İTÜ

İSTANBUL TEKNİK ÜNİVERSİTESİ 1773

250 YIL 1773–2023

METEM
TMMOB METALURJİ VE MALZEME MÜHENDİSLERİ ODASI EĞİTİM MERKEZİ

100 MİLLİ MÜCADELE'NİN YÜZÜNCÜ YILI

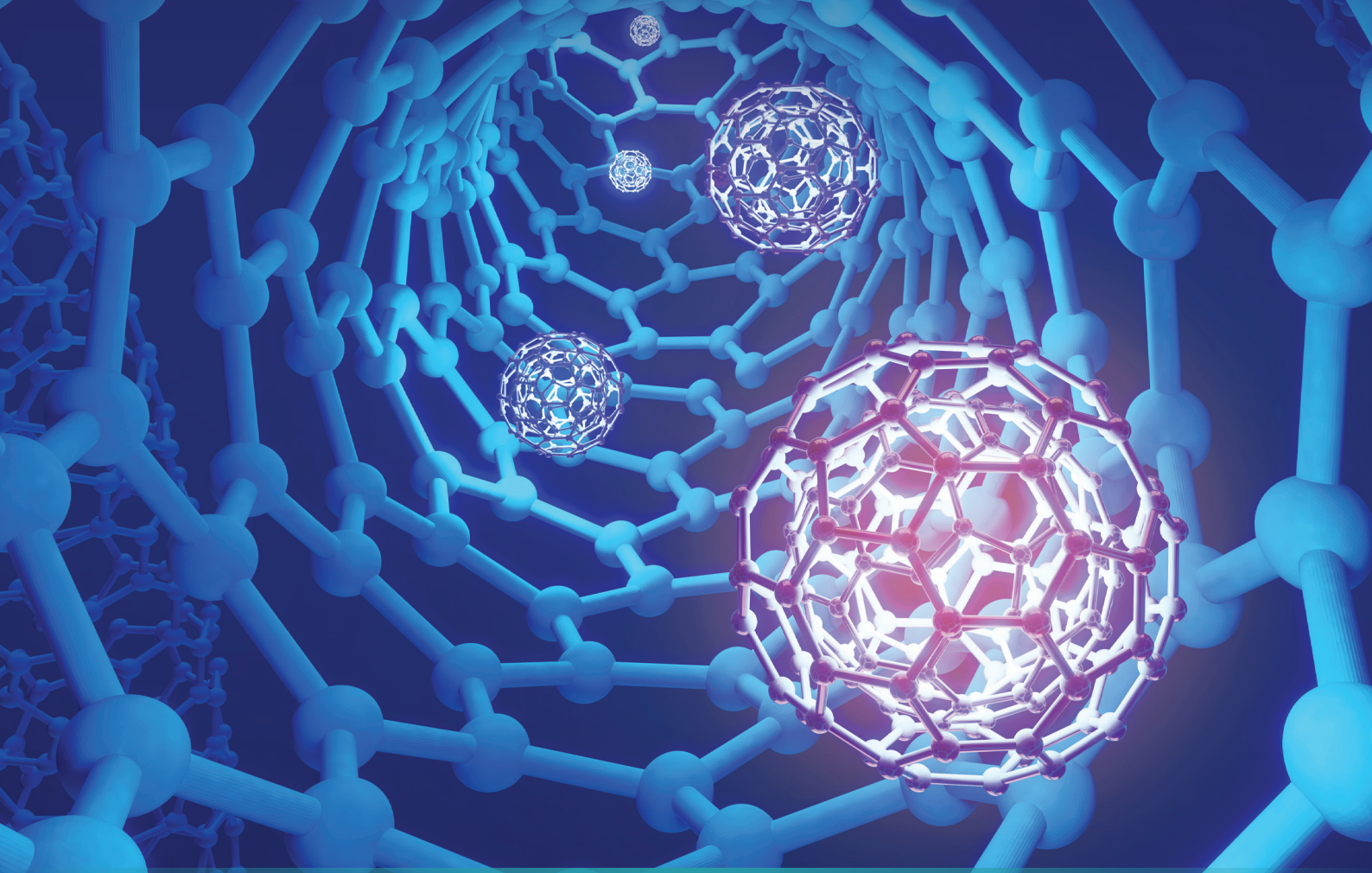
IMTMC
INTERNATIONAL MATERIALS TECHNOLOGIES AND METALLURGY CONFERENCE
OCTOBER 11-13
2023

3rd INTERNATIONAL MATERIALS TECHNOLOGIES AND METALLURGY CONFERENCE-2023

11-13 October 2023

ITU SULEYMAN DEMIREL CONFERENCE CENTER

ISTANBUL - TÜRKİYE



ABSTRACT BOOK

www.imtmc.org

CONTENTS

CONFERENCE CHAIRS

Prof. Dr. Gultekin Goller
Istanbul Technical University

Ipek Akin Karadayi
Assoc. Prof. Dr. Ipek Akin Karadayi
Istanbul Technical University

Baris Yavas
Dr. Baris Yavas
University of Connecticut

EXECUTIVE COMMITTEE

Buket Aksu
Prof. Dr. Buket Aksu
Altinbas University

Sedat Alkoy
Prof. Dr. Sedat Alkoy
Gebze Technical University

Erman Car
Met. Eng. Erman Car
METEM - The Union of Metallurgical and Materials Engineers Training Center

Sibel Daglilar
Prof. Dr. Sibel Daglilar
Yildiz Technical University

Cihangir Duran
Prof. Dr. Cihangir Duran
Yıldırım Beyazit University

Serdar Erol
Met. Eng. Serdar Erol
AVEKS

Hasan Gocmez
Prof. Dr. Hasan Gocmez
Dumlupinar University

Mustafa Guven Gok
Assoc. Prof. Dr. Mustafa Guven Gok
Gaziantep University

Hakan Gur
Prof. Dr. Hakan Gur
Middle East Technical University

Sebahattin Gurmen
Prof. Dr. Sebahattin Gurmen
Istanbul Technical University

Cengiz Kaya
Prof. Dr. Cengiz Kaya
Yildiz Technical University

Figen Kaya
Prof. Dr. Figen Kaya
Yildiz Technical University

Ozgul Keles
Prof. Dr. Ozgul Keles
Istanbul Technical University

Suleyman Can Kurnaz
Prof. Dr. Suleyman Can Kurnaz
Sakarya University

Ozden Ormanci
Asst. Prof. Dr. Ozden Ormanci
Mimar Sinan Fine Art University

Filiz Sahin
Prof. Dr. Filiz Sahin
Istanbul Technical University

Huseyin Savas
Met. Eng. Huseyin Savas
METEM - The Union of Metallurgical and Materials Engineers Training Center

Onuralp Yucel
Prof. Dr. Onuralp Yucel
Istanbul Technical University

CATEGORY:ADDITIVE MANUFACTURING

1050 - CHARACTERIZATION OF PA 12 MATRIX COMPOSITES PRODUCED BY SELECTIVE LASER SINTERING METHOD

Umut Can Cingöz [1], Burçin Özbay Kisasöz [2], Alptekin Kisasöz [1]
Yildiz Technical University, Department Of Metallurgical And Materials Engineering, Istanbul-Turkiye[1] Fatih Sultan Mehmet Vakif University, Aluminium Test Training And Research Center (aluteam), Istanbul-Turkiye[2]

The Selective Laser Sintering (SLS) method is a promising additive manufacturing (AM) technique for the fabrication of thermoplastic polymers and polymer composite materials. Polyamides, PA 12, PA 11, followed by PA 6 are the most widely used matrix materials for SLS AM method. In this study, PA 12 matrix composites were produced with 20% hollow ceramic microsphere reinforcement by SLS method. Prior to fabrication, PA 12 and the ceramic additive were mixed by dry mixing method with a rotary tumbler. Afterwards, thermal analysis (DSC and TGA) was performed to characterize the thermal properties of the powder mixture. The composites were fabricated with various energy values and the influence of the energy values on physical and mechanical properties was investigated. The surface roughness properties were also observed. The mechanical properties of the samples were determined by tensile and impact tests. Also, the fracture surfaces of the studied samples were examined.

CATEGORY:ADVANCED CERAMICS AND COMPOSITES

DIELECTRIC AND ELECTROMECHANICAL PROPERTIES OF TEXTURED $BiScO_3$–$PbTiO_3$ BASED HIGH TEMPERATURE PIEZOCERAMICS

Selva Astan [1], *Erdem Akça* [1], *Cihangir Duran* [2]
1Sivas Cumhuriyet University, Department of Metallurgical and Materials Engineering, 58140, Sivas, Türkiye

2Ankara Yıldırım Beyazıt University, Department of Metallurgical and Materials Engineering, 06010 Keçiören, Ankara, Türkiye

A promising high-temperature piezoelectric ceramics based on the perovskite-structured $2.5Bi(Zn_{0.5}Zr_{0.5})O_3$–$37.5BiScO_3$–$60PbTiO_3$ (BZZ-BS-PT) were crystallographically textured through templated grain growth method. The samples including 1, 3, 5 or 7 vol% $BaTiO_3$ (BT) microplatelets were prepared by the tape casting process and then sintered at 1100°C for 3 h in air. Phase and microstructural analysis showed that the templated growth of <001>-oriented BZZ-BS-PT block-like grains on the aligned BT template particles resulted in highly textured ceramics with ~90% Lotgering factor and >96% theoretical density. Compared to the randomly oriented counterparts, 30% to 70% improvements in the dielectric, ferroelectric and electromechanical responses were achieved due to crystallographic texturing of polycrystalline BZZ-BS-PT ceramics. Furthermore, the temperature-dependent electrical measurements obviously indicated that textured ceramics kept their superior electromechanical performance up to depolarization temperature (~400°C). In brief, textured polycrystalline BZZ-BS-PT ceramics with outstanding electrical properties and thermal stability can be used for various high-temperature applications.

Acknowledgement: This work was supported by the Scientific and Technological Research Council of Türkiye (TÜBİTAK), 3501- Career Development Program. (Project No: 121M682).

1062 - DETERMINATION OF ELECTROCALORIC PROPERTIES OF ND DOPED PNN PZT CERAMICS AND 0 3 PIEZOCOMPOSITES

Ezgi Yalçin [1], Ebru Menşur [1]
Gebze Technical University, Material Science And Engineering, Kocaeli-Turkiye [1]

The electrocaloric effect is a coupling between electrical and thermal properties. It is an electric field induced temperature change in an insulating material. When an electrocaloric material is polarized with an electric field under isothermal conditions, it assumes an ordered structure with a lower entropy. When electrical dipoles return to their disordered state after the external electric field is removed during the adiabatic depolarization, the entropy of the system increases that results in cooling.

In this study, undoped, 0.5, 1.0, 1.5 mol% neodymium doped lead nickel niobate-lead zirconate titanate (0.5PNN-0.5PZT) ceramics were synthesized by solid state reaction method. To fabricate 0-3 piezocomposites, powders were used as the active phase, polyvinylidene fluoride and polyurethane were chosen as the matrix phases. Piezocomposites were obtained by tape casting method. Structural and electrical characterizations of the 0-3 bulk ceramics and piezocomposites were investigated. Electrocaloric response (ΔT) of the materials was determined by indirect measurement method.

1066 - FABRICATION OF FUNCTIONAL POROUS CERAMICS BY GEL CASTING AND ITS APPLICATIONS

Takashi Shirai [1]
Nagoya Insitute Of Technology, Advanced Ceramics Research Center, Nagoya-Japan [1]

Porous ceramics are very widely used in many industrial applications, such as filters, catalyst for chemical industries and automobiles, light weight structural materials, biomaterials and so on. Among various processing technologies to fabricate porous ceramics, gel casting has gained much attention due to easy processing and easy to develop any complicated shape. We have successfully developed several materials with tailored pore structure such as ceramic filter, super-porous construction materials, and electrically conductive ceramics. Controlling the pore shape and size by gelcasting of slurry involving bubbles provides an effective and cheap way in fabricating porous ceramics. Various types of foamed slurries can be in-situ solidified by polymerization of monomer. This process also allows a development of endless recycling system of waste resources to produce ceramic materials with characteristics such as sound absorbance, super lightness, high insulation and easiness in machining.

1069 - (CR V)XCY T MXENE MATERIALS DERIVED FROM (CR V)2ALC MAX PHASES SYNTHESIZED VIA POWDER METALLURGY METHODS

Semih Ates [1], Ilayda Süzer [2], Ahmet Mirza Erol [1], Ahmed Emin Tok [1], Berkay Demircan [1], Hüseyin Kerim Yazici [1], C. Fahir Arisoy [1], M. Lütfi Öveçoğlu [1], Duygu Ağaoğullari [2]
Istanbul Technical University, Metallurgical And Materials Engineering, Pml, Graphene & 2d Materials Laboratory, Istanbul-Turkiye [1] Istanbul Technical University, Metallurgical And Materials Engineering, Pml, Graphene & 2d Materials Laboratory; Atarc, Istanbul-Turkiye [2]

MAX (Mn+1AXn) phases are class of ternary metallic ceramics that exhibit exceptional properties, making them attractive for various applications. However, one of the most important uses of MAX phase is as the starting material for the production of 2D MXene materials that are recently discovered advanced ceramic materials. They are obtained by selectively etching of the A-element layers from MAX phases, leaving behind ultrathin layers of MXene. The most common production method is based on wet chemical methods such as HF etching. These layered materials are pioneer for electronic applications because of high surface areas. In this study, (Cr,V)2AlC precursor was produced by pressureless sintering of mechanically milled pure metallic powder mixtures. Subsequently, MAX phase precursor was subjected to HF etching to obtain (Cr,V)-C based MXenes. Both MAX and MXenes were analyzed with XRD, SEM-EDS methods and micro-hardness measurements. The structure-property-production trilemma was evaluated according to examination of products.

1088 - EFFECT OF ND DOPING ON ELECTRICAL PROPERTIES OF 0.854BNT 0.12BKT 0.026BT PIEZOCERAMICS

Namik Kemal Gozuacik [1], Tugce Kocak [1], Rumeysa Yurttas [1], Sedat Alkoy [1]
Gebze Technical University, Materials Science And Engineering, Kocaeli-Turkiye [1]

Commonly used piezoelectric ceramics contain lead, so they are dangerous for human body and environment. Therefore, the development of environmentally friendly lead-free piezoelectric ceramics has become much more important. In this study, the effects of rare earth element neodymium (Nd) doping on the structural and electrical properties of lead-free bismuth sodium titanate - bismuth potassium titanate - barium titanate (0.854BNT-0.12BKT-0.026BT) ceramics were investigated in detail. Undoped and 0.25, 0.50, 0.75, 1, and 1.25 mol% Nd-doped BNT-BKT-BT ceramic compositions were synthesized using solid-state reaction method. A pure perovskite structure without any secondary phase was observed from the X-ray diffraction (XRD) patterns in all ceramics. Ceramic powders were calcined at 850°C for 2 h, and then the sintering process was carried out at 1150°C for 2 h. As electrical characterization, polarization-electric field (P-E) hysteresis and strain-electric field measurements, temperature and frequency dependent dielectric constant and dielectric loss tangent measurements were carried out.

1090 - LEAD FREE LITHIUM MODIFIED KNN SPHERICAL SHELL TRANSDUCER APPLICATION AND THEIR PROPERTIES

Ayse Berksoy Yavuz [1], Muhammet Boz [2], Sedat Alkoy [2], Ebru Menşur [2]
Istanbul Gedik University, Metallurgical And Materials Engineering, Istanbul-Turkiye [1] Gebze Technical University, Materials Science And Engineering, Kocaeli-Turkiye [2]

(Pb,Zr)TiO3 has been a wide front-runner material for sensor, sonar, and transducer applications since the 1950s. However, the damaging effects of lead-based systems on human and environmental health during sintering have led to the regulation use of these materials. Therefore, it is very considerably to develop alternative lead-free systems that do not affect human health. (K0.5,Na0.5) NbO3 ceramics, among the lead-free systems, is one of the most suitable alternatives due to its high Curie temperature and readily arrangeable piezoelectric response. In the current study, Li modified (K0.48,Na0.48)Li0.04NbO3 (KNLN) composition was investigated to underwater SONARs application. The hemispherical shell-shaped KNLN ceramics were fabricated using a slip-casting method and sintered at 1100ºC for 4 h. The piezoelectric charge coefficient of hemispherical shell ceramics was measured as 115 pC/N. The air admittance was taken between 50 Hz to 600 kHz. The polyurethane was coated on the spherical hydrophones to isolate them from the surroundings

CATEGORY:ARCHEOMETRY

1073 - MINERALOGICAL CHARACTERIZATION OF IRON AGE CERAMIC FRAGMENTS

Özge Boso Hanyali [1], Özden Ormanci [1]
Mimar Sinan Fine Arts University, Department Of Conservation And Restoration Of Cultural Heritage, Istanbul-Turkiye [1]

Ceramic petrography is a study method that can be utilized independently to examine the crucial facets of composition, technology, and provenance of prehistoric ceramics. However, its potential is better realized when petrographic data is combined with additional analytical methods. This study is focused on the minero-petrographic characterization of a group of Iron Age ceramic remains found during the excavations at the Old City, Fortress, and Mound of Van (Turkey), with the aim to reveal the technological level reached by the ancient manufacturers during the Iron Age, by means of optical microscopy and XRD. From the thin sections of the ceramic samples, the mineral and textural characteristics such as the distribution of the grains, optical activity, angularity, porosity, and clay matrix, have been described to identify the use of various clay sources. Mineralogical compositions and approximate firing temperatures were also determined with XRD.

1089 - MINERALOGICAL CHARACTERIZATION OF IRON AGE CERAMIC FRAGMENTS

Özden Ormanci [1], *Memduha Zeynep Atasayar* [1], Özge Boso Hanyali [1]
Mimar Sinan Fine Arts University, Department Of Conservation And Restoration Of Cultural Heritage, Istanbul-Turkiye [1]

Ceramic petrography is a study method that can be utilized independently to examine the crucial facets of composition, technology, and provenance of prehistoric ceramics. However, its potential is better realized when petrographic data is combined with additional analytical methods. This study is focused on the minero-petrographic characterization of a group of Iron Age ceramic remains found during the excavations at the Old City, Fortress, and Mound of Van (Turkey), with the aim to reveal the technological level reached by the ancient manufacturers during the Iron Age, by means of optical microscopy and XRD. From the thin sections of the ceramic samples, the mineral and textural characteristics such as the distribution of the grains, optical activity, angularity, porosity, and clay matrix, have been described to identify the use of various clay sources. Mineralogical compositions and approximate firing temperatures were also determined with XRD.

CATEGORY:BIOMATERIALS, BIOTECHNOLOGY AND DRUG DELIVERY SYSTEMS

1015 - EXPLORING THE POTENTIAL OF ZINC BASED COPPER AND MANGANESE ALLOY AS A NOVEL MATERIAL FOR URETHRAL STENTS

Sercan Basit [1], Yasemin Yilmazer [2], Burak Dikici [3], Elif Damla Arisan [4], Rinat Islamgaliev [5], *Hakan Yilmazer* [6]
Kirşehir Ahi Evran University, Mechanical Engineering, Kirşehir-Turkiye [1] Sabahattin Zaim University, Molecular Biology And Genetics, Istanbul-Turkiye [2] Ataturk University, Metallurgical And Materials Engineering, Erzurum-Russia [3] Gebze Technical University, Institute Of Biotechnology, Kocaeli-Turkiye [4] Ufa State Aviation Technical University, Institute Of Physics Of Advanced Materials, Ufa-Russia [5] Yildiz Technical University, Metallurgical And Materials Engineering, Istanbul-Turkiye [6]

The zinc-based stents can demonstrate desirable mechanical properties, including sufficient flexibility and radial strength to provide structural support. Overall, zinc-based biodegradable ureteral stents hold promise as a viable alternative to traditional non-biodegradable stents. Their biocompatibility, gradual degradation, and sufficient mechanical properties make them a potentially attractive option for temporary ureteral support.

In this study, the effect of Mn addition to Zn-Cu binary alloy was investigated as a potential biodegradable stent material. Microstructural, mechanical and degradation tests were systematically performed in the study.

Cu is one of the three most essential trace elements involved in the regulation of some basic functions in the human body. Likewise Mn is also essential for the proper functioning of many biochemical reactions in the body.

The authors are highly thankful the Scientific and Technological Research Council of Turkey (TUBITAK, grant number: 220N139) and Russia Federation Basic Research (RFBR, grant number: 21-53-46017) for financial support.

1051 - BIOCOMPATIBILITY STUDY OF LAB6 FILMS PRODUCED BY MAGNETRON SPUTTERING

Özden Kisacik [1], Cennet Yildirim [1], Erkan Kaçar [2], Burçe Çirakman [3], Yasemin Pazarçeviren [1], Öykü Irmak Dikkatli [1], Serap Topsoy Kolukisa [1]
Tenmak-boren, Ürün Ve Teknoloji Geliştirme Koordinatörlüğü, Ankara-Turkiye [1] Hakkari Üniversitesi, Malzeme Bilimi Ve Mühendisliği, Hakkari-Turkiye [2] Tenmak-boren, Ar-ge Ve Inovasyon Geliştirme Koordinatörlüğü, Ankara-Turkiye [3]

Lanthanum hexaboride is the most widely studied hexaborides due to their excellent thermionic emissions. However, the study on its biological applications are limited in the literature. On the other hand, La ions have outstanding biological properties so that there is an increasing attention for tissue engineering applications. It provides fast wound healing ability, biocompatibility, strong mechanical properties and anti-inflammatory behavior. Besides, La+3 ions can stabilize the apatite structure and enables appropriate properties for implants. Boron has also anti-bacterial activity. It can decrease the inflammatory effect, and reinforced the apatite on implant materials. This study investigates the biological properties of LaB6 films on Ti substrates produced by magnetron sputtering PVD. Structural and morphological analysis of films were determined by using XRD, FT-IR and FE-SEM. Additionally, biocompatibility, cytotoxicity and antimicrobial properties were also evaluated. The results showed that LaB6 films are also promising material in the field biomedical applications.

1092 - THE INFLUENCE OF THE TEST ENVIRONMENT AND THE COMPOSITION OF MAGNESIUM ALLOYS ON THE DEGRADATION PROCESS

Alina Robu [1], Aurora Antoniac [1], Iulian Antoniac [1], Alexandru Streza [1], Veronica Manescu (paltanea) [2], Iuliana Corneschi [1]
National University Of Science And Technology Politehnica Bucharest, Faculty Of Material Science And Engineering, Bucureşti-Romania [1] National University Of Science And Technology Politehnica Bucharest, Faculty Of Electrical Engineering, Bucharest-Romania [2]

The alloy microstructure and the test environment significantly impact the corrosion behavior of magnesium alloys.The biggest challenge in corrosion assay is the choice of the testing medium to reproduce more closely in vivo conditions1,2.The current study evaluates the influence of the alloy composition and the test environment used (DMEM and SBF media) on the corrosion behavior of different types of magnesium alloys (Mg1Ca alloy, Mg-Zn-Ag ternary system, Mg-3Nd alloys, and Mg-Zn-Mn-Ca alloys).The mass loss and corrosion rate were used to highlight the corrosion behavior.Also, the corrosion behavior was interpreted in correlation with the microstructural features of the experimental magnesium-based alloys revealed by optical microscopy,XRD,SEM coupled with EDX.In vitro research conducted demonstrates the influence of the microstructure of Mg-based alloys and the test media on their corrosion behavior.The results highlighted a better corrosion behavior for the Mg-3Nd and Mg-Zn-Mn-Ca alloys making them suitable as raw materials for manufacturing small trauma implants.

CATEGORY: COATINGS

1026 - INNOVATIONS IN THIN FILM TECHNOLOGIES AND PROPERTIES TO MEET INDUSTRIAL APPLICATION REQUIREMENTS

Hamid Bolvardi [1], Andreas Lümkemann [2], Jan Kluson [3], Daniel Karpinski [2]
Platit Ag, Innovation & Business Development, Selzach-Switzerland [1] Platit Ag, R&d, Selzach-Switzerland [2] Platit A.s., R&d, Sumperk-Czechia [3]

Steady raise of requirements in existing as well as emerging industrial applications has been the drive for continuous incremental and breakthrough innovations in thin film processes and technologies over the last decades. Cutting and forming tools, machinery components, decorative, medical applications are just few raised examples here. A broad range of deposition technologies with numerous coatings and processes have been tailor-made to address the applications in industry. More often than not developments are competing over same targeted application and markets. A successful implication of deposited coatings and desired properties thereof, relies not merely on proper choice of deposition technology and coating material systems but also on many other factors, e.g. process parameters, pre- and post-treatments. An attempt is made here to cover the developments and innovations ranging from deposition technologies to pre- and post-treatments, new material systems and implications of the coating solutions in applications and the performance improvements therefrom.

1033 - A NEW KIND OF PASSIVATION PVD COATING COMBINATION FOR DENTAL DRILLS RESISTANT TO AUTOCLAVE CYCLES AND TEMPERATURE MEASUREMENTS DURING DRILLING

Seda Ataş Bakdemir [1], *Cenk Türküz* [2], Doğuş Özkan [1], Serdar Salman [3]
National Defence University, Turkish Naval Academy, Mechanical Engineering, Istanbul-Turkiye [1]
Titanit Ultrahard Coatings Company, Titanit Ultrahard Coatings Company, Istanbul-Turkiye [2] National Defence University, Rectorship, Istanbul-Turkiye [3]

Successful implant treatment is possible with a dental drill design that is resistant to corrosion and wear. Stainless steel, which is often preferred in dental drills easily composes a chemically passive protective layer. However, experimental investigations report that corrosion resistance can be improved significantly with special passivation applications. Nitric, phosphoric and citric acids are widely used in commercially available stainless steel passivation treatments. In this study, different passivation procedures before PVD coating were applied to modify the surface chemistry of 440M stainless steel to improve its mechanical properties and corrosion resistance. The Tafel method was used to determine the corrosion properties during autoclave cycles. After determining the most effective passivation procedure, the wear properties of the new type of PVD coated dental drills against standard AlTiN coated ones were investigated. Finally, temperature measurements during drilling were made on the bone samples by using passivated and PVD coated dental drills.

1037 - Enhancing surface properties of titanium-based biomaterials through micro-arc oxidation and subsequent hydrothermal treatment

Faiz Muhaffel[1], Dilek Teker Aydoğan[1], Mertcan Kaba[1], Lukasz Maj[2], Hüseyin Çimenoğlu[1]
[1]Metallurgical and Materials Engineering Department, Istanbul Technical University, Maslak 34469, Istanbul, Türkiye ,[2]Institute of Metallurgy and Materials Science, Polish Academy of Sciences, Reymonta 25, 31-409 Krakow, Poland

Titanium and its alloys are widely adopted in the biomedical field for implant applications owing to their favourable mechanical properties and biocompatibility. However, their surface characteristics can be further optimised to enhance osseointegration, which is critical for the success of implants. As part of the present study, titanium samples were first micro-arc oxidised to form an oxide layer on the surface. The samples were subsequently subjected to hydrothermal treatment (HT) in an aqueous medium under controlled temperature and pressure conditions. The surface morphology, elemental composition, and phases were characterised using SEM, EDS, and XRD, respectively. Preliminary results indicate that the MAO process resulted in a porous surface morphology, which was further modified by the HT, leading to a more crystalline microstructure consisting of titanium oxide phases that is beneficial for better biocompatibility of MAO'ed surfaces. These treatments can be combined to develop better implants that integrate better with bone tissue.

1038 - INVESTIGATION OF THE EFFECTS OF COPPER WIRE SURFACE DEFECTS ON THE FINAL PRODUCT QUALITY IN ENAMELLED WIRES

Hakan Çatalkaya [1], *Zeynep Sirel* [1], Murat Öney [2], Mehmet Ali Akoy [2]
Sarkuysan Elektrolitik Bakir San. Ve Tic. A.ş., R&d, Kocaeli-Turkiye [1] -, -, Kocaeli-Turkiye [2]

Enamelled copper wire which are also called magnet wire or winding wire are core wire coated with thin layer of insulation material such as polyurethane, polyamide, polyester. The cross section can be round or rectangular. Insulation materials are in various thermal classes and show different features according to the usage area. These materials are used in electric motors, transformers, generators, electromagnetic equipment or similar areas.

In the production of enamelled wires, surface defects on the copper wire directly affect the smoothness of the enamel coating. In this study, defects in the form of bubbling on the enamelled wire surfaces were examined and the root causes were investigated. Check marks, mechanical damages like scratch and abrasion on copper wire may cause disruption on coated product.

On the enamelled product, problems like pits and bumps can be encountered and may cause of copper exposure which results in undesirable electrical arcing and pinhole.

1065 - INVESTIGATION THE STRUCTURAL EFFECT OF AMINE BASED CHAIN EXTENDERS ON MORPHOLOGY AND MECHANICAL CHARACTERISTICS OF THE POLYURETHANE UREA COATINGS

Irem Elmas Kant [1], Simge Tarkuç [2], Alper Yeşilçubuk [2], Nilgün Kizilcan [3]
Istanbul Technical University, Graduate School Of Science Engineering And Technology, Department Of Polymer Science And Technology, Istanbul-Turkiye [1] Research And Development Center, Arçelik, Department Of Metal And Surface Technologies, Istanbul-Turkiye [2] Istanbul Technical University, Faculty Of Science, Department Of Chemistry, Istanbul-Turkiye [3]

The properties of polyurethanes that used in medical, automotive, home appliances and many other industrial fields, have been varied by changing structure and composition of polyol, diisocyanate, and chain extender. In this study, the structural effect of amine-based chain extenders on the surface morphology and mechanical properties of the polyurethane and polyurea matrices were investigated with polyethylene glycol and isophorone diisocyanate based systems. Two types of chain extender aliphatic (piperazine) and aromatic (p-phenylene diamine) were used to examine the changes on thermo-mechanical properties. Various analytic techniques Fourier transform infrared spectroscopy, thermogravimetric analysis, water contact angle measurements, and scanning electron microscopy with energy-dispersive X-ray analysis have been utilized to evaluate the influence of each chain extender on the properties of the coatings. Adhesion strength, impact resistance and flexural strength were used to investigate the effect of aromatic (p-phenylene diamine) and cyclic aliphatic (piperazine) on the mechanical properties of the coating.

1071 - PRODUCTION OF SIC FOAM INTENDED FOR WIDE BAND RADAR ABSORBING MATERIAL

Cennet Yildirim [1], Muhammet Nasuh Arik [2], Irem Nas [3], Nuri Solak [4]

Tenmak-boron Research Institute / Istanbul Technical University, Metallurgical And Materials Engineering, Ankara-Turkiye [1] Tenmak-boron Research Institute / Yildirim Beyazit University, Metallurgical And Materials Engineering, Ankara-Turkiye [2] Yildirim Beyazit University, Metallurgical And Materials Engineering, Ankara-Turkiye [3] Istanbul Technical University, Metallurgical And Materials Engineering, Istanbul-Turkiye [4]

Melamine foam (MF), with its open-cell structure and high porosity, is a promising candidate for microwave absorption (MWA). Also, the ease of converting MF into carbon foam further enhances its potential. To enhance its MWA properties, SiC coatings are a promising solution due to their electrical conductivity and wideband absorption. The SiC coating acts as a conductive layer, converting MW energy into heat through resistive losses. Thus, necessary MWA properties can be provided with SiC coating. SiC can be coated by a variety of techniques such as CVD and CVI etc.In this study, the SiO gas CVD process (SiOCVD) was presented for SiC coatings/transformations.In this process, SiO(gas) was generated from SiO(s)-SiO(g) reaction. The experimental procedure was conducted under vacuum conditions using an induction heating system with varying temperatures (1250 and 1350 °C) and durations (3 and 6 hours).The composites were characterized using SEM, XRD, XPS, DTA-TG, RAMAN, and FTIR.

1079 - ELECTRODEPOSITION AND CHARACTERISATION OF POLYMER ZINC COMPOSITE COATINGS

Alina Crina Muresan [1], Daniela Laura Buruiana [1], Viorica Ghisman [1]
Dunarea De Jos University Of Galati, Materials And Environmental Engineering, Galati-Romania [1]

Global demand for refined zinc metal will exceed supply in 2023 with the extent of the deficit currently forecast at 45,000 tonnes (International Lead and Zinc Study Group). Composite coatings with polymer dispersed phase (phenol-formaldehyde resin, epoxy resin) increase the corrosion resistance of zinc, increasing its life cycle. The production method is electrodeposition (non-polluting, relatively low costs, cheap raw material) which allows controlling the thickness of the material applied to the support, uniform and decorative appearance. The effect of electrodeposition parameters (type, quantity, and mean diameter size of polymer particles in electrolyte bath; current density; time for electrodeposition and agitation rate) on the morphology and topography of the surfaces was investigated by SEM-EDX and AFM methods. The corrosion behavior of the composite coatings in 0.5 M NaCl solution was evaluated using electrochemical methods. For microbiological corrosion, the effect of sulphate reducing bacteria on the surfaces was evaluated using epifluorescence microscopy.

1083 - INVESTIGATION OF WEAR PERFORMANCE AND MICROSTRUCTURAL PROPERTIES OF NI B SI ALLOY WITH TUNGSTEN CARBIDE POWDER BY COATING WITH PTA METHOD

Ugur Iz [1], Cemal Meran [2]
Polat Makine A.ş., R&d Center, Aydin-Turkiye [1] Pamukkale University, Mechanical Engineering, Denizli-Turkiye [2]

The aim of study is improvement of wear resistance of scroll used decanter centrifuge machines. To achieve this purpose AISI 304 stainless steel specimens which used scroll manufacturing were coated by plasma transferred arc (PTA) method using 80 A, 90 A and 100 A current values under 4 bar N_2 gas cooling system. The coated specimens were applied abrasion test in accordance with ASTM G-65 standard and the average mass losses were determined. SEM, XRD and microhardness measurements were performed on the specimens.

1065 - INVESTIGATION THE STRUCTURAL EFFECT OF AMINE BASED CHAIN EXTENDERS ON MORPHOLOGY AND MECHANICAL CHARACTERISTICS OF THE POLYURETHANE UREA COATINGS

Irem Elmas Kant [1], Simge Tarkuç [2], Alper Yeşilçubuk [2], Nilgün Kizilcan [3]
Istanbul Technical University, Graduate School Of Science Engineering And Technology, Department Of Polymer Science And Technology, Istanbul-Turkiye [1] Research And Development Center, Arçelik, Department Of Metal And Surface Technologies, Istanbul-Turkiye [2] Istanbul Technical University, Faculty Of Science, Department Of Chemistry, Istanbul-Turkiye [3]

The properties of polyurethanes that used in medical, automotive, home appliances and many other industrial fields, have been varied by changing structure and composition of polyol, diisocyanate, and chain extender. In this study, the structural effect of amine-based chain extenders on the surface morphology and mechanical properties of the polyurethane and polyurea matrices were investigated with polyethylene glycol and isophorone diisocyanate based systems. Two types of chain extender aliphatic (piperazine) and aromatic (p-phenylene diamine) were used to examine the changes on thermo-mechanical properties. Various analytic techniques Fourier transform infrared spectroscopy, thermogravimetric analysis, water contact angle measurements, and scanning electron microscopy with energy-dispersive X-ray analysis have been utilized to evaluate the influence of each chain extender on the properties of the coatings. Adhesion strength, impact resistance and flexural strength were used to investigate the effect of aromatic (p-phenylene diamine) and cyclic aliphatic (piperazine) on the mechanical properties of the coating.

1071 - PRODUCTION OF SIC FOAM INTENDED FOR WIDE BAND RADAR ABSORBING MATERIAL

Cennet Yildirim [1], Muhammet Nasuh Arik [2], Irem Nas [3], Nuri Solak [4]
Tenmak-boron Research Institute / Istanbul Technical University, Metallurgical And Materials Engineering, Ankara-Turkiye [1] Tenmak-boron Research Institute / Yildirim Beyazit University, Metallurgical And Materials Engineering, Ankara-Turkiye [2] Yildirim Beyazit University, Metallurgical And Materials Engineering, Ankara-Turkiye [3] Istanbul Technical University, Metallurgical And Materials Engineering, Istanbul-Turkiye [4]

Melamine foam (MF), with its open-cell structure and high porosity, is a promising candidate for microwave absorption (MWA). Also, the ease of converting MF into carbon foam further enhances its potential. To enhance its MWA properties, SiC coatings are a promising solution due to their electrical conductivity and wideband absorption. The SiC coating acts as a conductive layer, converting MW energy into heat through resistive losses. Thus, necessary MWA properties can be provided with SiC coating. SiC can be coated by a variety of techniques such as CVD and CVI etc.In this study, the SiO gas CVD process (SiOCVD) was presented for SiC coatings/transformations.In this process, SiO(gas) was generated from SiO(s)-SiO(g) reaction. The experimental procedure was conducted under vacuum conditions using an induction heating system with varying temperatures (1250 and 1350 °C) and durations (3 and 6 hours).The composites were characterized using SEM, XRD, XPS, DTA-TG, RAMAN, and FTIR.

1079 - ELECTRODEPOSITION AND CHARACTERISATION OF POLYMER ZINC COMPOSITE COATINGS

Alina Crina Muresan [1], Daniela Laura Buruiana [1], Viorica Ghisman [1]
Dunarea De Jos University Of Galati, Materials And Environmental Engineering, Galati-Romania [1]

Global demand for refined zinc metal will exceed supply in 2023 with the extent of the deficit currently forecast at 45,000 tonnes (International Lead and Zinc Study Group). Composite coatings with polymer dispersed phase (phenol-formaldehyde resin, epoxy resin) increase the corrosion resistance of zinc, increasing its life cycle. The production method is electrodeposition (non-polluting, relatively low costs, cheap raw material) which allows controlling the thickness of the material applied to the support, uniform and decorative appearance. The effect of electrodeposition parameters (type, quantity, and mean diameter size of polymer particles in electrolyte bath; current density; time for electrodeposition and agitation rate) on the morphology and topography of the surfaces was investigated by SEM-EDX and AFM methods. The corrosion behavior of the composite coatings in 0.5 M NaCl solution was evaluated using electrochemical methods. For microbiological corrosion, the effect of sulphate reducing bacteria on the surfaces was evaluated using epifluorescence microscopy.

1083 - INVESTIGATION OF WEAR PERFORMANCE AND MICROSTRUCTURAL PROPERTIES OF NI B SI ALLOY WITH TUNGSTEN CARBIDE POWDER BY COATING WITH PTA METHOD

Ugur Iz [1], Cemal Meran [2]
Polat Makine A.ş., R&d Center, Aydin-Turkiye [1] Pamukkale University, Mechanical Engineering, Denizli-Turkiye [2]

The aim of study is improvement of wear resistance of scroll used decanter centrifuge machines. To achieve this purpose AISI 304 stainless steel specimens which used scroll manufacturing were coated by plasma transferred arc (PTA) method using 80 A, 90 A and 100 A current values under 4 bar N_2 gas cooling system. The coated specimens were applied abrasion test in accordance with ASTM G-65 standard and the average mass losses were determined. SEM, XRD and microhardness measurements were performed on the specimens.

CATEGORY: ELECTRONIC, MAGNETIC AND OPTICAL MATERIALS

1043 - SYNTHESIS OF BI0.5NA0.5TIO3 NANOCRYSTALLINE POWDERS BY A SOLUTION COATING METHOD

Volkan Kalem [1], Ilyas Şavkliyildiz [1]
Konya Technical University, Metallurgical And Materials Engineering, Konya-Turkiye [1]

Bismuth sodium titanate (Bi0.5Na0.5TiO3, BNT), a lead-free piezoelectric, is a promising alternative to lead-based systems due to its high piezoelectric strain value. However, initial stoichiometry can be deteriorated during the calcination of BNT powder, prepared by conventional mixed-oxide method. In addition, non-stoichiometric compositions lead to formation of undesired phases (e.g., NaBiTi6O14) which in turn worsen the electrical properties. To overcome these problems, a solution coating method was applied for synthesizing BNT powder. Formation of the undesired pyrochlore phases was prevented by coating the sodium-precursor solution on TiO2 particles. Nanocrystalline BNT powder was obtained by dispersing these particles in a bismuth-precursor solution, followed by calcination at 700 °C. A single-phase perovskite BNT powder with an average particle size of <100 nm was produced successfully using the solution coating method.

* This study was supported financially by The Scientific and Technological Research Council of Turkey (TÜBİTAK) under grant code of 122M028.

1075 - STRUCTURAL AND ELECTRICAL PROPERTIES OF (LA0.7SR0.3)MNO3 BIFEO3 MULTILAYER THIN FILMS PREPARED BY SOL GEL METHOD

Ji-su Yuk [1], Byeong-jun Park [1], Myung-gyu Lee [2], Sam-haeng Lee [2], Joo-seok Park [2], Sung-gap Lee [1]
Gyeongsang National University., Dept. Of Materials Engineering And Convergence Technology, Jinju-Korea, South [1] Korea Institue Of Ceramic Engineering And Technology, Business Support Division, Jinju-Korea, South [2]

In this study, (La0.7Sr0.3)MnO3/BiFeO3 (LSMO/BFO) multilayer films were fabricated using the spin-coating method on Pt/Ti/SiO2/Si substrate with (La0.7Sr0.3)MnO3 and BiFeO3 metal alkoxide solutions. And their structural and electrical properties with variation of the number of coatings were investigated for applications of electronic devices. LSMO precursor solutions were coated on Pt/Ti/SiO2/Si substrate using spin-coating method, dried at 200oC for 5 minutes, and thermally decomposed at 400oC for 10 minutes. After spin-coating the BFO precursor solution on the LSMO layer, drying and heat treatment were performed under the same conditions. This process was repeated 3~6 times to produce LSMO/BFO multilayer thin films. The average thickness of one layer is approximately 70 to 75nm. As the number of LSMO coating layers increased, the dielectric constant showed an increasing trend. And we aim to observe the dielectric constant, dielectric loss, leakage current, I-V properties, resistivity and ferroelectric hysteresis curves of LSMO/BFO multilayer films.

CATEGORY: ENERGY MATERIALS

1017 - DEVELOPMENT AND CHARACTERIZATION OF AL3+ BASED ELECTROCHROMIC STRUCTURES BY MAGNETRON SPUTTERING METHOD

Ali Kemal Mak [1], Öcal Tuna [1], Seniz Türküz [1], Osman Öztürk [2], Mevlüt Karabulut [2]
Şişecam, Vacuum Coating Department, Kocaeli-Turkiye [1] Gebze Technical University, Physics Department, Kocaeli-Turkiye [2]

The aim of this work is to investigate suitability of Al3+ ions as an alternative to Li+ ions which is frequently used in the coloration mechanism of electrochromic (EC) devices. Al3+ and Li+ liquid electrolytes prepared 0.3 M using aluminium perchlorate nonahydrate (Al(ClO4)3.9H2O) and lithium perchlorate (LiClO4) dissolved in propylene carbonate (PC). The WO3 film layers (thickness of 175 nm), a common EC material, were deposited on 1 x 5 cm2 indium tin oxide (ITO) coated glass substrates (thickness and sheet resistance of 150 nm and 15–20 Ω/) by Direct Current Magnetron Sputtering (DCMS) technic. Structural, morphological, optical and EC characterizations of the WO3 films were conducted. Additionally, effect of heat treatment on EC material from room temperature to 450 ºC were also characterized in combination with said liquid electrolytes.

1021 - COBALT FREE CATHODES FOR HIGH PERFORMANCE LITHIUM ION BATTERIES

Gülgün Zehra Şenyurt [1], Mehmet Yilmaz [1], Yiğit Bürümlü [1]
Istanbul Technical University, Metallurgical And Materials Engineering, Ankara-Turkiye [1]

Li-ion batteries are commonly used as energy storage systems and the cathode materials have the most significant impact on the electrochemical properties of the batteries. Cathode materials with cobalt have concerns about its environmental impact, cost and mining conditions. Layered LNMO is one of the mostly researched Co-free cathode material. However, it has low capacity retention and cycle life. In order to improve these properties, doping is considered as optimization strategy and zinc is a promising dopant. Zn2+ doping is expected to improve downsides by reduce cation mixing, increase interlayer spacing.

In this study, zinc doped layered LNMO cathode material was produced using the co-precipitation method. XRD, Galvanostatic Test, SEM, CV and XRF characterizations are applied. According to our preliminary results, both undoped and zinc doped cathode active materials delivers specific capacity above 120 mAh/g.

1022 - THE EFFECT OF DOPANT ELEMENTS ON THE HIGH VOLTAGE LITHIUM RICH CATHODES

Busra Cetin [1], Neslihan Yuca [2], M. Seref Sonmez [1], Emre Guney [3]
Istanbul Technical University, Metallurgical And Materials Engineering, Istanbul-Turkiye [1] Istanbul Technical University, Energy Institute, Istanbul-Turkiye [2] Enwair Energy Technologies Corporation, R&d, Istanbul-Turkiye [3]

Lithium-ion batteries, widely utilized in portable electronic devices and electric vehicles, have revolutionized energy storage technology. The positive electrode, known as the cathode material, is crucial in determining the battery's energy density, capacity, and cycling stability. The high-voltage lithium-rich cathode materials have been considerable attention among all layered cathode materials in recent years due to their high energy density and improved capacity retention for advanced lithium-ion batteries. However, the practical implementation of these materials could be improved by their inherent structural instability and voltage fading during cycling. In this research, the effect of dopant metals on the lithium-rich cathode has been extensively studied to enhance electrochemical performance and stability. The substitution of these dopants has shown promising results in mitigating voltage fading, improving cycling stability, enhancing overall electrochemical performance, and suppressing the irreversible phase transformation and structural degradation associated with lithium-rich cathodes during charge-discharge cycling.

1049 - NANO POROUS HIGH ENTROPY OXIDE ELECTROCATALYST FOR HYDROGEN PRODUCTION

Cagla Ozgur [1], Tuncay Erdil [1], Ersu Lokcu [2], Cigdem Toparli [1]
Middle East Technical University, Metallurgical And Materials Engineering, Ankara-Turkiye [1] Eskisehir Osmangazi University, Metallurgical And Materials Engineering, Eskisehir-Turkiye [2]

Electrochemical water splitting depends on two half-cell reactions, oxygen evolution reaction (OER) and oxygen reduction reaction (ORR), which simultaneously produce oxygen (O2) and hydrogen (H2) gaseous, respectively. However, both OER and ORR have sluggish kinetics. To mitigate the high overpotential of these reactions, state-of-the-art electrocatalysts Pt/C, IrO2, and, RuO2 have been used. Although these catalysts have shown high OER and ORR electrocatalytic activity, they are scarce, expensive and also present poor long term stability. As a result, designing cost-effective and stable bifunctional oxygen electrocatalysts for OER and ORR with superior performance is crucial. Herein, we successfully synthesized of nano-porous high entropy oxide through pore forming aging at low temperatures. Furthermore, we studied the OER and ORR performance of these new class of materials in alkaline media. The results showed that nano-porous high entropy oxides exhibit superior OER and ORR performance than the state-of-the-art oxygen catalysts.

1052 - COATING OF LA0.3CA0.7FE0.7CR0.3 CATHODE LAYERS ON GDC BY ESD

Emre Erğen [1], Tuğçe Özmen Egesoy [1], Sedat Akkurt [1], Can Sindiraç [2]
Izmir Institute Of Technology, Materials Science And Engineering, Izmir-Turkiye [1] Aspilsan Energy, R&d, Istanbul-Turkiye [2]

Electrospray deposition (ESD) is one of methods used for coating ceramics. This method utilizes electrical force to atomize liquids, allowing for the fabrication of coatings with desired compositions. Microstructure of the cathode layer can lead to improved performance in IT-SOFCs. Using cathode materials without cobalt is advantageous due to their lower thermal expansion coefficients, significant long-term chemical stability, and enhanced mechanical stability. There are also humanitarian issues associated with the mining of cobalt. In this study, gadolinium doped ceria (GDC) electrolyte layer was deposited with La0.3Ca0.7Fe0.7Cr0.3 cathode layer. Coral, cracked, and dense structural formations are observed by changing ESD parameters. ESD parameters are determined by using statistical experimental design methods. The coral-like structures have advantages such as larger surface area, easier oxygen transfer and more efficient oxygen reduction reactions (ORR). The results obtained from coatings are analyzed by photography, optical microscopy, scanning electron microscopy and X-ray diffraction.

1057 - AN ELECTROCHEMICAL APPROACH FOR BOROPHENE PRODUCTION

Duygu Kuru[1,], Cihan Kuru[2]*

[1]Bilecik Seyh Edebali University, Faculty of Engineering, Department of Chemical Engineering, 11100, Bilecik, Turkey

[2]Bilecik Seyh Edebali University, Faculty of Engineering, Department of Metallurgy and Materials Engineering, 11100, Bilecik, Turkey

*corresponding author: duygu.gokdai@bilecik.edu.tr

Borophene, 2-dimensional allatrope of boron, is considered as the new wonder material owing to its remarkable mechanical properties, high lithium storage capacity, lightness and metallic conductivity. Large scale production of borophene is critical for practical applications of borophene at inductrial scale. Many work have focused on sonochemical methods to produce free-standing borophene. However, these methods are insufficient to produce single layer borophene, time consuming and have low efficiency. In this work, we developed a novel electrochemical exfoliation method for the production of borophene nanosheets, which could circumvent the disadvantages of the above-mentioned sonochemical methods. The preliminary results regarding the structural and chemical characterization of borophene using atomic force microscopy (AFM), Raman spectroscopy and X-ray photoelectron spectroscopy (XPS) will be presented.

This study was funded by the Scientific and Technological Research Council of Turkey (TUBITAK) ARDEB 1002 Grant No 222M300.

Keywords: borophene, electrochemical exfoliation, scalable

1059 - RICE HUSK DERIVED SILICA ANODES FOR LITHIUM ION BATTERIES

Ipek Tunc [1], Ozgul Keles [1]
Istanbul Technical University, Metallurgical And Materials Engineering, Istanbul-Turkiye [1]

Increased demand in energy storage systems requires the development of sustainable and high-performance materials. Graphite, the main anode active material in commercial lithium ion batteries, finds its place in European Commission's Critical Raw Materials List. Thus, synthesizing anode-active material which is an alternative to graphite from organic or industrial wastes is becoming a focal point in recent studies.

In this study, rice husk-derived silica nanoparticles are investigated for their electrochemical performance to be used as an alternative to graphite anodes. Particles synthesized by NaOH leaching and acid precipitation method are tested for their structure and morphology by X-ray diffraction method and scanning microscopy. Finally, electrochemical characterization is realized by galvanostatic tests, cyclic voltammetry, and electrochemical impedance analysis.

1060 - DISCOVERING THE POTENTIAL OF B4C BN NANOCOMPOSITE POWDERS FOR THE FABRICATION OF NEW GENERATION SUPERCAPACITOR ELECTRODES

Suna Avcioğlu [1], Figen Kaya [1], Cengiz Kaya [1]
Yildiz Technical University, Faculty Of Chemistry And Metallurgy, Department Of Metallurgical And Materials Engineering, 34210, Metallurgical And Materials Engineering, Istanbul-Turkiye [1]

The development of supercapacitors with high energy density, stability, and a wide range of operating potential is an urgent issue. To satisfy the required enhancements on supercapacitor modules, new-generation electrode materials need to be designed.

In this study, B4C-BN nanocomposite powder is proposed as a novel electrode material. Nanocomposite powders were synthesized via cost effective sol-gel technique and processing conditions were optimized to tailor phase ratio, particle size, and morphology. The phase composition of synthesized powders was characterized by XRD. The morphology of the particles was examined by SEM and HR-FESEM techniques. The electrochemical performance of electrodes was investigated by using CV and EIS techniques. The results indicate that particle morphology, size, and the ratio of B4C/BN phases have a considerable impact electrochemical performance of fabricated electrodes.

Acknowledgments: The authors are grateful for the financial support from TUBITAK and YTU under the contract numbers of 122M836 and FBA-2023-5301 respectively

1061 - NON CATALYTIC SOL GEL SYNTHESIS OF NANO MICRO B4C FIBERS AND ITS UTILIZATION IN ELECTRODES FOR SUPERCAPACITORS

Vecihe Elif Imamoğlu [1], Suna Avcioğlu [1], Figen Kaya [1], Byung Chul Kim [2], Gültekin Göller [3], Cengiz Kaya [1]
Yildiz Technical University, Faculty Of Chemistry And Metallurgy, Department Of Metallurgical And Materials Engineering, 34210, Metallurgical And Materials Engineering, Istanbul-Turkiye [1] Sunchon National University, 255, Jungang-ro, Suncheon-si, Jellanamdo 57922, Advanced Components And Materials Engineering, Jellanamdo-Korea, South [2] Istanbul Technical University, 80626 Maslak,, Metallurgical & Materials Engineering, Istanbul-Turkiye [3]

Boron carbide (B4C) takes its place as a strategic material among advanced technology ceramics with its superior properties. Nevertheless, the potential of boron carbide as an electrode material has not been fully revealed yet.

Therefore, it has been shown that boron carbide particles can be synthesized in different morphologies, such as polyhedral-equiaxed, plate, and fibers by the non-catalytic sol-gel method. Phase distribution analysis of the produced powders was examined with XRD, and morphology of powders was examined with HR-SEM. Measuring the suitability of powders as electrode material was carried out with charge-discharge cycles and EIS analysis. As a result of the investigation of the capacitive properties of different morphologies of boron carbide, the suitability of its use as an electrode in supercapacitor applications was emphasized.

Acknowledgments: The authors are grateful for the financial support from TUBITAK and YTU under the contract numbers of 120M651 and FYL-2023-5680, and FBA-2023-5301, respectively

CATEGORY: MATERIALS CHARACTERIZATION AND COMPUTATIONAL MODELING

1011 - NEW INSIGHTS AND UNDERSTANDING OF HYDROGEN EMBRITTLEMENT OF DUPLEX STAINLESS STEEL COMBINED DFT MODELLING AND EXPERIMENTAL STUDY

Cem Örnek [1], Mubashir Mansoor [1], Alfred Larsson [2], Fan Zhang [3], Gary Harlow [4], Robin Kroll [5], Francesco Carlà [6], Hadeel Hussain [6], Bora Derin [1], Dirk Engelberg [5], Jinshan Pan [7], Bilgehan Şeşen [8]
Istanbul Technical University, Metallurgical And Materials Engineering, Istanbul-Turkiye [1] Lund University, Division Of Synchrotron Radiation Research, Lund-Sweden [2] Sussex University, Department Of Engineering And Design, Sussex-United Kingdom [3] University Of Oregon, Materials Science And Applied Mathematics, Eugene-United States [4] University Of Manchester, Department Of Materials, Manchester-United Kingdom [5] Diamond Light Source, Beamline I07, Didcot-United Kingdom [6] Kth Royal Institute Of Technology, Division Of Surface And Corrosion Science, Stockholm-Sweden [7] Max-planck-institut Für Eisenforschung, Department Interface Chemistry And Surface Engineering, Düsseldorf-Germany [8]

We conducted a comprehensive study on hydrogen embrittlement in super duplex stainless steel using slow-strain rate testing, in-situ microstructure imaging, and synchrotron diffraction. Tensile deformation during hydrogen absorption unexpectedly softens both austenite and ferrite phases, reducing the yield point and fracture strain. Hydrogen absorption before testing strengthens the microstructure, but subsequent hydrogen diffusion without energy barriers leads to softening in both phases. Continuous hydrogen absorption destabilizes the microstructure, resulting in hydride formation and embrittlement. DFT modelling shows changes in elastic constants due to hydrogen uptake, causing lattice expansion and reduced ductility. The austenite phase acts as a hydrogen sink, while hydrogen-induced cracks can form in the ferrite phase when trapping is compromised. Real-time measurements are vital for comprehensively understanding and preventing hydrogen embrittlement in duplex stainless steel.

1019 - THE EFFECT OF MN SUBSTITTIONS ON MECHANICAL PROPERTIES OF ALCR2B2 AN COMPUTATIONAL INVESTIGATION

Ahmet Sefa Atalay [1], Bora Derin [2]
Graduate School, Metallurgical And Materials Engineering, Kocaeli-Turkiye [1] Faculty Of Chemical And Metallurgical Engineering, Metallurgical And Materials Engineering, Istanbul-Turkiye [2]

AlCr2B2 draws attention with its superior mechanical properties compared to other ternary transition metal (TM) diboride (AlTM2B2) MAB phases like itself. In this study, the Cr in the AlCr2B2 alloy was reduced at specific rates, and the change in mechanical properties was calculated using first-principles calculations based on density functional theory (DFT) by adding Mn instead of the reduced Cr. Mechanical stability, elastic properties, elastic anisotropy, and, Debye temperature of AlCr(2-x)MnxB2 (x=0-1) alloys were investigated. It has been observed that the new alloys formed by adding Mn as the fourth alloying element instead of Cr, which is reduced at specific rates in the AlCr2B2 alloy, are mechanically stable and the added Mn element causes a decrease in stiffness, hardness, and Debye temperature while causing an increase anisotropy.

1023 - HIGH ENTROPY ALLOYS FOR HIGH TEMPERATURE APPLICATIONS DESIGN PRODUCTION AND CHARACTERIZATION

Cansinem Tüzemen Gündoğan [1], Gültekin Göller [1]
Istanbul Technical University, Metallurgical And Material Engineering, Eskisehir-Turkiye [1]

Although superalloy's evolution has proceeded to fulfill demanding operational conditions such as the invention of single crystal superalloys with refractory alloying elements (Re,Ru etc.), the addition of refractory elements increases the density and cost of the superalloys, also reached their design limit. In this study, competitive 7 different high entropy superalloy (HESA) compositions were developed thermodynamically modeled using the Calculation of phase diagram (CALPHAD) approach in Thermo-Calc Software. HESA-1 and HESA-7 compositions selected and produced by using Vacuum Arc Melting (VAM) and following homogenization and aging heat treatment were applied according to TC-DICTRA and Jmat Pro calculations. The characterization of the prepared and heat-treated samples were done in terms of their microstructural and mechanical properties.

1034 - MICROSTRUCTURAL EVOLUTION DURING HOMOGENIZATION OF AS VAR U720LI

Yiğit Buğa [1], Ali Firat Dinler [1]
Tei Tusas Engine Industries, Material And Process Development, Eskişehir-Turkiye [1]

Highly alloyed wrought nickel-base superalloys need to be homogenized before ingot to billet conversation due to microsegregation caused by casting process. This study focused on homogenization and incipient melting characteristics of as VAR U720Li alloy, which is mainly used for gas turbine hot section components. Degree of homogenization and melted phases are closely characterized by means of optical and scanning electron microscopy. Special attention is given to γ + γ′ eutectic, M3B2, Ni5Zr and η-Ni3Ti phases. Results will allow determining homogenization time and temperature of U720Li VAR ingot

1035 - AN EVALUATION OF TITANIUM FORGING MICROSTRUCTURE FOR AEROSPACE APPLICATIONS

Zeliha Idil Yondu [1], Ramazan Kirgil [1]
Tei, Material & Process Development, Eskişehir-Turkiye [1]

Titanium alloys are commonly preferred in aerospace applications due to their high strength to weight ratio. Since aircraft engines should withstand high temperatures and high stresses, it is important to determine an ideal microstructure which leads to desired mechanical properties. Titanium alloys can be manufactured by additive manufacturing, casting and forging methods. Due to low porosity, homogenously distributed finer grains and higher mechanical properties, titanium forgings are commonly used especially in aerospace engines. This study evaluates the effect of primary alpha and alpha beta phases in titanium microstructure on creep, tensile and dwell fatigue resistance. Mechanical tests and microstructural examinations have been performed to evaluate the direct relation between the microstructure and the mechanical properties of titanium forgings. Also, the effect of microstructure on ultrasonic examination which is a significant non-destructive testing method for forging evaluations in aerospace industry, has been examined with ultrasonic examination trials with different microstructures.

1036 - ELECTROCHEMICAL CORROSION PROPERTIES OF BISMUTH DOPPED AZ91D

Eray Abakay [1], Suleyman Can Kurnaz [1]
Metallurgical And Materials Engineering, Sakarya University, Sakarya-Turkiye [1]

AZ91D alloy has better corrosion properties, castability and good mechanical properties than pure magnesium. The addition of Bismuth as an alloying element enhances the mechanical properties of the AZ91D alloy. In this study, the electrochemical corrosion properties of AZ91D alloy containing different amounts of Bi (0.5, 1.0 and 2.0 wt%) were investigated for 0.1 M aqueous NaCl medium. Scanning electron microscopy (SEM) investigations showed that the addition of Bi caused grain refinement. The open circuit potential (OCP) stabilized at 0.5 and 1.0 wt% in about 150 seconds. According to potentiodynamic polarization studies, the corrosion potential of -1.50 V for AZ91D shifted positively with Bi doping and became -1.34 V for 1.0 wt% Bi. According to electrochemical impedance spectroscopy (EIS) studies, the corrosion mechanism of Bi-doped AZ91D alloys is charge-controlled. According to the results, Bismuth also slightly improves the corrosion resistance of the AZ91D alloy.

1046 - A COMPARISON OF STATIC AND FATIGUE PERFORMANCE OF HIGH STRENGTH BOLTS DEPENDING ON HEAT TREATMENT PROCESS

Doğuş Zeren [1], Burak Hizli [2], Sarper Doğan [2], M. Burak Toparli [2], Umut Ince [2]
Norm Civata San. Ve Tic. A.ş., Additive Manufacturing, Izmir-Turkiye [1] Norm Civata San. Ve Tic. A.ş, Research & Development, Izmir-Turkiye [2]

Fastening products such as high strength bolts are the crucial assembly parts for automotive industry. In the recent years, environmentally sustainable regulations have led to increasing demand for high-strength bolts in the industry to reduce the vehicle weight by lessening the number of bolts used in the assembly line. In this study, the static and fatigue properties of the high-strength bolts which were subjected to post heat treatment combined with varying tempering temperatures and times were investigated to achieve better durability and higher mechanical properties with desirable ductility. Obtained properties in terms of microstructural, mechanical and fatigue were evaluated. According to the results, it is observed that better mechanical properties up to 13.6% and 11.6% for yield strength and tensile strength, but deterioration in elongation around 47.4% compared to 12.9 grade. Additionally, bolts having higher static strength exhibited significantly lower fatigue performance considering the life cycles acquired from 12.9 grade.

1064 - A STUDY OF MICROSTRUCTURE EVOLUTION DURING HEAT TREATMENT OF BEARING STEELS USING COMPUTATIONAL MATERIALS ENGINEERING

Berke Erk [1], Ersoy Erişir [2], Burak Barutçuoğlu [1], Onur Öztürk [1]
Onatus Vision Technologies, R&d, Kocaeli-Turkiye [1] Kocaeli University, Metallurgical And Materials Engineering, Kocaeli-Turkiye [2]

Numerous parts in the transportation, railroad, energy, and aerospace sectors are made of bearing steel. The microstructure of bearing steel grades like DIN EN 100Cr6 (SAE 52100) is mostly made up of spheroidal carbides in a hard martensite matrix. It is common knowledge that mass percentage, composition, size, shape, and distribution of non-metallic inclusions significantly affect the rolling contact fatigue (RCF) life of bearing steel. The final microstructures of the bearing steels are obtained by homogenization, austenitization, and tempering heat treatments after production. This work determined tempering process parameters of 100Cr6 bearing steel after partial austenitization by making calculations with Computational Materials Engineering technologies. Different heat treatment parameters were applied to samples to investigate the dissolution and precipitation of secondary carbides. The carbide size and volume ratio change were determined by designing the optimal heat treatment parameters using the Computational Materials Engineering approach.

1078 - EFFECT OF IMMERSION TIME ON CORROSION BEHAVIOUR OF S235JR STEEL IN 3.5% NACL AND DRINK WATER

Daniela Laura Buruiana [1], Alina Crina Muresan [1], Viorica Ghisman [1], Nicoleta Lucica Bogatu [1]
Dunarea De Jos University Of Galati, Materials And Environmental Engineering, Galati-Romania [1]

S235JR steel is a very common carbon steel used in many applications. Some advantages of structural steel include good mechanical resistance and low cost comparing with other types of materials, but a big inconvenient is tendency to corrode which limits their applications. Samples of S235JR steel was tested at immersion time, after 2 weeks, 4 weeks, 8 weeks, and 12 weeks of exposure to corrosive mediums (3.5% NaCl and drink water). It was used ex-situ characterization such as SEM-EDX, roughness and microhardness analyses. The corrosion behaviour was evaluated using gravimetrical and electrochemical methods (open circuit potential, polarisation resistance, corrosion rate) by immersing samples in corrosive environments. The corrosive solutions were evaluated before and after corrosion tests using FTIR method and a multiparameter analyser (pH, conductivity, total dissolved solids, salinity) to evaluate corrosion products from tested solutions and to establish the chemical reactions between tested material and corrosive solutions.

1084 - PRODUCTION OF FUNCTIONALLY GRADED PANELS BY THE ADDITIVE MANUFACTURING METHOD AND INVESTIGATION OF THEIR ACOUSTIC BEHAVIOR

Nihal Yumak [1], Tayyip Can Bahadir [1]
Afyon Kocatepe Üniversitesi, Makine Mühendisliği, Afyon-Turkiye [1]

In this study, functionally graded panels with varying hole sizes with porous structures on the sound outlet way were manufactured for sound insulation by additive manufacturing methods. The sound absorption coefficients of the materials produced were determined by the impedance tube. In the samples produced, the porous structures were produced in the gyroid type at 30% and 60% filling rates. As a result of the tests, the sample with a 30% filling rate has the best acoustic performance. The samples with a 60% filling rate showed lower acoustic performance compared to the sample with a 30% filling rate. In the 3 non-porous structures produced, the sample with 50% diameter reduction showed the best acoustic performance in the non-porous structure. From this result, it is seen that porous structures, filling rate, and diameter geometry are the three main factors affecting acoustic performance in the study.

1085 - MANUFACTURING OF FUNCTIONALLY GRADED POROUS MATERIALS BY THE ADDITIVE MANUFACTURING METHOD AND INVESTIGATION OF COMPRESSIVE STRENGTH

Nihal Yumak [1], Burak Karaboğa [1]
Afyon Kocatepe Üniversitesi, Makine Mühendisliği, Afyon-Turkiye [1]

Functionally graded porous materials (FDGM) containing one or more infill geometries were designed to improve the compressive properties of porous materials. The materials were produced by the fused deposition method and the effect of functional grading on the compressive strength of the materials was investigated by applying compression tests. For the FDGM design, 4 types of infill geometry were determined trihexagonal, octet, gyroid, and concentric. By combining different filling ratios and geometries, a total of 16 FDGMs and 4 control samples with uniform pore distribution were produced. In the samples with uniform pore distribution, the highest compressive strength was obtained in the sample with the trihexagonal pore type, while the compressive strength increased in all samples graded according to the fill rate. In the samples where two and three different pore geometries coexist, the errors that occur at the junction of the pores with each other decreased the compressive strength.

CATEGORY: METALLURGY

1003 - IMPROVING DEEP DRAWING CAPABILITY WITH HEAT TREATMENT PARAMETERS IN EN AW 1050 ALLOY

Özlem Kirmizi [1], Selçuk Erkul [2], Ayberk Uzer [3], Muhammet Uludağ [4]
Pms Metal Profil Aluminyum San. Ve Tic. A.ş, Ar-ge, Bursa-Turkiye [1] Pms Metal Profil Aluminyum San. Ve Tic. A.ş, Kalite Ve Ar-ge, Bursa-Turkiye [2] Ulucon Arge Ve Danişmanlik Hizmetleri Anonim Şirketi, Metalurji, Bursa-Turkiye [3] Bursa Teknik Üniversitesi, Metalurji Ve Malzeme Mühendisliği Bölümü, Bursa Teknik Üniversitesi Metalurji Ve Malzeme Mühendisliği Bölümü, Bursa-Turkiye [4]

1050 aluminum alloys, due to their deformation capability, are used in the production of deep-drawable materials and as heat shields in the automotive industry. The deep-drawing ability is directly related to thermomechanical processes. The deep-drawing process is carried out through homogenization annealing. However, homogenization annealing is a high-temperature and long-duration application. Therefore, in this study, changes were made to the heat treatment parameters instead of the homogenization annealing step, aiming to ensure that deep-drawn products meet the necessary mechanical properties and can be produced without defects such as earing, wrinkling, and tearing. Three different temperature and duration experiments were conducted on deep-drawn products at 400°C, 425°C, and 450°C for 3, 6, and 9 hours, respectively. Tensile testing, hardness testing, chemical analysis, microstructure analysis, and Erichsen deep-drawing tests were performed on the obtained samples. By comparing the results, the optimum temperature and duration values were determined.

1006 - THE EFFECT OF CALCINATION ON CERIUM DISSOLUTION FOR ESKISEHIR BASTNASITE ORES

Çisem Çelik Kurtulan [1], Şevki Samet Kaplan [1], Elif Güloğlu [2], Gökhan Orhan [2], Sebahattin Gürmen [1], Mehmet Şeref Sönmes [1]
Istanbul Technical University, Metallurgical And Materials Engineering, Istanbul-Turkiye [1] Istanbul Universtiy - Cerrahpaşa, Metallurgical And Materials Engineering, Istanbul-Turkiye [2]

This work aims to determine the characterization of the ore and the optimal calcination conditions, which are the first two steps in the solvometallurgical extraction of rare earth elements (REEs) from bastnaesite ore, one of the most important riches of our country, located in the Eskişehir region, using a more environmentally friendly method compared to the existing methods. In the first step of ore characterization, sieve analysis was applied to determine at which particle size range the concentration of bastnazite ore increases. As the second step, the optimal calcination conditions of the ore were determined.

1007 - INVESTIGATION OF COMPATIBILITY OF AL 6016 SERIES SHEETS WITH DP800 SERIES SHEETS BY CMT METHOD

Cihan Yakupoğlu [1], Ufuk Öztürk [2], Faruk Varol [3], Ibrahim Acar [4]
Ak-pres Otomotiv A.ş, Ar-ge, Sakarya-Turkiye [1] Ak-pres Otomotiv A.ş, Kaynak Üretim, Sakarya-Turkiye [2] Sakarya Uygulamali Bilimler Üniversitesi, Makine Ve Kaynak Teknolojileri Bölümü Öğretim Üyesi, Sakarya-Turkiye [3] Sakarya Uygulamali Bilimler Üniversitesi, Metalurji Ve Malzeme Mühendisliği Bölümü, Sakarya-Turkiye [4]

In this study, 1 mm thick DP800 (Double Phase) steel plates used in the production of automotive body and chassis parts and 2 mm thick Al 6016 series sheets were combined with galvanized surfaces. These connections were made using the cold metal transfer (CMT) method of gas arc welding. The applied welding position is determined as the overlap. This application was carried out in a fully automatic robotic system using 1 mm diameter aluminum-based ER4043(AlSi5) filler wire. After joining processes with cold metal transfer (CMT) method, tensile strength (MPa), bending test, hardness values (HV), macro and micro tests in the joint areas were examined.

1010 - LINKING THEORY AND PRACTICE A COMPREHENSIVE STUDY OF NATURAL CONVECTION COOLING IN HORIZONTAL HOT COILS

Merve Öper [1], Cansu Şimşir [2], Yasin Akbaş [2], Saygin Kaçar [1], Ali Gözay [3], Ilhan Yilmaz [3]
Kadir Has University, School Of Graduate Studies, Istanbul-Turkiye [1] Bursa Technical University, Institute Of Graduate Education, Bursa-Turkiye [2] Borçelik, Borçelik, Bursa-Turkiye [3]

This research addresses the challenge of accurately predicting the cooling duration of steel coils post-heat treatment, a critical factor for efficient planning, time management, and storage space allocation in steel production. The temperature of the coils, post-cold rolling, oscillates between 90-150^{0}C, cooling naturally in a horizontal orientation. These coils need to reach below a threshold temperature for processing in the electrolytic cleaning line, which takes between 0.5 and 2 days. The study introduces a time-dependent thermal model, employing the finite element method, to estimate this cooling duration. Measurements from steel coils at the production facility validated the model. A weather forecast model, built using the random forest algorithm, was also integrated into the Management Execution System (MES) alongside the cooling duration model. This integrated system provides a more nuanced understanding of the cooling process and its relation to ambient temperature, enhancing the production facility's efficiency.

1039 - EFFECT OF CRYOGENIC HEAT TREATMENT ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF CUAL14FEMN2CO ALUMINUM BRONZE

Ümit Kaplan [1], *Volkan Karakurt* [1], Talip Çitrak [2], Orçun Ziğindere [1], Feriha Birol [1]
Sağlam Metal San. Ve Tic. A.ş., R&d, Kocaeli-Turkiye [1] Sağlam Metal San. Ve Tic. A.ş.sağlam Metal San. Ve Tic. A.ş., R&d, Kocaeli-Turkiye [2]

Nowadays, aluminum bronzes are used in the automotive and aerospace industries, as well as in plastic injection and spinning molds, due to their high strength and low weight ratio, as well as their good corrosion and fatigue resistance. The objective of this study is to investigate the effects of cryogenic treatment on the properties of CuAl14FeMn2Co aluminum bronze. For this purpose, CuAl14FeMn2Co aluminum bronze was subjected to cryogenic treatment after hot forging. The microstructure of the forged and cryogenically treated materials was examined by optical microscope (OM) and scanning electron microscopy-energy distribution spectroscopy (SEM-EDS). The amounts of phases precipitated in the materials and the chemical compositions of the phases were determined. The tensile strength and hardness changes of forged and forged + cryogenically treated materials were evaluated. It was found that the microstructure, tensile strength and hardness values changed as a result of the cryogenic treatment.

1040 - EFFECT OF TEMPERING HEAT TREATMENT ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF NICKEL ALUMINUM BRONZE

Yağmur Laleci [1], Uğur Kuruoğlu [1], Pelin Sezer [1], Recep Çalin [2]
Akdaş Döküm Sanayi Ve Ticaret A.Ş., R&d, Ankara-Turkiye [1] Kirikkale Üniversitesi, Metallurgical And Materials Engineering, Kirikkale-Turkiye [2]

This study used the sand mold casting method to produce CuAl10Fe5Ni5-GS (CC333G) nickel bronze alloy (NAB) parts. Samples were casted as test blocks and added to the mold for heat treatment and post-heat treatment, metallography, mechanical tests. These specimens were heat treated at 950 °C for 1 hour, followed by tempering at 600 °C and 650 °C and then quenched. In the study, spectrometry analyses were performed to determine the chemical composition of the alloy. Metallographic characterization and mechanical properties of the as-cast and tempering heat-treated specimens, tensile, hardness, and notch-impact tests were investigated. When the samples after casting and heat treatment were compared after the specified tests, it was observed that there was an increase in hardness and yield values after tempering, but a decrease in the energy absorbed in the impact test and percentage elongation values. Optimum tempering for NAB alloy was determined 2 hours at 600 °C.

1042 - DUPLEX STAINLESS STEEL (DSS) REDUCING THE INTERMETALLIC PHASES

Pelin Sezer [1], Uğur Kuruoğlu [1], Yağmur Laleci [1], Semra Kurama [2]
Akdaş Döküm A.ş., R&d, Ankara-Turkiye [1] Eskişehir Teknik Üniversitesi, Department Of Materials Science And Engineering, Eskişehir-Turkiye [2]

Duplex stainless steels are preferred in specific applications like offshore and marine industry due to their high corrosion resistance and mechanical properties compared to ferritic and austenitic steels by utilizing both austenite and ferrite phases. However, intermetallic phases such as alpha phase, sigma phase (σ), Chi phase (χ), G phase, R phase, and carbides may precipitate that during production can cause problems by decreasing the mechanical properties and make material extremely brittle. This reduces the service life of the part and causes unwanted failures. In this study, it is aimed to determine the most suitable condition for the reduction inter-metallic phases, and effect on the mechanical properties cast CD4MCuN and 1.4468 grade duplex stainless steel, and investigated of austenite/ferrite ratio on impact, tensile and hardness with the help of the heat treatment. In order to obtain almost 50% austenite and ferrite balance, solution heat treatment temperatures was applied at 1050-1150ºC.

1074 - THE LUXMET STORY FROM RESEARCH TO INDUSTRIAL APPLICATIONS HELPING THE STEEL INDUSTRY IN THE GREEN TRANSITION

Mikko Jokinen [1]
Luxmet Oy, Management, Oulu-Finland [1]

An Electric Arc Furnace (EAF) is a very energy-intensive process and before Luxmet's ArcSpec system there hasn't been a way to dynamically control the process reliably in real- time. We have seen a huge need for a new solution that could help operators to see what happens in the EAF process and support the decision-making in process control. Better control leads to significantly improved energy efficiency and capacity of the process. These benefits can only be achieved with real-time control of the process. As the steel industry moves towards fossil free production technology, it is even more crucial to have as much real-time information as possible from electric arc, ladle, and reheating furnaces. OES is a versatile measurement technology that can significantly help the steel industry in the ongoing green transition.

1082 - PROBLEMS OF PROCESSING IRON CONTAINING WASTES OF METALLURGICAL PRODUCTION

Marzhan Mukhametkhan [1], Yerlan Mukhametkhan [1], Anar Rakhmetova [1], Gulnara Zhabalova [1]
Karaganda Industrial University, Metallurgy And Materials Science, Temirtau-Kazakhstan [1]

Iron-containing wastes of metallurgical production are dusts and sludges of gas cleaning plants of sintering, blast-furnace, steel-smelting production, as well as oil and moisture-containing scale of rolling shops and iron-containing shavings of machine-building enterprises. Currently, there are technical solutions that make it possible to utilize gas cleaning dust and sludge in some volumes, mainly in the production of sinter or briquettes in the production of pellets with various binders, in particular using peat. The experience of industrial application of these methods has shown that in the mass of the charge, iron-containing wastes do not exceed 1.2%, and in dust and sludge the oil content should not exceed 1.5% (the usual oil content is more than 5%, and moisture - 9%).

CATEGORY: NANOMATERIALS

1030 - DESING OF FLY ASH BASED NANOCOMPOSITES FOR IMPROVEMENT THERMAL ENERGY STORAGE CAPACITY OF THE NITRATE SALTS

Elif Nida Göksu [1]

Tobb University Of Economics And Technology, Micro And Nanotechnology Engineering, Çankaya-Turkiye [1]

In Concentrated solar power plants, the development of fluids with high performance and low cost that can be used as both thermal energy storage (TES) fluids and heat transfer agents (HTA) is crucial. Choosing suitable HTS and TES materials can provide thermodynamic efficiency while minimizing the costs of heat storage tanks solar energy receivers, and heat transfer devices. When molten nitrate salts are used alone for HTA and TES agent, their thermal properties is low, limiting the storage time. Also, they can freeze in cold weather conditions and darkness, causing pipes to clog. Therefore, forming nanocomposites by mixing with a material with high thermal conductivity, such as fly ash, contributes to improving the thermodynamic properties of molten salts. In this study, the aim is to design cheap nanostructures with effective thermodynamic properties. The structural and thermal properties of fly ash- potassium nitrate mixtures were experimentally investigated.

1031 - ELECTROSPINNING OF ZEOLITE ZSM 5 REINFORCED PVA GELATIN NANOFIBERS FOR MAINS WATER PURIFICATION

Mücahid Özcan [1]
Adiyaman University, Mechanical Engineering, Adiyaman-Turkiye [1]

Water shortages and access to clean water are becoming more and more difficult because of the global economy, population growth, climate change, and rise in environmental pollution. Polymer membranes are extensively utilized in the treatment of potable water owing to their characteristics, which include efficient water purification and user-friendliness. The present investigation incorporated micro-nano zeolite particles into a blend of PVA and Gelatine polymers, followed by the production of nanofibers through the electrospinning technique. Zeolite is utilized due to its ability to eliminate organic substances from water through hydrophobic structures, which is made possible by molecules possessing a high Si/Al ratio. The sample surface's topography and composition were analyzed through SEM analysis, while the FT-IR Spectrum Device was utilized to identify organic compounds and obtain information about the functional groups present in the molecule. Additionally, TG/DTA analysis was conducted to determine the material's thermal and gravimetric changes as temperature increased.

1068 - TUNING THE PROPERTIES OF NANO MATERIALS BY LATTICE STRAIN CAUSE AND EFFECTS

Mert Saraçoğlu [1], Mubashir Mansoor [1], Servet Timur [1]
Istanbul Technical University, Department Of Metallurgical And Materials Engineering, Istanbul-Turkiye [1]

Physical and mechanical properties of nanomaterials depend on the macro-scale phenomena, such as morphology, and size. Therefore, fine-tuning the physical and mechanical properties of nanomaterials in accordance with an application area is of utmost interest. The changes in properties of nanomaterials, compared to their bulk counterparts, are primarily explained based on the quantum confinement and particle size. However, through density functional theory (DFT) calculations, and experimental references, we will demonstrate that the nano-size effects arise from atomic-scale strains. The source of this strain are surface relaxations, defects, core-shell and morphologic factors. Herein this work, main sources of lattice strain and strain induced changes in properties are investigated for a variety of nanomaterials such as Fe3O4 and Pt, through DFT. In other words, we demonstrate the possibility to explain size-effects through changes in local electron localization that stems from lattice strains that are inevitable in nanomaterials.

1086 - NANOPARTICLE ENHANCED MACHINABILITY OF NATURAL FIBER REINFORCED COMPOSITES EFFECT OF TOOL DIAMETER AND PROCESS PARAMETERS

Emine Feyza Sukur [1], *Cagin Bolat* [1]
Samsun University, Mechanical Engineering, Samsun-Turkiye [1]

The growing interest in sustainable and environmentally friendly materials has led to the exploration of natural fibers as reinforcements in composites, offering an alternative to traditional synthetic fibers. Basalt fibers, due to their improved properties and sustainability, have gained prominence as a viable replacement in various engineering applications. The purpose of this study is to investigate the effects of ceramic-based nanoparticles on delamination and thrust force during the drilling of natural fiber-reinforced composites (NFRP), with a particular focus on basalt fibers. SiO2-reinforced specimens drilled with an 8 mm tool exhibited the highest average thrust force, whereas the lowest average force was recorded for nanoclay reinforced specimens drilled with a 12 mm tool. Experimental results indicate that using small-sized tools and incorporating nano-SiO2 particles can improve the hole quality during dry drilling of NFRP. This study sheds light on the relationship between nanoparticle reinforcement, feed rate, tool diameter, and thrust force.

1097 - METALLIC NANOPARTICLES SUSTAINABLE APPROACH FOR ENVIRONMENTAL AND BIOMEDICAL APPLICATIONS

Simona Cavalu [1]
University Of Oradea, Faculty Of Medicine, Oradea-Romania [1]

Algae, plants, bacteria and fungus have been employed to produce energy-efficient, low-cost and nontoxic metallic nanoparticles. Despite the environmental advantages of using green chemistry-based biological synthesis over traditional methods, there are some unresolved issues such as particle size and shape consistency, reproducibility of the synthesis process and understanding of the mechanisms involved in producing metallic nanoparticles via biological entities. Bio-synthesized Ag, Au and ZnO NPs have received great attention in recent years for their potential to combat infectious diseases by closing the gaps in current antimicrobial formulation techniques, eradicating drug resistant microorganisms. Recently, we reported the remediation of methylene blue dye from wastewater by using ZnONPs loaded on nanoclay, the efficiency of removal varied from 90 to 97%. We have also developed FeONPs as an efficient nanocatalyst for heavy metal adsorption and water treatment, via the chemical route, offering better potential in comparison to other strategies for environmental applications.

CATEGORY: POWDER METALLURGY

1016 - ACTIVATED CARBON OBTAINED IN DYNAMIC SYSTEM FROM AGRICULTURAL PRODUCT WASTES IN SAKARYA REGION

Mürüvet Hazel Uysal [1], Derya Akbulut [1], Ali Osman Kurt [1], Hüseyin Altundağ [1], Zeynep Ilhan [1]
Sakarya University, Metallurgy And Matarial Engineering, Sakarya-Turkiye [1]

Huge amount of agricultural product wastes, such as pumpkin shell, hazelnut wastes are being disposed in an accumulating heaps or burning in randomly selected places every year causing serious health and environmental issues. Pumpkin shell is usually thrown directly into the garbage and left to rot in piles. However, the wastes of pumpkin shell and hazelnut shell and hazelnut husk, which have a very high carbon content, can be disposed of harmlessly by composting or converted into an effective product such as biochar and activated carbon (AC). This is the aim of current study, which numerous test were carried out in synthesising biochar and AC in the atmosphere controlled dynamic system/rotary kiln. Product characterizations were carried out by SEM-EDS, FTIR and BET analysis. For high porosity and yield, 1 hour at 500 °C was sufficient for biochar and 2 hours at 700 °C for activated carbon production, respectively.

1020 - PRODUCTION OF ACTIVATED CARBON VIA PYROLYSIS OF OLIVE SEEDS USING CO2 GAS

Derya Akbulut [1], Mürüvet Hazel Uysal [1], Ali Osman Osman [1], Öznur Oğuz [1]
Sakarya Universty, Metallurgical And Materials Engineering, Sakarya-Turkiye [1]

Safe disposal of industrial agricultural wastes has always been an important problem. One of the most common problems is that they are left to rot by being stored around carelessly. Olive seeds, which are industrial agricultural wastes, are incinerated instead of accumulating. However, after this study, it was revealed that this esteemed raw material can be easily converted into a much more valuable product, i.e., activated carbon (AC), with a number of simple processing processes. ACs with very high specific surface areas (above 1300 m2/g)with pore sizes of the in the micro/nano range were obtained using different temperatures, raw materials` grain sizes and using different inert atmospheres (N2 and/or CO2) in a static furnace or a rotary kiln. BET, SEM, XRD, and FTIR analyses of the products formed by both methods were compared. The findings have shown that products equivalent to commercial ACs can be produced under popper test conditions.

1029 - FINITE ELEMENT MODELING OF THE SPARK PLASMA SINTERING PROCESS OF ALUMINA

Mustafa Guven Gok [1]
Gaziantep University, Metallurgical And Materials Engineering, Gaziantep-Turkiye [1]

In the production process by using the spark plasma sintering (SPS), the inability to clearly read the temperature of the material and inhomogeneous temperature distributions are the most important problems of this process. These problems cause heterogeneous density and mechanical properties in the produced material. Therefore, it is important to be able to predict the temperature differences and distributions that will occur on the material and moulds during SPS. In the study, the SPS process of alumina was modelled using the finite element method. Thus, the heat flux, current and temperature distributions in the graphite moulds and alumina were determined. The temperature difference between the innermost surface of the die hole where the temperature was read and the center point of the alumina was around 3.15%. In addition, it was understood that this difference was 10.55% between the outermost surface of the mould and the center point of the alumina.

1044 - MECHANICAL ACTIVATION ASSISTED SYNTHESIS AND CHARACTERIZATION OF CR2ALC MAX PHASE

Berk Şenyurt [1], Nazli Akçamli Kaya [2], Duygu Ağaoğullari [3]
Bursa Teknik Üniversitesi-istanbul Technical University, Metallurgical And Materials Engineering, Bursa-Turkiye [1] Bursa Teknik Üniversitesi, Metallurgical And Materials Engineering, Bursa-Turkiye [2] Istanbul Teknik Üniversitesi, Metallurgical And Materials Engineering, Istanbul-Turkiye [3]

MAX phases defines the ternary layered-ceramic materials with Mn+1AXn formula where M is a transition metal, A is IIIA or IVA group element and X is C or N. MAX phases have properties of metal and ceramic materials that combine low density, high strength with high thermal conductivity, good fatigue strength and thermal shock resistance. In this study, Cr2AlC MAX Phase was synthesized via mechanical activation-assisted sintering process. Elemental powders of Cr, Al and C were utilized in two different stoichiometric ratios. Powder blends (prepared by mixing for 2h) were mechanically activated via high-energy ball milling for different durations (1,3,5h) and activated powders were pressed uniaxially under 600 MPa pressure. Green bodies were annealed under 1100,1300,1500oC to obtain single Cr2AlC phase. Structural and phase analysis of synthesized phases were carried out via XRD, SEM and TEM analysis. Also, microhardness and compression tests were applied to determine some mechanical properties.

CATEGORY: RECYCLING AND SUSTAINABILITY

1012 - DEVELOPMENT OF FLEXIBLE WATERPROOFING MORTAR FROM GEOPOLYMER

Meltem Ipekçi Terzioğlu [1], Halil Bircan [2], Ece Ünlü Pinar [3], Filiz Çinar Şahin [4]
Istanbul Technical University - Kalekim Chemicals Co. Inc., Metallurgical And Materials Engineering, R&d - Applied Research, Istanbul-Turkiye [1] Kalekim Chemicals Co. Inc., R&d - Product Development, Istanbul-Turkiye [2] Kalekim Chemicals Co. Inc., R&d, Istanbul-Turkiye [3] Istanbul Technical University, Metallurgical And Materials Engineering, Istanbul-Turkiye [4]

Since the production and application of cement are not environmentally sustainable, geopolymers can be a green alternative utilized in building chemicals. In this study, Ordinary Portland Cement (OPC) in the formula of a two-component mortar was tried to decrease by replacing geopolymer. Firstly, different formulas of geopolymers were cured at ambient conditions by using different ratios of fly ash/blast furnace slag, a fixed concentration of NaOH solution, a fixed weight ratio of Na2SiO3/NaOH, and different ratios of solid/liquid. The geopolymerization yields were monitored by XRD and FTIR. According to the yields, three geopolymers were chosen. After the application, the performance tests such as crack bridging (EN1062-7 and EN 14891), determination of liquid water permeability (EN 1062-3), and measurement of bond strength by pull-off tests (EN 1542) were performed. According to the results compared to the reference mortar, the sample having geopolymer J3 as 75% of OPC has the optimum properties.

1055 - THE PYROREFINING OF WAELZ OXIDE IN ROTARY KILN

Bilge Turanli [1], Burcu Bağlama [1], Mustafa Doğukan Türedi [1], Batu Evren [1], Hasan Güney [1], Selçuk Kan [1], Kağan Benzeşik [1], Onuralp Yücel [1]
Istanbul Technical University, Metallurgical And Materials Engineer, Istanbul-Turkiye [1]

It is known that iron and steel production in Turkey and the wastes generated during production reach high amounts. The recovery of precious metals in these production wastes has become of high importance. Waelz Process was chosen among the zinc recovery methods from EAF dust, with the aim of consuming less energy than the primary production methods, reducing the amount of waste, not requiring the use of reserves, and aiming to reduce the global warming potential and the amount of emissions. In this study waelz oxide that contains 58.63 wt. % Zn was calcined in a rotary kiln at 900, 1000 and 1100 °C for 2 hours. Samples were taken at different intervals and characterized by chemical analysis and XRD. Impurities such as Cl and Pb are reduced to 0.05 and 0.83 wt. % from 8.27 and 4.69 wt. % respectively. Zn content was enriched to 74.83 wt. %.

1056 - PCAM PRODUCTION FROM SPENT LITHIUM BATTERIES

Hayri Atalay Kul [1], Mahmut Karadaş [1], Berk Gülörten [1], Adem Yilmaz [1], Fatma Yavuz [1], Fatmagül Akçakoca [1]
Proses Makina, R&d And Production, Istanbul-Turkiye [1]

As Proses Makina, it is aimed to produce cathode active material directly in order to reduce investment costs, reduce operational costs and reduce the prices of the metals produced. In this study, especially NMC type batteries were preferred. According to our ongoing and completed studies it has been found that after mechanical and chemical processes production of cathode active material in two steps is possible. If the classical method is chosen instead of the direct production method, the number of production steps increases to five. For this reason, investment costs and operational costs increase.

1058 - THE PRODUCTION OF FUSED ALUMINA BY EAF USING ALUMINUM DROSS AS RAW MATERIAL

Necdet Oğuz Yanar [1], Ahmet Mete Arce [1], Mustafa Burak Yamaner [1], Burak Hiz [1], Hasan Güney [1], Selçuk Kan [1], Kağan Benzeşik [1], Onuralp Yücel [1]
Istanbul Technical University, Metallurgical And Materials Engineer, Istanbul-Turkiye [1]

In this study, the non-metallic part of the white dross was used to produce fused alumina by direct smelting or refining using an electric arc furnace (EAF). The calcination process applied to the non-metallic part of the white dross in the rotary kiln contributed to the increase of the alumina content of the raw material up to 86%. After the smelting, it was observed that the alumina content in the fused alumina samples increased to 90-95%. Density values were calculated by Archimedes' principle. Hardness test were applied and the results show that hardness and density increase with the increasing Alumina content. The products were analyzed by XRF and XRD. The data obtained as a result of this study showed that the produced products can be produced by pyrometallurgical methods from non-metallic waste (NMR), which is defined as a waste material, a product similar to Brown fused alumina in international standards.

1070 - OPTIMIZATION OF THE PARAMETERS USED DURING CITRIC ACID LEACHING OF METALLIC VALUES IN NMC CATHODE ACTIVE MATERIALS BY RESPONSE SURFACE

Selin Şahin [1], Oğulcan Güngör [1], Elif Güloğlu [1], Mert Zorağa [1], Gökhan Orhan [1]
Istanbul University-cerrahpaşa, Metallurgical And Materials Engineering, Istanbul-Turkiye [1]

In this study, the leaching process of NMC cathode active materials was investigated by using citric acid as a green leaching agent together with hydrogen peroxide to increase the reduction potential and enhance leaching kinetics. To optimize the leaching process parameters, such as the citric acid concentration, the hydrogen peroxide concentration, temperature, and time, Response Surface Methodology (RSM) was used. The independent variables were constructed at 5 levels, and the relationship between them was examined in 24 experiments out of 28 experiments conducted. The results showed that the parabolic effect of H2O2 concentration was significant with the model. Furthermore, the leaching efficiency decreased significantly when the hydrogen peroxide was not used, indicating that H2O2 was essential in the leaching process. The NMC cathode active powder and leached solution were analysed using X-ray Diffraction (XRD) and Inductively Coupled Plasma (ICP), respectively.

1072 - THE OPTIMIZATION OF THE WORKING PARAMETERS OF BIPOLAR MEMBRANE ELECTRODIALYSIS SYSTEM FOR ACID AND BASE SOLUTION PRODUCTION

Dilan Er [1], *Simge Tarkuç* [2]
Istanbul Technical University, Materials Science And Engineering Department, Istanbul-Turkiye [1]
Arçelik Co., Metal&surface Tehcnology, Istanbul-Turkiye [2]

Electrodialysis (ED) is a unique process used for several applications, including acid-base production, desalination, water purification, etc. Electrodialysis separates the ions/molecules and forces them to move in the desired direction via ion exchange membranes (IEM) under an applied electrical field. The state-of-the-art technology of the ED is the bipolar membrane electrodialysis (BPMED) since its high ion production by catalytically splitting the water into H+ and OH-. Also, BPMED is considered an emerging technology for sustainability-centered processes in the industry. Specifically, the production of acid-base from the salt solution via BPMED provides a highly efficient process in terms of energy consumption, resource usage, and waste management. In this study, we aimed to optimize the BPMED system for acid-base production from the concentrated salt solution. The solutions' applied potential, initial concentrations, flow rates, and system configuration are investigated to observe their effect on the system's conversion efficiency.

1077 - RECYCLING WASTE STEEL SLAG TO IMPROVE THE SOIL ACIDITY

Viorica Ghisman [1], Daniela Laura Buruiana [1], Alina Crina Muresan [1], Georgiana Ghisman [1], Elena Roxana Axente [2]
Dunarea De Jos University Of Galati, Materials And Environmental Engineering, Galati-Romania [1]
Dunarea De Jos University Of Galati, Faculty Of Medicine And Pharmacy, Galati-Romania [2]

Nowadays, the major problems in the steel industry today is the production of large amounts of waste. One of the priorities of the EU's HORIZON 2020 program consists in recovery and recycling of waste from the metallurgical industry (the goal of "zero waste"). Increasing the utilization of slag in different fields of application represents an imperative way for a sustainable development. The agricultural land resources are an issue worldwide and we showed that the waste slag dumped in landfill can help remediation of the soil acidity and increasing the crop yield. The chemical, structural and morphological properties of three investigated different slag samples are evaluated for recycling in agriculture. The obtained mixture presents a balance between soil pH = 5.2 corresponding to a medium acid soil and slag pH=12.5 which corresponds as strongly basic character which is beneficial in amelioration process of acidic soils for the improving of soil characteristics.

CATEGORY: SINTERING AND ADVANCED SINTERING

1047 - SINTERING AND DENSIFICATION BEHAVIOR OF NANOPARTICLE INFILTRATED ALUMINA SCAFFOLDS

Metin Özbekler [1], Sedat Akkurt [2]
Izmir Institue Of Technology, Materials Science And Engineering, Izmir-Turkiye [1] Izmir Institute Of Technology, Materials Science And Engineering, Izmir-Turkiye [2]

The aim of this study is to densify and sinter Alumina scaffolds at lower temperatures by infiltration technique. In this direction, CT3000 LS SG Alumina powder is turned into pellets with a uniaxial press at 200 MPa pressure and bisque fired at 1100oC with a soaking time of 1 hour. Bisque firing creates 40-50% pores in the alumina pellet and these pores become host to the infiltration solution to be prepared. Multiple infiltration and drying cycles were intended to fill the pores with nanoparticles, due to high surface area these nanoparticles are expected to react at lower temperatures than the sintering temperatures. Sintering and densification behavior of samples were continuously monitored with a horizontal dilatometer. Then, the temperature-dependent densification rate curves and relative density curves were examined. As a result, the densities of infiltrated Alumina scaffolds increased.

CATEGORY: SPECIAL TOPICS

1063 - FOOTPRINT OF THE CANNON CASTING INDUSTRY USULÜ'S SIYAGA

Hakan Koçak [1], Ömer Faruk Arslan [2], Orçun Ziğindere [3]
Sağlam Metal San. Ve Tic. A.ş., Management, Kocaeli-Turkiye [1] Sağlam Metal San. Ve Tic. A.ş., Culture And Arts Programs, Kocaeli-Turkiye [2] Sağlam Metal San. Ve Tic. A.ş.sağlam Metal San. Ve Tic. A.ş., R&d, Kocaeli-Turkiye [3]

Despite the importance of cannons in Ottoman history, there is no source book about the production of cannons. However, importance of cannon technology in Ottoman history was enormous. The first comprehensive Turkish work, the subject of which is cannon casting, is Usulü's Siyaga, written by Hoca İshak Efendi. However, on this copy, which is in the collection of the Military Museum, there is the seal of Hasköy Mühendishane-i Berri Hümayun dated 1851 and the signature of Abdülmecid. Between 1830 and 1836, Hoca İshak Efendi was the main teacher of Mühendishane-i Berri Hümayun, which is the foundation of ITU today. The book Usulü's Siyaga is defined as a textbook translated from various sources. As this is one of the first translated publications presenting the basics of metallurgical education, the presentation of this book and its contents will provide important information about the historical development of metallurgical materials engineering in our country.

1087 - THE PLACE OF NONDESTRUCTIVE EVALUATION IN THE MANUFACTURING CHAINS MODIFIED UNDER THE EFFECT OF INDUSTRY 4.0 AND 5.0

C. Hakan Gür [1]
Middle East Technical University, Metallurgical & Materials Engineering, Ankara-Turkiye [1]

Industry 4.0 and 5.0 force manufacturers to adopt new technologies to increase productivity and efficiency by considering smart factories, robotics, computer-based systems, big data, artificial intelligence, machine learning, etc. Non-destructive evaluation (NDE) methods, that sense the variations of the physical characteristics, have been used for detecting surface and internal flaws, determining microstructure, mechanical properties, and residual stress, and also, short-term assessment and long-term monitoring to prevent failures. Process/product improvement and quality control can benefit from innovative developments in NDE and their integration with artificial intelligence and machine learning. Integration of NDE into production lines will provide a fast/reliable data collection and analysis tool for verifying the accuracy and performance of the processes and products. Moreover, hybrid technologies combining several NDE methods may provide critical data about variations in product and process, and thus, remarkably contribute to digitally optimized process chains.

CATEGORY: TRADITIONAL, CLAY-BASED CERAMICS

1048 - DOPING SILVER TO ALUMINOSILICATE INORGANIC COMPOUNDS BY ION EXCHANGE

Ferhat Kara [1], Ilknur Kara [2], *Betül Aydemir* [3]
Eskişehir Technical Univercity, Material Science And Enginnering, Eskişehir-Turkiye [1] Anadolu University, Educational Science, Eskişehir-Turkiye [2] Eskişehir Technical University, Material Science And Engineering, Eskişehir-Turkiye [3]

In this thesis study, 5% and 10% silver were added to the geopolymers synthesized in suitable compositions by ion exchange, by replacing sodium. It is aimed to convert silver ions into silver nanoparticles in the geopolymer matrix. By adding carbon to the silver-doped geopolymers at different temperatures and at anti-oxidation ratios, calcination processes were applied in a reductive environment and ideal conditions were investigated. The obtained powder was applied to ceramic coating materials and gained antibacterial properties. XRD was used for the mineralogical examination of the prepared powders, XRF was used to calculate the amount of silver obtained in calcination studies, and Scanning Electron Microscopy for morphological analysis. Antibacterial tests were carried out on the synthesized silver added geopolymers after application and firing on the glaze surface.

PLATINUM SPONSORS

ERDEMİR

İÇDAŞ
İÇDAŞ ÇELİK ENERJİ TERSANE VE ULAŞIM SANAYİ A.Ş

TETRA 30 yıl
TEKNOLOJİK SİSTEMLER
www.tetratek.com.tr

GOLD SPONSORS

arges LASER SYSTEM

ATOMİKA TEKNİK

AVEKS

inteKno

metacore

SILVER SPONSORS

ATLANTIS WATER PARKS & POOL SYSTEMS

bilginoğlu tam, doğru, hassas endüstri

ESASÇELİK

GAMA COMPOSITE ENGINEERING & PRODUCTS

ionbond IHI GROUP

niche glass

ONATUS öngörü teknolojileri

SP MÜHENDİSLİK LTD. ŞTİ.

TEI TUSAŞ MOTOR SANAYİİ A.Ş. TUSAŞ ENGINE INDUSTRIES, INC.

TİTANİT ULTRA SERT KAPLAMALAR

İTÜ İSTANBUL TEKNİK ÜNİVERSİTESİ 1773

250 YIL 1773–2023

METEM
TMMOB METALURJİ VE MALZEME MÜHENDİSLERİ ODASI EĞİTİM MERKEZİ

100 MİLLİ MÜCADELE'NİN YÜZÜNCÜ YILI

3rd INTERNATIONAL MATERIALS TECHNOLOGIES AND METALLURGY CONFERENCE-2023

11-13 October 2023

ITU SULEYMAN DEMIREL CONFERENCE CENTER
ISTANBUL - TÜRKİYE

CONFERENCE OFFICE

DEKON
CONGRESS & TOURISM

Maslak Büyükdere St., U.S.O. Center Plaza No: 245
34453 Sariyer Istanbul - TURKEY
Phone : +90 212 347 63 00
E-mail : secretariat@imtmc.org
Web : www.dekongroup.com