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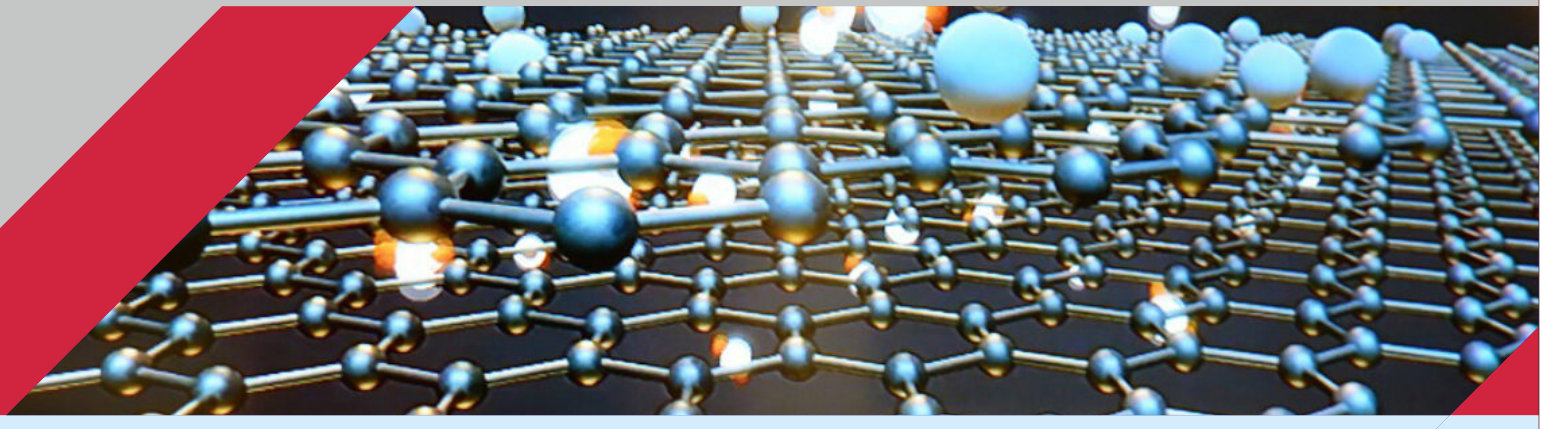

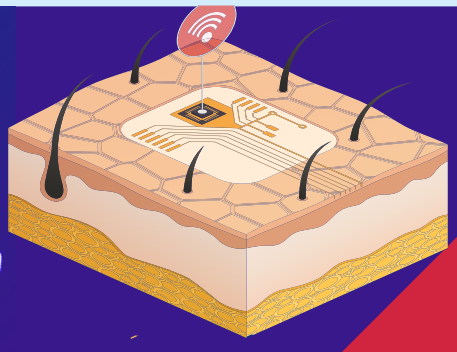

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PREFACE

As organizing this event of ICMATSE in 2022, we are excited and proud to have a magnificent scientific program, publish the main developments in the field in the form of 38 keynote/invited talks, a distinguished of 12 session presentations with recent advances. This book presents the abstracts of material science focused on advanced materials and nanotechnology having in energy conversion and storage and LED lighting, optoelectronics, biomedical, agricultural and food and mechanical and thermal applications as well as commercialization issues. A committee discussed and determined the conference topics that constituted of renowned representatives of academia from Turkey, several European and Asian countries and the USA.

Our world-renowned and top-ranked sponsors enriched our conference by opening exhibitions. They deserve all the thanks.

The academician organizers of the conference, from Gazi University, Iskenderun Technical University, other Universities from Turkey, in collaboration with experts and academician from the University of Illinois at Urbana-Champaign/USA are planning to publish a printed proceedings version after the conference, as well. This will be prepared depends on presenting and selected papers for journals. Papers that are not presented or registered will not be included in the proceedings book. Latest news will be announced by the conference website.

Our world-renowned and top-ranked sponsors enriched our conference by opening exhibitions. They deserve all the thanks.

Due to the COVID - 19 outbreak, one – on - one contact events were carried out through online platforms at ICMATSE 2020. Although we missed the face – to - face activities and there was a distance between them for public health, virtual meetings were considered to be used. The virtual meeting took place between 2 –4 October 2020. Remote/virtual presentations sessions were allowed for live interaction. But, now ICMATSE 2022 was held as hybrid format. The longing for face-to-face conferences is evident from the participation of a large number of audiences. We are proud to be able to achieve this.

See you at ICMATSE 2024; Wishing you a healthy and successful life. All this has been possible thanks to your participation, to our sponsors' support, and to our colleagues' involvement. We would like to thank to keynote/invited speakers, participants and all sponsors.

Hakan ATES (Prof. Dr) **Ersin BAHCECI (Assoc. Prof. Dr)**

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Green Deal and Sustainable Development

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Abstract. Green chemistry is the studies to reduce or eliminate the negative effects of chemicals or chemical processes on the environment, people and other living things. Green chemistry is a multidisciplinary movement to find a solution to existing and emerging problems. Recently, the Green Deal Agreement ruled out that; Prevention or reduction of the pollution, Recycling the materials, using alternative resources and preventing the release of wastes to the environment must be full filled by the signing countries. In this presentation, how to apply green chemistry rules and green deal agreement with a spotlight on environmental benefits to carry out a sustainable development especially in the field of polymer industry [1].

Keywords: Green chemistry, Green deal, Sustainable development, Polymers

Major environmental problems of the planet may be as following: Increasing carbon dioxide ratio in the atmosphere, Melting glaciers, Rising sea level, Increasing forest fires, Decreasing size of the lakes, Long arid periods, Drought in rivers, Increasing temperatures in winter season, Early spring, Erosion, Destruction of rainforests, Spreading diseases such as bird flu and swine fever all over the world, The disappearance of amphibians and the increase of ticks, Increasing temperatures at high geographic latitudes, Differentiation of living areas [2].

The impact of synthetic polymers and functional materials on human life is profound. Polymers are among the most important mass-produced materials on the earth. Polymers are mainly produced from petrochemicals. To ensure the sustainable synthesis of polymers, production of functional materials as alternative sources, feedstocks and routes are necessary. These routes are gathered in 12 Green Chemistry Rules. Namely: 1. Prevent Vaste, 2. Design Safer Chemicals, 3. Reduce Hazardous Chemicals, 4. Use Renewable Feedstock, 5. Use Catalysts, 6. Avoid Chemical Derivatives and Byproducts, 7. Apply Atom Economy, 8. Use Safer Solvents and Reagents, 9. Increase Energy Efficiency, 10. Design Chemicals and Products to Degrade After Use, 11. Analyze in real time to Prevent Pollution, 12. Minimize the Potential for Accidents [3].

According to the definition of The United Nations Commission on Environment and Development in 1987; ‘‘The sustainable development can be defined as providing for human needs without compromising the ability of future generations to meet their needs.”

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Peper id : 4

Atomically-Flat Colloidal Semiconductor Nanocrystals: From Synthesis To Application

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Abstract. Colloidal semiconductor nanocrystals (NCs) have become a highly promising materials for various applications ranging from optoelectronics to biology. Here, I will present the recent class of semiconductor NCs: colloidal quantum wells. These atomically-flat nanocrystals enable to access unique optoelectronic characteristics with their quasi-two-dimensional structure, resembling epitaxially-grown quantum wells. They exhibit narrower emission linewidth, larger absorption cross-section, giant oscillator strength, and suppressed Auger recombination as compared to spherically shaped NCs. Firstly, I will discuss the advanced heterostructures of colloidal quantum wells obtained by designing their three-dimensional structure, tuning their composition and engineering their band alignment. Secondly, I will focus on the specially designed core/shell heterostructures of colloidal quantum wells for the fabrication of highly efficient light-emitting devices.

Keywords: semiconductor nanocrystals, optoelectronics, colloidal synthesis, quantum wells

Two-dimensional colloidal quantum wells have recently arisen as a new class of semiconductor nanocrystals [1]. Their distinct optical properties and electronic structures makes them highly appealing for the achievement of low-threshold lasing and highly efficient light-emitting devices (LEDs)[1]. However, for the effective utilization of these exciting properties in optoelectronic devices, specifically designed heterostructures of colloidal quantum wells are required.

Here, we present the advanced heterostructures of colloidal quantum wells including CdSe/CdS/CdS core/crown/shell nanoplatelets (NPLs) [2], alloyed structures of $CdSe_xS_{1-x}$ NPLs [3], CdSe/CdTe core/crown NPLs [4] and $CdSe/CdSe_xTe_{1-x}$ core/alloyed crown NPLs [5]. By using these heterostructured colloidal nanoplatelets, highly tunable and low threshold optical gain (down to 10-100 $\mu J/cm^2$) performances have been demonstrated.

We also synthesized core/shell NPLs having a gradient shell composition to obtain enhanced performance in light-emitting devices [6]. Our proposed CdSe quantum wells with a graded shell, which is composed of CdS buffer interlayer and $Cd_xZn_{1-x}S$ gradient shell, exhibit highly bright emission (up to 89%) in the red spectral region (634-648 nm) with a narrow emission linewidth (down to 21 nm). Then, we fabricated solution-processed LEDs by using graded shell NPLs as an emitter. Our NPL-LEDs showed a very high external quantum efficiency (EQE) value of 9.92% with high brightness up to ~46000 cd/m^2 at 650 nm.

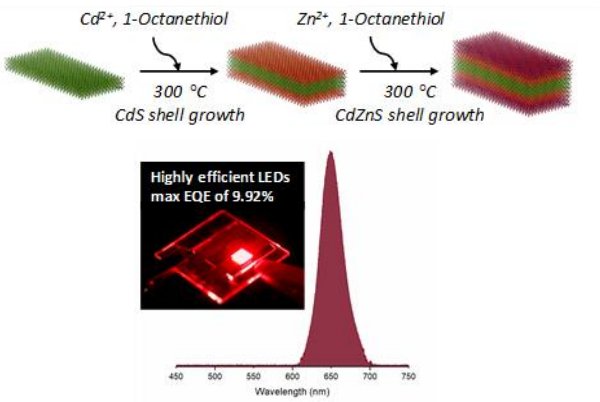

Figure 1. *Schematic demonstration of core/Shell nanoplatelets having a gradient Shell composition and electroluminescence spectra of nanoplatelet based light-emitting device together with the real colour image.*

These findings show that by carefully designing heterostructures of anisotropically shaped colloidal NPLs, we could obtain highly efficient NPLs with enhanced optical properties to realize their superior

performance in optoelectronic applications, overcoming the limitations of the spherically shaped NCs.

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Peper id : 5

Investigation of The Improvement of Mechanical Properties In Electron Beam Melting Additive Manufacturing

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Yalçın, H, Kaya, D, Küçüktürk, G. Investigation of the improvement of mechanical properties in electron beam melting additive manufacturing. Int. Conf. Advanced. Mater. Sci.& Eng. HiTech.and Device Appl.Oct. 27-29 2022, Ankara, Turkey

Abstract. This study, it was aimed to create a composite structure using ceramic powders, and it aimed to increase the hardness and bending resistance of the produced samples. Three-point bending test specimens with lattice structure were designed and these specimens were produced with Electron Beam Melting(EBM) technology. A study was carried out on the compressibility of powders by designing different lattice structure types. Metal matrix composite samples were obtained by compressing titanium dioxide powder as a reinforcement element between these produced samples. Then, these samples were sintered at 900 degrees for 12 hours. The three-point bending test results of the Ti6Al4V alloy and the metal matrix composite formed are compared, a significant increase in the bending resistance of the metal matrix composite was observed.

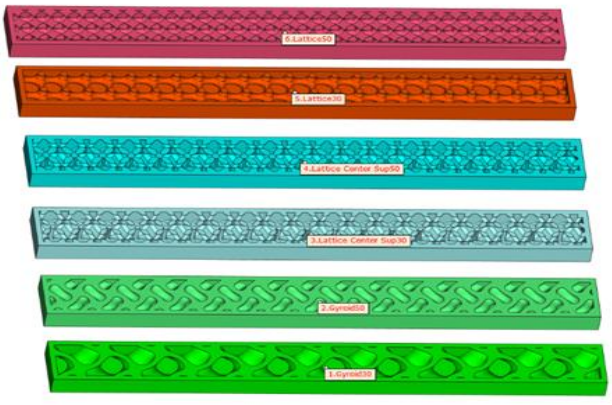

Figure 1. *Diffirent lattice designs*

Keywords: Additive manufacturing, powder metallurgy, metal matrix composites, bending resistance, microhardness,

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Peper id : 6

Effect of Circular Tool Shoulder End Features on Mechanical Properties of Friction Stir Welded Aluminum 6061 Alloy

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Abstract. Friction Stir Welding (FSW) is solid-state welding that uses non-consumable tools traversing and rotating along the interface of the materials to be welded. Heat generation by friction and shear deformation is one of the critical characteristics of the formation of bonds. The study aims to understand temperature characteristics, weld zone formation and tensile strength properties of Aluminium 6061-T6 Alloy during the FSW process for different shoulder end features. In this study, three FSW tools, each having various shoulder end features, were designed. The tools were made from AISI 4140 steel and used in a condition of 40 mm/min tool travel speed at 800 rpm. Friction stir welding experiments were performed, and the temperature during welding was measured with the thermal imaging camera. In addition, tensile testing was conducted, and the results were presented. Design with raised shoulder end tool has shown better performance in tensile testing and giving 190.1 MPa as UTS. A numerical model will be developed to deeply understand the effect of the new feature design for further improvement of tool pin design.

Keywords: Friction stir welding, aluminium 6061 alloys, ultimate tensile strength, shoulder end features

Peper id : 7

EU-Materials on and relevant to Nanomaterials: Definition, Regulation and Restrictions

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Abstract. This paper shall analyse the legal aspects related to nanomaterials under EU Law from three perspectives. At the outset it shall outline the EU's understanding of nanomaterials [1]. In this part, it shall be interesting to see how legal instruments define nanomaterials, which in essence is the result of a technological process that evolves with high velocity and by its nature stands in contradiction to the rigidity of legal definitions. Thereafter, it shall elucidate whether the EU has introduced any regulatory provisions on nanomaterial [2]. Finally, in view of the fact that nanomaterials have a wide spectrum of application, the paper shall focus on restrictions introduced by Brussels imposing restrictive measures (sanctions) and in particular restrictions related to military material [3], equipment for internal repression [4], dual-use goods and technology [5] and other equipment, technology and software [6]. This paper aims to producing the result of presenting to scientists who develop this technology, the legal frame that EU instruments create, and portray possible implications that can arise due to the imposed restrictive measures, once the technology has reached the commercialization stage.

Keywords: nanomaterials, legal definition, regulatory framework, sanctions

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2. *See* in particular Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, OJ 396, 30.12.2006, p. 1, as last amended by Commission Regulation (EU) 2022/586 of 8 April 2022 amending Annex XIV to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), OJ L 112, 11.4.2022, p. 6.

3. *See* for example Council Regulation (EU) 2015/735 of 7 May 2015 concerning restrictive measures in respect of the situation in South Sudan, and repealing Regulation (EU) No 748/2014, OJ L 117, 8.5.2015, p. 13, as last amended by Council Implementing Regulation (EU) 2022/748 of 16 May 2022 implementing Regulation (EU) 2015/735 concerning restrictive measures in respect of the situation in South Sudan, OJ L 138, 17.5.2022, p. 1.

4. *See* for example Council Regulation (EU) 2017/2063 of 13 November 2017 concerning restrictive measures in view of the situation in Venezuela, OJ L 295, 14.11.2017, p. 21, as last amended by Commission Implementing Regulation (EU) 2022/595 of 11 April 2022 amending certain Regulations concerning restrictive measures and setting out a single list for the Annexes to those Regulations containing the contact details of Member States' competent authorities and the address for notifications to the European Commission, OJ L 114, 12.4.2022, p. 60.

5. *See* for example Council Regulation (EU) No 401/2013 concerning restrictive measures in view of the situation in Myanmar/Burma and repealing Regulation (EC) No 194/2008, OJ L 121, 3.5.2013, p. 13, as last amended by Council Implementing Regulation (EU) 2022/662 of 21 April 2022 implementing Regulation (EU) No 401/2013 concerning restrictive measures in view of the situation in Myanmar/Burma, OJ L 121, 22.4.2022, p. 1.

6.*See* for example Council Regulation (EU) No 36/2012 of 18 January 2012 concerning restrictive measures in view of the situation in Syria and repealing Regulation (EU) No 442/2011, OJ L 16, 19.1.2012, p. 1, as last amended by Regulation (EU) 2022/595 (n 4 above).

Peper id : 8

Optical Properties of BaLiF3 Single Crystal: Ab Initio Investigation

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Abstract. Cubical perovskite LiBaF3 is a promising material for various applications such as scintillators, dosimeters, and other optical industries. In addition this crystal is a potential laser material when it is doped with divalent cations. In this work the full-potential linearized augmented plane wave method (FP-LAPW) based on the density functional theory (DFT) were used to perform the calculations to investigate the optical properties of BaLiF3 single crystal. The generalized gradient approximation (GGA) implemented in Wein2K code was used as the exchange correlation potential. The density of states, real and imaginary parts of the complex dielectric function, refractive index, extinction coefficient, reflectance, absorbance, real and imaginary parts of the optical conductivity, and energy loss of BaLiF3 single crystal are computed and discussed.

Keywords: Cubical perovskite $LiBaF_3$, Density functional theory (DFT), band structure, Optical properties

Cubical perovskite BaLiF3 is one of the interesting mixed metal fluorides (e.g. $BaLiF_3$, BaY_2F_8, $YLiF_4$, $LiCaAlF_6$, $LiSrAlF_6$) [1] with a wide energy band gap. So, they have great potential for a variety of device applications in optical, ferroelectric, antiferromagnetic systems [2,3]. In this work the the density of states, band structure, and other optical properties were determned.

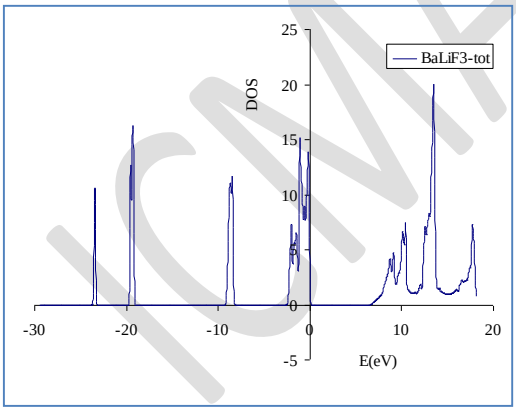

Figure 1. *Total density of states of BaLiF3 single crystal.*

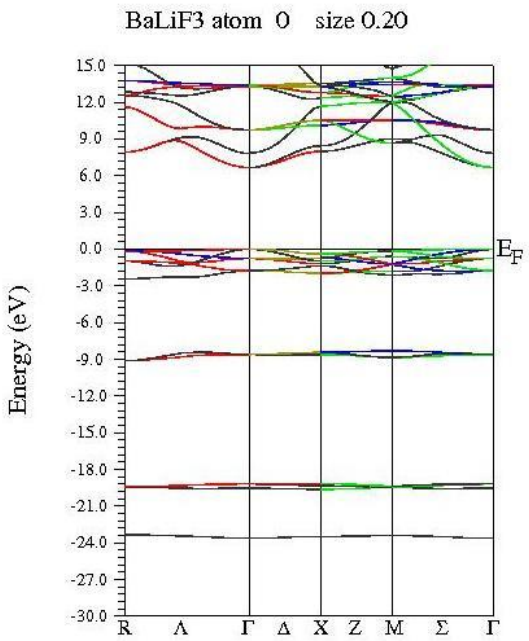

Figure 2. *Band structure of BsLiF3 single crystal.*

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Peper id : 9

Absorption edge of CdTe thin Films Prepared by Thermal Evaporation

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Abstract. Cadmium telluride (CdTe) is an important semiconductor that has applications in photovoltaic cells and optoelectronic industries. In this work, thin films of CdTe were deposited by thermal evaporation at ambient temperature on glass substrates. From the x-ray diffraction (XRD) measurements it is found that the films are polycrystalline with zinc-blende structure. Scanning electron microscopy supported by x-ray energy dispersive spectroscopy (SEM-EDS) was used to observe the morphology and composition of the films. Polycrystalline nature was confirmed through SEM micrographs, and the films showed stoichiometric composition. Transmittance of the films was measured at room temperature in the wavelength range 770-1100 nm and used to deduce the absorbance. The second derivative of the absorbance was used to detect the peaks in the near band-edge region. The most relevant peaks are discussed and explained.

Keywords: Cadmium telluride, Solar cells, Absorption edge

Cadmium telluride (CdTe) is an important II-VI compound semiconductor that can be used as an absorber in photovoltaic devices [1]. It has a band gap of about 1.5 eV at room temperature, which is in the middle of the solar spectrum. It has applications in photovoltaics and optoelectronic industries such as infrared and x-ray detectors. Besides, it has a large absorption coefficient large absorption coefficient (α >104 cm−1) for the visible solar spectrum [1].

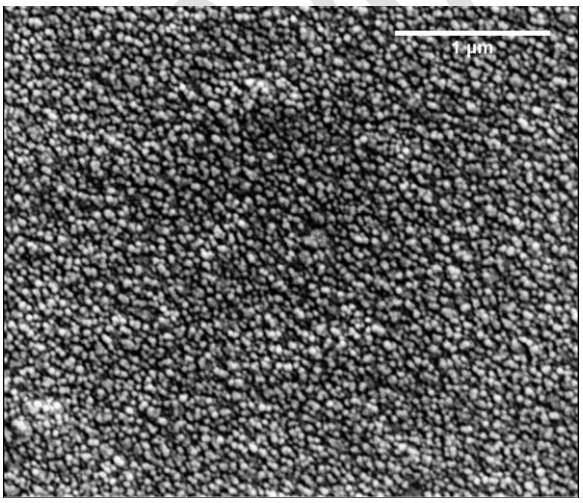

Figure 1. *SEM image of vacuum deposited CdTe thin film of thickness about 1 µm.*

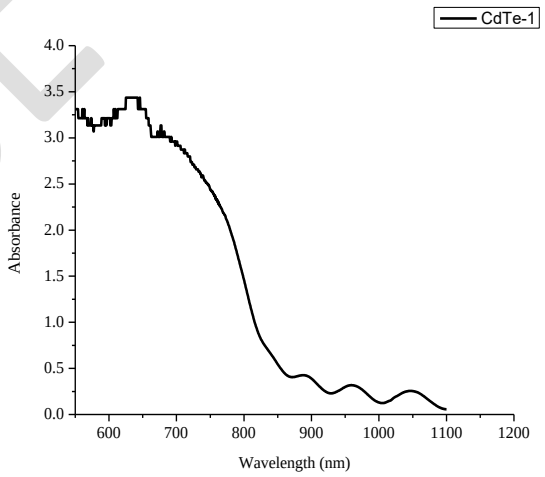

Figure 2. *Absorbance of thermally evaporated CdTe thin film*

Transmittance of the films was measured at room temperature in the wavelength range 770-1100 nm and used to deduce the absorbance. The second derivative of the absorbance was used to detect the peaks in the near band-edge region. The most relevant peaks are discussed and explained.

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Peper id : 11

Functional Nanomaterials – Tuning the Size and Surface Chemistry for Applications in Catalysis, Biomedical and Environmental Sciences

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Abstract. Abstract. The unique chemical and physical properties of nanoscale materials have triggered much scientific interest to explore their potential applications in biomedical sciences, energy technologies, agriculture, environment, catalysis and industry etc. The chemical and physical properties of metal/ metal oxide nanoparticles can generally be tuned by controlling their size, shape and surface chemistry. In this regard, we have developed several reproducible protocols to prepare functionalized metal/metal oxide nanoparticles from subnanometer to over 100 nm in aqueous/organic media with a decent control over their size, shape, and surface chemistry. We generally used chemical reduction approach for the synthesis of metal nanoparticles, where metal salts are reduced in the presence of stabilizers that can coat the initially formed metal nulcei at different stages of their growth depending on the nature of metal and the stabilizing ligand. Depending on the nature of ligands, nanoparticles stay away from each other due to electrostatic repulsion and steric repusion. Many of these metal nanoparticles have been used as building blocks to design/synthesize new nanostructured materials using template-based and template-less strategies. Template-based strategies have particularly been employed to form hierarchically porous nanocomposite materials for water remediation and inorganic oxide based porous catalysts (after removing the sacrificial template by calcination) for various catalytic applications.

The functionalized metal/metal oxide nanoparticles/nanoclusters possess interesting optical, recognition and catalytic/bio-catalytic properties. For example, we have used some of the fluorescent metal nanoclusters for the sensing of biomolecules and even explosives due to to the quenching of fluorescence in the presence of analytes. Similarly, we have produced cationic iron oxide nanoparticles that mimic horseradish peroxidase enzyme and used them as artificial enzymes for the detection of bacteria. We have also used silver nanoparticles and nanoclusters (both cationic and anionic) to kill resistant bacteria and tried to understand how the size and surface chemistry of nanoparticles affect their antimicrobial properties. We have also developed various metal nanoclusters based electrocatalysts (both homogeneous and heterogeneous catalysts) for electrocatalytic and photocatalytic splitting of water. Having developed some interesting electrocatalysts in this regard, we are now further extending their scope to be used as electrode materials for aqueous sodium ion batteries. In yet another project, we are developing graphene-photocatalysts nanocomposites on which hypercrosslinked polymers can be grown to facilitate the adsorption of CO2 and its subsequent conversion to the hydrocarbon fuel.

This talk would, therefore, be an overview of interdisciplinary research activities of Functional Nanomaterials Group at LUMS to synthesize customized inorganic/organic nanoparticles with tunable size and surface chemistry, and their composites having unique chemical and physical properties, and subsequent applications in biomedical sciences, environment, catalysis and renewable energy technologies.

Keywords: Green chemistry, Green deal, Sustainable development, Polymers

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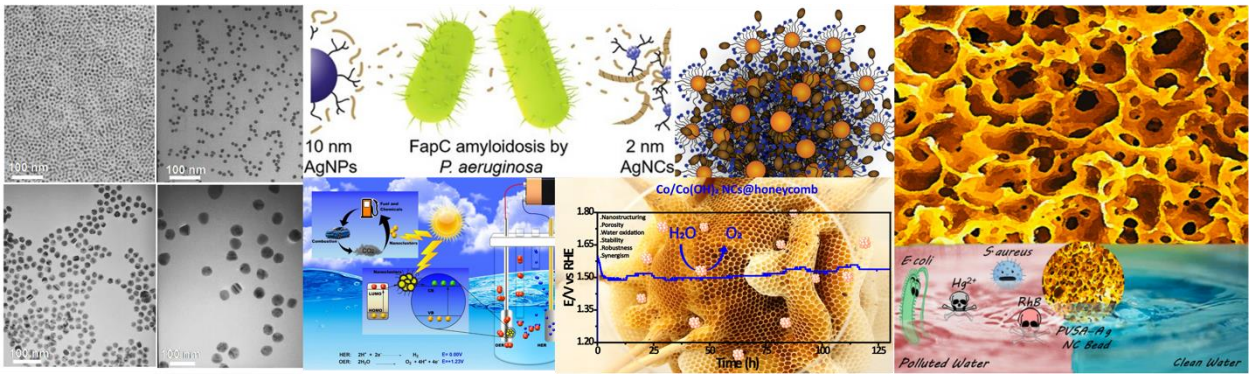

Fig. 01: A representative image showing the electron microscopic images, and cartoons for some of the nanomaterials being routinely prepared/used in Functional Nanomaterials Group at LUMS.

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Peper id : 14

Non-Destructive Methods for Assessment and Qualification of Metallic Components Additively Manufactured by Powder Bed Fusion Processes

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Abstract. Additive manufacturing (AM) has created possibility for producing high-value, complex, and customized components that could not be produced via conventional processes. Powder bed fusion type processes use a laser or electron beam to melt and fuse metal powder together. Variations in raw materials and processing parameters usually cause significant uncertainties, such as dimensional inaccuracy, discontinuities, nonhomogeneous microstructure, and anisotropic mechanical behaviour. Thus, qualification of additively manufactured components is one of the biggest challenges, and it requires extra efforts for verification and validation of the performance. Qualification via destructive tests are not so efficient with the AM processes due to the inconsistencies within the volume, across build lots and between platforms. These limitations have brought non-destructive methods for the qualification and verification of AM parts to the fore. However, AM parts are difficult to inspect with many conventional non-destructive evaluation techniques due to significant microstructural variability and their complex geometries. Therefore, the development of innovative non-destructive methods for assessment and quality control of AM components has critical importance. This paper reviews the non-destructive methods used for assessment and qualification of metallic components additively manufactured by powder bed fusion processes, including quality control of the feedstock material and the final component.

Keywords: Additive manufacturing, Powder Bed Fusion processes, Metallic materials, Quality control, Assessment, Nondestructive methods

Peper id : 15

THERMOPHYSICAL PROPERTIES OF 2-PENTANONE AND 2-HEPTANONE + AROMATIC AMINES AT THREE DIFFERENT TEMPERATURES

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Abstract. Proteins are polymers of amino acids linked to each other by a peptide bond. The study of these amino acids, amides, peptides and their derivatives is very interesting for knowledge of complex biological molecules. The carbonyl and amide groups present in the Alkanone and Aromatic amine mixtures are of interest to study their effect on the interactions. Furthermore, alkanone and amine have wide commercial applications and amines play an important role in advanced processes like carbon dioxide capture when used with ionic liquids. In the present investigation, an attempt has been made to evaluate the energy (ΔE_{vap}) and enthalpy of vaporization (ΔH_{vap}), internal pressure (P_i), isothermal compressibility and their corresponding excess parameters i. e. excess internal pressure (P_i^E) and excess isothermal compressibility (β_T^E) and interaction parameter (χ) for binary solutions of alkanones (2-Pentanone, 2-Heptanone) and aromatic amines (Aniline, N-Methylaniline, Pyridine) at 293.15, 298.15 and 303.15 K. Coefficient of thermal expansion (α) and isothermal compressibility (β_T) have also been computed and subjected to extensive applications to evaluate the aforementioned parameters. All the properties and their excess counterparts have been used to understand the nature of intermolecular interactions taking place.

Keywords: Internal pressure, Excess properties, Isothermal compressibility, Binary

Introduction: The study of thermophysical properties of liquid mixtures holds utmost importance due to their large applications in the chemical, paints, and pharmaceutical industries. These properties play a vital role in design processing and engineering calculations. The nature and extent of interactions can be well understood with thermophysical and their excess properties. In the current investigation, the molecular interactions between 2-Pentanone and 2-Heptanone with amines such as pyridine, N-methylaniline and aniline have been studied between the temperature range of 293.15K-303.15K using standard thermodynamic equations and properties to understand their interactive behaviour in a liquid state [1,2].

Fig. 1 represents the trends observed in excess isothermal compressibility of binary mixtures indicating the highest values for Aniline and the least value for Pyridine with both alkanones at 298.15 K. It reveals that the higher value of excess compressibility causes due to higher interactions [3]. Fig. 2 represents the interaction parameter at 298.15 K for the system under study. Here the highest interactions are seen between Aniline and Alkanones while the lowest are between Pyridine and Alkanones. Also, the interaction parameter values for 2-

Pentanone are higher compared to 2-Heptanone suggesting more interactions between 2-Pentanone and amines at 298.15 K.

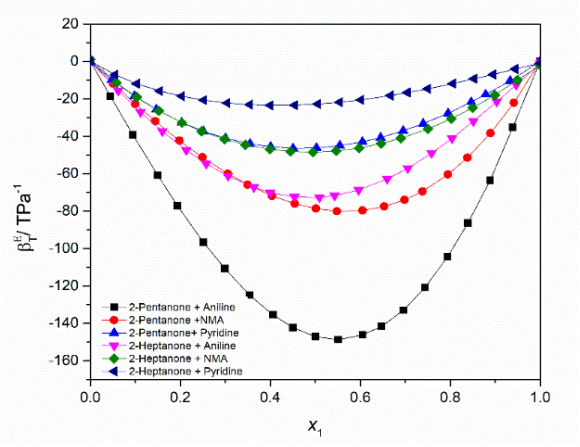

Figure 1. Excess Isothermal Compressibility of Alkanone+ Amines at 298.15 K

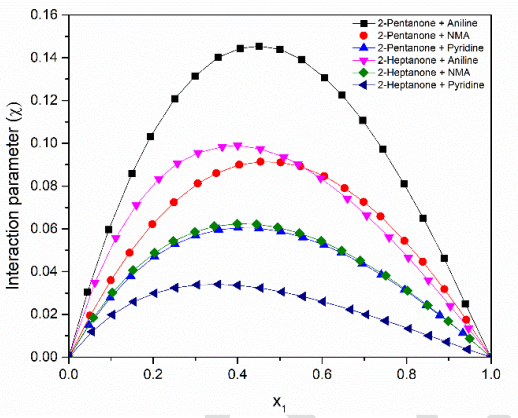

Figure 2. Interaction parameter of Alkanone+ Amines at 298.15 K

The results (Fig.2) suggest that for a particular alkanone, interactions are in order of Aniline > N-methylaniline > Pyridine for all three temperatures. The chain length in the alkanone compound also seems to affect the molecular interactions. The overall trends observed are due to hydrogen bonding capability in amines, stability of the Nitrogen atom in amines, the polarity of oxygen atom in carbonyl group and steric hindrance of both the components [3].

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Peper id : 16

Strategies for improving mechanical properties and high temperature oxidation resistance in silicides and ceramic composites for ultra-high temperature applications

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Abstract. Molybdenum and niobium silicide based multiphase intermetallic alloys, C_f-SiC and ZrB_2-SiC based ultra-high temperature ceramic (UHTC) composites have received significant attention for use at temperatures well beyond the limit for the Ni-based superalloys. These materials are being designed with the objective of simultaneously achieving specified high temperature strength along with adequate fracture toughness at the ambient temperature, as well as an impressive resistance to environmental degradation against oxidation and ablation. Whereas the silicide based intermetallic alloys have use in hot-end components of aero-engines, the UHTCs have potential applications in nose-cones and leading edges of hypersonic vehicles. In the multiphase silicide based alloys, the microstructures containing a mixture of ductile and hard phases ensure adequate fracture toughness at room temperature besides high temperature strength, whereas Si-containing phases contribute to formation of protective oxide scales. The C_f-SiC composites exhibits a typical damage tolerant behavior caused by crack bridging and closure by the partially debonded fibres, whereas the SiC seal-coating develops a self-healing coating of SiO_2 at high temperature. The ZrB_2-SiC composites are protected from damage by oxidation till 1500oC and ablation at ~2000^{o}C by formation of borosilicate and ZrO_2 scales respectively, whereas creep resistance in air is improved with oxidation resistance.

Keywords: Silicides, C_f-SiC composites, Ultra-high temperature ceramic composites, mechanical properties, oxidation resistance

Peper id : 17

Effect of graphene nanoribbon modification by metal oxide cluster on its adsorption for hydrogen sulfide

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Abstract. In this work, a first principles investigation is exceled to examine the adsorption of H_2S gas on pure and modified armchair-graphene nanoribbon (AGNR) [1]. CuO_x ($x = 0, 1, or\ 2$) cluster is introduced to AGNR by either substitution of carbon atoms or through the decoration on their surfaces. The influence of modification on H_2S adsorption is examined using density functional theory (DFT) computations of band structure, adsorption energy (E_{Ads}), charge transferred (ΔQ), adsorption length, as well as density of states (DOS) [2, 3]. The results present decent enhancement towards H_2S adsorption upon modification. In general, the adsorption energy of H_2S is greater for doped AGNR structures as compared with the decorated structures. The results reveal that AGNR doped with CuO_2 have the maximum adsorption energy, followed by AGNR doped with CuO. AGNR doped with Cu or decorated with Cu, CuO, or CuO_2 have lower adsorption energy for H_2S. Lastly, the obtained results designate that AGNR doped with CuO_2 or CuO exhibit potential for H_2S sensor applications.

Keywords: H_2S gas sensor; DFT; graphene nanoribbon; CuO_x, doping.

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Peper id : 18

Precision Medicine Today

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Abstract: Precision medicine has the potential to revolutionize the healthcare, where a patient's unique genetic profile can be used to detect the disease's onset, prevent its progression, and optimize its treatment. If genetic testing could be used to predict drug response, appropriate measures could be taken to more efficiently treat diseases, such as cancer, cardiovascular disease, and diabetes. Use of an individual's genetic information to select treatment options is already in practice, such as in the case of treatment with clopidogrel and other cardiovascular and anticancer drugs that will be discussed here in more details. Furthermore, there are regulatory, economic, social and ethical challenges, which are highly interlinked and often represent an obstacle in efficient transfer of precision medicine to the clinic. Continued professional education is another essential factor for the successful development and application of precision medicine today. Thus, transdisciplinary collaboration between healthcare institutions, academia, pharmaceutical and biotech companies, regulatory agencies, policy-makers, and other relevant stakeholders is essential for an effective translation of precision medicine in the current clinical practice.

Keywords: Precision medicine, pharmacogenomics, effective treatment, side-effects, professional education

Peper id : 19

Recent findings on gas sensors based on metal-oxide nanoparticles

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Abstract: This presentation reports on our recent findings of gas sensors based on metal-oxides nanoparticles. The focus of the presentation will be on two gases: H_2S gas that is highly toxic and results from petroleum extraction and refining activities, and H_2 that is promoted as a carbon-free and clean fuel for vehicles. The fabricated sensors are conductometric sensors where their response is indicated by the change in their electrical resistance. The nanoparticles are synthesized by chemical routes, and they include CuO, SnO_2, and PdO as well as their composites with magnetic nanoparticles such as Fe_2O_4 and Fe_3O_4 [1-6]. The metal-oxide nanoparticles exhibit semiconducting characteristics. Adsorption of the gas on nanoparticles modifies the concentration of free electrons thus their electrical conductance. The incorporation of two types of nanoparticles allows the formation of p-n junctions that boost the gas response signal. The morphology and composition of nanoparticles are characterized by different techniques including transmission electron microscopy, scanning electron microscopy, Fourier transform infrared spectroscopy, energy dispersive x-ray analysis, and x-ray diffraction. The charge transport and sensor response are characterized by dc electrical conductance measurements and ac impedance spectroscopy. The fabricated sensors are practical to fabricate on large scale with low cost and have low power requirements, thus, they qualify for practical device utilization in the hazardous gas sensor sector.

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Peper id : 21

Functional Materials for Sustainable Developent

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Abstract. Materials are chemical substances that derive the modern soceity. Materials enable technology for making beneficial devices. And chemical sciences play a central role in making these materials. There is an ever increasing demand for newer and better functional materials for performing technological operations to address many of the modern technological and environmental challenges facing the soceity. Sustainable development calls for environmentally benign and inexpensive materials. UN Brundtland Commission's definition of sustainable development is 'meeting the needs of the present without compromising the ability of future generations to meet their own needs'.

Transition metal oxide clusters or polyoxometalates (POMs) and their derivatives offer unprecented variety of versatile building blocks for making functional materials with properties suitable for application in such areas as catalysis, sensing, membrane technology, pollution control, energy storage, and biomedical usage. POMs, which are molecular systems of sizes up to several nanometer diameter and molecular weight at par with small proteins, can be made relatively inexpensively by employing environmentally benign 'green' synthetic methods. POMs can be functionalized readily and used as structural motifs for making new materials whose properties can be varied systematically and correlated with their constituents at the molecular level. It offers an attractive and sustaianable approach to new materials of desirable properties and functions.

Keywords: Sustainablity, functional materials, polyoxometalates, catalysis, sensors.

Peper id : 25

Helical light fields revolve materials science

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Abstract. We review advanced materials sceinces and technologies with helical light fields, that is optical vortices. The optical vortex possesses an orbital angular momentum (OAM) owing to its helical wavefront, and it enables the twist of materials, such as metals, polymers, and even ultrahigh viscosity liquids to form versatile helical structures on nano/micro-scale. Such optical vortex materials processing should offer new advanced material sciences and technologies.

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Keywords: Optical Vortex, Helical Light Fields, Laser Materials Processing, Laser Induced Forward Transfer

Helical light fields, that is optical vortices, carry unique physical properties, such as a donut-shaped spatial profile and an orbital angular momentum, arising from their helical wavefronts. They has been widely studied in versatile fields, including optical tweezers/manipulations, optical/quantum communications, and scanning microscopes.

In recent years, optical vortex materials processing has been proposed, and it enables the fabrication of a variety of nano/micro-scale chiral structures owing to the orbital angular momentum transfer. Extending beyond the conventional laser materials processing technologies, the optical vortex materials processing should open the door towards advanced materials science and technology, such as chiral photonics, plasmonics and metamaterials at high efficiencies.

Also, an optical vortex laser induced foward transfer technology, that is an entirely exotic non-contact printing technology with an optical vortex, allows the direct print of solids and even ultrahigh viscosity liquids at high spatial and pointing resolutions without any nozzle clogging. This technology will pave the way towards next generation printed photonics/electronics and bioprinting as a non-contact and cost/energy-saving process.

In this paper, we report on the review of the state-of-art of the optical vortex materials processing and optical vortex laser induced forward transfer technologies.

[1-3].

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Peper id : 26

Metal Additive Manufacturing: Trends, Oppurtinities and Challanges

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Abstract. Additive Manufacturing (AM) draws great attention from both academia and industry due to its flexibilities in productions steps and design. Although, AM has began its journay with rapid prototyping using polymeric materials, in the last decade AM became and alternative manufacturing method for metal parts with higher design complexities and efficient material use. This presentation implies with trends, opputinities and challanges in metal additive manufacturing. Metal AM is highly curicial for many industries since it facilitates design complexities, multiple material use, large and dense part produciton and so on. The recent studies which have been appear in the literature are mainly about metal AM. Besides, the most mature and costly machines are delivered for metal AM industry. However, there are still many gaps and research topics in metal AM, such as microstructure control, alloying, anisotropy, process monitoring and control etc.

Keywords: Additive Manufacturing, Metals, Digital Manufacturing

Metal Additive Manufacturing (AM) methods can be classified as powder bed and material fed methods. Powder bed methods uses powders and laser-elctron beam as energy source to melt the powder layer upon layer. Material fed methods laser, electron beam and welding arc as energy source directed to material which is fed through as powder and wire form. In both case, metal rwa material melts and solidify in a short time and produce layers [1,2].

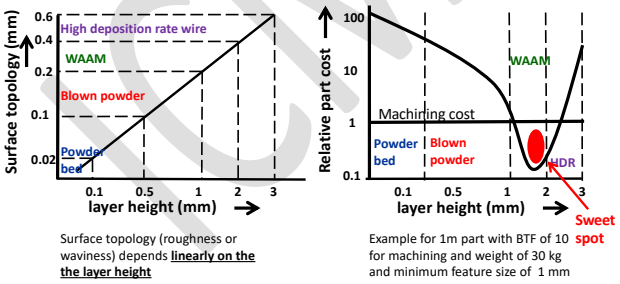

Figure 1. *Comparison of Metal AM methods*

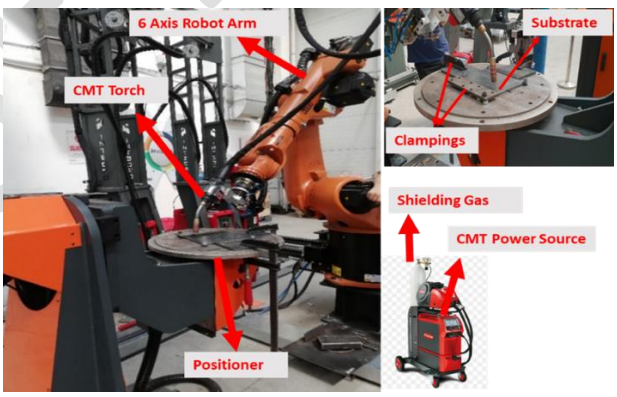

Figure 2. *WAAM:Wire Arc Additive Manufacturing*

Figure 1 depicts the differences of metal AM methods in terms of surface topology and relative part cost. Wire arc additive manufacturing (WAAM) is clearly having less part cost and higher deposition rates. However, WAAM produces higher surface roughness compared to other metal AM methods. Figure 2 shows a typical WAAM unit [1].

Metal AM methods are capable of producing both large-dense parts and complex lattice structures. It gives great potential for critical sector, such as aerospace, to produce metal parts with low investment cost, light weight parts with higher design complexities.

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Peper id : 27

Combination of Photonic Tools and Nanostructured Materials for Biomedical Applications

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Cite this paper as: Gorin, D. Combination of Photonic Tools and Nanostructured Materials for Biomedical Applications, Int. Conf. Advanced. Mater. Sci.& Eng. HiTech.and Device Appl.Oct. 27-29 2022,Ankara, Turkey

Abstract. The presentation text starts here and continues. The abstract should be prepared via Calibri (Font) and 10 pts, single spaced with 2 cm margins on all sides and align full. The length of Abstract should be between 150 and 200 words. The abstract should be informative by referring study aims, the methodology, the instruments, the major findings and the implications of the study. This talk will review the combination of nanostructured materials and photonic tools that can be used for their visualization, navigation and remote-controlled release of bioactive substances, and last but not least, the application of optical sensors for early diagnosis and evaluation treatment efficiancy. There are many biological objects that can be used as markers of various pathological states including cancer. These comprise, but are not limited to, proteins, exosomes, and circulation tumor cells. Exosomes are a very promising marker for early cancer diagnosis and even for evaluating treatment efficiency. An exosome is a small vesical at 100 nm size produced by a cell. Exosomes contain specific proteins and are distributed on the surface of cell membrane. The exosomes can be sent by both normal and pathological cells. It can be used for early diagnosis of neuro, cardio, and onco-diseases [1]. We have already elaborated a different types of photonic based sensors including SERS [2], nanozyme based optical sensor [3,4], hollow-core microstructured fibres [5], and photonic integrated circuits [6]. The combination of a photonic integrated circuits (PIC), a microfluidic devices (MF) and a surface modification can improve not only the sensitivity but also the specificity of exosomes' detection .

Additionaly, the application of photonic and acoustic tools can be used for visualization, navigation of multimodal and multifunctional carriers and remote-controlled release of bioactive substances. These particles will combine the ability to deploy drugs in a controllable manner with physical triggering, multimodal detection, and visualization as well as sensing of important biological markers. It was required to apply a new bottom-up method as layer by layer assembly [7] and freezing induced loading [8] and their combination [9,10]. It can be allowed us to vary the volume fraction of components and their chemical composition led to the control of the optical and thermal properties of multifunctional carriers [11]. Raman spectroscopy is perspective method for *in situ* monitoing of freezing induced loading method [12]. Physical targeting of carriers was realized by the gradient of the magnetic field [13], optical tweezers approach [14]. Acoustics has a good perspective for the same purpose. The carrier sensitivity to external influences such as laser irradiation, ultrasound treatment can be changed by variation of volume fraction and chemical composition of inorganic nanoparticles and/or organic dyes in the carrier shells. The same approach is applied for drug delivery carriers imaging by MRI, FT, US and optoacoustics using inorganic nanoparticles and/or organic dyes as contrast or functional agents [4,9,10]. Photonic tools are also promissing method for the monitoing of the diatom colonies growth [15]. The diatom algae is responsible for 20 % oxygen at our planet. Thus, the combination of photonic tools with microstructured materials has a good perspective for application in biology and medicine.

This work was partly supported by RSF Project 22-14-00209.

Keywords: Fotonic Tools, Nanostructured materials, Biomedical Applicatrion,

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Peper id : 30

Ukrainian track to the green energy transition

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Abstract. The article observes solutions for energy safety in the global climate context of the war in Ukraine. The new opportunities for renewable energy sources (RES) and low-carbon post-war development in Ukraine are being considered.
Keywords: RES, green transition, electricity.

In spite of the full scale Russian invasion, Ukraine has a significant potential for investments in energy sector, moreover energy can become one of the drivers of the recovery of the Ukrainian economy. Electricity exports from Ukraine could replace 17% of Russian natural gas consumed by the European Union countries. In the context of the strategy of transition to climate neutral development of the EU, it is important that a significant part of the exported electricity should come from RES, moreover it`s more profitable now to build new renewable energy power plants. According to some investigation electricity assumes a share of RES in 83% by 2050 [1]. At the same time, today, in the conditions of electricity produced by nuclear power stations surplus, owners of solar power plants are forced to reduce the volume of electricity production. Such modes of operation significantly reduce the productivity of solar stations and jeopardize their economic profitability. According to the calculations, the amount of system restrictions of only the SPSs is 573 GW/h, or approximately 30% of the potential generation. Instead of restrictions and underproduction, “green” energy can be exported to the EU countries in the future, reducing the financial burden and payments of the “green” tariff for the system restrictions. The electricity surplus Ukraine currently has, will allow individual countries to quickly abandon Russian gas. To support the energy sector Ukraine has joined the unified continental European electricity system ENTSO-E and completed an emergency synchronisation of its power grids with the ENTSO-E; on June 30th 2022, Ukraine started selling electricity to Romania and in July to Slovakia. Currently, Ukraine has the following interconnections with the ENTSO-E countries with about 1850 MW export and 1500 MW import capacities.

The energy sector in Ukraine is on the brink of the major change. These changes are made to provide energy transition and favourable investment climate for RES enlargement in the after war period [2].

Acknowledgement

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Peper id : 31

Production and Characterization of Green Nanotechnology-Based Nanofibers

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Abstract. Using plants in the production of nanofibers by electrospinning is an emerging field. Nanofibers, like all other nanomaterials, have high surface area/volume ratio, porosity, elasticity and mechanical strength, and their processability make them suitable materials for tissue engineering and drug delivery systems in nanomedicine.
For this study, onion extracts in different concentrations were produced as nanofibers by electrospinning method. Characterization (FTIR and SEM) tests of the produced nanofibers were performed and three concentrations (1:50, 1:25 and 1:12.5) showing the best nanofiber behavior were selected according to their results. In SEM analysis, it was observed that as the onion extract concentration increased, the fiber diameters decreased (avg. 694,24 nm, 529,23 nm, 525,38 nm, 422,4 nm and 377,7 nm) and the fiber morphology deteriorated.
Baicalein and propolis, which are herbal materials with known antibacterial effects, were added to the onion extract samples with selected concentrations and nanofiber production was carried out with them. FTIR and SEM tests of nanofibers containing onion extract, Baicalein and Propolis were also performed. In Baicalein-containing nanofibers, as the onion extract concentration increased, the mean fiber diameters decreased (avg. 611,25 nm, 583,57 nm and 476,47 nm). Similarly, nanofibers containing propolis decreased in diameter gradually (avg. 1179,01 nm, 731,87 nm and 729,03 nm).
Keywords: Green Nanotechnology, Plant Extract, Anti-inflammatory, Nanofiber, Nanomedicine.

Green nanotechnology involves the application of green chemistry principles in the production and usage of nanomaterials. The green approaches can be summarized as either the eco-friendliness of the solvents or the green production methods (sonochemical, solvothermal, hydrothermal, electrochemical, microwave, green catalysis or biosynthesis, etc.) instead of traditional chemical methods [1].
Electrostatic spinning method for nanofiber production is a versatile polymer processing process that results in the formation of nanosized fibrils by applying high electric field to the the polymer solution [2]. Ultrafine polymer fibers can be produced with this method and new application areas can be created due to the different modifications of these fibers. The resulting nanofiber layer is morphologically similar to the extracellular matrix (ECM) of normal tissue with its pore distribution, high porosity, mechanical properties and unique biochemical properties [3]. In addition, due to this structure, it is used as an ideal biomolecule transport agent. With the addition of functional molecules such as antibacterial agents to nanofibers, the applications of these materials for wound dressings, protective textiles, tissue scaffolds and biomedical devices are much improved compared to other conventional antimicrobial materials [4].
In this study, a natural antimicrobial agent, onion, is used for creating electrospun nanofibers. First of all, different concentrations of onion solution were prepared and analyzed with FTIR and SEM. According to the results of the all characterization studies, three appropriate compositions were chosen. Propolis and Baicalein were added the onion solutions in various concentrations and also examined. As a result,

all test results were compared and reviewed for using of these natural fiber materials as a tissue engineering material.

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Peper id : 32

Effect of Alignment on Infrared Emissivity for Electrospun Nanofibers

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Abstract. Apart from radar, the infrared signature is one of the most widely exploited characteristics of military targets as objects with a temperature above absolute zero emit light mostly in infrared (IR) wavelengths. Hence, concealment of highly precious components is desirable and materials with low absorptivity and high reflectivity can satisfy such demands. Metal or semiconductor filler materials and micropatterned structures are proposed for low emissivity systems but they suffer from significantly increased weight and increased cost/labor respectively. Electrospun fiber-based composites (produced through the combination of electrospinning, physical, and chemical deposition methods) are more recently introduced IR stealth material alternatives with lightweight and multifunctional properties. Nanofibers' directionality influences optical (e.g. transmittance) and mechanical (e.g. strength and toughness) properties. However, how directionality changes with IR emissivity has not been established in the literature. Hence, in this study, I perform electromagnetic simulations to determine the effect of alignment (non-aligned, moderately aligned, and highly aligned) on the IR emissivity of fibrous nanocomposites for different polarization states of light. The findings can be significant to both the concealment and detection of strategic assets.

Keywords: Electrospun nanofibers, infrared emissivity, polarization, computational electrodynamics, directionality

Peper id : 33

Scaling up Superconducting Quantum Processors: Materials and Fabrication Challenges

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Abstract. Scaling up quantum processors based on superconducting qubits will require continued technology improvements in the areas of qubit quality, gate performance, and scalable microwave signal generation and delivery. In recent years at IBM, we have delivered the first gate-based superconducting processor to break the 100-qubit barrier and have demonstrated coherence time approaching 1 msec on test devices. Despite these positive developments, there are two key challenges that need to be overcome to reduce noise and errors and as a result enable continued scaling- (1) coherence stability versus time due primarily to qubit interactions with two-level systems (TLS) that are attributed to defects in amorphous materials and (2) frequency collisions due to variability in Josephson junction (JJ) fabrication. Overcoming these will require work to identify the microscopic origin of the defects and eliminate them through materials and process improvements that achieve cleaner surfaces/interfaces combined with improved fabrication control.

Peper id : 34

First principles study of structural,elastic and mechanical properties of Ti-(44-x)Al-5Zr-xNb alloys

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Abstract. In this work, structural, elastic and mechanical properties of Ti-(44-x)Al-5Zr-xNb alloys have been analyzed via first principle calculations based on density functional theory. Crystal structures of the alloys have been developed by Virtual crystal approximation (VCA) method. Niobium (Nb) has been doped up to 5 wt. % in increments of 1 wt. % to Ti-44Al-5Zr alloy. Lattice parameters, elastic constants and mechanical properties have been calculated and discussed. Calculated elastic constants and bulk moduli values imply that mechanical properties have been improved by doping Nb whereas ductility has been diminished when Nb doping concentration is greater than 2 wt. %.

Keywords: First-principles, virtual crystal approximation, elastic constants, Nb doped

Ti-Al alloys draw great attention due to low density, high melting point, high specific strength as well as oxidation resistance [1]. They are promising materials for aerospace and automobile industries. However, low ductility at room temperature prevents of extensive usage of Ti-Al alloys [2]. To solve this problem alloying studies with transition elements are performed. Theoretical approach is useful methodology to develop alloying and investigate properties. In this study, first principles calculation is are performed utilizing Cambridge Sequential Total Energy Package (CASTEP) code [3]. $TiAl_2$ alloy with Zr addition has been chosen as starting point which was performed by our previous works. Ti-44Al-5Zr alloys have been doped with Nb concentration.

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Peper id : 37

The Use of Chitosan as a Corrosion Inhibitor with Graphene Oxide

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Narmina Guliyeva, Elshan Aliyev, Aynur Mammadova, Elsun Azizov. The Use of Chitosan as a Corrosion Inhibitor with Graphene Oxide. Int. Conf. Advanced. Mater. Sci.& Eng. HiTech. and Device Appl. Oct. 27-29 2022, Ankara, Turkey

Abstract. Based on the results of the work done, it was determined that the inhibitory composition based on graphene oxide and chitosan provides anti-corrosion protection for St3 grade steel operated in an acidic environment, following the example of sea water. Gravimetric experiments were carried out according to standard procedures. Three parallel experiments were carried out, and for greater accuracy, an average value was taken to calculate the corrosion rate.
The best results were obtained with the concentration of the composite mixture Graphene Oxide/Chitosan (GO/Chs) = 0.5/5. This is explained by the presence of large amounts of functional groups containing nitrogen and oxygen atoms.

Key words: graphene oxide, chitosan, corrosion, industry.

Peper id : 38

The Use of Chitosan with Graphene Oxide to Create a Membrane for Water Purification

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Guliyeva Narmina. The use of chitosan with graphene oxide to create a membrane for water purification.Int. Conf. Advanced. Mater. Sci.& Eng. HiTech.and Device Appl.Oct. 27-29 2022,Ankara, Turkey

Abstract. Research on chitosan is carried out in more than 15 countries, and currently up to 70 directions for its practical application are known. The most important of them are the directions given below: In the food industry - as thickening and structure-forming substances necessary for the production of dietary food products used for radionuclide purification in the body; in the production of simple and multi-component emulsions, additives, pastes, beer, juice, wine; they are used as preservatives and also as flavor and odor enhancers. The bactericidal property of chitosan allows its use in the production of films for the storage of various types of food products. The protective properties of chitosan films coated on the surface of fruits and vegetables - apples, oranges, strawberries, tomatoes, peppers - are the most well-known [1,2].

The purpose of our work is to create a composite material in the form of a membrane for water purification based on graphene oxide [3] with chitosan. For this purpose, we have synthesized graphene oxide and structured membrane.

After analyzing the obtained graphene oxide nanoparticles, it can be seen from the SEM and FTIR images that the obtained GO was obtained with a thin layer and was compatible with chitosan in our water purification membrane construction. The resulting composite GO/chitosan showed good results in the water purification process.

Keywords: membrane, graphene oxide, chitosan, water pirification

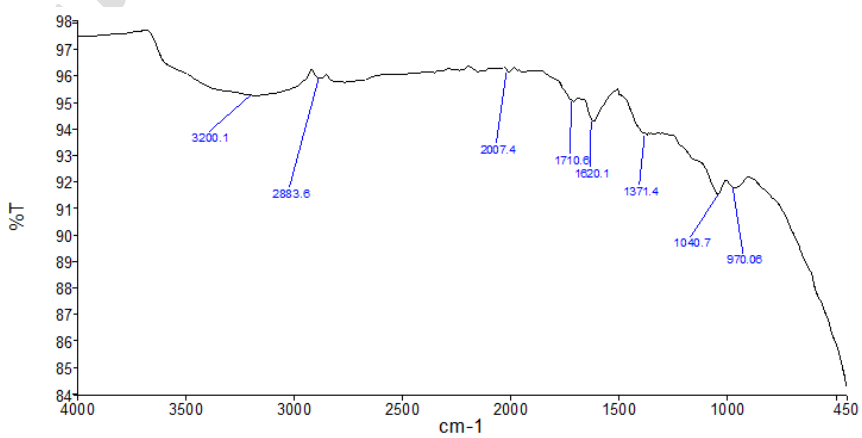

Figure. 1. *FTIR analysis of graphene oxide nanoparticles*

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Peper id : 39

Fabrication of Electrospun Nanofibrous Mat with Unmodified and Modified Graphene Oxide

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Abstract. Food packaging is an important multidisciplinary area that maintains the freshness and quality of foods. Despite its importance, the current materials lack some properties such as desired mechanical properties, flexibility, thermal stability, gas and water vapor barrier properties, etc. Therefore, electrospun mats fabricated from biodegradable polymers have drawn much attention due to their potential application for food packaging instead of petroleum-based materials [1]. Polycaprolactone (PCL) is one of the well-known synthetic biodegradable aliphatic polyesters that has been broadly studied as a biopolymeric material due to its biocompatibility, biodegradability, and easy spinnability [2]. Due to its hydrophilic, biocompatible, and non-toxic features, polyvinylpyrrolidone (PVP) can be used as an additive that is safe to be utilized in the health industry, especially in medicine and food [3]. Moreover, the incorporation of impermeable fillers (nanoplatelets) such as graphene oxide (GO) into polymer matrix improves their barrier properties. To disperse GO homogeneously in the polymer matrix, a hydrophobic silane coupling agent is used to modify the graphene oxide sheets [4]. This study aims to fabricate PCL-PVP nanofibrous mats with GO and silane-modified GO for a food packaging material. For this purpose, fabricated mats were subsequently characterized by SEM, FTIR, and XRD. Furthermore, surface hydrophilicity and water absorption properties were analyzed. In conclusion, the results of SEM analysis showed that these mats were successfully fabricated by the electrospinning technique without the occurrence of bead defects. FTIR and XRD characterizations of the fabricated materials exhibited the interaction of polymers and GO. The materials can act as a precursor for the development of new food packaging materials.

Keywords: food packaging, electrospinning, biopolymer, graphene oxide, silane

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Peper id : 42

Utilization of biomass-based hard carbon in energy storage

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Abstract. In this study, obtaining hard carbon (HC) from biomass, which is a very current topic in recent years, has been studied to be used in the field of energy storage. As a result, biomass-based hard carbon is considered a promising alternative in energy storage systems due to its low cost and environmentally friendly properties. It also provides a great advantage in terms of large-scale production and commercialization.

Keywords: Energy storage, hard carbon, biomass.

Introduction: Due to the rapid developments in technology in recent years, the number of materials that are constantly used in daily life and that work with energy is increasing, and this causes the need for energy to rise day by day. The most suitable material to meet this need is batteries and similar systems. Moreover, the most suitable raw material for energy storage as a battery is biomass-based carbonizedn material (carbonized biomass, activated carbon, carbon black, graphene, hard carbon, etc.). Biomass, which is the only raw material of such materials, is one of the most abundant renewable energy sources in various wastes (agricultural, forest, urban) and organic material such as plants and trees sources. It is mainly composed of lignin, cellulose and hemicellulose, with minor amounts of protein, ash and pectin, and also has a carbon content that can exceed 60% (in dry form). Thanks to these properties, biomass is one of the most popular raw materials for carbon production. Recently, a great attention has been paid to studies of carbonaceous materials derived from biomass, which can be an alternative to graphite, and it is a field that has been studied extensively in the current literature to be used for energy storage in supercapacitors, sodiumion, lithium-ion and potassium-ion batteries.

In general, carbonaceous materials are produced from biomass by applying different methods such as carbonization, activation and surface modification.

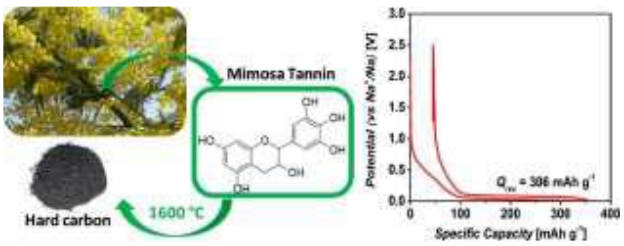

Figure 1. Illustration of high performance hard carbon from tannin (Tonnoir et. al., (2022) [1])

With the pyrolysis method, which is one of the carbonization processes among these methods, graphitic structure is obtained by producing hard carbon in an inert atmosphere at high temperature without requiring any activation, and high-capacity energy storage can be provided. Fig. 1 shows the use of high-performance hard carbon obtained from tannin in a sodium-ion battery.

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An investigation of the biomass-derived carbon for next-generation energy storage systems

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Abstract. From this study, it was concluded that by converting biomass wastes into high-performance value-added carbon materials and using them in high technology new generation energy storage systems, the cost of electrode material that is essential for sustainable energy technology will significantly reduce and contribute to the elimination of fossil fuel-related environmental problems.

Keywords: Biomass, carbon, next-generation energy storage.

Utilization of fossil fuels in energy production causes environmental pollution, global warming and climate changes. Negotiations and agreements are made in the international arena to solve these problems. With the Paris Agreement (2015), it is aimed to keep global warming to no more than 1.5 °C and lower carbon emissions to zero by 2050. In addition, due to the growing energy crisis and environmental problems of fossil resources, there is a great interest in clean renewable energy technologies, which are obtained by sustainable methods. In this context, it is foreseen that all vehicles in the European Union countries will consist of electric vehicles until 2030. Our country has accepted this prediction until 2050. Other countries, especially Japan, attach great importance to the production and expansion of electric vehicle use. Although there is no problem in terms of vehicle production technologies in this transition, the most important problem is the necessity of long and sustainable energy storage systems. The most widely used materials for this purpose are biomass-derived end products.

Electrochemical renewable energy technologies which can be seen in Fig.1 are considered the most promising energy storage and conversion systems in order to address the problems regarding fossil fuel. On the other hand, with the decrease in population density in rural areas due to the development of technology and industrialization, the amount of

biomass is gradually increasing and approximately 130 billion tons of biomass waste is generated annually. The low utilization of this large amount of biomass is still a serious problem. In addition, the carbon composition in the biomass content can be about 45-50% (as dry) that indicates that biomass is a carbon-rich raw material. Therefore, the use of biomass-derived carbon materials abundant, low-cost and environmentally friendly in next-generation energy storage systems is critical both in solving the energy crisis and in preventing environmental damage.

Fig. 1 shows the synthesis of carbon material from biomass by various techniques and next generation energy storage systems where it can be used.

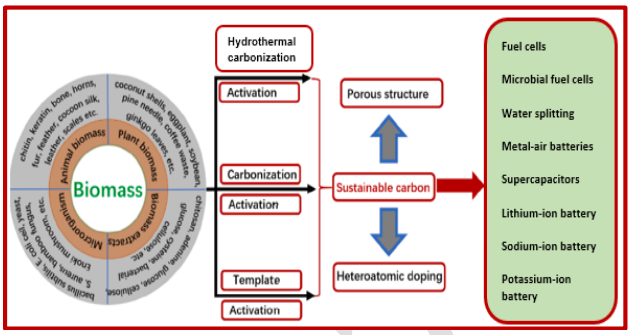

Figure 1. Diagram of biomass-based carbon for energy storage and conversion [1]

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Tuning the Properties of Spray-Deposited Zinc Oxide (ZnO) for Solar Cells and Optoelectronic Applications: A Review

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Abstract. Zinc oxide (ZnO) is a very important transparent conducting oxide. It is a wide band gap II-VI compound semiconductor of several applications in solar cells and optoelectronic industry, especially in thin film form. Naturally ZnO has n-type conductivity due to native defects, but it can be doped to become p-type semiconductor. For these applications the high quality of the produced material and low cost production methods are required. The spray pyrolysis method is a low cost method that enables the production of large area and highly transparent undoped and intentionally doped thin films. Through this method, tuning the properties of the produced films is accessible through changing several deposition parameters such as substrate temperature, concentration of the precursor solution, types of the dopants and their concentrations, annealing, nozzle size, and nozzle to substrate distance, etc. A review of the methods used to tune the structural, morphological, optical, and electrical properties of spray-deposited ZnO thin films to be suitable for the different applications is performed. It is found that; structure, morphology, band gap, transmittance, resistivity, and other related properties of these films can be tuned to fit the requirement.

Keywords: Zinc oxide, Spray Pyrolysis, Solar Cells, Doping, Annealing.

Peper id : 46

Spherical Powder Production Methods for Metal Additive Manufacturing Processes

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Abstract. The application spectrum of metal powders is wide; It ranges from the direct use of powders in chemical processes, soldering/welding, techniques for the production of layer structures to component production, powder metallurgy parts, and powder bed and powder fed additive manufacturing methods. Spherical powders are needed for additive manufacturing processes for the desired property of powder flowability. In this paper, challenges for spherical powder production and important powder properties will be discussed for additive manufacturing.

Keywords: Metal powder, powder production, gas atomisation, plasma atomisation

Additive manufacturing (AM) is gaining more and more industrial attention, as the technologies involved such as selective laser melting (SLM), electron beam melting (EBM) and direct metal deposition (DMD) for metals allow the production of complex shaped parts. The feedstock of powder-bed and powder-fed Additive Manufacturing (AM) processes is powder. Therefore, the first step in these AM methods is to prepare the powder of metallic materials [1], [2]. Key in powder-bed-based additive manufacturing is the use of appropriate powder materials that fit to the process conditions. There are many parameters affecting the build process and the corresponding quality of the parts being built. Therefore, an accurate assessment of the powders becomes important. Such an assessment involves, besides others, the powder flowability, which should be sufficient in order to create good-quality powder layers. Powder flowability can be increased with increased powder sphericity. Powders for additive manufacturing are most commonly produced using gas atomization in an inert gas atmosphere. A high energy flow of gas atomizes the liquid metal upon impact. The atomized liquid metal forms into spherical droplets and turns solid when cooling below the melting temperature. The solid particles are screened and sorted by their size [3], [4]. Atomization processes can be grouped by the method of melting the material, with or without the use of a crucible, and by the type and geometry of the nozzle used. When the material is melted in a crucible, inductive heating or a plasma torch are used. Subsequently, the melt is led through the nozzle into the atomization chamber. In this study, spherical powder production methods will be given and discussed for the desired powder properties for additive manufacturing processes.

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Peper id : 47

Investigation of The Effect of Leaching Applied To Rice Hull Ash On Silica Content and BET Surface Area

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Abstract. In this study, it was carried out to increase the SiO_2 amount and BET surface area value of RHA. In this context, leaching and calcination processes were applied to RHA. For the calcination process, the optimum temperature and time were determined by using two different techniques, directly and gradually. According to the XRF result, it was determined that the calcination process performed gradually was more successful. Leaching process was carried out using 0,5 M HCl and HNO_3 chemicals. At this stage, it is aimed to remove metallic impurities from the structure before the calcination process to obtain RHA synthesis with higher purity and silica content. Characterization studies were carried out with SEM, XRF and BET surface area analyzes. According to XRF analysis, the highest SiO_2 content and the highest BET surface area value were obtained as a result of leaching with 0,5 M HNO_3 and 0,5 HCl, respectively. This study showed that chemical pretreatments are necessary to obtain silica with high purity and high surface area. In addition, it has been observed that chemical pretreatments are necessary to remove metallic impurities. As a result of the pretreatment, the silica content of RHA increased from %92,075 to %99.13 and the BET surface area value increased from 247,9205 m^2/g to 296,0692 m^2/g. In addition, it has been determined that the RHA obtained from this Turkey has better properties compared to similar studies in the literature.

Keywords: Rice hull ash (RHA), Silica, Leaching, BET Surface Area.

Peper id : 48

The Effect of Welding Parameters on Axial Shortening in Length and Hardness Analysis of Inconel 718 Superalloy and AISI 316L Stainless Steel by Continuous Friction Welding

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Abstract. In this study, Inconel 718 superalloy and AISI 316L stainless steel were joined by continuous friction welding. 6 different welding parameters were used. All welds were made at a constant rotational speed of 1600 rpm. The other parameters were determined 2 different friction times (16-12 sec) and 3 different friction pressures (60-40-20 MPa). AISI 316L material made the rotational movement in continuous friction welding. In the welded parts, the axial shortening of the welded samples was measured and hardness analysis of the welding zone was made. Thus, the axial shortenings of these dissimilar metals after welding were compared and the hardness changes were interpreted. It is aimed to contribute to the continuous friction welding studies that will be carried out later for these two materials. The axial shortenings in welded parts were measured with digital caliper. The hardness analyzes were made at the cross section along the central axis of the cylindrical welded samples. A total of 21 Vickers hardness measurements were made for each welded samples. In addition, microscope, SEM and EDS analyzes were made in the weld zone. As a result, these dissimilar materials were welded with continuous friction welding and the welding parameters were evaluated.

Keywords: Friction welding, Superalloys, Stainless Steels, Inconel 718, AISI 316L

Friction welding is solid state manufacturing processes with great potential for manufacturing industries [1–4]. In friction welding, a quality joint can be obtained by configuring the parameters of rotational speed (rpm), friction pressure (MPa), friction time (s), forge pressure (MPa), and forge time (s). Inconel 718 super alloy has superior properties such as excellent corrosion resistance, high temperature strength and impact resistance, as well as good weldability. Inconel 718 superalloy is preferred over stainless steels because of its good mechanical properties at temperatures above 650 °C [5]. It is an indispensable material in stainless steels at lower temperatures, such as superalloys in the automotive, machine building industry, aerospace industry [6]. Compared to superalloys, the material cost is very low.

In this study, nickel-based Inconel 718 super alloy and AISI 316L stainless steel were welded by continuous friction welding method. 6 different welding

parameters were used. All welds were made at a constant rotational speed of 1600 rpm. The other parameters were determined 2 different friction times (16-12 sec) and 3 different friction pressures (60-40-20 MPa). AISI 316L material made the rotational movement in continuous friction welding. In the welded parts, the axial shortening of the welded samples was measured and hardness analysis of the welding zone was made (Fig. 1 and 2). In addition, microscope, SEM and EDS analyzes were made in the weld zone.

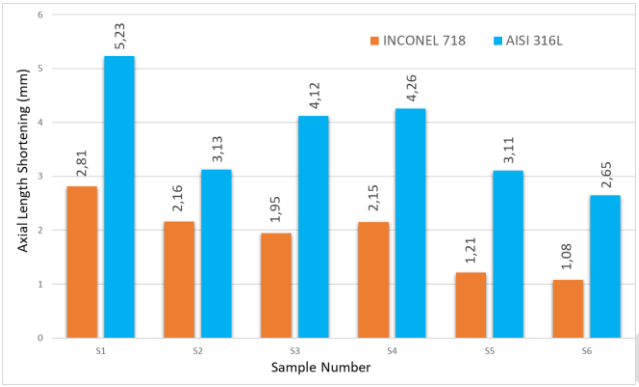

Figure 1. *The axial length shortenings in welded samples*

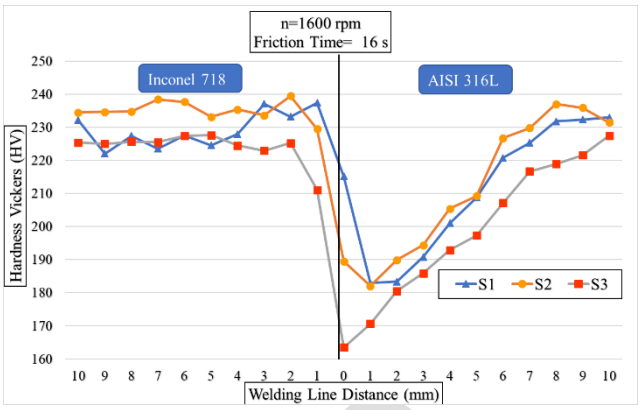

Figure 2. *Hardness graph of S1, S2 and S3 samples*

Acknowledgement

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Synthesis of Three-Dimensional Graphene Coated, Molybdenum Loaded Electrode as Microbial Fuel Cell Anode

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Abstract. Microbial fuel cells (MFCs) are chemical reactors that can convert the chemical energy stored in the bonds of organic compounds into electrical energy through the catalytic reactions of microorganisms in an anaerobic environment. With these cells, while electrical energy is produced, waste water treatment can be done simultaneously. The wastewater treatment systems used today are quite costly. For this reason, it is necessary to use MFC systems, which consume less energy, do not produce sludge and provide efficiency by using the energy they produce, as a wastewater treatment process and improve their performance.

In this study, anode electrodes were synthesized with different synthesis methods in order to increase the performance of the anode cell, which is a defining element of Microbial Fuel Cells (MFC), and the most suitable method for the synthesis process was determined.

For this purpose, first a three-dimensional graphene foam with a macroporous structure (250-500 µm) was synthesized. Then, different molybdenum (Mo) loading methods were studied to increase the adhesion of electroactive species to the surface. In total, seven samples were prepared and the characterization of the samples was made with EDS analysis and SEM images. According to the data obtained, it was concluded that the best result was in the NK/rGO/Mo/EG sample loaded with 84.39% molybdenum.
Keywords: Microbial Fuel Cell, Anode Electrode Synthesis Graphene Synthesis, Molybdenum Loading

In this study, graphene loadings on nickel foam were loaded with the Hummers method used by Wang et al., (2013)[1] and the effect of hydrogen (H_2) gas on molybdenum loading was also investigated. Ethylene Glycol (EG) was used as a dispersing agent in some studies in molybdenum loadings [2,3], while EG was not used in some studies [4]. In our study, two different loading methods were used to determine which method was better, and it was concluded that the loadings made using EG loaded higher Mo and the surface morphology was more homogeneous. All of the syntheses were made using the hydrothermal synthesis method and 80% of the autoclave volume was filled with solution [5]. In our study, seven different anode electrode samples were prepared and the prepared samples were characterized. The syntheses of the mentioned anode electrode samples are given in Figure 1.
Here, sample no. 1 (Nickel Foam), sample no. 2 was treated; GO reduced Nickel Foam (NK/rGO), sample 3; By passing H2 gas (NK/rGO/H2) over GO reduced Nickel Foam at 400 °C, sample no. 4; By loading Mo on sample number 2 (NK/rGO/Mo), sample number 5; By adding Mo salt and EG on sample number 2 (NK/rGO/Mo/EG),

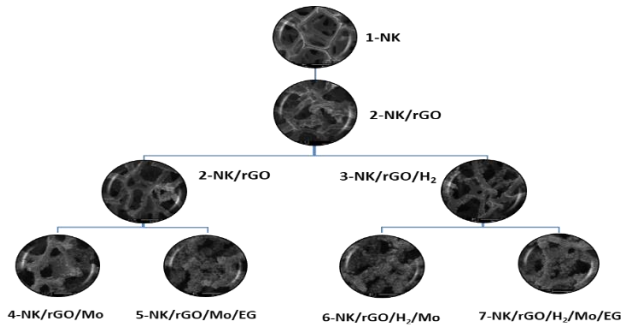

Figure 1. *Anode Electrode Synthesis Steps*

sample number 6; By loading Mo on the 3rd sample (NK/rGO/H2/Mo) and the 7th sample; It was synthesized by adding Mo salt and EG (NK/rGO/H2/Mo/EG) on sample 3, and in the final stage, samples 4, 5, 6 and 7 were prepared by heat treatment with Argon gas at 500 °C in a horizontal oven for 2 hours.

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Peper id : 50

Characterization of Radar Absorption Performance of Polyurethane Paint Combined With Different Reinforcements

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Abstract. It is aimed to produce polyurethane paint with absorbent reinforcing element on aluminum plates and to examine the magnetic permeability properties. Materials with low visibility or invisibility properties are widely used in military aircraft. First of all, absorbing nano powders with polyurethane paint and then applying to surfaces were investigated for absorbing radar waves. The homogeneous mixture was prepared by adding 5 %, 10 %, 15 % (C, MnO_2, C+MnO_2, Fe) powders by weight to the polyurethane paint. Then, spray coating (painting) method was applied to the aluminum plate surfaces with different thicknesses (approximately 43, 51,32 and 68 microns). Network Analyzer was used for the transmission and reflection values of the coated plates. TGA/DSC analysis and SEM characterization method were used to determine the physical and mechanical properties of the mixed polyurethane paint. It was determined that a single coat of 5 %, 10 % and 15 % C and MnO_2 reinforced paint application had better absorption properties at values between 70 % and 98 % in the wide frequency band. However, it was observed that the paint retained its properties with multi-layer painting. It has been determined that the paint is distributed homogeneously on the surfaces in general, there is no change in the chemical properties of the paint and it wets the reinforcement.

Keywords: : Radar Absorption Materials (RAM), Polyurethane, Nano Powders, Spray Coating Method

Peper id : 51

Post-Process evolution and fatigue deformation behavior of Ti-6Al-4 V alloy via electron beam melting

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Abstract. Laser Powder Bed Fusion (LPB-F) is a metallic AM process that is capable of achieving complex geometric forms of high structural integrity in aerospace grade alloys. However, all primary structural applications will need to be surfaced finished to achieve a homogenous outer surface free from the thin as-built semi-sintered surface layer that is a feature of the process. The finishing process will also be needed to improve the surface roughness normally associated with LPB-F. The typical complexity of LPB-F products demands a shape-agnostic processing method. The project will investigate the suitability of available finishing processes by conducting an industry survey and make recommendations for subsequent investigative work. This investigative work will require samples to be produced and processed through the selected candidate processes to determine suitability and limitations. The samples will include fatigue test specimens. The study report will inform on the strengths and weaknesses of the evaluated methods in terms of material removal, roughness and dynamic material fatigue performance.

Keywords: First-principles, virtual crystal approximation, elastic constants, Nb doped

Ti-6Al-4 V alloy possesses unique performance advantages such as high specific strength, excellent corrosion resistance and good thermal stability below 500 ◦C, which is widely used in the field of aerospace manufacturing [1]. Despite the high demand, the manufacture of Ti-6Al- 4V components is always challengeable because of its high melting point, large deformation resistance and active chemical reactivity to oxygen. Traditional manufacture of Ti-6Al-4 V products is inevitably high processing cost, long production cycle and low material utilizationrate, which is difficult to meet the requirements of modern production. Additive manufacturing (AM) [2], as an advanced near-net formingtechnology, has the advantages of freeform fabrication capability ofcomplex parts, short forming cycle, and potential ability to manufacturecomponents with unique microstructures and high performance [3],which facilitates the production of aviation Ti-6Al-4 V parts.Ti-6Al-4 V components fabricated by AM have been investigatedextensively. Recent advances have demonstrated that the formingaccuracy, process complexity and mechanical properties of AM Ti-6Al-4V parts can be comparable to the wrought ounterparts [4]. However,their fatigue life is lower than the wrought counterparts owing to theircoarse microstructure and surface roughness.Oxidation and partially melted particles adhesion on the parts Surface are the main causes of the high roughness in EBM parts. Post treatments (polishing, chemical etching, etc) are then required

to overcome the EBM process defects since they can improve surface finish and therefore the strain to failure and fatigue resistance. This project to compare the fatigue performances of as built condition and also different post-process applications applied to Ti6Al4V parts manufactured by the EBM process.

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Advanced Materials and Manufacturing Concepts for Next-Generation Aircraft Development Programs

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Abstract. A well-engineered airframe incorporates advanced structural materials and functional material technologies to demonstrate the utmost operational capability for civilian transportation as well as military purposes. Over the last decade, Turkish Aerospace has undertaken the indigenous design and development responsibility of various multi-role next-generation air platforms. This article provides an overview of the ongoing efforts to realize advanced material and manufacturing concepts on these air platforms. Firstly, the state-of-the-art material and manufacturing technologies currently used in aerospace are discussed to highlight the emerging needs for improved structural performance in an aircraft. Following on, the most recent and innovative research efforts are explained in the realm of material and manufacturing systems to pinpoint critical technologies to be implemented in the downstream air platform programs. The development and qualification projects managed by Turkish Aerospace, in collaboration with leading international and national research institutes and industrial partners, in part to advance the current status of structural assemblies as well as include additional functionalities on the air platforms are presented. Finally, the potential research and development areas are featured that shall impact the future of the aerospace industry in the upcoming decades.

Keywords: aerospace industry; advanced materials; manufacturing technologies.

Figure 1. *A representative image of the fifth-generation Turkish Fighter Aircraft.*

Peper id : 53

Development and Characterization Of 3d Printed Frequency Selective Surface Structures in Aerospace Applications

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Abstract. In this study, a frequency selective surface (FSS) combined with metamaterial structure (MTM) is developed and investigated using 3D printed materials as substrate layer. The samples manufactured with 3D printing technology are in the dimensions of fitting a waveguide measurement setup (in Ku band) which provides electromagnetic permittivity (ε) and permeability (μ) values of the samples. Samples with four different raster orientations are used and their performances are compared to obtain the highest efficiency. The FSS structure is designed to provide band-pass behavior at f=6 GHz while the MTM structure integrated on the top layer of the structure allows an EM absorption behavior. FSS structure is optimized in a way to increase the bonding between 3D printed layers. In order to show the performance of the proposed design, an antenna operating at f=6 GHz is designed and simulated using the proposed design as a radome. The proposed design does not alter the working performance of the antenna while improving the Radar Cross Section (RCS) value. The designed structure is tested for various angles of incidence. Due to the nature of the design, it can be adjusted to any desired frequency for filtering and the absorption response. Thanks to the 3D printing technology, wideband or multiband absorption behaviors along with band-pass response can be easily and cost efficiently obtained not only flat surfaces but also on any non-planar surfaces which is a significant challenge in radome designs in aerospace industry.

Keywords: 3D Printing, frequency selective surface, metamaterials, RCS reduction, RF/EM Absorber

In 3D printing process, the samples with four different raster orientations ([-45° +45°], [0° 90°], [0° 0°], [90° 90°]) are fabricated and their electromagnetic performances are measured using waveguide measurement setup operating between 12-18 GHz. In recent years, 3D printing technology started to be used in material engineering due to its fast production and cost-efficiency in various fields [1] including the design of metamaterials along with frequency selective surfaces as in [2]. These types of structures are preferred to reduce Radar Cross Section (RCS) in Aerospace [3]. This study focuses not only on using FSS for providing band-pass filter response but also on reducing RCS by adding a metamaterial layer with help of 3D printed substrates.

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Peper id : 55

Processing and material design approaches for advanced oxide thermoelectrics: representative cases

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Abstract. Oxide materials are currently considered a promising alternative to traditional thermoelectrics. Moderate charge carrier mobility stemming from strong covalent and ionic bonding, combined with relatively high thermal conductivity, represent known disadvantages of these materials for thermoelectric applications. However, oxides offer a possibility to operate at high temperatures, resulting in a higher Carnot efficiency. In addition, their known structural and microstructural versatility can open new horizons for thermoelectric applications. This work reviews some representative cases of engineering the composition and microstructure of a series of selected oxides towards high thermoelectric performance. The selected approaches will include laser processing, in situ formed composites, defects tailoring and aluminothermy-boosted sintering, also taking into account the unique redox-tuning capabilities of oxides. Representative examples will include ceramic materials based on $SrTiO_3$, ZnO, $CaMnO_3$ and $Ca_3Co_4O_9$.

Keywords: thermoelectrics, energy conversion, electroceramics, oxides.

The UN 2030 Agenda goals give particular emphasis to the growing need for low-carbon and energy-efficient technologies. Significant efficiency savings can be thus achieved by recovering useful energy from waste heat. A promising solution is direct thermal to electrical energy conversion based on the Seebeck effect and using thermoelectric materials. Thermoelectric technology offers a short route to power generation and is self-sufficient to enable mobile or remote applications [1]. The efficiency of a thermoelectric generator is directly linked to the performance of the semiconducting materials from which it was composed. Different material families have promising thermoelectric properties [1,2], with the focus given to oxides when considering high-temperature applications, owing to their stability in air at elevated temperatures and abundance. The results presented in this work was obtained for bulk ceramic thermoelectric materials. Detailed structural, microstructural, electrical and thermal

charactirization (Fig. 1) was performed to obtain new guidelines for processing and design of performing oxide thermoelectrics. Laser floating zone (LFZ) method was demonstrated as a suitable method for processing ceramics with good thermoelectric properties, although the equilibration of the phase composition after growth represents a challenge [3].

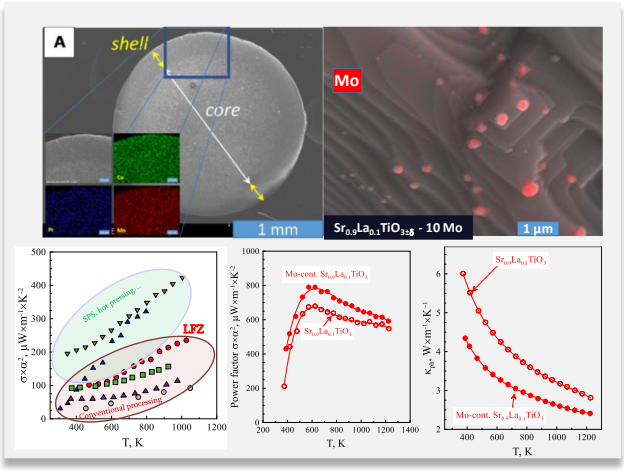

Figure 1. *Representative microstructures and thermoelectric performance of some laser-processed ceramics and in-situ formed composites.*

The thermoelectric properties of oxides can be tuned and enhanced by redox-sensitive additions, as exemplified by the cases of Sr(La)TiO_3 – MoO_3 composites [4] and $Ca_3Co_4O_9$ containing metallic Co addition [5]. Aluminothermy reaction can be used to promote the donor doping of ZnO-based thermoelectrics, leading to an enhancement of the elerctical performance. These and some other approaches are discussed in the present work.

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Microstructural and Mechanical Effects of Intercritical Annealing on Mid-Mn Steels

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Abstract. Since the last century, the priorities of the automotive industry have changed, and factors such as fuel consumption and passenger safety have been decisive in the design of automobiles. This has led to the development of advanced high-strength steels with high strength and enhanced elongation. Safety rules and renewed demands have increased the need for new AHSS types over time and forced the steel industry to produce new generation AHSS. One of these new types of AHSS is medium manganese steels. In this study, the effect of intercritical annealing on the microstructure and mechanical properties of 0.16C-5.5Mn mid-Mn steel was investigated. The 0.16C-5.5Mn steel plate manufactured by casting has been thinned into sheet form by hot press and hot forging method. Then, intercritical (675°C) and conventional (800°C) annealing processes were applied to the samples. Microstructures were observed with optical microscopy (OM) and scanning electron microscopy (SEM), and volume fractions of retained austenite were calculated by X-ray diffraction (XRD). The mechanical behavior of 0.16C-5.5Mn steel was investigated by tensile and hardness tests, and the fracture behavior was examined with SEM micrographs. The findings revealed that the intercritical annealing improves the strength-elongation combination in 0.16C–5.5Mn steel. The fracture surface images showed that the cooling rate had an effect on the fracture behavior.

Keywords: Mid-Mn, Intercritical Annealing, AHSS

Medium Mn steels are defined as a type of steel containing approximately 4–10% Mn [1]. Samples from 0.16C-5.5Mn steel sheet were applied to different annealing cycles (Fig. 1), after which these samples were subjected to a series of microstructural and mechanical tests.

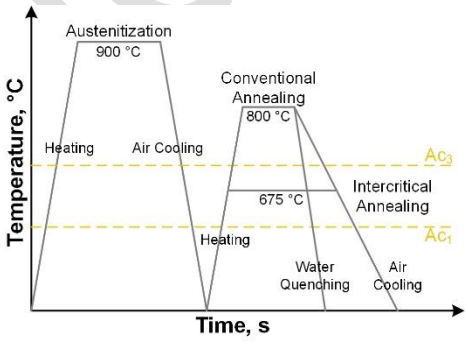

Figure 1. *Annealing cycles*

The obtained results showed that the multiphase microstructure provided by the critical annealing process improved the mechanical properties of 0.16C-5.5Mn steel [2]. It has been determined that the samples annealed in the critical temperature range have a much better tensile strength-total elongation (TSxTE) combination (Table 1).

Table 1. *TSxTE values of samples*

Sample	Annealing Type	TSxTE (GPa.%)
S1	Intercritical	21.3
S2	Conventional	15.9

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THE PREPARATION OF Al_2O_3-Ag CORE-SHELL MICROSPHERES BY USING SEED MEDIATED GROWTH ELECTROLESS PLATING

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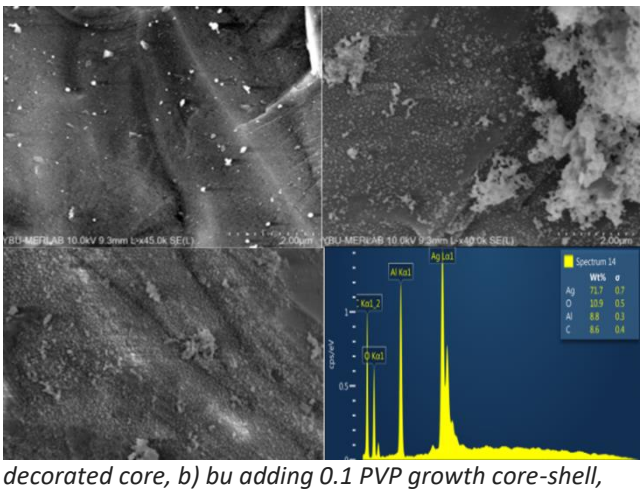
Abstract. In this study, Al_2O_3-Ag Core-shell microspheres were synthesized via seed mediated electroless plating method. Polyvinylpyrrolidone(PVP) was used to control uniform shell synthesize. Morever, the influence of the PVP content and Ag powder concentration during the Ag shell syntesized was investigated by high resolution scanning electron microscopy (HR-SEM), energy dispersive spectroscopy (EDS). The results show that silver powder concentration and adding PVP during shell synthesis are important parameters for homogeneous and uniform silver shell synthesis.

Keywords: core-shell, Al_2O_3-Ag, electroless plating,

Recently, the core-shell microspheres have interested materials due to excellent properties such as, mechanical stability, good electric magnetic properties and thermal conductivity [1,2]. Specially, seramic core like silica, polystrene and noble metal shell such as gold and silver has an important role to apply surface enhanced raman scattering, plasmon resonance frequency applications and so on [3,4]. We studied seed mediated electroless plating to grow homogenous and uniform silver shell on alumina spheres. The syntesized Al_2O_3-Ag core-shell was characterizated high resolution scanning electron microscopy (HR-SEM) and energy disperse spectroscopy (EDS). While the silver shell synthesized without the addition of PVP accumulated heterogeneously, but the addition of PVP in the synthesis of the silver shell ensured the shell formation to be uniform and homogeneous.



decorated core, b) bu adding 0.1 PVP growth core-shell, c) growth core-shell without PVP, d) EDS images of core-shell.

Figure.1 shows that homogeneous and uniform silver shell synthesis was successful by adding PVP. In silver shell synthesis without the addition of PVP, silver ions interact with each other to form a heterogeneous and agglomerated shell structure.

The chosen Al_2O_3 powders has an average size 40µm. Whole process was completed in 30°C temperatues and under the stirring with 400 rpm. The syntesized samples were characterizated SEM and EDS.

This results were indicated that the PVP addition protects the shell structure by preventing silver ions from interacting with each other. In addition, silver decoration was used instead of expensive activating precursors such as palladium. In this way, more cheaper and homogenous silver shell was synthesized on the alumina core.

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Laser Technologies to fabricate Large Scale Bi-2212 Superconducting Plates

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Abstract. Due to the properties anisotropy exhibited by high temperature (HT_c) superconductors, develop adqate processing technologies is a major challenge. Recently, the laser induced solidification techniques have been using to improve the microstructure of *HTc* superconductors namely, $Bi_2Sr_2CaCu_2O_{8+x}$ (Bi-2212), $REBa_2Cu_3O_{7-x}$ (RE-123, RE=Y,Gd). Different laser technologies have been used to fabricate well-textured samples and to machine them without generating cracks. Texture has been controlled using a Laser Zone Melting (LZM) technique while the sample is at thigh temperature in a system calle Laser Furnace. This tecniue can be considered as a modification of the laser line scanning protocol. A very flat solidification front has been obtained in samples up to 100 mm wide. We have fabricated Bi-2212 superconducting samples up to 10cm x 10cm size. The flatness reached in the solidification front allows obtaining misorientation angles lower than 15º in the full width of the sample. The transport properties of these superconducting materials have been correlated

with the level of texture and the thickness od the tectured region reached during the laser process. It can be argued that the size of the plate samples is adequate to desing several electrical circuits adapted for different applications.

Keywords: Laser Zone Melting, Bi2212 Plate, SEM-EDX.

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Fabrication of spinel ferrite nanoparticles via laser ablation

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Abstract: Transition metal ferrite ceramics present very interesting magnetic properties, and are presently being considered in nanometric grain sizes for a number of applications in bioscience. Depending on the preferred transition metal for usage, these ferrite ceramics show stable melt behavior. Thus, they become ideal candidate materials for laser melt processing. Laser Zone Melting process provides many advantages, although until recently it was not possible to process large areas under controlled solidification conditions. These are necessary to exert a good degree of microstructure control. An effective solution to achieve a satisfactory directional solidification interface is found using Laser Line Scanning [1,2], where an instantaneous melting line is obtained on a substrate with a planar geometry. The resulting sharp melt-solid interface provides controlled microstructures and a stable melt on a moving material. In this particular case, the movable material is the preferred transition metal ferrite ceramic compact. Laser Line Scanning generates a dense compact on the machined surface that may be suitable for the subsequent production of nanoparticles with controlled properties via Laser Ablation. The purpose of present research is to focus on the evaluation of the microstructural and magnetic properties of nanoparticles of Mn ferrite spinel material fabricated via Laser ablation process.
Keywords: Subnanosecond Laser Ablation, Nanoparticles, Spinel ferrites.

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Hybrid Terminal Block Design With Two Diffirent Connection Types

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Abstract. Terminal blocks are widely used in the manufacturing, construction and transportation industries today. They are the most preferred products for securely connecting two or more conductors in application areas. According to the usage areas of the terminals; There are many types such as row terminals, metal terminals, terminal blocks. Terminal blocks are terminals that are generally used in electrical panels by arranging them side by side on EN Norm Rails, the dimensions of which are internationally standardized. A rail terminal basically consists of conductive busbar, insulating body and connection mechanism parts. There are many connection mechanisms (screw pressure, spring pressure, push-in connection, lug connection, etc.) available to connect the conductors with the conductor busbar. Each of these mechanisms is used in different places and has various advantages and disadvantages compared to each other.
In the study, by designing the terminal block with push-in connection on the left and screw connection on the right, the installation time of the applicator was shortened and it was ensured that he could interfere with the conductors whenever needed. By design, the conductor is mounted on the screw-connected side of the terminal block, parallel to the ground, while the spring-connected side is mounted at 90 degrees from the ground. This provides ergonomics and convenience in the assembly of cables coming from different directions in the panel. The product designed as closed on both sides; slots are designed for snap-on labels on the right and left, and a strip label can be used on it. This has also increased the level of security.

Keywords: Terminals, Terminal blocks, Design, Screw connection, Spring connection, Conductor

Peper id : 64

Exciton optoelectronics in two-dimensional monolayer interfaces

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Abstract. Unusually high exciton binding energies in two-dimensional (2D) materials exhibit stable excitonic many-body effects and provide opportunities for exploring exciton optoelectronic devices at room temperature. Many-body neutral excitons, trions, bi-excitons, and defect-induced excitons are rarely realized in bulk materials at room temperature. Here we investigate different excitonic states invoked by the crystal defects in monolayer tungsten disulfide (WS_2) at the substrate interface. This was achieved by carrier screening engineering with photogenerated carrier modulation, external doping, and substrate scattering. Defect-induced trions strongly coupled with inherent SiO_2 hole-traps under high photocarrier densities and become more prominent in rhenium-doped WS_2. The absence of defect-induced trion peaks was confirmed using a trap-free hexagonal boron nitride substrate, regardless of power density. Furthermore, excitonic solar cell properties were investigated in graphene/n-Si Schottky Ideal diode structure by minimizing trap charge density in the graphene-Si interface. We controlled the doping methods to increase the conductivity of graphene that transforms nonlinear kink photodiodes with low FF and solar cell efficiency toward trap-free nearly ideal diode photovoltaic *I-V*. The solar cell efficiency obtained with our strategy is around 13.6% and suggests the possibility to reach the theoretical limit of 19%.

Keywords: exciton binding energy, defect-induced B-trion, neutral-to-trion conversion, space charge current, Schottky solar cell

We demonstrate a clear signature of defect-induced A-trions and B-trions in monolayer WS_2 *via* carrier screening engineering. Here, carrier screening was performed in three separate ways – i) photo-generated carrier modulation, ii) impurity (rhenium) doping, and iii) reduction of the substrate-induced hole trap effect. These effects were employed to distinguish A and B-exciton charge-state properties from their neutral state. Defect-induced trions prevailed on SiO_2/Si substrates and became more dominant in rhenium-doped WS_2 (Re-WS_2), whereas they disappeared on hexagonal boron nitride (h-BN) substrates. PL and STS investigations were utilized to obtain the binding energy of the trions, and defect-induced trions compared with the neutral exciton species. Our results demonstrate i) the identification of defect-induced A and B trions and their BE modulation *via* carrier screening engineering, ii) observation of two distinct screening regimes triggered by neutral-to-trion conversion, and iii) spatial BE distributions of many-body exciton species on the micrometer scale.

Furthermore, we have systematically demonstrated the effect of conductivity improvements of Gr using homogeneous doping throughout the junction region in the Gr/n-Si Schottky diode to realize the linear I-V characteristics. Ionic-liquid electrolyte gate was used to facilitate high conductivity of Gr (two orders of magnitude improvement over the pristine sample) together with homogenous doping distribution to achieve a solar cell efficiency of 13.6%. This efficiency without interface engineering and antireflection coating is highest among doped Gr. We further studied the charge trapping and recombination processes in different I-V regions of Gr/n-Si solar cells by diode modeling with the shunt resistance and space-charge-limited-current analysis in the injection region. Our findings suggest that the trapped charges at the native oxides layer can be compensated by homogeneous Gr doping. This is deemed necessary to improve the overall device performance and for commercialization prospective of Gr/n-Si Schottky solar cell.

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Peper id : 65

Study of the effect of pressure and temperature on the microstructure and thermoelectric performances of hot-pressed Sr-doped $Ca_3Co_4O_9$

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Abstract: Pressure and temperature are the main factors influencing the microstructure of hot-pressed materials which can, in turn, affect the electric performances of these materials. In this work, the effect of different pressures and temperatures on the microstructure and thermoelectric performances of Sr-doped $Ca_3Co_4O_9$ materials is explored. Samples were prepared using attrition milled precursors, which reduced the particle sizes, and increased their reactivity, drastically decreasing the processing time. Consequently, it has been found that calcination to decompose Ca and Sr carbonates can be performed in only one step at 850ºC for 1h. After uniaxial cold pressing in form of discs under 200MPa, they were hot-pressed using temperatures between 800 and 900ºC and pressures from 51 to 71MPa, for only 1h. Out-of-plane X-ray diffraction showed that all samples are formed by the thermoelectric phase, with a good grain orientation, improved with T, and P, as demonstrated by the calculated Lotgering factor. Scanning Electron Microscopy has shown that grain sizes and orientation are enhanced with T, and P. Moreover, density determined through Archimedes's method follows the same trend. All these structural and microstructural characteristics are reflected in the three-point flexural strength and microhardness values. Electrical resistivity is decreased when temperature and/or pressure, are increased. The minimum electrical resistivity, 6.4mΩ cm at 800ºC, has been determined in samples processed at 900ºC and 71MPa, which is about the best reported values in the literature. On the other hand, contrarily to the typical behavior observed in these types of materials, they also displayed the highest S values, 182μV/K at 800ºC, which are similar to the best reported values for high density textured materials. However, total thermal conductivity values do not follow a regular evolution with the hot-pressing conditions, probably associated to the presence of internal stresses; anyhow, the lowest values at 800ºC were determined in samples processed at 800ºC and 51MPa (1.51W/K m) or 900ºC and 61MPa (1.53W/K m). Consequently, the highest ZT values have been determined in samples processed at 900ºC and 61MPa (0.35) which is higher than the best reported values in literature for bulk textured samples, to the best of our knowledge.

Keyword: Thermoelectric, Power factor, Seebeck coefficient,

Peper id : 67

Laser Zone Melting Process for fabricating $MnFe_2O_4$ spinel ferrites

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Abstract. The Laser Furnace (LF) technology has been used to produce uniform, dense $MnFe_2O_4$ spinel disks from a mixture of Fe and Mn oxides for controlled synthesis of spinel nanoparticles via Laser Ablation. Application of a CO_2 laser in Line Scan mode onto a sample with the desired stoichiometry, enabled melt processing above 1580^oC at its outer surface layer. In this process, a combination of a laser system and a continuous roller furnace operating at a maximum volume temperature of 1000^oC is used. Such combination helps avoid excessive thermal stress, crack formation and catastrophic failure of these magnetic ceramic monoliths. Higher energy incubation values yield increased molten volumes and a thicker resolidified surface layer with a dense microstructure. Despite the high solidification rates imposed, $MnFe_2O_4$ spinel is the main phase obtained according to X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and magnetization studies. LF processed samples exhibit a reduction of the coercive fields and an increase of the saturation magnetization values, evidence for soft ferromagnetism and characteristic of the magnetic behavior associated with this spinel. This work demonstrates the convenience of the LF method for preparation of uniform, dense targets for Laser Ablation and other evaporation based techniques used in the fabrication of nanoparticles.

Keywords: Laser Furnace, Laser Zone Melting, Spinel ferrites.

Acknowledgements
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Peper id : 68

The investigation of Pd_2Si/n-Si(111) Schottky barrier diodes (SBDs) from $C-V-T$ and $G/\omega-V-T$ measurements on the basis the generalized model

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Abstract. In this study, both the capacitance-voltage ($C-V$) and conductance–voltage ($G/\omega-V$) characteristics of Pd_2Si/n-Si(111) SBDs have been investigated in the wide temperature range of 79-360 K and ± 1V for 500 kHz. On the basis of the temperature dependent characteristics potential barrier height (Φ_B), the doping concentration of donor atoms (N_D), the Fermi energy level (V_n), series resistance (R_s), distribution of applied bias voltage and the role of surface states were analyzed. The value of Φ_B was irregular changed between 0.46 and 0.69 eV with temperature. Such behavior in Φ_B with temperature was attributed to the influence of surface states and electrons exchanging between surface states and semiconductor or metal under temperature and voltage effects. In addition, it has been taken into account the generalized model of the metal-semiconductor (MS) contact/SD with a thin dielectric interlayer. The distribution of applied voltage (V) between this dielectric interlayer (V_1) and depletion layer (V_2), the recharcing potential of surface states (V_1^i) have been investigated based on this model. The voltage dependent profile of R_s was obtained by using Nicollian and Brews method for each temperature.
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Keywords: Pd_2Si/n-Si(111) Schottky barrier diode (SBDs); basic electrical parameters; surface states and series resistance

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Peper id : 69

Microfluidic Human Placenta DNA purification using superparamagnetic microbeads

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Abstract. In this study, we purified the Human Placenta DNA using superparamagnetic microbeads in PDMS based microfluidic chip with 3D printed magnetic platform. Unlike packed column-based chromatographic systems, microbeads could move inside the microchannel in either the same or opposite direction of the magnetic field. The magnetic field was analyzed using COMSOL. Nanodrop readings gave the purification results to obtain the adsorption curve. The developed system could be an alternative to chromatographic separations with rapid analysis time and no-requiring high-pressure equipment.

Keywords: Human DNA purification, microbeads, microfluidics, superparamagnetic, high-throughput

DNA (Deoxyribonucleic acid) is a valuable substance for biochemistry, microbiology, genetics, and forensic science [1]. There are many techniques to purify DNA, such as spin columns and high-pressure liquid chromatography (HPLC). Compared to commercial static bench-top analysis, we propose a miniature device with a PDMS-based microfluidic chip to purify DNA using superparamagnetic microbeads. The novel magnetic platform provides a rapid adsorption-desorption rate and enables to study of 10µL sample volume.

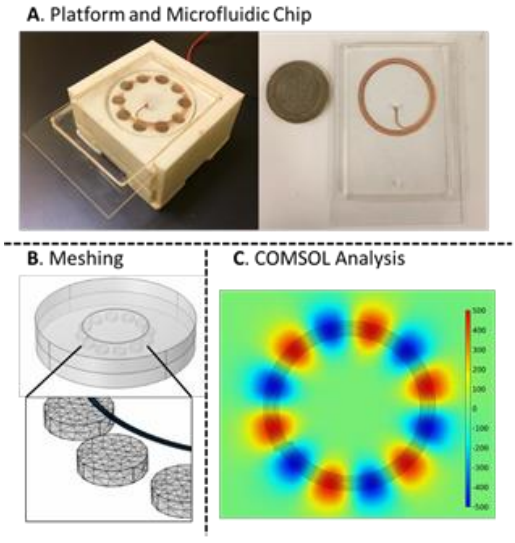

Figure 1. *3D printed-magnetic microfluidic platform and COMSOL Multiphysics meshing model and analysis*

The platform was 3D printed and assembled with permanent magnets on a brushless motor moving compartment (in Fig 1-A) [2]. COMSOL Multiphysics was used to develop a 3D time-dependent model to evaluate the rotational effect of the magnets. The free tetrahedral mesh structure was employed (in Fig 1-B). Each magnet was modeled by using its remanent flux density. Then, the generated magnetic flux density in the channel was determined by Gauss' Law for magnetism (in Fig 1-C).
The PDMS-microfluidic chip was designed as spirals placed over the moving compartment with dimensions of 200µm x 400µm and 0.42m in length. The superparamagnetic silica microbeads were loaded in PDMS based-microfluidic chip.

The superparamagnetic silica microbeads were synthesized using a multi-step polymerization technique [3]. The silica beads were grown on magnetic carboxyl functional polymeric beads and then calcinated to remove the polymeric part.

The microbeads were obtained around 8µm monodisperse in size with superparamagnetic character (in Fig 2-A). The microbeads were used for human placenta DNA (Sigma-D3035) with 20µL/min adsorption and 10µL/min desorption flow rate.

For this purpose, different amounts of DNA were loaded into the microfluidic chip. First, microbeads washed with adsorption buffer (6M Guanidium HCL-Tris Buffer pH:6.0). Then known amount human placenta DNA sample (0.6mg to 250mg) loaded with adsorption buffer. Then, microbeads were washed with 4:1 (v:v) isopropanol/water. Final step, DNA was collected using elution buffer (10mM tris buffer pH:9). The adsorbed DNA concentration (Q_{DNA} [ng DNA/mg dry particles]) was analyzed by Nanodrop (Thermo Fisher Scientific ND 2000,USA).

(Eq 1) $Q_{DNA} = (C_o V_o - C_f V_f)/M_p$

where C_o is initial DNA concentration (ng DNA/µL medium); V_o is the volume of the adsorption buffer (µL); C_f is the final DNA concentration (ng DNA/µL medium), V_f is the volume of the collected desorption buffer (µL) and M_p is the amount of particle (mg). The isolation experiments were carried out with 3 independents replicated for each concentration.

The adsorption curve was obtained to determine the maximum adsorption capacity (in Fig 2-B). The maximum adsorption capacity was approximately 100mg/mg particle from experimental data. The desorption yield was 40% for adsorbed-DNA on the microbeads.

The high-throughput with small amount of sample volume and fast processing time are favorable properties compare to similar material and techniques in the literature [4]. Due to the motion of the microbeads in the microfluidic channel, the diffusion barrier observed in packed systems was diminished in our proposed model. This motion effect could increase the adsorption yield of the microbeads.

This new device could be promising tool for the detection or purification of specific targets and biological samples such as exosomes, cffDNA, mRNA, bacteria and viruses with the proper surface modification of the superparamagnetic microbeads.

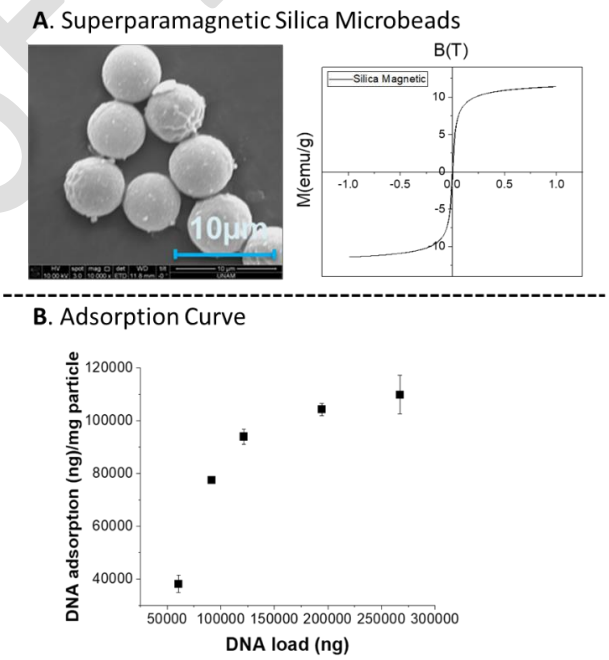

Figure 2. *Superparamagnetic silica microbeads and adsorption curve*

Acknowledgments: This study is financially supported by the Turkish Scientific and Technology Research Council, under Grant No. TEYDEB- 1170524.

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Peper id : 70

Weldability of Haynes 188 Cobalt Based Super Alloy and AISI316L Austenitic Stainless Steel

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Abstract. Due to their high temperature and oxidation resistance, the similar and/or dissimilar metals welding are needed in the production of gas turbine and rocket engine parts, in which cobalt-based super-based super alloys are also used. The fusion welding processes such as Gas tungsten arc welding (TIG), Laser beam welding (LBW), Electron beam welding (EBW) and Plasma arc welding (PAW) are widely used for similar and dissimilar welding application. Welding defects such as solidification cracks in the melting zone of weld metal of the alloys to be used at high operating temperatures and liquefaction cracks in the heat-affected zone may occur. One way to overcome these problems is to use a low heat input in the welding process. Force TIG welding machine, which has been developed in recent years, allows semi-automatic or fully automatic welding with its integrated systems. Thus, it provides the opportunity to obtain the heat input homogeneously and to perform autogenous welding with its control on the welding parameters. In the study, the requirement for dissimilar weldability of Haynes188 alloy with AISI316L stainless steel, which is used in high temperature applications, has been determined as a research subject. In this context, it is aimed to investigate the weldability of the Haynes 188-AISI316L couple, as supplied, automatically with the Force TIG welding machine, without opening the weld groove, without using any additional metal (autogenously). For this purpose, the mechanical properties of dissimilar welded sample were determined and its microstructure was evaluated in detail.

Keywords; Haynes 188 super alloy, AISI316L austenitic stainless steel, Weldability, Microstructure and mechanical properties

Peper id : 71

Superconducting Base Elements for Artificial Neural Network

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Radical reducing of energy consumption becomes the important goal in the advance of supercomputers. The Artificial Neural Networks (ANN) based on superconducting spintronic elements seems to be the most promising solution. Superconducting ANN needs elaboration of two main elements – nonlinear one (neuron) [1] and linear connecting element (synapse) [2]. Results of our theoretical and experimental study of the proximity effect in a stack-like superconductor/ferromagnet (S/F) superlattice with Co- ferromagnetic layers of different thicknesses and coercive fields, and Nb-superconducting layers of constant thickness equal to coherence length of niobium are presented.

It was designed and investigated superconducting spin-valves as artificial neuron and kinetic conducting element, based on layered hybrid S/F nanostructure, serves as synapse.
We present results of our theoretical and experimental study of the proximity effect in a stack-like superconductor/ferromagnet (S/F) superlattice with Co- ferromagnetic layers of different thicknesses and coercive fields, and Nb-superconducting layers of constant thickness equal to coherence length of niobium.
The layered nanostructures Nb/Co demonstrate change of the superconducting order parameter in thin s-films due to switching from the parallel to the antiparallel alignment of neighboring F-layers. We argue that such superlattices can be used as tunable kinetic inductors for ANN synapses design.
The study was financially supported by the Russian Science Foundation Grant (RSF) No. 20-62-47009 “Physical and engineering basis of computers non-von Neumann architecture based on superconducting spintronics”, and partially by the Moldova State Program Project «Nanostructuri şi nanomateriale funcţionale pentru industrie şi agricultură» no. 20.80009.5007.11.

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Peper id : 72

Direct and Continuous Routes for the Synthesis of Complex Advanced Functional Ceramic Materials

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Abstract. Laboratory scale Continuous Hydrothermal Flow Synthesis (CHFS) systems for the controlled synthesis of inorganic nanoparticles (diameter <100 nm) have many potential commercial applications from catalysts to sunscreens and battery materials to fuel cell components. CHFS systems offer many advantages over batch processes: it is a green technology (using supercritical water as the reagent at >374°C and 22.1 MPa), and uses inexpensive precursors (e.g. metal nitrate salts), and parameters such as *T*, *P*, etc. can be controlled independently for the synthesis of high-quality, technologically-important functional nanomaterials in a single step (or fewer steps than conventionally used). ***The Clean Materials Technology Group at UCL, now use CHFS made intimately mixed metal oxide precipitates as precursors to the direct synthesis of "difficult to make" solid-state phases using only a single heat treatment step and no grinding (i.e., "Bake Without the Shake!").*** This approach can be used for rapid materials discovery and also to manufacture materials using continuous, low energy manufacturing methods which are inherently scalable. As well as the use of CHFS for battery materials discovery, the talk will discuss the design and operation of a scaled-up CHFS Pilot Plant capable of Kg/h synthesis of nanoceramics as well as future directions for the CHFS technology. A review article on the topic has been published and gives an excellent overview on the technology, see Darr JA, et al. "*Continuous Hydrothermal Synthesis of Inorganic Nanoparticles: Applications and Future Directions",* ACS Chem. Rev. **2017**, *117* (17), 11125–11238

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Keywords: Functional Ceramic Materials

Figure 1. *Lab view*

Peper id : 73

Coating glass polycapillary optic with luminescent silicon nanoparticle to enhance the optical characteristics in the EUV/X-ray regime

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Abstract The refractive index n at the high-frequency limit of scattering electromagnetic waves (x-ray/EUV) from matter is complex with dependence on the frequencies of the incident photon and the plasmon of the material, with its real part is ever so slightly less than one ≤ 1. Such high frequency when propagating at grazing incidence from vacuum to matter suffers total external reflection. Arrays of curved and tapered glass capillary (polycapillary optic) utilize this effect to collect X-ray tube output, guide and focuses it onto smaller areas with flux that is orders of magnitude greater than what can be achieved by mechanically collimated systems. We examine the feasibility of internal surface doping, which may produce a thin silicon coating that assumes the shape of the polycapillary. We show that unlike static incubation or drying in a colloid of 2.85-nm silicon nanoparticles, slow self-assembly via dynamic circulation of the colloid through the capillary over extended time produces homogenous coating to reduce roughness. Optical, luminescence and SEM imaging and spectroscopy show uniform silicon-coated polycapillary that is optically active in the UV. Silicon coatings promise larger critical angles for x-ray propagation over what glass provides, which provide higher focusing power. The use of ultrasmall nanoparticles (2.85-nm

diameter) ensures reduced losses to roughness-related scattering with uncompromised transmission intensity, which may increase the spatial resolution and speed of imaging and diagnostics.

Keywords: Polycapillary, luminescent, silicon, nanoparticle.

Peper id : 74

Investigation of Mechanical Properties of $Ni_xW_6Se_8$ $(x = 1, 2, 3, 4)$ Chevrel Phase Compounds

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Abstract. After the discovery of Chevrel phases in 1971, it has been an interesting research area in the literature in terms of usage areas such as batteries, catalysis and thermopower technology. Also, the wonderful examples of coexistence and interaction between superconductivity and long-range magnetic interactions are of interest. In this work, the mechanical properties of $Ni_xW_6Se_8$ $(x = 1,2,3,4)$ Chevrel phase compounds have been investigated using Density Functional Theory (DFT) where these properties have not been studied as far as known studies in the literature. The determination of elastic constants provides information about the mechanical stability and mechanical properties of a material. Therefore, $Ni_xW_6Se_8$ $(x = 1,2,3,4)$ Chevrel phase compounds have been investigated for their mechanical properties in detail to reveal their possible applications in this study. This work is supported by TUBITAK under project number 120F305.

Keywords: Chevrel phases, mechanical properties, density functional theory

In this study, the Vienna Ab-initio Simulation Package (VASP) [1] is used for the investigation of the mechanical properties of $Ni_xW_6Se_8$ $(x = 1, 2, 3, 4)$ Chevrel phase compounds. The DFT calculations are performed with a 700 eV cut off energy and 10x10x10, 8x7x7, 7x7x7, 7x9x6 k-points with a Γ-centered Monkhorst-Pack mesh [2] for NiW_6Se_8, $Ni_2W_6Se_8$, $Ni_3W_6Se_8$, $Ni_4W_6Se_8$, respectively. Moreover, the energy and force convergence tolerances are set as 1×10^{-11} eV per atom and 1×10^{-6} eV/Å, respectively. The stress-strain method [3] is used that is implemented in VASP to calculate the mechanical properties of these compounds. In addition, 3D schematic representations of Young's modulus, linear compressibility, shear modulus and Poisson's ratio are obtained using ELATE software [4].

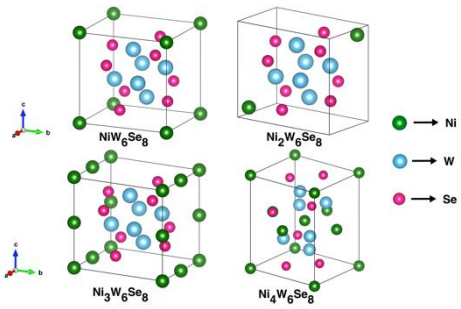

Figure 1. *The crystal structures of* $Ni_xW_6Se_8$ *compounds*

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Peper id : 75

Investigation of $Fe_XMo_6Se_8$ (x = 1, 2, 3, 4) Chevrel Phases for Photocatalytic Hydrogen Production Performance and their Topological Properties

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Abstract. Currently, the World faces energy crisis due to limited sources of the fossil fuels that are most used energy source nowadays. However, there is a huge effort to explore the alternative energy sources especially renewable eenergy sources. Hydrogen energy is one of these energy sources that is enviromentally friendly. The hydrogen production is crucial for the hydrogen energy and photocatalytic hydrogen production that is one of the hydrogen production method, only uses sun light to generate hydrogen. The photocatalyst should have appropriate band gap and suitable redox and oxidation potential levels to generate hydrogen. In this study, the $Fe_XMo_6Se_8$ Chevrel phases are investigated for the photocatalytic hydrogen production. Furthermore, the topological properties of these phases are considered to enhance their water splitting performance. This work is supported by TUBITAK under project number 120F305.

Keywords: Chevrel phases, water splitting, topological properties, density functional theory

In this study, $Fe_XMo_6Se_8$ Chevrel phases are studied using the Vienna Ab-initio Simulation Package (VASP) [1] that is based on the Density Functional Theory (DFT). The Chevrel phases were discovered by Chevrel and Sergent in 1971 [2] that have superior properties such as superconductivity, cathode material properties, etc [3,4]. The general chemical formula for the Chevrel phases are $M_xMo_yCh_8$ where M is a metal and Ch is a chalcogen [5]. The x values can be 0, 1, 2, 3 or 4 and y could be 3 or 6. In this study, $Fe_XMo_6Se_8$ Chevrel phases are investigated for their photocatalytic hydrogen production properties. Figure 1 shows the crystal structures of $Fe_XMo_6Se_8$ Chevrel phases.The water splitting performance and topological properties of $Fe_XMo_6Se_8$ Chevrel phases will be presented in this study.

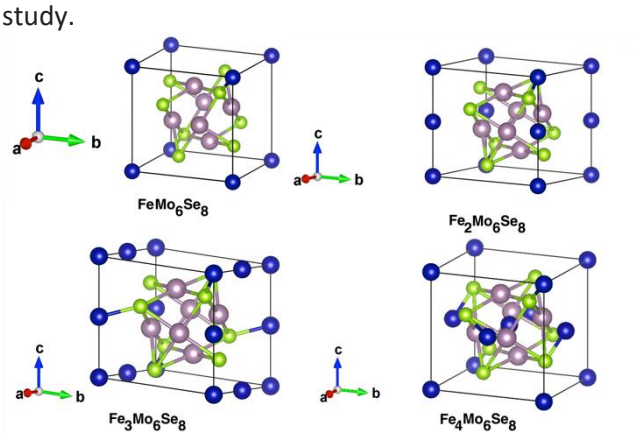

Figure 1. *Crystal structures of* $Fe_XMo_6Se_8$ (x = 1, 2, 3, 4)

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EFFECTS OF UNDERCUT DEPTH AND LENGTH ON WELD STATIC STRESS CONSANTRATION AND DUCTILITY

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Abstract. Undercutting is a welding defect that appears as a groove in the base metal directly along the edges of the weld metal. It is inevitable in fillet and butt joints if improper welding parameters are used in the operation. It is a discontinuity in the welding which produces stress concentration and lowers the strength of the weld. The stress concentration factor of an undercut is due to reinforcement angle, undercut width, undercut depth and undercut root radius.
In this study 20 mm thick mild steel plates were welded by gas metal arc welding process. Before welding a 30° single bevel groove angle was obtained by milling on the longitudinal side of a test plate. Two plates were welded with one pass. After welding the weldment was tested with radiographic NDT process. A defect free weldment was obtained. Then standard tensile test samples were machined from the weldment. A groove was drilled in the heat affected zone, adjacent to the weld metal boundary on every tensile test sample. Each groove resembled an undercut. The length, root radius and depth of grooves were varied. Then samples were broken on a tensile test machine. From the test results the static stress concentration factor of each groove was calculated. The effects of groove geometry on stress concentration factors and mechanical properties were determined.

Keywords: Welding defects, Undercut, Undercut geometry, Static stress concentration factor

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ACTIVATING FLUX GAS METAL ARC WELDING PROCESS

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Abstract. A more efficient and economical method of improving the productivity of gas metal arc welding process is using activating fluxes in welding. The activating fluxes which consist of halogens and oxides have a positive effect on electric arc formation and droplet transfer of electrode metal to the liquid metal pool. Activated Flux Gas Metal Arc (A-MIG) welding can increase the joint penetration, weld depth/width ratio and weld area. In this review paper, the effects of A-MIG welding on weld bead shape in mild steels, austenitic stainless steels, aluminum and magnesium alloys are examined. The effects of this welding process on weld mechanical properties weld distortions are explained.

Keywords: MIG welding, A-MIG welding, MIG activating fluxes

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Enhanced VGG16 Deep Learning Network for Classification of Deformation Rate from Microstructure Images

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Abstract. The promising outputs obtained in image recognition and classification studies have revealed the great potential of deep learning in microscopic analysis in materials science. Microstructures provide significant data about the features of the material they belong to. The phase structures visible in the material microstructure give clues about the deformation rate of the material, which the naked eye cannot notice. In this study, S235JR structural steel was deformed at different rates via a tensile test in the laboratory environment before metallographic processes. In the next step, a data set belonging to five classes and images of microstructure were obtained via an optical microscope. The deep learning model developed by preprocessing was determined on the data set containing 10000 images of S235JR structural steel, contributing to the literature. The novelty of the model created using VGG16 is to adjust the network architecture to fit the microstructure images. The dataset is trained to classify images through their microstructure and then to estimate the accuracy. As a result, the classification success was over 89%. Results were checked against new methods.

Keywords: Deep learning, VGG16, S235 JR structural steel, deformation rate

There is a significant relationship between the deformation rate and the remaining life of the material [1-2]. Recently, more advanced and successful Deep Learning approaches than machine learning techniques have been applied in the classification, segmentation, and analysis of microstructure images. Deducing meaningful inference with the help of deep learning networks by processing the features of material microstructure images contributes to the field [3]. In this study, the deformation rate of structural steels was determined. The reason why structural steels are preferred as material; structural steels are widely used and can be easily studied in a laboratory environment. Samples deformed at different rates by the tensile test were subjected to metallographic processes, and their microstructures were obtained via Light Optical Microscopy (LOM). In this way, an original data set was created, and so was a contribution to the literature. Obtained microstructures were classified automatically with respect to the deformation rate via the VGG16 algorithm [4], one of the Deep Learning algorithms. The cutting-edge innovation of the method is the ability to the adjustment of the VGG16 architecture in accordance with the microstructure images.

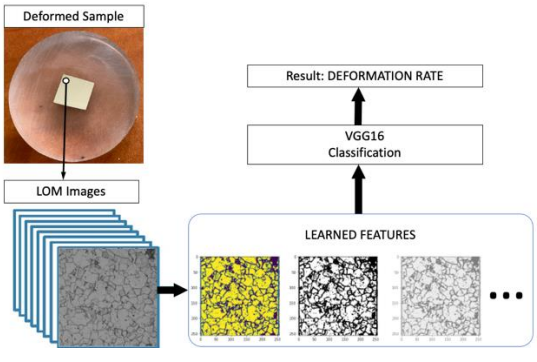

Figure 1. *Determination of the deformation rate of structural steels via deep learning network*

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Copper Ferrite Nanoparticles: structural, magnetic, optical, photocatalytic activity and blood compatibility properties

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Abstract. The synthesis and the investigations of magnetic nano particles have been playing an important role in several application areas, such as catalyst, MR imaging, high-density magnetic storage, and controlled drug delivery, biomedical, and pigment applications. Ferrites are materials that are extremely valuable and suitable for other application areas such as MRI and magnetic hyperthermia thanks to the control of their physicochemical properties using an external magnetic field. Among the magnetic nanoparticles, the spinel ferrites (SFs) are shown by the chemical formula of MFe_2O_4 where M refers to a divalent cation such as Co, Cu, Fe, Mn, or Ni [1-5]. In this study, spinel ferrite $CuFe_2O_4$ nanoparticles (NPs) have been successfully synthesized via the co-precipitation method. Based on chemical composition and considering biological properties of $CuFe_2O_4$ ferrites nanoparticles, the structural, magnetic, photocatalytic and biocompatibility properties were investigated. X-ray diffraction analysis (XRD), Scanning electron microscope (SEM) and UV-vis diffuse reflectance (DRS) spectrum techniques have been employed to analyze the structural, morphological, and magnetic properties of nanoparticles. The NPs have a cubic structure with a space group *Fd3m*. The direct and indirect gap energies of the Cu-ferrite NPs samples were obtained as 3.24 and 2.6 eV, respectively. Photocatalytic activity tests showed that $CuFe_2O_4$ nanoparticles could degrade 55.4% of total organic dye after 1440 minutes of the model dye. Characteristics of the absorbance spectra obtained from hemolysis tests also revealed the possible interactions of copper and thiol (–SH) groups. Moreover, the observation of the formation of a characteristic black precipitate in hemolytic activity tests was interpreted as clear evidence for the formation of heme-iron complexes. The M-H loop shows a *S*-shaped pointing to the soft ferromagnetic behavior with the coercivity field (H_c) value of 1412 Oe, saturation magnetization (*Ms)* value of 14.06 emu/gr

Keywords: Spinel Ferrite, Nano particles, Microstructure, Photocatalysis, Blood compatibility

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Laser Induced Reverse Transfer

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Abstract: Laser irradiation of transparent substrates in front of an absorbing target results in ablation of the target material and the consequent coating on the back of such substrate [1-4]. The use of pulsed near-IR lasers is reviewed in this talk, with particular attention to coatings or surface modification produced on glass substrates. This method enables the fabrication of thin coatings on glass at low cost and without the need for vacuum or chemicals. It is thus attractive from the environmental and efficiency points of view.

This relatively new fabrication method will be briefly presented and overviewed, and a number of examples analyzed in relation to the coatings obtained and types of lasers used.

Keywords: Laser Ablation, Surface Modification.

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In Situ SEM Scratch Testing to Evaluate Wear Mechanisms of TiC-Ti6Al4V Nanocomposites Manufactured by Selective Laser Melting

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Abstract. Ball-on-disk and reciprocating wear tests are common methodologies to evaluate the friction and wear properties of metallic alloys and composites. However, it can be a challenge to fully understand time-dependent wear mechanisms by post-mortem examination of wear tracks, particularly at the micro-nano scale. Here, scratch tests are carried out in situ in a scanning electron microscope (SEM) to enable real-time imaging of microstructural evolution during scratch tests. In this talk, in situ SEM tribology is applied to evaluate the wear mechanism of novel Ti6Al4V-TiC nanocomposites. In situ nano-TiC reinforced Ti6Al4V matrix composites and plain Ti6Al4V alloys were manufactured using selective laser melting (SLM). The tribological properties of these alloys were quantified using dry reciprocating wear tests and in situ SEM scratch tests. Post mortem optical profilometry of the wear tracks showed that despite their higher hardness, in situ TiC reinforced composites had a higher wear rate compared to the parent Ti6Al4V matrix. In situ SEM scratch tests revealed that nano-sized TiC particles dissociate from the Ti6Al4V matrix under frictional forces and cause a higher wear rate despite their positive contribution to improved part hardness.

Keywords: (Calibri, 10 punto, 3-up to 5 should be given)

Peper id : 89

In situ X-ray Microscopy tensile testing of Ti6Al4V Parts Manufactured by Selective Laser Melting

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Abstract Additive Manufacturing (AM) can offer advantages over conventional manufacturing methods such as complex geometries and unique microstructures. However, the porosity of AM parts can deteriorate their mechanical properties and limit their applications. To evaluate the effect of internal pores on mechanical properties, here we apply in situ tensile loading of AM parts inside an X-ray microscope (XRM). In situ XRM mechanical testing enables 3D quantification of internal pores under increasing load, including their shape, 3D distribution and movement under compressive loading.

This talk will discuss the opportunities, capabilities and limitations of in situ XRM microscopy to evaluate the behaviour of porosity within additively manufactured Ti6Al4V components under load. Ti6Al4V parts were manufactured by selective laser melting (SLM) using a high energy density to generate keyhole pores within dog bone shape test pieces specific to the in situ XRM mechanical test rig. Samples were imaged using XRM under increasing tensile load conditions. The changes in pore morphology, position, movement and combination of the pores within the sample, has been evaluated. While the load stayed within the elastic zone, no observable change of pores was detected. However plastic deformation of the Ti6Al4V part changed porosity distribution and shape, with merging and deformation of small pores occurring inhomogeneously throughout the 3D volume.

Keywords: (Calibri, 10 punto, 3-up to 5 should be given)

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A review of the microstructural evoluation of the parts which produced with wire arc additive manufacturing technique

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Abstract. Wire arc additive manufacturing (WAAM), which is a sub-branch of metal additive manufacturing, is a production method in which wire is used as raw material and arc energy is used as energy source. The deposition rate in WAAM production technique is higher than other metal additive manufacturing methods. In addition, large parts can be produced in WAAM compared to other metal AM methods. Due to these positive aspects, WAAM has been the focus of attention of researchers. Researchers are working on the mechanical properties of the produced parts as well as the development of the production technique. In this study, -in scope of WAAM- the materials that produced with various welding types and wires were examined. The studies conducted in the review focused on the microstructure formations that directly affect the mechanical properties. In this context, what kinds of microstructures are formed in various parameters (especially at different heat inputs) have been compiled. The properties of each material group were evaluated within itself. Thus, the effect and contribution of the changes in the parameters used in production in the same material group on the microstructure were reviewed by literatures.

Keywords: wire, arc, additive munufacturing, microstructure

Additive Manufacturing is defined in the ASTM F2792 standard as, "The process of joining materials to make objects from 3D model data, usually layer-upon-layer, as opposed to subtractive manufacturing methodologies".[1] Wire+Arc Additive Manufacturing is the sub-branch of AM.[2] Parts can be produced in WAAM using MIG, MAG and PAW welding methods and different welding wires.[3] Additionally Cold Metal Transfer (CMT) is also used in WAAM.[4] WAAM is preferred due to low equipment cost and high deposition rates according to other AM methods. But the parts that produced with WAAM has disadvantages like surface roughness. The usage of WAAM has been proved on steels[7], aluminum[41], titanium[30], inconel[56]. Beside mechanical properties of parts which produced with WAAM, improving of the production parameters are examined by Researchers. These examinations still ongoing.[5] In WAAM, there are

many challenges like, especially, heat accumulation and the intricate thermal conditions. Because of microstructure get effected to the heat accumulation and cooling rates, heating and cooling conditions directly affect mechanical properties.[6] So microstructural analysis are vital importance in the scope of the WAAM.

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Peper id : 92

Electrodeposition of Dense Lithium and Sodium Battery Cathodes for Solid-State Batteries

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Abstract. Conventional Li-ion batteries are formed using slurry-cast electrodes whose random nature and porosity limits both energy density and rate performance. Slurry-cast electrodes also are generally incompatible with solid-state batteries unless the slurry contains solid electrolyte particles in addition to active material. While such composite electrodes, consisting of a mixture of active material, solid electrolyte, and potentially conductive additives are under active investigation, such designs exhibit power and energy limitations due to the tortuosity of the ion and electron conduction pathways. I will present our work on the molten salt electrodeposition of thick and nearly dense Na and Li-based cathodes on metallic current collectors, including cathodes based on LiCoO2, NaCoO2, LiMn2O4, and Al-doped LiCoO2 which overcomes some of these challenges. The capacities are near-theoretical, and the crystallinities and electrochemical performance are comparable, or in some cases, even better than powders synthesized at much higher temperatures. A very attractive element of the electrodeposition process is control of the crystallographic orientation of the deposited film. For example, the crystallography can be oriented such that the fast electron and ion conduction directions are perpendicular to the substrate. Finally, I will discuss solid-state batteries built these electrodes and how the crystallography of the electrode | solid-electrolyte interface impacts interfacial reactions, rate performance, and cycle life.

Keywords: energy storage, batteries, electrodeposition

Peper id : 93

The role of defects on structural and optical properties of ZnO nanorods synthesized by a hydrothermal route at various growth times and temperatures

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Abstract. Zinc oxide (ZnO) nanorod arrays were manufactured by a hydrothermal route at various growth times (3, 4, and 5 hours) and temperatures (90, 120, and 150 oC). X-ray diffraction, SEM, energy-dispersive X-ray spectroscopy, UV-Vis spectrophotometry, and photoluminescence spectrophotometry were performed to analyze the role of defects on structural and optical properties of ZnO nanorods. All samples showed a typical ZnO wurtzite crystal structure.
There were no contamination and secondary phases in the X-ray diffraction patterns. At a growth temperature of 150 oC, perfect hexagonally shaped nanorods transformed into pyramid-like nanorods. The average optical transmittance and energy band values were obtained to be higher at relatively low growth time (3h) and temperature (90oC). A photoluminescence spectrophotometer was also employed to investigate the deficiency type and density, and crystal quality of ZnO nanorods. The broad visible emission band (including yellow-orange and red emissions) was detected. The yellow-orange and red emissions might be accredited to the double charged oxygen vacancy (V_o^(++)) and oxygen interstitials (O_i) which were strongly dependent on the growth time and temperature.

Depending on the results, these nanorods with manipulated optical properties could be an ideal candidate for the application in UV light emission.

Keywords: ZnO nanorods, hydrothermal route, optical transmittance, Photoluminescence properties.

In this study, we focused on the relationship between the synthesis parameters (growth time and temperature) and the role of defects on structural optical properties. We synthesized ZnO nanorods using a hydrothermal route at various growth times and temperatures. The defect density of ZnO nanorods manufactured by the hydrothermal route is investigated by Gaussian decomposition of the photoluminescence (PL) spectrum.

We also investigated the changes systematically in the optical properties concerning the structural and defects evolution of this compound. We observed that optical properties, including visible transmittance, the bandgap is easily organized by changing hydrothermal growth time and temperature.

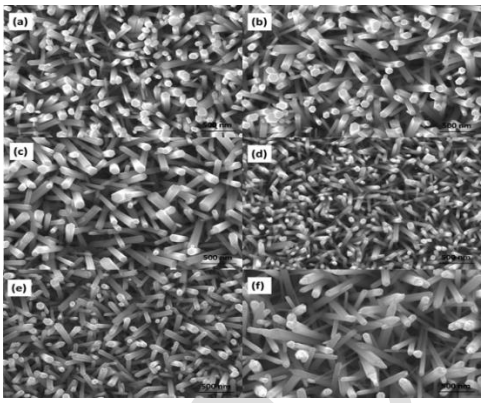

Figure 1. . SEM images of ZnO nanorods produced at various growth times as (a) 3h, (b) 4h, (c) 5h at 90 oC and growth temperatures as (d) 90 oC, (e) 120 oC, (f) 150 oC in 3h growth time.

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Carbide-Free Bainitic Steels-A Short Review

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Abstract.

In this study, carbide-free bainitic steels (CFBS) developed in recent years were investigated by making a short literature survey. In the presented study, the chemical composition, production, microstructure and mechanical properties of CFBS's were given and the transformation mechanisms were investigated. CFBSs can be produced with high mechanical properties (strength, hardness, fracture toughness, etc.) without the need to add expensive alloying elements and without the need for mechanical processes (rolling, forging, etc.). As it is known, advanced high strength steels are produced by thermomechanical rolling processes in large and complex rolling lines. In addition, strict process controls are needed in the production of these steels. Therefore, the cost of advanced high-strength steels is relatively high compared to other steel products. CFBSs, which can be produced at low cost thanks to their well-known heat treatment process, have great importance in science and industry as they are an alternative to reduce to cost of a steels such as 3rd generation advanced high strength steels, armor steels and maraging steels.

Keywords: Bainite, High silicon cast steel, Carbide-Free Bainite, Nano-Bainite, Austenitizing, Austempering

Carbide-free bainitic steels (CFBS) have been developed in recent years and are a new type of advanced high-strength steel. They have microstructures of ultra thin carbon-rich stable austenite and bainitic ferrite plates. CFBSs can be produced at low cost by heat treatment processes, without the need for expensive alloying elements and complex mechanical processes. Due to its superior mechanical properties (high strength, high hardness and high fracture toughness), it is an alternative to all steels requiring high strength in the machinery, automotive, defense and aerospace industries.[1-7]

Microstructures consisting of very thin bainitic ferrite plates 20-40 nm thick in a carbon-rich austenitic matrix are called "carbide-free bainite".

CFBSs can be produced at low cost by heat treatment processes, without the need for expensive alloying elements and complex mechanical processes.

This structure, which can be obtained in high carbon steels containing minimum 1.5% silicon by weight, has 19 times lower cost compared to maraging steels and shows similar toughness (30-40 MPa m1/2) and strength (2500 MPa tensile strength, %5-%30 elongation, 700 HV hardness) draws attention.

Carbide-free bainitic steels are promising for industrial applications due to their high mechanical properties and being economical

CFBSs are a strong alternative to 3rd AHSS with the lowest cost.

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Peper id : 95

DEVELOPMENT OF CONTINUOUS COLOR COATING LINE FOR STEEL & ALUMINUM STRIP

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Abstract. For the first time in Turkey, we have developed the mechanical, automation and software systems of the continous color coating line (CCCL) in a complete manner within our group companies. The line has been designed both for steel strip and for alimunium strips. We have determined all design parameters by cosidering the strip type, quality, thickness, width and production capacity according to our customer demands. We have designed, manufactured, assembled, and taken into operation all line units succesfully in our customer production area in Ankara. The production of the line is monitored and contolled operators with the Scada screens. In additon we have level-2 software to integrate with ERP systems and to direct the control system of the line to follow the products, to collect the data of the product and the line. By integrating tension leveler system to the line quality of stip is upgraded from A2 qulity (due to wavy surface form) to A1 quality. In additon we have also designed regeneratif thermal oxdizer (RTO) system to recover exhaust gas energy, to inrease thermal efficiency, to decrease production cost and also to prevent air pollution caused by solvents and votalities.

Keywords: Continous Color Coating Line.

Peper id : 96

2D MoS_2 Nanoparticle Based Solar Cell on Si

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Abstract. In this work the performance of MoS_2 Nanoparticle/Si solar cell is studied. The MoS_2 nanoparticles (NPs) was synthesized through a chemical exfoliation method, and it was drop casted on a Si substrate, and it was characterized using SEM, and AFM, it was observed that MoS_2 NPs gives a good coverage of the substrate. The synthesized MoS_2 NPs was used to fabricate a MoS_2 NPs/Si solar cell, and the performance of this solar cell was tested under AM1.5G. Also the MoS_2 Si photodiode shows increased responsivity compared to Si alone. Moreover, it was concluded that the MoS_2 NPs can absorb a significant amount of photons making them suitable for future low cast solar cells**.**

Keywords:

Molybdenum Disulfide (MoS_2) is one of widely studied layered two-dimensional transition metal dichalcogenides (2-D TMDs) materials, it has unique electronic, optical, and attractive semiconducting properties, in addition, it is abundant in the nature MoS_2 nanoparticles synthesized using a chemical exfoliation method was used to fabricate [1-8] MoS_2 NPs/p-Si photodiode, to synthesize the MoS_2 NPs, a 0.5 g of the MoS_2 powder was dispersed in a 50 mL of N-Methyl-2-pyrrolidone (NMP), then it is sonicated in an ice bath using a probe sonicator, followed by two stage centrifugation steps, finally NMP was removed, and the MoS_2 NPs was filtered and re-dispersed in a 50 mL of IPA. A photo of the fabricated solar cell is shown in figure 1 (a), and figure 2 (b) shows the final device. To test the performance of the fabricated solar cell, a solar simulator (Sol3a 94123A) was used. Figure 6 shows the measured J-V curve characteristics under 1sun, A.M. 1.5G of the solar with open circuit voltage (V_{OC}) is 0.25 V. The obtained J-V curve has shown a solar cell function and proof of concept using MoS2 nano particles to make the junction. The low current is due to thin metal and no optimized interface.

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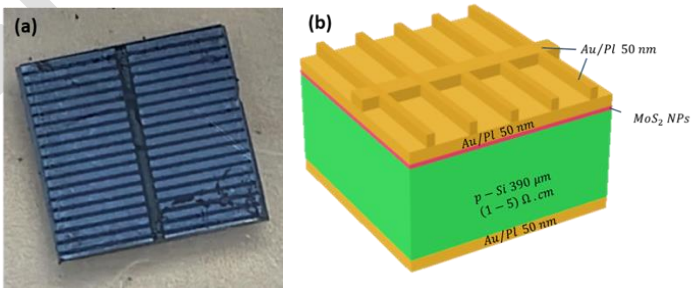

Figure 2 (a) The fabricated MoS_2 NPs/p-Si Solar Cell, (b) Schematic of the final structure of the fabricated MoS_2 NPs/p-Si Solar Cell.

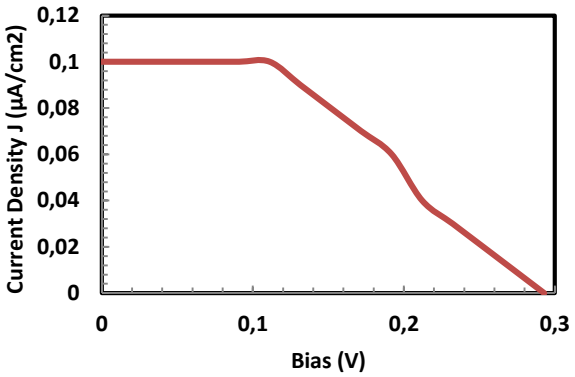

Figure 2. The J-V characteristics of the MoS_2 NPs/p-Si solar cell under 1 Sun, A.M. 1.5G.

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Solar Energy Forecasting Using Machine Learning Models

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Abstract. . In this paper, photovoltaic (PV) system production data and wheather data given enercast GmbH were analyzed by using Python codes on Jupyternotebook. These analyzed data showed the irregular energy production of PV systems described in the literature review section. In this study, the annual energy production amount from day to day has illustrated by the graph. As can be seen in the graph, the production amount of energy of each day is different from each other. Some of the days too much energy is produced meanwhile some days less energy is produced. Furthermore, the data which were provided by Enercast has been tried to obtain the best estimation result by applying machine learning techniques. Since, another graph emerges when the daily average of PV system energy production data is analyzed. It has been observed that while less energy is produced in the morning and evening hours, maximum energy is produced in the afternoon. This is due to the way it comes to the panel. When the PV system production data is analyzed on a monthly basis, it can be seen that more energy is produced in summer than in winter. This is due to the fact that the angle of incidence of the sun and the duration of sunshine are different in summer and winter. The nRMSE value of simple artificial neural network (ANN) is 8.33%. Although this closely matched the structure of the data, it was unable to accurately forecast the value of the power generated. Another approach which is time interval selection method was applied to dataset. Weather parameters exhibit different behavior at each time interval during the day. Thanks to this method, each interval is passed through the ANN model separately, increasing the predictive power. The ANN model includes only one hidden layer and containing 16 neurons. The solar model has a 7.29% nRMSE value. It is nearly flawless at forecasting when the panels will start producing and can predict the output during the day.

Keywords: Solar Energy Production Forecast, Machine Learning, Artificial Neural Networks

Introduction.

The production of PV panels has increased every year due to the demand of PV. The biggest reason for this is that the use of fossil fuels increases global warming and air and water pollution with the released gases. To reverse this situation, some states financially support people who want to use renewable energy. Another major reason is that there is no other cost other than the PV panel cost. Because these panels provide enough profit to cover their own costs within a few years after installation and can produce energy for many years. Because of the enhanced efficiency of solar energy generation and distribution, local residents have taken on the role of energy generators, even receiving credit for electricity provided to the grid under the net-metering policy[1]. All continents contributed significantly to global growth in 2020, with an expected 20 countries adding at least 1 GW of new solar PV capacity, up from 18 countries in 2019 [2, 20,21] .

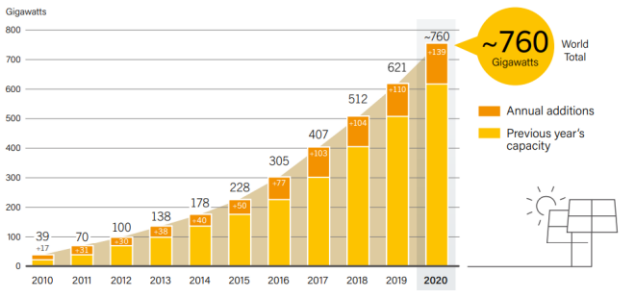

Figure 1. *Solar photovoltaics global capacity from 2010-202 [2].*

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Peper id : 100

Presentation Real time microstructural control for product quality and new steel grade development using electromagnetic sensors

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Abstract. The ability to measure microstructure (and properties) in real time during steel processing is highly desirable. Electromagnetic (EM) sensors are being used on-line during steel processing for quality control, for example in cold strip mills with the sensor signals being correlated to mechanical properties. This allows strip quality to be monitored along length, matched to specification and the option for feedback control. More recent innovation is the use of EM sensors for microstructural characterization during hot strip processing, specifically for quantification of phase transformation during cooling on the run out table after hot rolling. There is potential for EM sensors (and other sensor technologies) to be used for real time microstructure control in other process scenarios. For this to occur it is important that the sensitivities of EM signals to different microstructural features and external factors such as temperature, stress and sample/product geometry are understood, and where possible modelled. This talk will include discussion on: the application of EM sensors for steel microstructure and property monitoring; the fundamental principles and models linking the EM signals to microstructure; and opportunities for future use of EM sensors for real-time microstructural monitoring and hence future steel grade development.

Peper id : 101

Boron R&D Activities and TENMAK BOREN

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Abstract. With globalization, we can summarize all kinds of activities of countries as interacting internationally. With globalization, events, activities, interactions, scales gain an international character beyond national borders. The economic performance of a country can be measured by the sum of the competitiveness of institutions and organizations. R&D is one of the most important activities required for innovation in the world . In the first quarter of the current century, there are intense and well-fictionalized research and development studies behind the rapidly advancing technology, product development and innovative approaches. In parallel with these, the application areas of boron minerals and products used in a wide and various fields are increasing day by day. Since boron is used more or less in more than 250 areas, it is known as the "Salt of the Industry" and offers a wide range of uses in the sector. Boron is frequently used in chemistry, materials, automotive, construction, nuclear energy, defense industry, cleaning and detergent, glass, ceramics, health, agriculture, aerospace and aircraft, military vehicles, fuels, electronics and communications, polymeric materials, nanotechnologies and metallurgy and many chemicals and products are still developed. Besides the reserve and market conditions of boron in the world and in our country, in order to increase the economic contribution based on boron in our country, researches are presented to develop high value added boron products and technologies and to spread their usage areas with researches in this field.

Keywords: Boron, Boron materials, BOREN, R&D

Boron minerals are natural compounds containing different proportions of boron oxide (B_2O_3) in their structures. There are more than 230 boron minerals in nature, and tincal, colemanite, ulexite and kernite are the most common commercially [1]. The chemical formulas and B_2O_3 contents of the main boron minerals with commercial value are given in Table 1.

Table 1. *Commercial Boron Minerals.*

MINERAL	FORMULA	B_2O_3 CONTENT (% by weight)
Colemanite	$Ca_2B_6O_{11}.5H_2O$	50,8
Ulexite	$NaCaB_5O_9.8H_2O$	43,0
Tinkal	$Na_2B_4O_7.10H_2O$	36,5
Kernit	$Na_2B_{14}O_7.4H_2O$	51,0
Pandermite	$Ca_4B_{10}O_9.7H_2O$	49,8
Hydroboracite	$CaMgB_6O_{11}.6H_2O$	50,5

Boron; It has many known effects such as strength enhancer, heat insulator, flame retardant-smoke suppressor, antimicrobial agent, radiation and defense armor, energy carrier-storage, plant nutrient and cleaner.

Since its establishment in 2003 by Turkish Energy, Nuclear and Mineral Research Agency Boron Research Institute (TENMAK BOREN), a total of 348 projects have been supported and the work of 25 projects continues.As a result of these projects, 31 patent certificates were obtained and 16 products were commercialized.

By the TENMAK BOREN, which aims to produce economic value based on knowledge and technology from boron ore, which is an important national resource; Boron Coating, Boron Materials, Boron Biotechnology, Organobor and Polymer and Boron Composite Materials Research Laboratories have been established.

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Development of a New Lining Material with Boron Addition

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Abstract. In this study, it is aimed to develop a new brake lining material that does not harm human health and the environment, has a stable friction coefficient, can be used in passenger cars, and includes the economic and technological evaluation of valuable boron reserves in Turkey. Produced by powder metallurgy; rockwool, graphite, phenolic resin, barite, cashew, hexagonal boron nitride (h-BN) content of the lining material in varying proportions (0.5%, 1%, 3%), in different sizes (1-3 µm and 1-10 µm) boron carbide (B4C) is added. Mixing, sintering and all production processes of the powders were carried out in METISAFE lining R&D laboratories. The samples were subjected to pin-on disc wear test after their production. Test; 20 s braking and 90 s no-load time were performed as 15 periods. According to the test results; While 0.5% and 1% additions of 1-10 µm boron carbide improved the wear properties of the material, a slight decrease in properties was observed as a result of the addition of 3%. In the lining samples produced by adding 1-3 µm boron carbide, the wear properties were improved in all of the additives at 0.5%, 1%, and 3%. When comparing the dimensions, it has been observed that 1-10 µm boron carbide doping provides more improvement in wear properties than 1-3 µm. With this study, it is expected to add a new one to the usage areas of boron reserves in Turkey, to obtain a product that will add added value to Turkey and to shed light on the next studies to be made on this subject.

Keywords: Brake Pad, Boron Carbide, Tribology, Powder Metallurgy

According to the components in Table 1, the sample was produced by powder metallurgy method. Unlike the studies in the literature, 0.5%, 1%, 3% boron carbide by mass was used in the composition [1,2]. Boron carbide was added in two different sizes as 1-3 µm and 1-10 µm.

Table 1. *Compositions of the friction composite materials*

Component	Ingretiens
Reinforcement	Rockwool
Binder	Phenolic resin
Space filler	Barite
Friction modifier	h-BN, boron carbide
Others	Graphite, CNSL

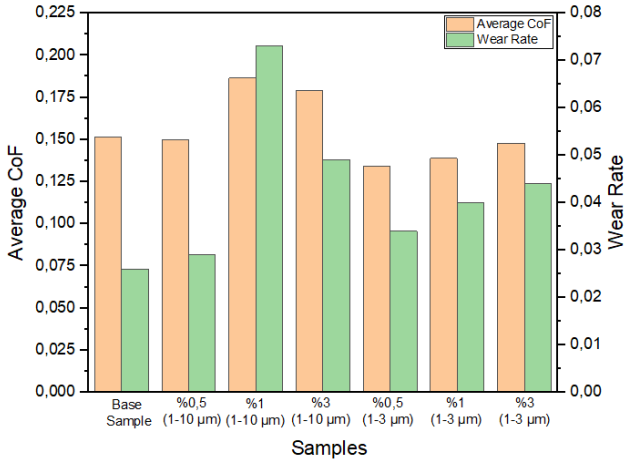

Figure 1. *Variation of average CoF and wear rate of the samples*

The sample was sintered at 150 °C for 15 minutes, then cured at 200 °C for 20 minutes. According to the NF F 11 292 French standard, a 15-period pin-on disc type test was performed with a braking time of 20 seconds. The data obtained as a result of the test are shown in Figure 1. Accordingly, the addition of 1% of boron carbide in the size of 1-10 µm increased the wear of the material from 0.026 to 0.073. A decrease in wear was observed with the addition of boron carbide above 1%. The friction coefficient also increased from 0.15 to 0.18 with the addition of 1% boron carbide. The wear value reached 0.44 with the addition of 1-3 µm boron carbide. When the two sizes are compared, it has been observed that 1-10 µm boron carbide doping provides more improvement in wear properties than 1-3 µm.

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Design, Fabrication and Characterization of Tunable Metamaterials

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Abstract. Unique metamaterial structures tailored to work in the terahertz range combined with high quality vanadium (VO2) thin films was investigated in order to develop fast modulators. THz modulators, the goal is to develop devices which have excellent electrical characteristics and that also can be modulated by applying an electrical or optical signal. The metal insulator transition for vanadium will be triggered using optical and electrical techniques, resulting in a rapid phase change this will allow the vanadium based metamaterial devices to modulate the THz radiation at high rates. To ensure that these devices work well in the THz region the frequency tunable metamaterial structures as well as the resonant features have to be optimized. In this work, the phase change behavior of vanadium dioxide (VO2) thin films grown by RF magnetron sputtering and post annealing process, has been studied by its optical and electrical parameters. The phase change behavior of VO2 is investigated not only in two extreme regimes: hot (metallic) and cold (insulating) states but also in the transition temperatures, where VO2 acts like an inherent metamaterial with mixed metallic insulating character. In this range, the portions of metallic and insulating inclusions are tuned iv by temperature, and therefore a gradual change of optical parameters can be achieved.

Keywords: Tunable, metataerials, design, fabrication characterization

Metal-based metamaterials are artificial structures consist of arrays of metallic components with subwavelength dimensions embedded in a dielectric background. These structures have emerged following their initial introduction [1], and are the subject of intensive investigations for applications in frequency selective surfaces [2] and transformation optics, e.g. cloaking [3], negative index materials and super-lensing [4]. Split-ring resonators (SRRs) are the basic elements for many metal-based metamaterial designs due to their ease of fabrication and modeling. Each SRR has a distributed inductance, L, and capacitance, C, arising from charge build-up at the notch. The choice of materials and resonator dimensions set these two parameters and determine the resonant frequency of the metamaterial [2].

On the other hand, active metamaterials which are designed and fabricated by integrating metal-based metamaterial and materials with tunable electrical or optical properties, show further control over their resonant responses. By changing the capacitance in the SRR gap using an optically tunable semiconductor, it is possible to switch the resonances from the first mode to the second one [5]. As an alternative geometry reported in [5] for the active SRR metamaterials, self-aligned, hybrid Ag/vanadium oxide (VO_2) SRR bi-layers were designed and fabricated to tune the metamaterial response in the near-IR by controlling the resonator geometry with the phase transition of VO_2 [6]. Vanadium oxide is a promising candidate that exhibits a dramatic change in its complex refractive index arising from a structural phase transition from insulating monoclinic to metallic rutile upon either direct heating or optical pumping. Here, using measured values of DC resistance, carrier density and carrier mass of our fabricated VO_2 sample, we design active SRR metamaterials operating at mid-IR. The top view of our design is schematically illustrated in the inset of Fig. 1.

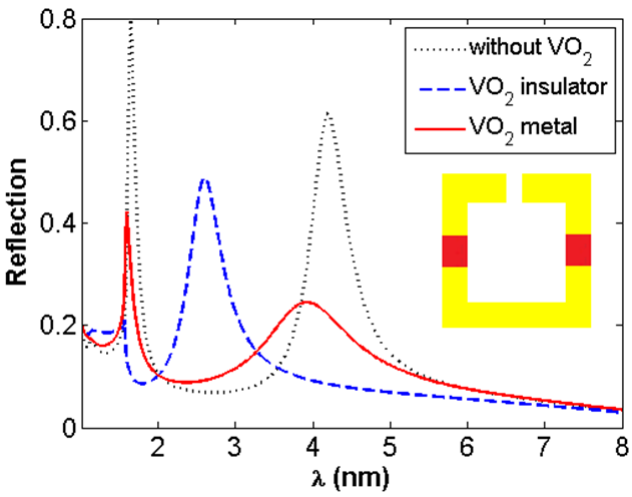

Fig. 1: *Reflection of the considered gold SRR array for the absence (dotted-black) and presence of VO2 (dashed blue insulator phase and solid-red metal phase). The inset schematically shows the unit cell of the considered structures. Width of the gap and the arms of SRR is 100 nm, length of the arms is 460 nm, unit cell dimension is 900x900 nm², and the thickness of gold is 70 nm. The incident plane wave in the simulation is normally incident to the array with the electric field perpendicular to the SRR arms.*

As expected, the SRR array without the presence of VO_2 exhibits two sharp peaks in the reflection spectrum corresponding to the electric and magnetic resonances. Once we consider VO_2 in its insulator phase (T=20 ^{0}C), the resonances of the dashed-blue curve are weakened and blue-shifted, as compared to those of dotted-black curves. On the other hand, in case of increasing temperature to 80 ^{o}C and changing the phase of VO_2 to metal, it is seen from the solid-red curve illustrated in Fig. 1 that red-shift of those resonances can be observed in comparison with those observed in the insulator phase.

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Highly efficient Cr(VI) removal from aqueous solution by SnO_2 loaded wild plumb kernel shell biochar composite

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Abstract. Wastes like Cr(VI) contribute more and more each year to the contamination of underground and surface natural spring waters increases every year. The mixing of Cr(VI) into drinking water and daily use water has become a global public health problem. There is currently intense interest in eliminating Cr(VI) contamination in the water. Biochar-nanostructure composites have drawn attention as promising removal agents for their high catalytic and adsorption activity, low cost, and environmental friendliness. In this study, a novel composite of wild plumb kernel shell biochar (WPKSB) loaded with SnO2 nanoparticles (WPKSB@SnO2) was successfully prepared for the highly effective removal of Cr(VI) from aqueous solution under UV-light irradiation. The composite sample was structurally, morphologically and optically characterized by XRD, FT-IR, SEM and UV-visible spectroscopy analysis. Cr(VI) removal was investigated with an aqueous solution containing 5, 10 and 25ppm Cr(VI). Furthermore, Cr(VI) removal was also examined with 20, 30, and 40mg composite addition into an aqueous solution. The results indicated that superior Cr(VI) removal efficiency (~100%) for biochar-SnO2 composite had been achieved after 135 minutes of UV-light illumination with 30mg composite addition into 10 ppm Cr(VI) containing aqueous solution. This study shows that the prepared WPKSB@SnO2 composite structure exhibits highly efficient Cr(VI) removal capacity from an aqueous solution.

Keywords: Biochar, SnO_2 nanoparticles, Cr(VI) removal, water purification.

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High throughput DFT calculations and UHS sintering on high entropy diboride ceramics

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Abstract

High entropy materials have become a cornerstone of rapid advancements in the materials world with novel and enhanced properties when compared to traditional multicomponent systems, making high entropy materials an active area of research for a variety of applications [1]. Diborides are especially interesting amongst the high entropy ceramics, due to their superb hardness that can be in excess of 30 GPa, and high melting temperatures, as well as the phase stabilities at low pressures, thus making it possible to synthesize super-hard material that do not require high pressure high temperature (HPHT) conditions, unlike diamond [2]. However, considering the vast phase space of the high entropy diborides, it is not feasible to explore the possibilities using traditional trial and error based experimentation and characterization [3]. We have conducted a high-throughput computation on the possible equimolar high entropy diboride compositions that can be formed from the nine B-group refractory elements (Hf, Mo, Ti, W, Zr, V, Nb, Cr, and Ta) and boron, in the AlB_2 hexagonal crystal structure. The mechanical properties including elastic constants and moduli, thermal expansion, hardness, and fracture toughness have been calculated through ab-initio density functional theory (spin polarized DFT), similar to the successful ab-initio methodology we have recently applied on $(HfTiZrW)B_2$ ceramics [4]. The most promising of the diborides were then synthesized experimentally by using the ultra-fast high temperature sintering method (UHS) [5], followed by their characterizations. We demonstrate new Ashby diagrams on the diboride phase space, and experimentally validate the computed data on a number of promising compositions.

Keywords: DFT, high-throughput, diborides, high entropy ceramics, UHS.

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OPERATION of PbSe DETECTORS IN THE PLASMIC MEDIA

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Abstract.

Infrared radiation-sensitive device development not only increases its popularity today but also hosts many different devices and applications. The importance of semiconductor materials in the market, industry, space research, fiber optic structures, defense, and weapon industry is increasing with the developing technology. Semiconductor technology has gained an advantageous position with dc, ac, and rf power supplies, with the composition of group VI elements from II and its usage in plasmas. By using semiconductors in plasmas, the infrastructure of Tokamak and fusion energies, which are currently under construction, and are considered an unlimited power source, is also provided.

Keywords: PbSe Detector, Comsol Multiphysic, Migrative Electron Flux, Electron Density

Introduction

Lead selenide (PbSe) with IV-VI semiconductor composition is a semiconductor material. They can operate at room temperature without the need for cooling from any external source. It has a direct band gap of 0.27 eV. It is used in the manufacture of infrared detectors for thermal imaging [1]. The mineral clostalite is a naturally occurring lead selenite. It can be formed by the reaction between lead and selenium. PbSe was one of the first materials to be found to be sensitive to infrared radiation used for military applications, and it is suitable for use from nanostructures to all high-tech structures with developing technology. For the first time, PbSe devices were used by the Germans, Americans, and British during and immediately after the Second World War. Infrared detonators and Passive Infrared Marking systems (PICs) have been used as photodetectors [2]. As an infrared radiation-sensitive material, PbSe can detect IR radiation in wavelengths from 1.5 to 5.2 µm (medium wave infrared window, abbreviated MWIR). Due to its quantum nature, it also offers a very fast response, making this material an excellent candidate as a detector of low-cost, high-speed infrared imagers [3]. Lead selenite is a photoconductive material. The detection mechanism is based on the change of conductivity of the polycrystalline thin film of the active material when photons arrive. These photons are absorbed within the PbSe microcrystals and then cause electrons to rise from the valence band to the conduction band. Lead selenide is a thermoelectric material. Lead selenide nanocrystals embedded in various materials can be used as quantum dots [4], for example, in nanocrystalline solar cells.

There is great interest in lead crystals because they have a number of interesting physical properties as well as numerous potential applications. Peak sensitivity is temperature dependent and ranges from 3.7–4.7 µm.

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UNDER ATMOSPHERIC PRESSURE PLASMA RESULTS OF THE MICRODISCHARGE CELL WITH GaSb CATHODE

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Abstract

In this study, simulations were made with the help of Comsol Multiphysics program under atmospheric pressure placed in a plasma system using GaSb material. Space charge densities were found at different anode-cathode distances and between 0.05 mm cathode diameter. Thus, the spectral working range required for a plasma system and the operation of GaSb material in the field of optics and IR were investigated.

Keywords: GaSb Wafer, Microplasma device, atmospheric pressure plasma systems

Introduction

GaSb is an important material due to its increasing applications in optics, electronics, and detector technology. It is of great importance in high-speed electronics, space exploration, photonic devices, and fiber optic technology [1]. GaSb, a group III–V semiconductor material, is encouraged to be used in microplasma cells. GaSb is a narrow band gap semiconductor material with direct absorption from the valence band to the conduction band. When the material is used as a cathode in plasma systems, it gives priority to this material due to its high-speed optoelectronic response to incoming radiation. The properties of the plasma are directly proportional to the quality of the cathode material and the optical properties of the material. With the effect of electrons, ions, and photons interacting with the gas in the plasma tube, the disintegration mechanism takes place between the cathode and the anode [2,3]. This process is also called self-sustaining discharges. On the other hand, optical, electrical, and IR wave absorption of the material used in the process, also known as the secondary electron emission mechanism, affects plasma formation very significantly. As it is known, plasma systems do not occur in all time intervals, at all wavelengths, at all pressures, and at the distance between each anode and cathode. GaSb has a lattice-matched energy gap between 0.36 eV and 1.61 eV [4,5]. They can work at room temperature.

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ENERGY EXCHANGE VIA GaAs ELECTRODE IN A PLASMA SYSTEM

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Abstract.

The GaAs electrode has been used as a cathode which is near Infrared material that causes the conversion of the Infrared energy to the visible one in the pressure range between 22 Torr and 760 Torr. It has a direct narrow band gap. Electron-based energy graphs and plasma formations were calculated with the COMSOL simulation program. The Energy Exchange mechanism between the cathode and plasma occurs when the appropriate plasma conditions are reached in the system.

Keywords: GaAs cathode, Comsol Multiphysics plasma module, Mean electron energy, Energy exchange

INTRODUCTION

GaAs is one of the most common semiconductors in the III-V group, which is used in photon energy conversion systems that provide costly quantum efficiency, which is mostly used in high concentration photovoltaic systems [1,2]. In microdistance plasma systems, it is effective in improving the absorption of incoming light through the enhancement of light beams in the microchannel plates (MCP). The system transforms with the microplasma unit and provides the energy increase and electro-multiplication with the MCP structure. These devices also form the basis of night vision devices and are also the head of multiplier systems. This research focused on the scientific understanding of the energy conversion process and plasma formations by examining microchannel plasma devices with average mean electron energies for various interelectrode distances and gas pressures.

GaAs-containing multi-joint cells are the most suitable PV cells that provide 47.1% efficiency with their triple structure. They have been developed from the smallest electronic equipment to the largest satellites and for special applications such as space exploration. Simultaneous coupling of three or more in the growth process results in high quantum efficiency, and also cultivation methods such as metal-organic chemical vapor deposition technique contribute to their high yields [3]. GaAs FETs are also widely used in power amplifiers and receiver amplifiers and frequency converter applications [4-5]. The performance of the converters is a result of the high electron mobility of group III-V materials. Moreover, the TIRS focal plane houses three sensor chip groups consisting of GaAs quantum well IR detectors related to the electronic structure of GaAs and the design of the system [6].

In this work, an effort has been made to find undefined plasma parameters such as mean electron energy and electron current density and migrated electron flux by incorporating the flow of gas using the plasma module of COMSOL multi-physics to make clear energy conversion. Model results clarified the complex behavior of the plasma. By analyzing mean electron energies, electron densities also current densities, the contributions of the different plasma parameters for the optimal operation range in the material and device physics are studied.

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Production and Characterization of Commercially Pure (Cp-Ti) and Alloy (Ti64) Porous Titanium Medical Implants using Laser Powder Bed Fusion (L-PBF) Technology Surgery

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Abstract.
Titanium is preferred for biomedical implants since suitable for biocompatibility and mechanical strength. But recently, the decreasing bulk weight without losing biomechanical properties is rising for ideal metallic implants. The PorouSLM project aimed to design and develop gyroid lattice structures in titanium plates for tissue integration using laser powder bed fusion (L-PBF) technology and to optimize L-PBF manufacturing parameters for thin lattice titanium structures. Mechanical properties of gyroid lattice structure designs which have different porosity rates were obtained by finite element analysis to compare literatüre and experimental data. Also manufacturing process development was completed in 3 steps from determined optimum energy density parameter to the fine tuning parameters to achieve almost full dense parts production. Cleaning process was developed to remove unmelted powders which adhered to the part surface without detrimental degradation which causes mechanical strength loss. Gyroid lattices in titanium mini plates are investigated to match the mechanical properties of current commercial plates.

Keywords: Osteosynthesis Miniplate, Titanium, Gyroid, Laser Powder Bed Fusion

Introduction

Ti6Al4V alloy osteosynthesis implants made with traditional methods in the market cannot show ideal implant properties due to disadvantages such as high mechanical strength, stress protection effect and low ductility [1]. Commercial pure titanium (cp-

Ti) implants, which are free of Al and V toxic effects and have controlled pores that can achieve the mechanical properties of bone, can be produced with L-PBF (Fig. 1) to solve disadvantages of Ti6Al4V [2]. The aim of this study is to manufacture high-density cp-Ti parts and to develop a process for creating thin walled gyroid lattice structures that eliminate defects that may occur during the process. Then, the cleaning process is applied to remove unmelted powder from strut surface of porous structure without detrimental degradation which causes mechanical strength loss.

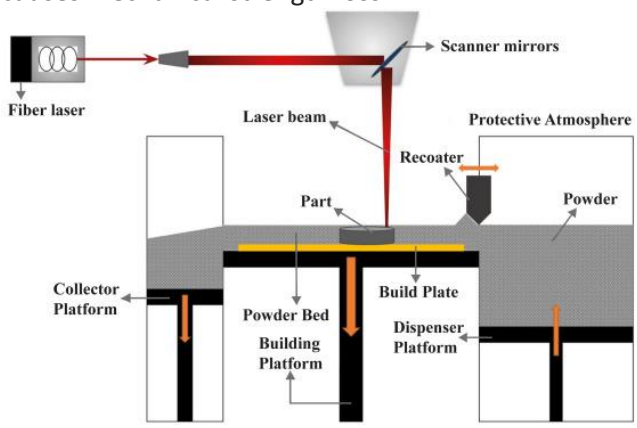

Figure 1. *Laser Powder Bed Fusion technology Process and Equipment [3]*

Methods

Gyroid latticed cubic designs were created with 3 mm unit cell size (UCS) and various strut thickness (ST) from 0,3 to 0,7 mm by nTopology Software. Compression tests of created gyroid cubic models were completed with adding 2 solid plates to up and down of gyroids via Finite element analysis (FEA) in ANSYS software. Elastic modulus values were calculated and investigated with different porosity rates of gyroid designs. Manufacturing process development started with thin wall and L-PBF manufacturing parameter optimization using with ASTM F67 cp-Ti (EOS TiCP Grade 2) powder in L-PBF process (EOS M290) to reach full dense parts. Then gyroid lattice structures were manufactured with fine tuning parameters to improve dimensional accuracy. Stereomicroscope and metallography density measurements were made for post production characterization. Chemical etching was applied to gyroid parts into acid solution following with ultrasonic bath and dried for cleaning process. Mass loss and strut thickness loss were investigated.

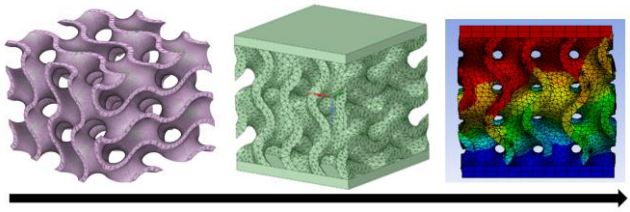

Figure 2. (Left) *Gyroid lattice design, (Middle) Gyroid model with 2 solid plate for FEA compression test, (Right) Compression FEA deformation of gyroid.*

Results

As the porosity increased, the elastic modulus ratio decreased (Table 1). Obtained data was consistent with the hook's law. In addition, FEA results were consistent with the gyroid titanium lattice structures given in the literature.

Table 1. *Elastic modulus values of gyroid designs at different porosity rates via FEA*

Design	Porosity Rate (%)	Elastic Modulus (GPa)
3 mm UCS-0,3 ST	80,63	3,1
3 mm UCS-0,5 ST	67,63	6,0
3 mm UCS-0,7 ST	54,44	9,9

As a result of production parameter optimization, the production of the parts with almost fully dense (Fig. 3) and geometric accuracy (Fig. 4) was achieved. In addition, the cleaning process test will be repeated in less than 12 minutes since unwanted micro-pits are formed on the surface.

Figure 3. *Produced part which has almost full dense.*

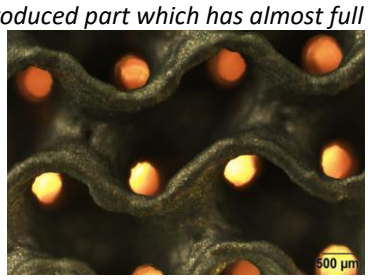

Figure 4. *Produced gyroid lattice part.*

Conclusion

The design and production final parameters have been determined, and the gyroid lattice structure will be integrated into the mini plate and produced at the specified L-PBF production parameters.

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Creating an innovation culture in research and development in a volatile world

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Abstract. Here, we speak about the importance of adopting creativity and innovation in research and development to solve challanging global problems such as climate change, pandemics, energy crisis, etc. Typically in PhD projects, researchers aim to complete their doctoral work by publishing research papers in peer reviewed journals and working on some form of novelty (big or little), which is introducing something new, either new process, new material, new characterisation techique or even application. However, novelty is different from innovation. We will give examples of the difference in the two in the presentation. Novelty is simply described as an incremental change to an existing product, process etc. Whereas, innovation is the successful implementation of new creative ideas to develop something brand new. True innovation changes the way industries operate and is a game changer for business creation and societal impact. Substantially more needs to be done to support researchers wanting to do innovative work and to consider entrpeneurship to translate innovative research to market and commercialisation, and over time contribute to global sustainable development goals.

Keywords: Innovation, Creativity, Novelty, Trailblazer, Game-Changer

It's very important to understand why one needs to innovate. We innovate to solve problems. In the last 2 years, we see how the different innovative covid vaccinations have been helping to save millions of lives around the world by providing protection to humans from the deadly coronavirus. To innovate, it's crucial to come up with creative and novel ideas. It's better to collaborate with more people to come up with 'best' ideas. Ideas are the powerhouse for your invention. It's not necessary that you use sophisticated techniques to innovate. The discovery of graphene took place using a simple scotch tape method, and persistence.

Researchers publishing papers in journals are making a limited impact because publishing is a slow process and not everyone reads journal papers, especially the public and entrepeneurs. We work in the lab each day and encounter problems, which if we don't solve could be a risk, however, we solve them without actually thinking about it (Figure 1). Some of these steps can be 'inventive'. This means we are doing innovation daily and with time we are doing more and more. By sharing our experiences with others we create usefulness, and with this chain continuing to grow in spreading innovative steps and innovation a momentum is created which impacts the scientific community and the society (Figure 2).

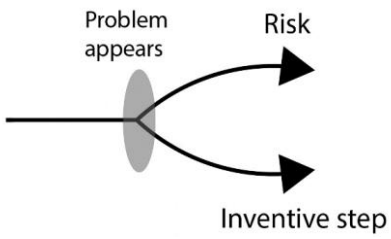

Figure 1. *Outcomes of solving/not-solving problems.*

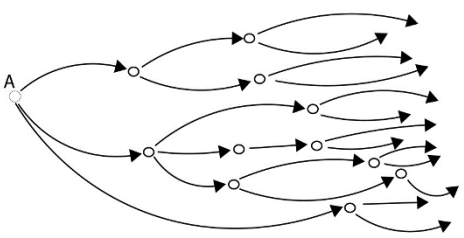

Figure 2. *Building a growing momentum in taking more inventive steps and doing more innovation by sharing experiences*

Peper id : 113

Hyaluronate-Based Thermo-sensitive Hydrogel for Vitreous Body Substitute

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Abstract. Human vitreous is a gelatinous substance that is predominantly composed of collagen fibril, hyaluronic acid (HA) and water (97–99%). Vitreous substitutes are needed to tamponade the detached retina after vitrectomy when treating retinal detachments. However, several drawbacks associated with current vitreous substitutes have been reported. In the present study, we developed a colorless, transparent and injectable hydrogel as a vitreous substitute that was formed by oxidated HA (oxi-HA) and adipic acid dihydrazide (ADH). The results of biodegradation demonstrated that the hydrogel could maintain its gel matrix over at least 35 days depending on the ADH concentration. In addition, the biocompatibility was evaluated on a retina pigmented epithelium (RPE) cell culture following ISO 10993-5 (tests for in vitro cytotoxicity), and the hydrogel was found to be nontoxic. This study suggested that the injectable oxi-HA/ADH hydrogel could fulfill many critical elements that are desirable in vitreous substitutes.

Keywords:

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