlerin basınç yükleri altında kendini algılaması

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## Özet
Beton, dayanımı arttıkça gevrekliği de artan bir malzemedir. Betonun hem yüksek dayanıma sahip olması hem de sünek bir davranış göstermesi araştırmalara konu olmuştur. Lif takviye edilen çimento esaslı kompozitler gelişen beton anlayışı için önemli bir yer tutmuştur. Beton içerisine takviye edilen lifler sayesinde betonun eğilme dayanımı, tokluğu, sünekliği vb. özellikleri iyileşmektedir. Bu sayede beton basınç bölgesinde etki gösterirken lifler de çekme bölgesinde etkili olarak betonun eksik yönlerini tamamlayan bir kompozit oluşturulmuştur. Bu liflerden biri olan karbon lif hem yüksek dayanımıyla hem de yüksek iletkenlik özelliğiyle öne çıkmaktadır. Bu çalışmada çimento esaslı harç içerisine %2, %3 ve %4 oranlarında karbon lif ilave edilmiş, karbon lifin elektriksel iletkenliği sayesinde beton içerisinde bir sensör görevi görerek beton hakkında bilgi vermek suretiyle betonun basınç yükleri altında kendini algılaması amaçlanmıştır.

**Anahtar kelimeler:** Karbon lif; çimento esaslı harç; kendini algılama; sertleşmiş harç mekanik özelikleri.

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# The solution of digital transformation challenges with the future of operations in the field of IoT &AI

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**Abstract**
This paper reveals state-of-the-art technologies, their implications and the challenges associated with the future of operations in the field of Internet of things (IoT) & artificial intelligence (AI). Some of the challenges that may face in the future with the digital transformation of IoT and AI are the following:

- Data Security: With the increased connectivity and data exchange in IoT and AI, the risk of data breaches and cyber-attacks becomes a major concern. Securing sensitive data and protecting it from unauthorized access will be a significant challenge. By Implementing robust security measures such as encryption, access controls, and regular vulnerability assessments, data security can be increased. Furthermore, stay updated with the latest security threats and adopt best practices for protecting data in transit and at rest. Continuously monitor and patch vulnerabilities to ensure a secure environment.

- Interoperability: IoT devices and AI systems come from various vendors and may use different protocols and standards. Ensuring seamless integration and communication between these heterogeneous systems will be a challenge, especially when they are deployed on a large scale. Firstly, prioritize interoperability during the planning and design phase. Secondly, choose IoT devices and AI systems that adhere to industry standards and protocols. And finally, invest in middleware or integration platforms that can facilitate seamless communication and data exchange between different systems.

- Scalability: As the number of connected devices and data generation increases, organizations need to ensure that their infrastructure and systems can handle the scalability requirements. This includes managing large volumes of data, processing tasks in real-time, and maintaining high-performance levels. Firstly, design a scalable architecture that can accommodate future growth. Secondly, consider solutions like cloud computing or edge computing to handle large data volumes and processing requirements. And, regularly assess and optimize the infrastructure to ensure scalability and performance.

- Skill Gap: The successful implementation of IoT and AI requires highly skilled professionals who can analyze and interpret data, develop algorithms, and manage complex systems. However, there is a shortage of qualified individuals in these domains, which can pose a challenge for organizations trying to leverage IoT and AI effectively. Firstly, invest in training and development programs to upskill existing employees or hire new talent with the necessary skills in IoT and AI. Secondly, partner with educational institutions or industry associations to participate in training programs and certifications. Thirdly, encourage collaboration and knowledge-sharing within the organization to foster a learning culture.

- Ethical Concerns: The use of AI and IoT technologies raises ethical concerns related to privacy, bias, and transparency. Organizations need to establish guidelines and policies to address these issues and ensure responsible and ethical use of these technologies. Develop clear guidelines and policies regarding data privacy, bias in AI algorithms, and transparency in decision-making processes. Establish a governance framework to ensure compliance with ethical standards and regulations. Involve stakeholders, including legal and ethics experts, to address potential ethical challenges effectively.

- Continuous Innovation and Upgrades: The field of IoT and AI is continuously evolving, with new technologies and advancements emerging regularly. Organizations need to keep up with these changes and consistently upgrade their systems to stay competitive and leverage the latest innovations. By staying informed about new technologies, trends, and industry advancements. Continuously assess and evaluate emerging technologies that can enhance your IoT and AI capabilities. Conduct pilot projects or proof-of-concepts to test and validate new solutions before implementing them on a larger scale.

The successful digital transformation of IoT and AI requires organizations to address these challenges effectively and proactively to unlock the full potential of these technologies for improved efficiency, productivity, and innovation. Digital transformation is an ongoing process, and organizations need to be agile and adaptable in their approach. Regularly assess the progress, measure outcomes, and adjust strategies accordingly. Embrace a culture of innovation, collaboration, and continuous improvement to successfully navigate the digital transformation journey.

Keywords: Digital transformation, Internet of things (IoT), Artificial intelligence (AI).

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# Preparation and characterization of nanoemulsion encapsulating curcumin

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**Abstract**

Curcumin is the most active component obtained from the turmeric (*Curcuma longa*) plant. The current work attempted to use nanoencapsulation technology to address the instability of curcumin during processing & problems of bioavailability. With an encapsulation effectiveness of 90%, curcumin powder was encapsulated in nanoemulsion droplets of medium-chain triglyceride (MCT) oil generated by high-shear stirring & high-pressure homogenization using maltodextrin and Tween-80 as emulsifiers. The nanoemulsion generated has a particle size with an average diameter of 150.64 ± 10.4 nm & a ζ-potential of −6.0 mV. Emulsion stability was determined by centrifugation at 1300xg at 5 degrees for 30 minutes and heating at 80 degrees for 30 minutes.

Keywords: Bioavailability, curcumin, high-Shear Stirring nanoemulsion, stability

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# Hydroxyapatite porous scaffolds

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**Abstract**
Bone is an organ responsible for maintaining the body structure, strength, and transmission of force and movement in humans and other animals. Bone injury is considered one of the challenges of medical science, which allocates much money for treatment worldwide every year. The mineral structure of bone is composed of hydroxyapatite, and its protein part is mainly composed of collagen. Hydroxyapatite is one of the essential bio-ceramics used in medicine and dentistry. It has attracted attention recently due to its unique biological properties and structural similarity to hard bone tissue. The production of bone substitutes requires the complete similarity of their structure with the mineral phase of bone cells on both large and small scales. Functional grading of materials is one of the required characteristics of artificial tissues. Creating a functionally graded bone implant can regulate bone regeneration and facilitate healing. In this research, hydroxyapatite scaffolds were made by pressing and sintering methods, and calcium carbonate and polyethylene glycol with specific granulations were used to create porosity in the scaffolds. In order to characterize the samples, physical properties tests, compressive strength tests, scanning electron microscope imaging, bioactivity tests by immersion in SBF solution, and cytotoxicity tests by MTT method were performed. The results of the tests show that well-established gradual porosity changes, average porosity of about 50%, and compressive strength of about 40 to 50 MPa show good compatibility with bone tissue. Also, the results of SBF and MTT tests showed the successful formation of an appetite layer and significant cell proliferation. All the results show the usability of the material defined in this project as a bone tissue scaffold.

Keywords: Bone Scaffold, Hydroxyapatite, Functionally Graded Material, Porosity.

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# Etial 177 alüminyum alaşımının dökümünde niyobyum ilavesinin beslenebilirlik üzerine etkisinin incelenmesi

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## Özet

Alüminyumun ve alaşımlarının dökümde dayanımının fazla olması, elektriksel iletkenlik özelliklerinin güçlü olması ve mekanik özelliklerinin de oldukça iyi olması nedeniyle kullanımı yaygın olan önemli bir malzemedir. Günümüzde bu sebeplerden dolayı savunma sanayi, endüstriyel üretimlerde ve makine sanayinde kullanımı oldukça yaygındır. Günümüzdeki teknolojik gelişmeler sebebiyle sürekli farklı mekanik ve fiziksel özelliklere sahip malzeme ihtiyacı karşımıza çıkmaktadır. İhtiyaç olan malzemelerinse hammaddeleri hem kolay temin edilebilmeli hem de maliyeti ucuz olması gerekmektedir. Saf halde bulunan metaller belli özelliklere sahip olup bu özellikleri değiştirmek ve iyileştirmek için alaşımlar oluşturulur. Alaşım, elementlerin ilave oranına göre değişiklik göstermektedir. Bu kapsamda alüminyum alaşımlarının özelliklerinin geliştirilmesine yönelik olarak Niyobyum elementi de son yıllarda kullanılan alternatif malzemeler arasındadır. Bu çalışmada primer Etial177 alüminyum alaşımı ilavesiz ve değişen Nb oranlarında dökümler yapılacaktır. Nb ilave miktarı için mevcut literatr bilgisi ve ekonomik olması düşünülerek %0,03, %0,06 ve %0,1 oranları belirlenmiştir. Dökümlerde 200 °C kalıp ısıtma sıcaklığında ördek ayağı kokil kalıbı kullanılmıştır. Kalıp içerisinde 2 farklı modüle sahip kesit mevcut olup değişen katılaşma zamanlarındaki beslenebilirlik etkisi tespit edilmesi amaçlanmıştır. Çalışma sonucunda değişen ilave miktarında beslenebilirlik sonuçlarında farklılıklar tespi edilmiştir. Ayrıca Nb ilave miktarının da beslenebilirlik değişimin üzerinde etken olduğu tespit edilmiştir.

**Anahtar Kelimeler:** Etial177 alüminyum döküm, Ördek ayağı kalıbı, Beslenebilirlik, Nb ilavesi.

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# Investigation of the effect of niobium addition on feedability in casting of Etial177 aluminium alloy

## Abstract

It is an important material that is widely used due to the high strength of aluminium and its alloys in casting, strong electrical conductivity properties and very good mechanical properties. Today, for these reasons, it is widely used in the defensive industry, industrial production and machinery industry. Due to today's technological developments, the need for materials with different mechanical and physical properties constantly arises. The raw materials of the materials needed should be both easily available and cheap in cost. Pure metals have certain properties and alloys are formed to change and improve these properties. The alloy varies according to the addition ratio of the elements. For this reason, Niobium element is among the alternative materials used in recent years in order to improve the properties of aluminium alloys.

In this study, castings will be made without the addition of primary Etial177 aluminium alloy and with varying Nb ratios. For the amount of Nb addition, 0.03%, 0.06% and 0.1% were determined considering the available literature and economics. Duck foot permanent mould was used in castings at a mould heating temperature of 200 °C. There are sections with 2 different modules in the mould and it is aimed to determine the feedability effect at varying solidification times. As a result of the study, differences were detected in the feedability results in the varying amount of additives. In addition, it has been determined that the amount of Nb addition is also a factor on the feedability change.

**Keywords:** Etial177 aluminium casting, Duck feet mould, Feedability, Nb addition.

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# Erbiyum ilavesi ve katılaşma zamanının etial 160 alüminyum alaşımının dökümünde mikroyapı değişiminin incelenmesi

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## Özet

Alüminyum alaşımları mühendislik yönden birçok avantajı sayesinde otomotiv, havacılık, savunma, uzay endüstrisi, makine imalat, gıda endüstrisi gibi birçok alanda yaygınca kullanım bulmaktadır. Alaşım elementi ilaveleri ile gelişen teknoloji sonucu gerekli ilave özellik gereksinimlerinin de karşılanmasına yönelik çalışmalarda önem kazanmıştır. Teknoloji geliştikçe malzemelerden ilave özellik beklentileri ortaya çıkmaktadır. Bu kapsamda alaşımın nihai yapısına doğrudan etki eden katılaşma sürecinin kontrol altına alınması gerekmektedir. Bu sebeple dökümde uygulanan proses ve alaşım elementi ilaveleri ile ortaya çıkan modifiye edilmiş ve ince taneli yapılarda akışkanlığın arttığı, daha iyi besleme ve daha gözeneksiz bir yapı oluştuğu, mekanik özelliklerin iyileştiği, yorulma direnci, sızdırmazlık direnci değerlerinin arttığı bilinmektedir.

Bu çalışmada Etial 160 alüminyum döküm alaşımına %0,03, %0,05 ve %0,1 Erbiyum ilavesi ile dökümler yapılmıştır. Dökümlerde değişen kesitler içeren basamak şeklinde kokil kalıp kullanılmıştır. Kalıpta kesit değişimlerine bağlı olarak farklı katılaşma zamanları elde edilmiştir. Böylece katılaşma zamanı ve Er ilavesinin Etial 160 alüminyum alaşımında mikroyapı üzerinde etkileri incelenmiştir. Çalışmada ergitme, kokil kalıba döküm, metalografik işlemler, mikroyapı inceleme teknikleri kullanılmıştır. Sonuçlar incelediğinde katılaşma zamanına ve Er ilave miktarına bağlı olarak döküm mikro yapılarında değişimler olduğu tespit edilmiştir.

Anahtar Kelimeler: Etial160 Alüminyum, Döküm, Katılaşma zamanı, Mikroyapı, Erbiyum.

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# The effect of boriding temperature on the structural and morphological properties of ramor 550 steel

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**Abstract**
Ramor 550 armor steel falls under the category of high-strength ballistic protection steel, featuring a hardness and thickness ranging from 460 to 540 HV and 3 to 15 mm, respectively. Its purpose is to endure high-velocity impacts effectively. Boriding is a thermo-chemical reaction based on the diffusion of boron, resulting in a hard surface coating consisting of mixed boron compounds in accordance with substrate material. In the present study, box boriding was applied to Ramor 550 steel with using Ekabor II boron powder to perform boriding at 900 °C, 950°C and 1000°C for the duration of 2 hours. The structural and morphological properties were examined with scanning electron microscopy (SEM), X-ray diffraction (XRD), and profilometry.

The surface roughness, boride layer thicknesses, and structural characteristics of the steels were compared based on the boriding temperature. Therefore, it was observed that the surface roughness and boride layer thickness values increased with the increase of boriding temperature.

Anahtar Kelimeler : Ramor 550, boriding, boriding temperature, thickness of the boride layer, characterization

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# Effect of surface modification on biocompatibility and corrosion of Ti and Ti6Al4V alloy

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## Abstract
In order to develop biomaterials, protective layers are formed on the material surface by using thin film preparation methods. One of the thin film preparation methods is the sol-gel method. Sol-gel is a widely used method in the preparation of organic-inorganic hybrid based coating materials. In this study, it is aimed to improve the surface properties of pure titanium and Ti6Al4V alloy by sol-gel dip coating method. TMSPM (3-(Trimethoxysilyl)propyl methacrylate) and GLYMO (3-(Glycidoxypropyl)trimethoxysilane) silane bonding agents were used on the surface of pure titanium and Ti6Al4V alloy, and pure, titanium alkoxide added, zirconium alkoxide added and boron alkoxide added thin films were formed on the surface of the coatings. properties were examined. The films obtained by using TMSPM silane agent were UV cured, and the films obtained by using GLYMO silane agent were thermally cured. Scanning Electron Microscopy (SEM), surface roughness measurement, contact angle measurement (CA), and biocompatibility tests were performed for the characterization of the prepared films.

Keywords : Biomaterials, Ti alloy, Coating, Silanes, Sol-gel

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# Reduced graphene oxide based polymer nanocomposites

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## Abstract
Graphene is a material in the class of carbon-based 2D materials and can show superior properties in terms of mechanical, thermal and electrical properties. This material, which has an Sp2 bond structure, is the material with the highest strength known today. At the same time, its specific surface area is higher than other materials and its application areas are quite wide. However, since graphene has limited use, researches based on polymer nanocomposite production are preferred.

In this study, graphene oxide (GO) was produced from graphite flakes using Hummers modified method. Produced graphene oxide and reduced graphene oxide (rGO) were added to polyester and silicon at 0.5 and 1% ratios. The distinctive properties of the samples were revealed by the tensile and compression test. As the contribution of graphene oxide nanoparticles added to the structure increased, the elasticity modulus value increased. When the compression test results are examined, the highest values were seen in the samples with %1rGO additives. It was found as 34 MPa in polyester and 6.73 MPa in silicon. It was characterized by XRD and SEM analysis.

Keywords : Graphene oxide, Hummers, Composite

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## Acknowledgement

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# Preparation and characterization of antifungal hybrid coatings

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## Abstract
In this study, thyme oil, black pepper oil, cumin oil and tea tree oil added 3-(Trimethoxsilyl)propyl methacrylate (TMSPM) and tetraethyl orthosilicate (TEOS) binder based hybrid coatings were applied to polycarbonate (PC) and polymethyl methacrylate (PMMA) surfaces. Hybrid coating surfaces are thermal and UV cured. Coated PC and PMMA polymer surfaces were characterized by Fourirer Transform Infrared (FTIR) Spectroscopy analysis, digital microscope imaging, contact angle analysis and antifungal susceptibility. A contact angle of 87.84° for uncoated PC and 95.89° for PMMA is given. Characteristic peaks were obtained for TEOS, thyme oil, cumin oil, tea tree oil and black pepper oil in FTIR analysis. Thickness in the range of 2.059-49.322 µm was obtained for digital microscope images. Additive effects for Aspergillus flavus mold in the anrifungal susceptibility test were followed by thyme oil, tea tree oil, cumin oil, TEOS and black pepper oil, respectively.

Keywords: Antifungal, essential oils, Coating, Silanes, Sol-gel
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## Acknowledgement

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# Modification of glass surfaces with silanes and metal oxides

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## Abstract
In this research, it was aimed to improve the surface properties by coating the surfaces of microscope slide glass materials with silane and metal oxide solutions using the sol-gel method. The importance of the study is to determine the solutions with suitable content to increase the hardness and scratch resistance of the glass materials developed and to apply them to the glass surfaces. In the study, solutions prepared by mixing different amounts of silane and metal oxides using the sol-gel method were coated on the surfaces of glass materials with the help of wet film applicator. Light transmittance, turbidity, contact angle and pencil hardness tests were applied to examine the properties of the coated surfaces. Results were found between turbidity 0.39% and 37.3%, light transmittance between 85% and 91.7%, contact angle between 45.16° and 115.44°, and pencil hardness between 2H and 6H. According to the value ranges found, SR13 and SR14 samples with Group 4 solution were observed as the hardest samples with 6H, SR11 and SR12 samples with 5H values.

Keywords : Coating, Hydrophobic, Silanes, Sol-gel

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# Fabrication, and characterization of plasmonic nanoarrays for point-of-care applications

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## Abstract

The increasing demands within the healthcare sector have underscored the significance of "point-of-care" (PoC) clinical screenings, real-time disease diagnostics, and personalized treatment approaches. In this context, biosensor technology has gained prominence, focusing on attributes like affordability, swift outcomes, and real-time analysis, alongside portability and automation. The ability to manipulate fluids within micrometer-scale channels and the alignment of these microfluidic systems with optical-based measurement techniques enable more effective observation of chemical and biochemical interactions. This study encompasses the nanofabrication of plasmonic-based chip surfaces, functionalization for tailored measurements, and validation processes using reference samples. Highlighting the potential of biosensor technology in medical diagnostics, this study aims to leverage the interaction of plasmonic-based chips with microfluidic systems for more precise and accurate outcomes. In meeting the demand for rapid, accurate, and individualized healthcare solutions, this study stands as a significant step forward.

**Keywords:** Biosensor, Nanowhole arrays, Plasmonics, Fabrication, Characterization

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# Dissolution characteristic of 15-5 PH ss in electrochemical machining in terms of time and voltage

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**Abstract**
The behavior of passive film layers on the surface of 15-5 PH stainless steel during electrochemical machining as a function of machining time and voltage is investigated in this study. The continuing degradation and regeneration of the passive film layer are investigated to understand their impact on the machining process. Material removal rate (MRR) is examined by changing the input parameters of voltage (8V, 12V, 16V) and machining time (5, 10, 15 min). As the machining time increased, the effect of the passive film layers on the surface decreased due to the corrosive electrolyte environment. Furthermore, increasing the voltage causes an increase in current density, which causes the material to dissolve rapidly by deteriorating the protective passive film layer. As a result, the MRR is proportional to both voltage and machining time. However, the impact of machining time decreases with increased voltage due to the rapid degradation of the film layer at higher voltage levels.

Keywords: Electrochemical Machining, 15-5 PH, Stainless Steel, Dissolution Behavior

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# Strengthening of perforated brick masonry wall using fiber reinforced mortar

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**Abstract**
This experimental study aims to improve the behavior of perforated brick masonry walls by using thin layers of fiber reinforced mortars coating. To carry out this investigation, a shear triplets tests under uniaxial loading have been carried out to evaluate the performance of reinforcement technique in terms of strength, rigidity and ductility .A series of shear triplets were built with perforated bricks masonry of dimensions (220 x110 × 55) using bastard mortar (1: 1: 5).The shear triplets were coated with a thin layer of normal and polypropylene fiber reinforced mortar. The test results of the reinforced and unreinforced specimens were compared with each other in terms of stress-strain relationship and shear strength. The test results showed that the reinforced coating significantly increase the deformation ability and improve the shear strengths of the specimens. Through the reinforced coating application, fracture of the samples was prevented and a ductile behavior was obtained.

Keywords: shear triplets, polypropylene fiber, fiber reinforced mortars, coating.

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# An application of ftır spectroscopy and chemometrics for zeolite Y characterization

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Abstract
Recently various applications of chemometrics have been proven to be very useful across many disciplines. Fast and non-destructive methods for the determination of Zeolite properties are important. A rapid (in minutes), non-destructive, high throughput analysis (HTA) method was developed for the prediction of Zeolite Y's a group of (8 properties) different properties (Si/Al ratio, x, WDR ($cm^{-1}$), WTOT($cm^{-1}$), a(nm), Unit cell size(A), weight loss @300 °C (wt%) and weight loss @600 °C(wt %)). FTIR spectroscopy has been used in connection with multivariate partial least squares (PLS) chemometrics using about 1 mg of a sample. The method covers the steps of generating a predictive data set and using this data set to determine unknown Zeolite Y's properties with the help of commercial FTIR OMNIC TQ Analyst software. The peak shift values (WDR, WTOT) and molar fraction of Al, $x = (1+Si/Al)^{-1}$ were quantified using FTIR spectra, crystallographic data, and weight loss data obtained from XRD and XRF, and TGA, respectively. The FT-IR spectrum is collected for each sample and correlated with the corresponding properties determined by standard methods. The developed method simultaneously predicted a group of properties in the spectral data between 4000−400 $cm^{-1}$. The calibration results were determined as RMSEP=0.0771, RMSEC=0.0452, correlation coefficient=0.9996, and Performance Index (PI) value as 99.9%. After cross-validation, the PLS method was found to have a high prediction ability for determining Zeolite Y properties of RMSECV=0.0557, R2 =0.9986 with 5-factor values. The proposed analysis method can include more characterization methods and be used for screening zeolite samples, quality control, and fast decision-requiring processes. FTIR spectroscopy and chemometrics are a great combination and may enable rapid and inexpensive characterization of many materials in the near future.

Keywords: Si/Al ratio, Chemometrics, High Throughput Analysis (HTA), FTIR.

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# Lityum-iyon pillerin empedans spektoskopisi yöntemiyle çevrim karakterizasyonu

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## Özet

Lityum-iyon piller, taşınabilir elektronik cihazlardan elektrikli araçlara kadar geniş bir uygulama yelpazesinde kullanılan temel enerji depolama cihazlarıdır. Bu çalışmanın amacı, lityum-iyon pillerin performansını değerlendirmek ve anlamak için empedans spektroskopisi yöntemini kullanarak çevrim karakterizasyonunu incelemektir. Empedans spektroskopisi, elektrokimyasal sistemlerin frekans aralığında tepkisini analiz ederek sistem özelliklerini belirlemek için kullanılan güçlü bir tekniktir.

Bu çalışmada, lityum-iyon pillerin çevrim kararlılığı, elektrokimyasal etkileşimleri, iç direnç ve batarya parametre değişimleri incelenmiştir. Deneyler, farklı deşarj/şarj hızlarında gerçekleştirilmiştir. Empedans spektroskopisi verileri, Nyquist diyagramları ve Bode çizimleri gibi grafiksel analizlerle değerlendirilmiştir. Bu analizler, elektrokimyasal arayüzlerdeki değişiklikleri, elektrot malzemelerinin etkisini ve lityum-iyon iletim kinetiğini anlamamıza yardımcı olmuştur.

Elde edilen sonuçlar, lityum-iyon pillerin performansını artırmak için tasarım ve optimizasyon süreçlerinde rehberlik edebilecek önemli içgörüler sunmaktadır. Empedans spektroskopisinin, lityum-iyon pillerin çevrim kararlılığı ve uzun ömürlülüğünü anlamak için değerli bir araç olduğu sonucuna varılmıştır. Bu çalışma, lityum-iyon pil teknolojisinin ilerlemesine katkıda bulunmayı amaçlamaktadır.

Anahtar Kelimeler: Lityum-iyon pil, empedans spektroskopisi, performans değerlendirmesi.

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# Çimento ikame malzemesi olarak yüksek fırın cürufunun ve pomzanın mekanik ve içsel kürleme özelliklerine etkileri

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## Özet

Hızlı nüfus artışına bağlı olarak artan alt ve üst yapı gereksinimi çimentoya olan talebi sürekli olarak artırmaktadır. Artan çimento üretimi enerji ve hammadde tüketimini artırmakta, ekolojik çevrenin bozulmasına, karbondioksit ve diğer sera gazı emisyonlarında artışa neden olmaktadır. Çimentonun neden olduğu çevresel etkilerin minimize edilebilmesi için yüksek fırın cürufu, uçucu kül, taban külü vb. endüstriyel atıklar, pirinç kabuğu külü vb. tarımsal atıklar, pomza, perlit vb. malzemeler çimento yerine farklı oranlarda çimento ikame malzemesi olarak beton üretiminde kullanılmaktadır. Yapılan deneysel çalışmada yüksek fırın cürufu %20, 35, 50, pomza tozu %10 ve 15 oranlarında çimento ikame malzemesi olarak kullanılarak, 40x40x160 mm boyutunda harç numuneleri üretilmiş, numunelere standart su kürü ve kür odasında (% 70 rutubet, 30 °C sıcaklık) 3, 7, 28 ve 90 gün süre ile kür uygulanmış, sertleşmiş harç numunelerin basınç ve eğilme dayanımları test edilmiştir. Ayrıca artan küresel ısınmaya bağlı olarak azalan su kaynaklarının çimentolu kompozitler de neden olacağı kür probleminin çözümü için de pomza tozunun oluşturacağı içsel kürlenmeye bağlı olarak farklı yaşlardaki mekanik dayanımlara etkisi çalışma kapsamında irdelenmiştir.

Anahtar Kelimeler: Yüksek fırın cürufu, pomza tozu, eğilme dayanımı, basınç dayanımı, içsel kürleme

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# The current research for wire arc additive manufacturing

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**Abstract**
The additive manufacturing (AM) processes are also named "rapid prototyping" or "3D printing". With AM, a layer geometry can be generated in any orientation from 3D CAD data. The material properties are created during the manufacturing process and no product-specific tool is required. The 3D data can be easily transferred to other machines with an STL interface. Wire Arc Additive Manufacturing (WAAM) is an arc additive manufacturing process for component manufacture that uses welding wire as the material. The many outstanding possibilities that this process offers, make it interesting for industry and research to promote cost efficiency and innovation. If the number of research papers that have been produced in recent years is considered, it results in an exponential increase. Due to this fact, this work was created to summarize the current research works and to provide an overview of the development of the WAAM technology. This allows us to identify current research priorities or potential research fields. The research fields are divided into process, material, and simulation as well as automation. The current research works were assigned to the research field in this paper and described.

Keywords: Wire Arc Additive Manufacturing, Automation, Simulation, Material, Process

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# 3D printing using dissolvable materials: Investigations of structure and materials

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## Abstract
Recently, the application of inkjet printing technology has gained immense among professionals and researchers in material engineering, biology, chemistry, electronics, and medical fields. With the ability to print various materials, as well as remarkable precision and speed, this technology has found significant application in additive manufacturing processes. The primary objective of this paper revolves around analyzing 3D geometry while placing a strong emphasis on materials and structural aspects within this domain. The main goal of this paper is to eliminate conventional coating methods like lithography, focusing on adhering to established standards and maintaining the quality of previous techniques. To achieve this aim, it is imperative to establish a seamless synergy between the chosen mechanical structure and materials. A significant hurdle in 3D printing lies in fabricating intricate geometries. To address this issue, support structures are employed, which must be removed once the printing is finished. These supports can be printed using dissolvable materials. The process of constructing layers using separate print heads contributes to this structural complexity. Utilizing this technology, the creation of individual droplets is facilitated by a piezoelectric element integrated with the nozzle. This component triggers the expulsion of ink from the nozzle. The process of forming distinct droplets is inherently contingent upon the viscosity of the ink and its ability to adhere to specific parameters. The successful printing of various materials relies on achieving the optimal viscosity and resistance characteristics of the ink. Additionally, this paper shows the utilization of heater and ultrasonic technologies to expand the range of printable materials. This versatile technology is capable of accommodating a broad array of materials, encompassing nanoparticles, cells, polymers, and pigments that can be either dissolved or dispersed within a fluidic medium. Furthermore, incorporating conductive ink into this technology opens up the potential for its application in the field of printable electronics.

**Keywords:** 3D printing, Conventional Coating, dissolvable materials, printable electronics

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# Comprehensive Effects of characteristic Microstructure and morphology of WC-Co on hardness and density as a functional property

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## Abstract

Hard metal is a kind of industrial composite consisting of tungsten carbide particles, hard and brittle, as a reinforcement and the metal cobalt which is soft and ductile as a matrix and binder. The special behavior of this material in hardness and wear resistance led to the use of them in industries such as STUD and Edge block which are parts of High-Pressure Grinding Rolls (HPGR) machines. In this study effects of microstructural characterization and defects like eta phase, cobalt pool, carbon leaching, particle size limitation and morphology on the hardness and density as functional properties were investigated via SEM (Scanning Electronic Microscope), X-ray map, EDS, Line-Scan, Image and Statistical analysis. Three years of failure analysis and monitoring research show an effective relationship between grain size and the formation of unwanted phases and hard metal properties (11.27 g/cm3density and 792 HV hardness referred to 1.78 µm particles size and 10.30 g/cm3 and 761 HV referred to 1.98 µm particles size), as an effective industrial tool, in the manufacture and use of parts in the grinding industry.

Keywords: Hard metal, Tungsten Carbide, Cobalt, High-Pressure Grinding Rolls, failure analysis.

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# Study of optical densities by means of ionizing radiations interactions with radiochromic films

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**Abstract**
Radiochromic films are particularly used as dosimeters in Intensity Modulated Radiotherapy (IMRT) and to control sophisticated equipment like linear accelerators and scanners. The dose measurement of these films is about few Grays to kilo-Grays. They are constituted of several layers and based on the active one that is placed in sandwich. This layer is composed of diacetylene monomer, which has the property to become polymer if it is submitted to ionizing radiations. This polymerization leads to characteristic color production and is proportional to the absorbed dose. The principle of these films is based on the measurement of its optical density before and after irradiation. This work is part of this framework; we have studied the impact of a few parameters on optical densities. We used several samples (5×5 $cm^2$) of EBT2 radiochromic films, where EBT stands for External Beam Therapy. Each specimen was irradiated using a Varian Clinac DHX linear accelerator operating at six MV accelerating voltage. We studied the effects of temperature and relative humidity on optical densities and noticed that they are dependent on these parameters. The optical densities of the films stored at low humidity (H~ 30%) was higher than that corresponding high humidity (H~ 80%). Concerning the effect of scanner temperature, the variations depended on the dose received by the film. They were greater for the lowest (D=0.5 Gy) and highest (D=8 Gy) doses and were almost insignificant for intermediate doses. We note that the results obtained in this work are in agreement with literature.

Keywords : optical density, radiochromic films, ionizing radiation.

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# The effect of application time on the coating layer in coating with pack aluminizing

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**Abstract**
In materials exposed to repeated loads or operating in atmospheric environments, the onset of damage starts from the surface. Today, surface coating methods are applied because they are both more economical and regional processes to increase the resistance of materials against external factors. The biggest advantage of plating with pack aluminum is that it is economical and easy to apply.

In this study, the change of the coating layer depending on the time was investigated by coating AISI 1040 steel at 750 °C for 2, 4, 6 hours with the box aluminum method. A smooth coating layer was obtained in the coating matrix transition region in the processes applied under all conditions. The layer thickness was 26 µm for 2 hours, 41 µm for 4 hours, 49 µm for 6 hours, respectively, and it was determined that the layer thickness increased with the increase of the coating time. In XRD examinations made for all conditions, FeAl is dominant and there are also $Fe_2Al_5$ and $Al_2O_3$ peaks. The hardness of the coating layer varies between 400 $HV_{0.05}$ and 500 $HV_{0.05}$, and it has been observed that the surface hardness increases approximately 3-4 times when the pack aluminum is coated with AISI 1040 steel.

Keywords : Pack aluminizing, coating layer, hardness

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# Effects of mineral fillers on the properties of polymer composite density tracers

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**Abstract**
The world has gone through uncertain and challenging times due to the pandemic announced in 2020, and the problems experienced have greatly impacted the energy sector. The limitations in daily life because of the Covid-19 pandemic have revealed the industry's energy demand and prices. After the vaccine was found and restrictions eased, the energy market started to recover in late 2021. However, the energy sector was caught unprepared for the demand that came with the recovery. The beginning of the Russia-Ukraine war in 2022 was a second blow to the world. In response to the embargo imposed by Europe, Russia's stopping of European gas shipments caused Europe to turn to alternative energy sources. As a result, European countries turned to coal again in the energy crisis.
Coal is one of the leading alternative energy sources because it is low-cost, easy to discover, and widely available. Enrichment is the most commonly used method to improve the quality of the extracted coal. Dense media baths are used to process a variety of feed particle sizes. Density Monitors are polymer composites prepared in different densities and sizes.
This study aimed to reveal the effects of mineral fillers on the mechanical and physical properties of density tracers. Marble dust wastes and high-density fillings were used as mineral fillers. Different densities were obtained by adding different ratios in the polyester matrix. The prepared mixtures were poured into a silicone mold and shaped. The mechanical and physical properties of the obtained products were examined.

Keywords : Coal, Tracers, Polymer composite

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# Isothermal reduction of Kahnuj ilmenite concentrate by hydrogen

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## Abstract

The hydrogen reduction of Kahnuj ilmenite concentrate from Kerman, Iran, was investigated under varying process parameters utilizing the Response Surface Methodology (RSM) approach. The study aimed to elucidate the effect of key influencing factors on the reductive mass loss of pellets derived from ilmenite concentrate. The independent variables examined consist of the reduction temperature range of 850-1050°C, pre-oxidation temperature in the range of 800-1000°C, and gas flow rates of 200-500 mL $min^{-1}$. It was found that all three factors mentioned were the most significant factors affecting the mass loss. the optimum conditions for mass loss were identified as follows: reduction temperature of 1045°C, pre-oxidation temperature of 860°C, and hydrogen flow rate of 217 mL $min^{-1}$. The experimental mass loss at these optimal conditions, measured at 15.1%, closely aligned with the anticipated value of 15.3%, validating the predictive capability of the model.

**Keywords:** Kahnuj ilmenite concentrate; hydrogen reduction; Response Suface Methodology (RSM); Pre-oxidation process.

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# Bacterial and enzymatic degradation of low density polyethylene/poly(lactic acid) blends

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## Abstract

Biodegradation of low-density polyethylene and poly(lactic acid) (LDPE/PLA) blends was investigated using as biological media an activated sludge, collected from a wastewater treatment plant, and an enzyme cocktail, containing proteases and esterases. Blends were prepared by melt blending using a twin-screw extruder followed by compression molding, to prepare films, or grinding to obtain powder. The estimate of LDPE/PLA blends biodegradability was conducted by the monitoring of weight loss, changes in mechanical characteristics (tensile strength and microhardness), as well as alterations in the structure as determined by X-ray diffraction analysis. The assessment of enzyme degradation kinetics was conducted using chemiluminescence and gravimetric techniques. The films exposed to both media were also examined by FTIR spectroscopy and scanning electron microscopy. The findings from a 13-week exposure to activated sludge indicate that LDPE/PLA blends have a higher propensity for biodegradation compared to homopolymers. Notably, the 50/50 composition of LDPE/PLA demonstrates the most pronounced effect in this regard. This statement is corroborated by X-ray diffraction diffractograms, which exhibit a reduction in both the amorphous regions and crystalline peaks intensity. This alteration is caused by medium bacteria breaking down macromolecular chains. On the other hand, the findings pertaining to the enzymatic degradation kinetics of the binary blends indicate that the degradation rate of pure PLA is comparatively slower when compared to PLA-based blends. Furthermore, the mixture comprising 50% PLA had the shortest induction period and the highest rate of degradation, whereas pure PLA exhibited the longest induction period and the lowest rate of degradation. These findings were corroborated by the weight loss experiment, wherein LDPE/PLA blends exhibited greater values compared to pure PLA.

Keywords: Biodegradation, Polyethylene, Activated sludge, Enzymes, Poly(lactic acid).

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# Effect of citric acid doping on the physicochemical and morphological properties of polyaniline

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## Abstract
In the fast-growing science of polymers, conjugated polymers (or conductive polymers) give us new materials with unique properties that are crucial to our daily lives. According to patents and publications, polyaniline (PANI) is the most interesting conjugated polymer due to its facile preparation and its excellent chemical, electrical, and optical properties. Despite its numerous advantages, conventional PANI doped with HCl has been accused of damaging equipment, due to the small size of the doping agent, and posing a health risk due to its low-molecular-weight reaction byproducts. Nowadays, some organic acids are used as dopants in PANI to produce non-toxic materials with high conductivity. Among their many applications are batteries, anticorrosion protection, and intelligent food packaging. In the present work, we aimed to use citric acid (CA), a well-known non-toxic organic acid, as doping agent for PANI. The resulting materials are characterized by several techniques: FTIR, UV-Vis, XRD, SEM, conductivity measurements, etc. The FTIR spectra of CA-doped PANI display both the characteristic bands of the doping acid and those of polyaniline with conjugated structures. However, the doping effect of citric acid is obvious from the large bands revealed by UV-Vis spectra. Furthermore, when compared to HCl-doped PANI, CA-doped PANIs exhibit lower conductivities, which suggest a lower level of oxidation. Moreover, SEM images highlight distinct morphologies wherein doping with HCl leads to a "cauliflower" structure while doping with citric acid results in a “rod-like” structure.

Keywords: Polyaniline, Citric acid, Conjugated polymers, Doping.

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# Effect of applied potential on optoelectronic and morphological properties of electrodeposited $Cu_2O$ for photocatalytic water splitting

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**Abstract**
Hydrogen is considered as one of the most promising alternative energy sources with the potential to withstand future energy challenges. The availability of sunlight as a sustainable energy source has enabled the generation of hydrogen through photocatalytic water splitting. Among various photocatalytic systems, semiconductor catalysts based on metal oxides have attracted much attention due to their facile preparation and associated low cost. Cuprous Oxide ($Cu_2O$) is a direct band gap semiconductor with a narrow band gap (Eg = 1.9–2.2 eV) in which the conduction and valence band positions are compatible for photocatalytic water splitting. The relatively high absorption coefficient of $Cu_2O$ makes it a promising material for photocatalytic water splitting.

In this work, A simple electrochemical deposition technique is developed for the synthesis of $Cu_2O$ nanostructures on fluorine-doped tin-oxide (FTO)-coated glass substrates from Cu(II) sulfate solution with $C_6H_8O_7$ chelating agent. The optical measurements show a direct band gap between 1.8–2.5 eV depending on the applied potential. Photoelectrode for hydrogen evolution reaction (HER) was -0.3 mA·cm-2 at the applied potential of -0.4V *vs. SCE* because you have a higher activity photocatalytique.

**Keywords:** Electrodeposition, $Cu_2O$, thin films, photocatalytique.

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## Effect of different pre-heat temperatures on wc decomposition in Ni/WC hardfacing deposited by oxy-acetylene welding

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**Abstract**
In the present work, the hardfacing coatings were obtained by Oxy-acetylene welding with different Pre-heat temperatures. The dissolution phenomena of WC reinforcement particles with the formation of $W_2C$ eutectic phase and its effect on the wear resistance and the mechanisms were studied. The Ni/WC hardfacing samples were characterized by scanning electron microscope (SEM) coupled with EDXS line Scan, EDXS Spot and EDXS Map Scan, X-ray diffraction (XRD), micro-hardness measurements, solid particle erosion test (SPE) and pin on disk test. The results showed that the 600°C pre-heat and 300°C pre-heat were optimum temperatures in sliding wear and erosive wear applications respectively. By changing the impact angles in SPE test, the wear mechanisms gradually changed from ductile behavior to brittle one. Also, the wear mechanism changed from abrasive wear in a ploughing mod to brittle fracture because of the reduction in plasticity and fracture toughness.

Keywords: Dissolution phenomena, $W_2C$, Ni/WC hardfacing, Pre-heat temperature, Wear mechanism, Oxy-acetylene welding.

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## Experimental Study of Compression behviour of Corrugated Composite Sandwich panel and Corrugated Composite Sandwich Panels Reinforced by without Pre-strain Shape Memory Alloy Wires

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**Abstract**

Composite materials have high specific strength, specific stiffness and energy absorption as well as offer other benefits such as part consolidation, styling flexibility, good noise/ vibration characteristics and good corrosion resistance, which are well suited for future lighter and more energy efficient for different industries. Sandwich structures consisting of various facesheets and cores. Composite corrugated panels, are a subdivision of sandwich panel structures which could decrease the number of parts used in a structure, which increases the speed of assembly and reduces the manufacturing costs. This paper present experimental investigation of

compression behavior of lightweight corrugated core composite (CCC) sandwich panel and corrugated core smart composites (CCSC) sandwich panel subjected to quasi-static edgewise compression loading. Presence of shape memory alloy (SMA) wire and their pre-strain percentages are the parameters studied in this investigation. Manufacturing method presented and evaluation of the mechanical characteristics of the CCC and CCSC sandwich panels are expressed. The core geometry of specimens is trapezoid corrugated core manufactured by aluminum grade 3105 series. The facesheets of specimens have four layers of woven glass fibers reinforced epoxy composite. For evaluation the effect of presence of SMA wires on mechanical specifications of sandwich panel, three SMA wires without percentages (0%) are embedded in each composite facesheets of specimens. Mechanical properties of CCC and CCSC sandwich panels such as maximum force and critical damage force were evaluated. Results showed that CCC sandwich panel has higher mechanical specifications than CCSC sandwich panels with 0 % pre-strain.

**Keywords:** Compression properties, Corrugated core, Experimental Study, Sandwich Panels.

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# Effect of K-Doping on Structural and Electrical Properties of $Sr_2NaNb_5O_{15}$ Ceramics

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**Abstract**
Lead-free $Sr_2Na_{1-x}K_xNb_5O_{15}$ (x=0.00-0.07) piezoelectric ceramics were prepared by single step solid state conventional method. Pure tungsten bronze structure could be obtained in all ceramics and K substitution could accelerate the phase formation at lower temperatures. The lattice constant calculation indicated expansion of the unit cell and reduced distortion of the crystal structure with K substitution due to the bigger ionic size of $K^+$ (1.64A˚) compared to that of $Na^+$ (1.39A˚). Electrical properties of $Sr_2Na_{1-x}K_xNb_5O_{15}$ ceramics greatly dependent on the K content. Curie temperature Tc shifted downward, whereas the maximum dielectric constant $\varepsilon_m$ and the degree of diffusion phase transition all increased initially and then decreased as K content increased, indicating that proper amount of K substitution with x between 0.00 and 0.03 could enhance the dielectric properties of this formulation. All the ceramics showed an intermediate relaxor-like behavior between normal and ideal relaxor ferroelectrics according to the modified Curie–Weiss law. The piezoelectric coefficient was also followed the same pattern as of relative permittivity, increased initially and then decreased with increasing amount of K. Besides, the mechanism for variations of the electrical properties due to K substitution was explained in this work.

**Keywords:** TTB, Lead free, Piezoelectric

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# Surface Modification Of Magnesium Alloys Through Advanced Coating Processing For Biomedical Applications

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**Abstract**
In bone implants, metallic biomaterials are frequently employed because of their excellent mechanical qualities. For this application, stainless steel and titanium alloys are typically employed. However, they have several drawbacks, such as the stress shielding effect, bio-inertness, the need for revision surgery, etc. In order to solve these issues, magnesium-based biomedical implants are used. Mg alloys, however, deteriorate more quickly in the human body, which limits their usage in bone implants. Surface alteration can solve this problem. Plasma electrolytic oxidation (PEO) is being used to modify surface by coating a layer of silicate and tri-calcium phosphate. To assess morphology, elemental analysis, and corrosion resistance, respectively, scanning electron microscopy (SEM), energy dispersive x-ray spectroscopy (EDX), x-ray diffraction (XRD), and electrochemical testing (in SBF) are used. Morphological analysis shows the presence of silicate and TCP particles on Mg surface. XRD analysis confirms the peaks of silicate in the sample. Potentiodynamic Polarization (PDP) test was performed in a SBF solution to evaluate the corrosion characteristics of the sample. In-vitro bioactivity test reveals the formation of apatite on the surface. In the end, this study aims to overcome the drawbacks of conventional metallic biomaterials used in bone implants by increasing the biocompatibility and degradation resistance of magnesium alloys.
**Keywords:** Biomedical, Mg alloy, biodegradable

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# Synthesis and In-Vitro Bioactivity Analysis of 58S Mesoporous Bio-Active Glass

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## Abstract

In this study 58S (SiO2-CaO-P2O5) Mesoporous Bio-Glass (MBG) particles were successfully synthesized using surfactant incorporated sol-gel method. The synthesized particles were heat treated with two different temperature ranges (550°C and 700°C). Both heat treated variants i.e. 58S-550 MBG and 58S-700 MBG were examined using several characterization techniques such as Laser Particle Analysis, XRD, SEM, EDS for structural and chemical analysis. the In-vitro bioactivity analysis were performed via SBF immersion test. The results revealed that particles size obtained was in the range of 5-10 microns. Moreover, SEM results authenticate the mesoporosity within the particles ranging from 50 to 100 nm. Further, it was noticed through XRD results that 58S-550 MBG particles yielded amorphous structure while 58S-700 MBG (treated at higher temperature) showed some crystalline peaks. In addition to this, samples were immersed in SBF for 72 hours, which on SEM examination showcased that a bone like appatite layer was formed on the surface. it is also worth mentioning that 58S-550 MBG which was amorphous in nature showed more In-vitro bioactivity as compared to other. From the mechanical point of view, the 58S-700 MBG was more stable as no cracks were formed on the surface after SBF immersion but in-vitro bioactivity was compromised to some extent. Conclusively, the synthesized MBG produced some good results and definitely have a potential to be utilized for bio-medical applications.

**Keywords:** Bioglass, mesoporous, bioactivity

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## Chromatograhic analysis of the parietal polysaccharides of the roots of retama raetam

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**Abstract**
The aim of this study was to characterize the cell wall polymers of a Fabaceae, Retama raetam (or « R'tem »). This species adapted to arid environments, develops a particularly important root system in depth and on the surface in the soil. Cellulose, hemicelluloses and pectin were extracted from a parietal residue. The weight assay indicates that cellulose remains the major component of the wall (27% in young roots and 80% in adult roots) ahead of hemicelluloses (14.3% in young roots and 3.6% in adult roots) and pectin (17.3% in young roots and 4.1% in adult roots). Gas chromatographic analysis and infrared spectrometry of hemicellulosic extracts show the presence of xylose as the main monosaccharide (47. 8% in young roots and 59.5% in adult roots). For pectin, it indicates the presence of homogalacturonans and rhamnogalacturonans1. These results constitute the first data obtained on the biochemical analysis of the parietal compounds of the roots of a species, which grows in an arid environment; compared to the results of the same analyses on the arial parts.

**Keywords :** Retama raetam, roots, cell wall, monosaccharide.

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## Exploring different techniques for analyzing slope stability

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**Abstract**
The Deforestation, urban sprawl, and climate change have contributed to an increase in landslides, particularly in fragile environments like northeastern Algeria. To protect unstable slopes, it is important to identify fault zones and use mathematical and numerical tools to find the best protection solution. In this study, the section of Wilaya Street 15 in Annaba, Algeria, which has suffered from multiple landslides, was analyzed using the Plaxis code. Three numerical solutions were compared: slab and nailed wall, geotextiles and nailed walls, and micro piles and nailed walls. The choice of method depends on the specific situation of the project, and a detailed analysis of various factors is required. Considering the lithology of the site, the chosen technologies were geotextiles and nailed walls, which provided a satisfactory safety factor and displacement. The Using of mathematical and numerical tools is crucial for making informed decisions about slope reinforcement and protection, as highlighted by the study's findings.
**Keywords**: Numerical modeling, PLAXIS, sliding, Reinforcement, Safety coefficient.

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# Synthesis of highly porous cyclowollastonite bioactive ceramic

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## Abstract
Recently bioactive ceramic materials have been applied in biomedical field as bulk, granular, or coating materials for more than half century. More recently, bone tissue engineering scaffolds made of highly porous bioactive ceramic, glass-ceramic, and composite materials have also been created. As a result, recent bioactive ceramic structures have a high bioactivity rate, an open pores network, and good mechanical characteristics simulating cortical bone. Cyclowollastonite frameworks are also suggested for use as a graft material. As a porogenous agent, with various amounts the polymethyl methacrylate (PMMA) powders were used in this study's successfully to synthetize a highly interrelated, nanostructured porous cyclowollastonite with a large specific surface area. Where the morphology, porosity, was investigated. Cyclowollastonite sintered dense discs were submerged in simulated body fluid (S.B.F.) for various periods of time (1-4 weeks) to assess the bioactivity and biocompatibility. The results demonstrate that even after soaking for several days, the surface of cyclowollastonite ceramic can generate a dense and consistent layer of hydroxyapatite. The results showed that cyclowollastonite framework exhibit a good InVitro bioactivity due to highly interconnecting porous structure and open macropores.
Keywords : Porous, Bioactive, Biomaterials, S.B.F, Cyclowollastonite, Biodegradability.
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# X-ray diffraction study of ordering in the ternary Ti-Al-C lightweight metallic alloys

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## Abstract

This article focuses on the study of microstructural properties of the ternary alloys Al - Ti - C. A set of samples alloy Al-$Ti_X$-$C_Y$ at. % (X = 20, 30, and Y=, 60, 80) made under a high-frequency induction fusion from mixtures of powders of Ti and Al, C purity laboratory cold compacted in cylindrical form. The search for all possible phases in the ternary alloys Al-Ti-C was used to identify the microstructure and to the microstructural evolution in these alloys based on aluminum content. A detailed of X- ray diffraction study has been observed on the phases, Al3Ti, B2-TiAl, gamma -TiAl Ti3Al and TiC , XRD was used to determine the degree of long-range order (LRO).which are still subject of research in materials for industrial applications.

**Keywords:** Al -Ti –C alloys, XRD, intermetallic compounds, identification of phases, microstructural

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# Emerging trends in the remediation of persistent organic pollutants using nanomaterials and related processes

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## Abstract

Persistent organic pollutants (POPs) have become a major global concern due to their large amount of utilization every year and their calcitrant nature. Due to their continuous utilization and calcitrant nature, it has led to several environmental hazards. The conventional approaches are expensive, less efficient, laborious, time-consuming, and expensive. Therefore, here in this review the authors suggest the shortcomings of conventional techniques by using nanoparticles and nanotechnology. Nanotechnology has shown immense potential for the remediation of such POPs within a short period of time with high efficiency. The present review highlights the use of nanoremediation technologies for the removal of POPs with a special focus on nanocatalysis, nanofiltration, and nanoadsorption processes. Nanoparticles such as clays, zinc oxide, iron oxide, aluminum oxide, and their composites have been used widely for the efficient remediation of POPs. Moreover, filtrations such as nanofiltration and ultrafiltration have also shown interest in the remediation of POPs from wastewater. From several pieces of literature, it has been found that Nano-based techniques have shown complete removal of POPs from wastewater in comparison to conventional methods, but the cost is one of the major issues when it comes to nano- and ultrafiltration. Future research in nano-based techniques for POP remediation will solve the cost issue and will make it one of the most widely accepted and available techniques. Nano-based processes provide a sustainable solution to the problem of POPs.

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# Impact of thermal radiation on hydromagnetic boundary layer flow

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## Abstract

The effects of radiation and transverse magnetic field with the presence of an adverse pressure gradient on the two-dimensional laminar incompressible boundary layer flow over a flat plate have been investigated. The nonlinear partial differential equations were transformed and the resulting ordinary differential equations were solved analytically by Mathematica software using the Generalized Adomian Decomposition method. Thereafter, these equations are solved numerically using the fourth order Runge Kutta method featuring shooting technique. Temperature and heat transfer characteristics for different values of effective Prandtl number $Pr_{eff}$ and radiation parameter $R$ are graphed. An motivating result of the analysis is that the thermal radiation's effect increases as the value of $R$ increases. A comparison between analytical and numerical studies has been done and we found an excellent agreement.

***Keywords**:* MHD boundary layer flow, Heat transfer, Thermal radiation.

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# Study of the physico-chemical properties of ceramic tiles

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## Abstract

This paper studies the physicochemical properties of aggregates from the grinding of ceramic tiles based on clay dating back to the 18th century. The main objective is to determine the physico-chemical properties of these ceramic tiles for the formulation and characterization of the composition of the material in order to manufacture new ceramic tiles by the same composition of the material for use in the restoration of this monument in order to preserve this historical monument. Several characterizations of different classes have been carried out, in particular the fineness modulus and the grain size. In addition, a study on the chemical analyzes and the mineralogical composition using X-ray fluorescence (XRF), X-ray diffraction (XRD) and Scanning electron microscopy (SEM) of three (03) samples already prepared and ground, as part of the preparation of this work, which revolves around the ceramic tiles in the neo-Moorish monuments of the city of Skikda. The results obtained from the analysis carried out allow us to know the nature and the originality of the material in order to arrive at the manufacture of new material of the same nature for the restoration of this precious historical monument.

Keywords: Ceramic tiles, Physico-chemical properties, Characterisation, XRF, XRD, SEM.

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# Proposal for an optimal sizing methodology for a wind/PV energy production system for agricultural irrigation in northern Algeria

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## Abstract
In this article, a methodology for optimizing the size of an autonomous wind/PV hybrid system is presented. This approach uses metaheuristic methods to suggest, from a list of system devices available on the market, the optimal number and type of PV panels and wind turbines, while minimizing the total cost of the system and ensuring energy availability through the use of large water reservoirs for storage. The mathematical modeling of the main components of the wind/PV hybrid system is presented, highlighting the most relevant design variables. This enables the development of a multi-objective optimization approach for sizing a hybrid system that respects a given specification related to the desired irrigation area. An application of the adopted methodology is demonstrated for an irrigation system in an agricultural land in the Skikda region in northern Algeria. The obtained results demonstrate the practical utility of the sizing methodology used for the hybrid system.

***Keywords:*** wind/PV hybrid system, electrical energy, optimal sizing, multi-objective optimization, genetic algorithms, irrigation.

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# Predicting the state of engines oils with markov chains

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**Abstract**
Markov chains are memoryless random sequences that can be used in predictive analytics and are highly dependent on probability theory.
In this study we used Markov chains because they allow to predict the change of state of the viscosity of engine oils after a determined operating time. This work aims to model the change of state of the viscosity of lubricating oils using a Markov model, which allows us to follow the deterioration of the quality of the oil by calculating the probability that the viscosity will be degraded throughout its lifetime on one side and to give an estimate of the remaining lifetime on the other side. The Markov chains gave with precision the probabilities of the change of the quality of the engines oisl which allowed us a good estimate of the state of its viscosity.

Keywords: Modeling1, Engines oils2, Markov chains3.

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# Effects of temperature and nanoparticles volume concentration on heat transfer of hybrid nanofluids

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## Abstract

The present work aimed to evaluate numerically the heat and hydraulic performances of hybrid nanofluids using different models of thermophysical properties temperature-dependent. The term “nanofluid” was first coined by Choi in 1995 to describe the process of making stable colloidal suspensions of copper nano-sized particles (1–100 nm) in water (base fluids). The thermophysical properties of heating/cooling fluids plays a vital role in the development of energy efficient heat transfer equipment for electronics, heat exchangers, and automotive cooling systems. The thermophysical properties of nanofluids are different from those of conventional fluids. The results show that the heat transfer enhancement and friction factor behavior of the hybrid nanofluids are highly dependent on the volume concentration and temperature.

**Keywords:** hybrid nanofluids; thermophysical properties; heat transfer; volume concentration.

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# Comparative investigation of basic fuchsin removal efficiency using raw and modified biomaterial as potential adsorbents

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## Abstract

The pollution of water by industrial discharges is a serious problem in several countries. In order to reduce the harmful effects of pollutants, various wastewater treatment processes are implemented, particularly the adsorption technique. The present study aims to investigate the removal of a cationic dye (basic fuchsin, BF) using a natural adsorbent based on raw prickly pear seeds powder (**PPS**) and the chemically modified PPS with Fe-Cu (**PPS/Fe-Cu**). Effect of operating parameters like pH, contact time, adsorbent dosage, initial dye concentration, and temperature during the adsorption were investigated and consequently optimised. The optimal amount of PPS and PPS/Fe-Cu was 2 g/L and 0.75 g/L, respectively, The maximum adsorption capacity was found to be 6.84 and 17 mg $g^{-1}$ for PPS and PPS/Fe-Cu at pH 6.7, the contact time of 120 min, concentration of BF of 20 mg/L and temperature of 20°C. The results obtained show a remarkable improvement in the rate of kinetics and removal efficiency of BF by the modified material (PPS/Fe-Cu). The kinetics were assessed using three models: pseudo-first order, pseudo-second order, and intra-particle diffusion model. The adsorption kinetics of BF by both materials fitted well the second-order model. The equilibrium adsorption behaviour of this dye was examined using Langmuir, Freundlich, Temkin, and Dubinin-Radushkevich isotherm models. The equilibrium data were in best agreement with the Freundlich model for both materials. The thermodynamic parameters indicated that the adsorption of BF on both materials was spontaneous and exothermic.

Keywords: Prickly pear seeds, Basic Fuchsin, Adsorption.

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# Structural evolution of the ball-milled Co50Al50 powders

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## Abstract

The mechanical alloying process has been used to prepare nanocrystalline $Co_{50}Al_{50}$ alloy from elemental Al and Co powders in a planetary ball mill under argon atmosphere. The evolutions of structural, microstructural and mechanical properties of the obtained powders were studied by means of X-ray diffraction analysis using the parametric Rietveld refinement method. The procedure consists in modeling the diffraction profiles by analytical functions in order to characterize the microstructure of the powders. Depending on the variation of milling time , the first solid state reaction was an allotropic transformation of Co from the fcc to the hcp form. In addition, it was also found that two phases with different structures were formed into this alloy. The microstructural study reveals the formation of nanoscale grains for all the phases. Different structural and microstructural properties such as the crystallite size, micro strains, lattice parameters and stacking faults are determined.

**Keywords:** X-ray diffraction; Rietveld method; Solid state reaction; Mechanical alloying.

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# Mixed convection hybrid nanofluid flow through a horizontal duct

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## Abstract

The need to enhance the heat transfer of fluids in energy systems has given rise to the development of a new technique; among these technologies, we find the technique of improving the thermal properties of fluids by adding different metal nanoparticles to these fluids. These solid-fluids mixture are called hybrid-nanofluids. Many technological and industrial applications, including hydraulic heating and cooling of buildings, electronic cooling and solar energy, rely heavily on mixed convection heat transfer. For that reason, this work presents a numerical study of mixed convection of ZnO-Ag/water hybrid nanofluid in a horizontal duct. The governing elliptic partial differential equations are discretized by the finite volume method. The resulting discretized equations are solved iteratively, using the Tri-Diagonal Matrix Algorithm. The effects of hybrid nanoparticles volume fraction and type of nanoparticles on velocity profiles and heat transfer rate (Nusselt number) are analyzed and discussed. It is found that the effect of the nature of the fluid on the axial velocity is negligible, and the hybrid nanofluid transfers heat more efficiently compared to pure base fluid and nanofluid.

Keywords: hybrid nanofluid, horizontal duct, mixed convection, ZnO nanoparticles, Ag nanoparticles.
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# Fabrication of core/shell nanofibrous sheets as dexamethasone carrier for bone healing

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## Abstract

Owning to the possible beneficial effects of dexamethasone (Dexa) on human mesenchymal stem cells (MSCs) osteogenesis and cell proliferation, it's essential to generate an appropriate carrier that can tightly regulate Dexa's release profile. Therefore, this study's main goal was to develop a unique drug delivery system (DDS) built around core/shell nanofibrous components, facilitating Dexa to be released over an extended time. To accomplish this, core/shell nanofibrous sheets generated via coaxial electrospinning from chitosan (CS) and polyethylene oxide (PEO) as core and polycaprolactone (PCL) as shell where Dexa (2 wt. %) was introduced into the core. In this method, a coaxial spinneret made of stainless steel with two concentrically aligned needles was employed. Different characterization methods such as SEM, TEM, FTIR, tensile test, and thermal stability analysis were used to evaluate the fabricated core/shell sheets. In addition, the sheets' wettability and degradability characteristics were also investigated. In vitro assays were conducted to investigate dexa's release behavior. Furthermore, the survival and differential potential of MSCs cultured on nanofibrous containing Dexa were investigated. Results indicated that under ideal conditions, CS+PEO+Dexa/PCL core-shell sheets with a core diameter of about 370 nm and a shell thickness of around 70 nm could be effectively fabricated. It has been demonstrated that plasma treatment enhanced the sheets' wettability and drug-release characteristics. The structure of the fabricated DDS was also validated to contain each component. Furthermore, the Dexa addition showed no appreciable impact on the CS+PEO+Dexa/PCL core-shell nanofibrous sheets' mechanical properties. Moreover, it was discovered that the extended release of Dexa from the fabricated DDS. The Dexa-carrying nanofibrous structure demonstrated higher MSC proliferation and improved osteoblast regeneration. Accordingly, it can be concluded that the CS+PEO+Dexa/PCL core/shell nanofibrous components are capable of being used as a persistent release system for Dexa for a long time, resulting in an appropriate choice of targeted bone repair.

Keywords: core-shell nanofibrous sheets, dexamethasone, persistent release system

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# Sliding mode control of a doubly fed induction generator (DFIG) coupled to a variable speed wind turbine

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**Abstract**
This work presents a technique of sliding mode control applied to the doubly fed induction genarator (DFIM) in the wind power production.
We applied the vector control in active and reactive stator power. Using PI regulators wich present, some disadvantages such as the sensitivity to parametric uncertainties of the machine and their variations. Against of this disadvantage, and to improve the system performances, a nonlinear control strategy was presented. Results obtained in Matlab/Simulink environment show that the sliding mode control is more robust, have superior dynamic performance and hence found to be a suitable replacement of the conventional PI controller.

Keywords : Doubly-Fed Induction Generator (DFIG), sliding mode control, field-oriented control, PI controller.

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# Synthesis of a polypyrrolepolybis (4-oxybenzene sulfonicacid) phosphazene composite high-performance cathode polymers : application - lithium-ion batteries

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## Abstract

With the rapid development of electronic devices, the corresponding energy storage equipment has also been continuously developed. As important components, including electrodes and diaphragms, in energy storage device and energy storage and conversion devices, they all face huge challenges. Polyphosphazene polymers are widely used in various fields, such as biomedicine, energy storage, etc., due to their unique properties. Due to its unique design variability, adjustable characteristics and high chemical stability, they can solve many related problems of energy storage equipment. They are expected to become a new generation of energy materials.Current electric storage systems eagerly focus on high-power and energy-dense Lithium-ion batteries to cope with increasing energy storage demands. Since cathode materials are one of the bottlenecks of these batteries, there is much interest in layered lithium-rich manganese oxide-based (LLMO) cathode materials which can be a solution for developing this technology. However, Initial Coulombic Efficiency (ICE) loss is still persistent as one of the biggest problems for these materials.Electrochemical performance and morphology change of the cathodes before and after cycling are investigated and compared with the PVDF-based binder under the same conditions. The resulting composite binders show low charge transfer resistance, high cycling stability and excellent discharge capability

**Keywords:** Polymer Composites, Polyphosphazene, Layered lithium rich cathode, Binder

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# Electrochemical and thermodynamic study of the inhibitory efficacy of corrosion of extract of Cytisus Multiflorus on carbon steel in acid medium

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## Abstract

The extract of Cytisus Multiflorus Flower has been evaluated as corrosion inhibitors for XC38 steel in 1 mol/L hydrochloric acid. Gravimetric experiments showed that inhibitor present 98 % anticorrosive efficiency at 2ppm (298 K). At higher temperatures (318 and 338 K), this value go up to 93. %. Electrochemical measurements depicted that the charge-transfer mechanism controlled the corrosive and inhibitive processes and that the presence of the inhibitor in the electrolyte enhanced the polarization resistance and significantly diminished the corrosion density current, acting by adsorption on the metal surface. Polarization curves confirmed that they all are mixed-type corrosion inhibitors. Atomic Force Microscopy illustrated the topography of the metallic surface and suggested to the formation of a protective layer. Density Functional Theory revealed the formation of covalent bonds between quinolone molecules and the iron surface.

**Keywords** : EIS, temperatue , XC38 steel, extract , Cytisus Multiflorus Flower,DFT, DM

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# The influence of an antioxidant on the biomedical performance of 304L stainless steel

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## Abstract
Abstract The formation of porous films on the surface of 304 medical stainless steel was studied using the anodizing process in an organic electrolyte in the presence of acid, in order to monitor the effect of different concentrations of Nigella sativa L granule extracts (0, 1 g/l 0.2 g/l 0.3 g/l) as additives on the quality of surfaces formed in the anodizing process Structural analyses of surfaces before and after the process with and without additives were carried out by XRD, FTIR, AFM and SEM. Nigella sativa extract was shown to modify the surface microstructure of stainless steel, which can affect the thickness of the oxide block layer. It also contributes to the formation of porous surfaces with moderate roughness. In addition, electrochemical analyses of the surfaces were carried out by observing the free potential and polarization curves. We found that Nigella sativa L extracts clearly contribute to improving the effectiveness of stainless steel surfaces against corrosion in biological environments.

**Keywords** : Stainless steel, porous films, anodizing, Nigella sativa L, Structural, XRD, FTIR, AFM, BEM electrochemical, free potential, polarization
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# Experimental and adorption Study of the surface proprity and corrosion inhibition on carbon steel of polysaccharides extracted from prickly pear nopals Pulp (PPUN) of Opuntia ficus-indica in 1M HCl

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## Abstract

The inhibition impacts of Pulp (PPUN) from prickly pear nopals of Opuntia ficus-indica on mild steel corrosion in 1M HCl solution has been exploted using electrochemical tests. The surface of mild steel was examined by scanning electron microscopy (SEM) and atomic force microscopy (AFM). In order to obtain information on the inhibition mechanism occurring on mild steel, the XPS technique was applied. Potentiodynamic polarization study demonstrates that the inhibitor retards both cathodic and anodic processes through the inhibitor absorption on the metal surface and the blocking of the active corrosion site. Change in impedance parameters (charge transfer resistance $R_t$, and double layer capacitance $C_{dl}$) were indicative of adsorption of PPUN on metal surface. PPUN and product film analysis have been carried out using SEM, and AFM.

**Keywords :** MS, corrosion**,** *PPUN, LPR, EIS, SEM, AFM, XPS.*

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# Cyclodextrin-based antibacterial preservative ıncorporating cinnamon leaf oil

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## Abstract

Synthetic preservatives which are used to protect perishable products are considered as one of the main causes of health problems for consumers. There is thus an ever-increasing interest in natural-based preservatives as an alternative to synthetic ones. This research aimed to develop an original and innovative material system combining cinnamon leaf essential oil (CEO) and β-cyclodextrin (βCD) as alternative natural preservation solutions. For this purpose, the inclusion complex (IC) with CEO and βCD was developed with a 1:1 molar ratio by the freeze-drying method. The formation of complex was characterized via methods including SEM, DLS, FTIR, TGA and DSC, each of which provide specific information serving to confirm the intermediate and final product. The analysis evidenced that IC was successfully formulated. In vitro antibacterial activity of CEO/βCD-IC was also tested against pathogenic bacteria, Gram (-) *E. coli* and Gram (+) *S. aureus* and proved the bacteriostatic behavior. The overall outcomes confirmed the positive effect of cyclodextrin and suggest that obtained IC possess great potential for use in various antibacterial purposes as an eco-friendly antibacterial preservative.

**Keywords:** Cyclodextrin, Essential oil, Nanocarrier, Antibacterial, Characterization

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# Ammonium persulfate doped $SiO_2$ anti-fog coating by sol-gel method

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**Abstract**

Anti-fog glass coatings are an important technology that increases the quality of vision by preventing fogging (humidification) on glass surfaces. Anti-fog coatings facilitate the spread of water droplets on the surface, preventing fogging and providing a clear view. These coatings, which are widely used in the automotive, medical, security and eyewear industries, contribute to a more comfortable and safe experience for users in daily life. In this study, a mixture of certain amounts of pure water, VTES, PEG-300 and APS was prepared and mixed in a magnetic stirrer for 12 hours. The prepared coating solution was coated on the flat glass surfaces by spraying method using a spray gun. The coated surfaces were heat treated at 100 degrees for 1 hour. Afterwards, anti-fog performance and functional surface properties were evaluated by FT-IR analysis on the coating solution and hot-fog test, pencil scratch test, light transmittance test on the coated surfaces.

**Keywords:** Sol-gel, Anti-fog coating, Functional surfaces.

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# $AgNO_3$ doped $SiO_2$ antibacterial coating by sol-gel method

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## Abstract

Antibacterial glass coatings are an important technology that prevents the growth of bacteria and microorganisms on the glass surfaces we use in our daily lives. Especially in the food and health sector, when used in intense contact areas such as schools, offices, homes, it increases hygiene and health and reduces the risk of spreading diseases. At the same time, it saves time and resources by reducing the cleaning frequency, and offers a more sterile and safe environment to its users. In this study, a coating solution was prepared by mixing certain amounts of TMSPM silane compound, IPA (isopropanol), distilled water and silver nitrate mixture in a magnetic stirrer for 5 hours. The prepared solution was coated on the flat glass samples by spraying method using a spray gun. Afterwards, the coated samples were heat treated at two different temperatures (100 ºC – 700 ºC). Functional surface properties and antibacterial-antifungal activities were evaluated by performing FT-IR analysis on the coating solution, contact angle, scratch test, color analysis, light transmittance and antibacterial-antifungal tests on the coated surfaces.

**Keywords:** Sol-gel, Antibacterial coating, Functional surfaces.

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# Kanola Yağının Rafinasyon Aşamalarında Nano Boyutdaki Safsızlıkların Belirlenmesi

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Abstract

In this study; In the refining stages of canola oil, which is widely used in the world and in our country, nano-sized impurities of canola oil were investigated at every stage, starting from the crude oil until it turns into refined canola oil, in neutralization, bleaching, winterization and deodorization stages. In this direction, the results are given as scanning electron microscope (SEM) images as pictures and with elemental tables. In this direction, the impurities detected at each stage during the refining process are 20.35-62.47% C, 4.87-44.49% O2, 1.60-3.14% Na, 0.59-5.70% Si, 0.20-3.20% P, 0.56-28.92% Ca, 0.95-2.74% Cl, 0.97-2.70% Mg, 0.94-2.63% Al, 0.24-1.26% K, 0-0.95% Fe and 0-0.77% S elements were determined. As a result of both element analysis and SEM analysis; It has been determined that there may be nano-sized impurities that can be mixed into the oil during the refining process of canola oil and can be contaminated by the machinery and equipment used in the process stage. Further research on this subject is recommended.

**Keywords:** Canola oil, refining, contamination, SEM.
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# Investigation of specific capacitance properties of ZnO nanowires and ZnO nanoparticles

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## Abstract

Due to its outstanding qualities, zinc oxide (ZnO) has a unique place among materials for energy applications. Numerous applications, including dilute magnetic semiconductors (DMS), light-emitting diodes (LED), nanogenerators, sensors, and others are made possible by the large diversity of ZnO morphologies. For this reason, ZnO nanoparticle and ZnO nanowire morphologies were selected to investigate the specific capacitance and storage mechanism in supercapacitor applications. The microwave-assisted hydrothermal method was chosen to produce ZnO nanowires, and a co-precipitation method was used to produce ZnO nanoparticles. For these two production methods, ZnO with a defective structure was also analyzed by using an electron paramagnetic resonance (EPR) device. Results show acceptable specific capacitance of 95 and 77 F/g for nanoparticles and nanowires, respectively.

Keywords : Zinc oxide (ZnO),specific capacitance, nanowires, nanoparticles,EPR.

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# Investıgation the influence of precipitating agent and reaction time on zinc ferrite grain size synthesized by the chemicalco- precipitation method

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## Abstract

Zinc ferrite with the chemical formula ZnFe2O4 is widely used in electrical and electronic industries, magnetic parts and magnetic drug carriers. In recent years, ferrite nanoparticles have received much attention due to the difference in electrical, magnetic and optical properties compared to the bulk state. Among the different synthesis methods of ferrite nanoparticles, chemical co-precipitation method is one of the multi-purpose techniques, which is considered because of its simplicity and productivity, the need for less dangerous materials and processes, and lower synthesis temperature compared to methods such as sol-gel and combustion synthesis. In this research, zinc ferrite was prepared by co-precipitation method and the effect of the parameters of the amount of precipitating agent and reaction time on the particle size was investigated. In order to check the appropriate temperature of water exit, differential scanning calorimeter(DSC) and X-ray diffraction (XRD) have been used to check the formation of the target material. Also particle size of the samples was analyzed by scanning electron microscopy technique(SEM). The obtained results showed that the size of the particles depends on both the precipitating agent and the reaction time. Increasing these factors to an optimal size will reduce the size of the particles.

**Key words:** zinc ferrite, co-precipitation, precipitating agent, reaction time

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# Investigation and evaluation of silk-screen printing quality on different types of glasses

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## Abstract

This study focuses on the application of a stencil containing five different colors (blue, red, yellow, black, white) prepared on the surface of different glass types (flat glass, ultraclear, solar (sandy), solar (prismatic)) by silk-screen printing and heat treatment (tempering) of these glasses. It aims to characterize and compare the prints formed on the glass surfaces. By using four different types of glass, flat glass, ultraclear solar glass (sandy) and solar glass (prismatic) and rough-smooth surface were divided into two and their comparisons were made. The basic steps of the study are as follows: First, the prepared template containing five different colors will be applied to the glass surfaces by silk-screen printing method. Afterwards, the printed glass will be subjected to heat treatment (tempering). The tempering process is done in order to increase the durability and safety of the glass and to ensure that the print is permanent by penetrating the surface. Then, various tests such as color test, light transmittance test and gloss test will be performed. These tests will be performed to evaluate the color accuracy, light transmittance and gloss performance of different glass types. The results obtained can provide valuable information for the development of glass printing techniques and their use in the design of glass surfaces.

**Keywords:** Screen printing, Glass surface, Glass types.

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# Production of dye sensitized solar cell using grafen nanoplatelet doped TiO2

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## Abstract

In this study, nano-sized, multi-layered, graphene nanolayer doped, dye-containing TiO2 thin films were produced on different silane-binding compounds. In the study, the effect of parameters such as the amount of graphene nanolayer (7µ, 18µ, 30µ), TiO2 source and silane type were investigated. Graphene nanolayers were characterized by FT-IR and digital microscope analysis. Characteristic peaks were obtained for GLYMO, ITO, TiO2, TMSPM, ruthenium and 3(APTES) in FTIR analysis. The coating thickness in digital microscope images was in the range of 4.456-23.581 µm. After the coating process, the samples converted into solar cells were measured in UV, dark and light, and their efficiency was determined. FF (Fill Factor) and battery efficiency were examined in solar cell cells analyzed with precision current source (I-V). Then, the findings obtained from dyed and unpainted solar cell cells, which were subjected to digital microscope and UV-Visible analysis, were compared.

Keywords : Solar cell, graphene, Coating, Silanes, Sol-gel

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# Studying the strain rate sensitivity of heterogeneous FCC-BCC high entropy alloy

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## Abstract

Alloys can be subjected to different applied forces which can introduce them at various strain rates. The exposed alloy microstructure can show different mechanical behavior under such circumstances. This research work represents that the introduced work hardening during applied various strain rates can determine the final mechanical behavior in the under studied high entropy alloy (HEA). During plastic deformation, besides the dislocation slip, the transformation induced plasticity (TRIP) mechanism can improve the present mechanical behavior with enhancing strain hardening rate (SHR). Employing various thermomechanical processes for studied TRIP-assisted HEA, the strain rate sensitivity (SRS) highlights the effect of the evolved microstructure during yielding processes. To gain a comprehensive understanding of the mechanical properties, three distinct strain rates are applied during monotonic mechanical tests conducted at room temperature. It has been observed that the TRIP mechanism is consistently present across various annealed conditions and applied strain rates. Notably, the strength and SHR levels exhibit a dependence on the applied strain rate, showcasing diverse trends based on the microstructural characteristics. The obtained results reveal that the yield strength (YS) of the TRIP-assisted HEA remains relatively unchanged when adjusting the strain rate values. However, the ultimate tensile strength (UTS) values show sensitivity to the strain rate, indicating SRS within the alloy system. These conclusions are supported by characterization techniques such as transmission electron microscopy (TEM), X- ray diffraction (XRD), and scanning electron microscopy with electron backscatter diffraction (SEM-EBSD).

**Keywords :** High-entropy alloys, Strain rate, TEM, Transformation induced plasticity (TRIP).

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# Synthesis of plastic biofilm from cellulose of dwarf palm of Algeria

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## Abstract

The substitution of petrochemical plastics with vegetable raw materials renewable energy is a crucial perspective. This substitution is carried out by chemical modification of polysaccharides which are present in large quantities in plants and therefore represent an abundant and biodegradable raw material. Dwarf palm or *Chamaerops humilis* L. belongs to the Commelinids clade, Arecales order, Arecaceae (Palmae) family, Coryphoideae subfamily. It is variously called European fan palm, or Mediterranean dwarf palm. The main objective of this investigation is to investigate the quantitative analysis of the cell wall carbohydrates extracted from the *Chamaerops humilis* L. leaflets. The extraction was carried out by aqueous alkaline solutions to extract the hemicelluloses. The pectins were solubilized by boiling water and by ammonium oxalate. The results showed that the cellulose is predominant fraction 48.94%, followed by hemicelluloses 07.46%. However, pectins represent the lowest fraction 5.31%. New cellulose-based plastic films was synthesized. After extractions, the cellulose was modified by dissolution by a LiCl / DMA solvent system followed by acylation in lauric acid in the presence of DMAP, this step resulted in the formation of a final ester which is obtained after air drying, it represents a plastic film.
As regards the esterification tests, it has been demonstrated that the wall polysaccharides of *Chamaerops humilis* L. could be used as a substrate for the synthesis of plastics after esterification with lauric acid chloride. It would be necessary to revive the work by essentially going through a study of the conditions of esterification.

Keywords : *Chamaerops humilis* L., Plastic biofilm, cell wall polysaccharids, esterification

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# Application of mathematical optimization methods in the calculation of slope stability

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## Abstract

The technique of slope reinforcement using geosynthetics has undergone considerable development in the field of civil engineering, the use of geotextiles has become widespread, thanks to a low manufacturing cost and an easy-to-use method. In this work, we have treated a real case by numerical simulation with the PLAXIS software, reinforced by layers of geotextile by varying their characteristics for several spacings between the layers of this material, we have proposed the application of a mathematical method optimization to determine the optimal solution for this type of soil reinforcement. The results obtained by the modeling allowed us to see the effect of the spacing between the layers of geotextile and the stiffness EA on the variation of the factor of safety, we notice that the factor of safety increases with the increase of the stiffness EA and reduction of spacing, the results are satisfactory and in line with international recommendations.

Keywords : Optimization, Geosynthetic, PLAXIS, Rigidity, Safety factor.
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# Enhanced photo thermoelectric terahertz detector based on graphene integrated with nano grating gates

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## Abstract

We present a high-performance terahertz detector that utilizes the photo thermoelectric effect in graphene. Our approach facilitating a strong interaction of terahertz light and the active graphene layer to enhance terahertz absorption through combination ofthe localized surface plasmon resonance ofa dua! grating gate and the resonant modes of a Fabry-Perot microcavity configuration. Our numerical investigation reveals frequency selectivity within the terahertz absorptance spectrum for incident waves with near-perfect absorptance of graphene. This high absorption creates an amplified thermal gradient across the graphene channel. The detector's absorption can be adjusted by altering the geometrical parameters and extemal gate voltage. Additionally, the integration ofa dua! grating gate to form a pn-junction results in a non-uniform Seebeck coefficient along the channel, which in turu increases the output voltage. At a resonance frequency of 1.5 THz, the detector demonstrates a responsivity of 1.86 V/W operating ata low gate voltage of0.3 V.

**Keywords:** Terahertz, detector, Photo Thermoelectric, Graphene.

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# Investigation on mechanical and biological properties of functionally graded hydroxyapatite/barium titanate-calcium titanate for bone tissue engineering application

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## Abstract

Piezoelectric materials produce electrical energy by applying mechanical stress and vice versa. Natural bone has intrinsically shown piezoelectric behaviour. In order to solve the weaknesses and disadvantages of hydroxyapatite, adding other materials and making composites seems to be a suitable way. on account of the fact that bone naturally has a graded structure, in this research, by making functionally graded samples including seven layers of materials such as hydroxyapatite, barium titanate, and calcium titanate with the variable middle layer, electrical response, mechanical properties, and biological properties were investigated. In order to study the morphological properties and confirm the formation of the functionally graded composite, FESEM images were taken then Line scan and EDS analysis from cross-sectional FESEM images confirmed the formation of a seven-layer graded composite as designed. The 60BT sample, which had the highest amount of barium titanate in the middle layer, showed the lowest concentration of phosphorus and calcium in the SBF solution on the last day of storage and compared to hydroxyapatite without additives, showed a 16% increase in the piezoelectric constant ($g_{33}$). Among the composites, sample 50BT, which had a balanced amount of both barium titanate and calcium titanate, had the highest strength and elastic modulus, and the ultimate strength was 29.8 MPa and the elastic modulus was 65 MPa less than pure hydroxyapatite.

**Keywords :** Bone, Hydroxyapatite, Barium titanate, Calcium titanate, Biocomposite, Functionally graded materials, Mechanical properties, Biological properties, Piezoelectric ceramics.

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# Synthesis Methods of the Fascinating Graphene

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## Abstract

Coal is a local and low-cost, abundant natural resource in the world. Coal is one of the most important energy sources that form the backbone of humanity and social development. Coal is a critical building block of the world energy market, and therefore coal plays a vital role in producing cheap electricity worldwide. Coal-based functional carbon materials and their derivatives are fascinating to scientists and engineers. These include porous carbons, fullerenes, carbon nanotubes, carbon spheres, carbon fibers, graphene, and carbon dots. Graphene, one of these materials, was discovered in 2004 by Andre Geim and Konstantin Novoselov. Later, Andre Geim and Konstantin Novoselov were awarded the 2010 Nobel Prize in Physics by the Royal Swedish Academy of Sciences. He was awarded the highest award in the scientific world for his pioneering work with the world's thinnest material. Graphene is a nanomaterial containing a one-atom-thick planar two-dimensional (2D) layer of C atoms arranged in a honeycomb crystal lattice. Nanomaterials are typically known with nanoscale dimensions between 1 and 100 nm. Materials at the nanoscale have unique physical, mechanical, optical, electronic, and quantum properties compared to their bulk behavior. Hence, graphene has become one of the most exciting topics in materials science and solid-state physics. Various techniques have been developed to produce graphene from coal and other sources, such as mechanical exfoliation, chemical exfoliation, chemical synthesis, pyrolysis, arc discharge, chemical vapor deposition, oxidation and extraction, chemical leaching, chemical oxidation-reduction, thermal treatment or dielectric barrier discharge, and plasma. This paper summarizes the latest developments in graphene synthesis.

Keywords : Carbon, Graphene, Nanomaterials

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# Single-walled carbon nanotubes mediated DNA delivery to squash leaves

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## Abstract

Gene delivery in plants is challenging due to the presence of the plant cell wall. An innovative approach to tackle this hurdle involves utilizing carbon nanotubes (CNTs) as carriers for introducing a 'gene of interest' into plant tissues. In this study, we have successfully demonstrated CNT-mediated gene delivery in *Cucurbita pepo* (squash) leaves, employing a linear DNA vector expressing green fluorescent protein (GFP). To achieve this, we initiated the process by covalently functionalizing carboxylated single-walled CNTs (COOH-SWCNTs) with positively charged polyethyleneimine (PEI). This functionalization allowed PEI to engage in electrostatic interactions with the negatively charged GFP vector. The success of this functionalization was confirmed through various analytical techniques, including thermogravimetric analysis (TGA), Raman spectroscopy, and zeta potential measurements. Next, we introduced PEI-functionalized COOH-SWCNTs into the abaxial interveinal surface of squash leaves at varying concentrations (1.25 ng/ul-10 ng/ul). Interestingly, leaves infiltrated with the lowest concentration of PEI-functionalized COOH-SWCNTs exhibited only slight leaf chlorosis. Subsequently, we combined PEI-functionalized COOH-SWCNTs with the GFP vector in a 1:1 ratio and infiltrated them into squash leaves. GFP gene delivery was confirmed by observing GFP expression using a confocal microscope 96 hours post-infiltration. This breakthrough suggests their potential utility as a gene delivery tool for advancing functional genetics research and potentially treating diseases in squash plants.

**Keywords:** Carbon nanotube, nanocarrier, DNA delivery, Characterization, *Cucurbita pepo*

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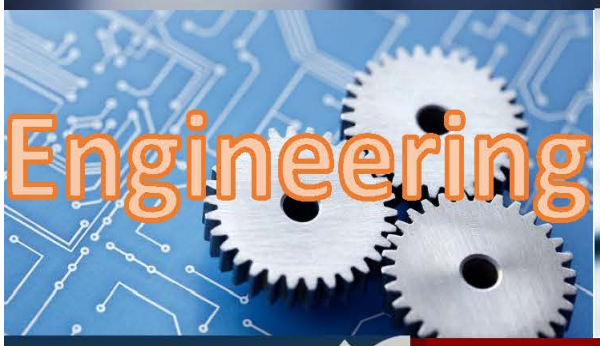




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