Symposium on Functional Materials Science and Engineering
(SFME 2024)

ABSTRACTS AND PROCEEDINGS

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FACULTY OF ENGINEERING

Symposium on Functional Materials Science and Engineering
(SFME 2024)

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INVITED SPEAKERS
Prof. Dr. Kasım OCAKOĞLU Department of Engineering Natural Sciences, Faculty of Engineering, Tarsus University **Title: Biometric approaches in nanomaterial design: Engineering strategies for an eff. Artificial leaf**
Prof. Dr. Amirullah M. MAMEDOV Honor Sciencist of Azerbaijan, State Prizes Winner, Senior Researcher Nanotechnology Research Center, Bilkent University **Title: Acoustic metamaterials for aeronautic applications: a review**
Assist. Prof. Dr. Evren ARIÖZ Department of Chemistry Engineering, Faculty of Engineering, Eskisehir Technical University **Title: Geopolymer:A novel functional material**
Prof. Dr. Sefa ERTÜRK Department of Biophysics, Faculty of Medical, Niğde Ömer Halisdemir University **Title: Hybrid Imaging Technology and Materials**

PROGRAM

08:30-09:00		**Registration**
09:00-09:10		**Opening Ceremony**
09:10-09:15		***Prof. Dr. Ömer ARIÖZ*** *Rector, Toros University*
09:15-09:20		***Prof. Dr. Adnan MAZMANOĞLU*** *Dean of Engineering Faculty, Toros University*
Session I-Invited Speakers *Chair, Prof. Dr. Adnan MAZMANOĞLU, Scientific Organization Committee*		
I1	**09:20-09:55**	**Biomimetic approaches in nanomaterial design: Engineering strategies for an eff. artificial leaf** ***Prof. Dr. Kasım OCAKOĞLU*** *Department of Engineering Natural Sciences, Faculty of Engineering, Tarsus University*
I2	**09:55-10:30**	**Acoustic metamaterials for aeronautic applications: a review** ***Prof. Dr. Amirullah M. MAMEDOV*** *Honor Scientist of Azerbaijan, State Prizes Winner, Senior Researcher* *Nanotechnology Research Center, Bilkent University*
Coffee Break /Poster Session ***Assist. Prof. Dr. Merve ÖZCAN, Vice Chair of Scientific Organization Committee***		
P1	**10:30-11:00**	**Synthesis and characterization of poly (1-vinyl-1,2,4-triazole) as dielectric layer for organic field effect transistors** ***Lecturer Dr. Yasemin TORLAK*** *Plant and Animal Production Department, Tavas Vocational School, Pamukkale University*
P2		**Functionalization of thin films prepared for cosmetic applications with honey bee products** ***Begüm ARSLAN, Fatma UYSALOĞLU, Bensu YEŞILHÜYÜK, Atakan TOKLU,*** ***Assist Prof. Dr. Didem DEMIR*** *Depart. of Chemistry and Chemical Proces. Technologies, Tech. Sci. Voc. High Sch., Tarsus University*
P3		**Theoretical and experimental investigation of the radiation shielding and antimicrobial properties of ZnO doped Pbo glass material** ***Assist. Prof. Dr. Arzu COŞKUN, Assoc. Prof. Dr. Efdal Oktay GÜLTEKIN*** *Department of Medical Services and Techniques, Health Vocational School, Toros University*
P4		**Frequency Dependent Dielectric Properties of PA 66 Polyamide Composites with Graphene Nanoplatelets for Aerospace Applications** ***Mehmet KURUCAN[1], Assoc. Prof. Dr. İbrahim KARTERI[1,2]*** *[1]Department of Enrgy Sys.Eng., Faculty of Elbistan Engineering, K.Maraş Istiklal University* *[2]Department of Materials Sci.& Eng., Institute of Graduate Education, K.Maraş Istiklal University*
P5		**Graphite Doped Engineering Plastic Composites: A Novel Material for Aero-space Applications** ***Mehmet KURUCAN[1], Assoc. Prof. Dr. İbrahim KARTERI[1,2], Muhammet KARATAŞLI[3]*** *[1]Department of Enrgy Sys.Eng., Faculty of Elbistan Engineering, K. Maraş Istiklal University* *[2]Department of Materials Sci.& Eng., Institute of Graduate Education, K. Maraş Istiklal University* *[3]Department of Elect.&Com. Eng., Faculty of Engineering and Architecture, Beykent University*
P6		**Optical, structural, and morphological properties of SnS thin film by chemical bath deposition** ***Mohamed El Moustapha ABD DAYEM[1] Lec.Sevda İldan ÖZMEN[2] Prof. Dr. Hülya Metin GÜBÜR[1]*** *[1]Department of Physics, Mersin University, Mersin, Turkey* *[2]Advanced Technology Education Research and Application Centre, Mersin University, Mersin, Turkey*
P7		**New Water-Soluble Phthalocyanine Derivatives for Photodynamic Therapy Applications** ***Perihan K. DEMIRCIOGLU[1], Şifa DOGAN[1], Assist. Prof. Dr. Abdulcelil YÜZER[2], Assoc. Prof. Dr. Derya YETKIN[3],*** ***Prof. Dr. Mine INCE[1], Furkan AYAZ[4]*** *[1]Department of Natural and Mathematical Sciences, Faculty of Engineering, Tarsus University* *[2]Dep. of Elect. and Auto., Voc. School of Tech. Sci. at Mersin Tarsus Org. Ind. Zone, Tarsus University* *[3]Mersin University, Advanced Technology Education Research and Application Center* *[4]Mersin University, Department of Biotechnology, Faculty of Arts and Science*

Session II-Invited Speakers *Chair, Prof. Dr. Zehra YEĞİNGİL, Scientific Organization Committee*		
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I4	**11:35-12:10**	**Hybrid Imaging Technology and Materials** ***Prof. Dr. Sefa ERTÜRK*** *Department of Biophysics, Faculty of Medical, Niğde Ömer Halisdemir University*
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O2	**13:20-13:40**	**Production and Characterization of Polyvinyl Alcohol (PVA)Chitosan (CH) Wound Dressings Enriched with Hypericum perforatum L. extract** ***Assist. Prof. Dr. Evren ARIÖZ, Assist. Prof. Dr. Suzan AY, Duygu ERKMEN*** *Department of Chemistry Engineering, Faculty of Engineering, Eskişehir Technical University*
	13:40-14:00	**The use of acrylic sheets in strain measurement** ***Assoc. Prof. Dr. İbrahim YILDIZ*** *Department of Mechatronics Engineering, Faculty of Engineering, Necmettin Erbakan University*
O3	**14:00-14:20**	**Stresses occurring on a cylinder with annular silicon carbide (SiC), Ti_6Al_4V and copper (Cu) materials** ***Assoc. Prof. Dr. Hüseyin Fırat KAYIRAN*** *Department of Agriculture and Rural Development Support (ARDSI)*
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O5	**14:40-15:00**	**Design and production of new type reinforced U-profile composite panels** ***Merve USLU[1], Prof. Dr. Mete Onur KAMAN[1], Assist Prof. Dr. Cenk YANEN[1], Lecturer Dr. Mustafa ALBAYRAK[2], Prof. Dr. Serkan DAĞ[3], Assist. Prof. Dr. Serkan ERDEM[1], Prof. Dr. Kadir TURAN[4]*** *[1]Department of Mechanical Engineering, Engineering Faculty, Fırat University* *[2]Department of Machine and Metal Technologies, Industrial Zone Vocational School, Inonu University* *[3]Department of Mechanical Engineering, Engineering Faculty, Middle East Technical University,* *[4]Department of Mechanical Engineering, Engineering Faculty, Dicle University*
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O7	**15:40-16:00**	**Contribution of artificial intelligence and computer architecture to materials science** ***Assoc. Prof. Dr. Hüseyin Fırat KAYIRAN[1], Oğuz Kağan BILICI, Dt. Eşref KAYIRAN*** *[1]Department of Agriculture and Rural Development Support (ARDSI)* *[2]Tepebaşı Ağız ve Diş Sağlığı Hastahanesi, Başhekimi, Keçiören, Ankara*
O8	**16:00-16:20**	**Organik temelli CdS elektrodunun fotoelektrokimyasal aktivitesinin incelenmesi** ***Derya KAYA, Research Assist. Dr. Rukan Suna KARATEKIN, Prof. Dr. Meltem Kahya DÜDÜKÇÜ*** *Department of Chemistry, Faculty of Science and Letter, Mersin University*

O9	**16:20-16:40**	**Tensile properties of carbon nanotubes reinforced high density polyethylene nanocomposite materials** ***Lecturer Murat MIRIK[1], Prof. Dr. Necmettin TARAKÇIOĞLU[2], Prof. Dr. Levent Cenk KUMRUOĞLU[3]*** *[1]Department of Motor Vehicles and Transportation Technology Rail Systems Machine Technology Program Sivas Vocational School of Technical Sciences Sivas Cumhuriyet University* *[2]Department of Metallurgy and Materials Engineering Technology Faculty Selcuk University* *[3]Dep. of Metallurgy and Mat. Engineering Facu. of Eng. and Nat. Sci. Iskenderun Technical University*
O10	**16:40-17:00**	**Investigation of Luminescence Properties of Baddeleyite Dopped Dy3+** ***Assist. Prof. Dr. Özlem YIĞIT[1], Assist. Prof. Dr. Şenel ÇOBANER[2], Prof. Dr. Kasım KURT[3]*** *[1]Aydıncık Vocational of School, Mersin University* *[2]Nanothecnology and Advanced Materials, Mersin University* *[3]Science Faculty, Physics Department, Mersin University*
O11	**17:00-17:20**	**Investigation of Radioluminescence of Natural Fluorites Collecting from Kırşehir Region** ***Saadet Özdemir ARSAKAY[1], Assist. Prof. Dr. Özlem YIĞIT[2], Prof. Dr. Kasim KURT[3]*** *[1]Mersin Vocational of School, Mersin University* *[2]Aydıncık Vocational of School, Mersin University* *[3]Science Faculty, Physics Department, Mersin University*
Closing Ceremony		
17:20		***Assoc. Prof. Dr. Ali Kemal HAVARE*** *Chair of Scientific Organization Committee, Toros University*

Toros University Publication Policy

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Toros Üniversitesi Yayın Politikası

Symposium on Functional Materials Science and Engineering (SFME) 2024'te yayınlanan özetlerin dil, bilim, hukuki ve etik sorumluluğu yazarına aittir. Özetler kaynak gösterilmeden kullanılamaz.

Preface

Dear Participants,

Symposium on Functional Materials Science and Engineering (SFME) 2024 was held in Toros University, Turkey on 11 June 2024.

It aimed to share and discuss theoretical and practical knowledge of Functional Materials in a scientific framework by bringing together scientists, educators, non-governmental organizations, and private sector representatives in a multidisciplinary environment. This workshop will provide a multidisciplinary meeting opportunity for the presentation and discussion of scientific studies in Applied Sciences, Advanced and Functional Materials, Materials and Devices, New Materials for Energy and Energy Conversion, Biomaterials, Theoretical/Modeling/Computer Simulations of Functional Materials, Spectroscopy for Advanced Materials, Hybrid and Composite Materials, Magnetic Materials, Emerging Materials for Ionizing Radiation Detectors and Dosimeters.

The valuable presentations from expert speakers and the intriguing research shared by participants have provided a rich experience in terms of interaction and learning. Knowledge sharing and collaboration were the cornerstones of this event.

As SFME organizing committee, we will continue to organize scientific meetings to inspire each other and to contribute to science. Hope to meet at future events.

Vice Chair of the Organizing Committee	**Chair of the Organizing Committee**
Assist. Prof. Dr. Merve ÖZCAN	Assoc. Prof. Dr. Ali Kemal HAVARE

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ORAL PRESENTATIONS

A novel microwave enegry-based approach towards hybrid nanomaterial preparation for energy stırage applications

Selçuk POYRAZ

Department of Textile Engineering, Faculty of Engineering, Adıyaman University, Adıyaman, Turkey

Corresponding author:spoyraz@adiyaman.edu.tr

Abstract

By using short-term microwave (MW) energy heating, a promising hybrid electrochemical energy storage material was prepared from carbonized conducting polymer (cCP) i.e., polypyrrole (PPy) nanoparticle (NP), host with concurrently surface-grown carbon nanotube (CNT), and metal oxide nanowire (MONW) guests. This novel hybrid nanomaterial (HNM)'s preparation and the tackling of commonly encountered conventional synthesis methods' difficulties were both succeeded by systematically combining an in-situ polymerization/coating process with an ex-situ MW energy-based technique that has proven to be a well-established, facile, and rapid. Through this highly efficient and easily scalable combined preparation approach, such HNMs were produced cost-effectively, with distinct features of morphology (SEM/TEM), elemental (EDX), spectroscopic (XRD, Ra-man), and electrochemistry (CV), all of which are substantially backed by material characterization tests, and the literature support, as well. Consequently, this combined approach is expected to provide CNT and MONW decorated cPPy NPs, with promising potential to be the preferred material soon for its electrochemical energy storage applications.

Keywords: Carbon nanotube, Conducting polymer, Electrochemical energy storage, Metal oxide nanowire, Microwave energy

1. Introduction

By addressing the demands and tackling the obstacles in the electrochemical energy storage applications, supercapacitor (SC)-based systems have acquired significant technological value over more than 60 years. Thanks to their unique functional groups, different active material species in HNMs' structure can provide synergistically blended morphological, spectroscopic, thermal and electrochemical features. This is why HNMs have been on the focus of researchers working in the SC field, as well. (1-9). Since their discovery in 1991, CNTs' exceptional thermal, electrical, mechanical, and electrochemical properties enable them to become one of the most common building block materials in affordable, high performance, and value added HNM production for sensory, energy storage, and magnetic resonance imaging (MRI) applications (10-14). In recent years, MW energy-based synthesis have also been commonly practiced as a productive, cost-effective, and a scalable alternative to obtain high quality CNTs (15-22). This is due to its simple, quick, adjustable, cost-effective working principle that is based on volumetric heating of a target material that can absorb MW energy through its dielectric and/or polar nature (15-22). In addition, nanostructured metal oxides (MOs) e.g., Fe2O3 or Fe3O4 have been frequently used together with CNTs to both improve and differentiate their properties, and to enrich their use in HNM production, as well (23-27). Among them, Fe2O3's low electrical conductivity severely restricts its application performance, and its structural cycling stability is adversely affected by the volumetric expansion during electrochemical reactions. However, its high theoretical specific capacitance and eco-friendliness, along with its affordable and easily accessible nature can be considered as the main reasons for the researchers' wide interest towards this material. In this study, Fe2O3 was simultaneously prepared in relevant nanostructured morphology, i.e., NW along with CNTs as this would both provide vast accessible specific surface area, and also would ensure high intrinsic electrical conductivity to effectively compensate its drawbacks during repeating electrochemical reaction cycles (10-14, 23-27). Additionally, a few favorable factors including (i) its high yield via convenient and cost-effective synthesis, (ii) its controllable and relatively high electrical conductivity, (iii) its long-term stability under ambient conditions, and (iv) its promising electrochemical performance enables PPy to dominate the relevant field of research (28-31). Also, in a variety of studies, the MW energy-based approach has been utilized to obtain the carbonized counterparts of such nanostructured PPy in different morphologies (32-34). In short, here, HNMs were systematically prepared through a combined approach which includes both in-situ (polymerization/coating) and ex-situ (MW energy-based carbonization/growth) processes.

2. Materials and Merhods

Ammonium peroxydisulfate (APS, (NH4)2S2O8, 98% min.), ferrocene (99%), acetone, and pyrrole (98%), were all purchased from Alfa Aesar (Haverhill, MA, USA), and used for the synthesis reactions. Iron pentacarbonyl (Fe(CO)5, 99.5% and 99%-Fe) was purchased from Strem Chemicals (Newburyport, MA, USA), and used for MW energy-based MONWs' growth. All chemicals and reagents were used as-received without any further purifica-tion unless otherwise specified.

In-situ polymerization reactions were conducted at ambient conditions to coat fine ferrocene particles' surface with PPy, as can be seen from Figure 1. After putting 50 mg of PPy/ferrocene powder in a glass vial, 0.1 mL of Fe(CO5) was added to fully saturate it. For the MW energy-based heating process, the damp sample was placed into a domestic MW oven chamber as soon as Fe(CO5) had partially evaporated. During ~15 s of heating process, intense interactions were observed inside the MW oven chamber due to; (i) PPy NP coating's carbonization through MW energy absorption, and its consequent rapid heat generation, (ii) which leads to simultaneous decomposition/deposition, and formation of ferrocene/Fe(CO5) synthesis gas phase that eventually results in (iii) the growth/decoration of CNT and MONW nanostructures on cPPy NPs' surface, respectively (16, 17, 25, 35, 36).

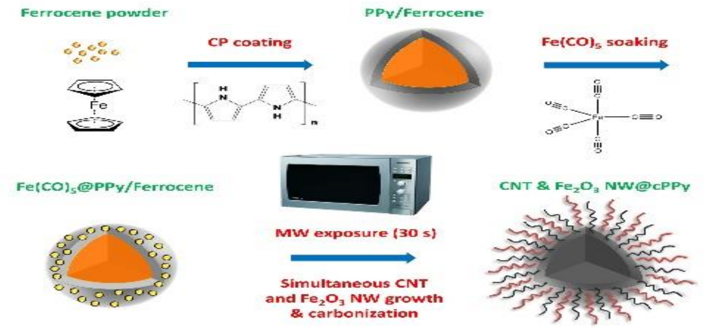

Figure 1. Schematic illustration of the combined approach towards HNM preparation

3. Results and Discussion

Figures 2A, A' and 2B, B' exhibit the as-grown nano-sized surface decorations' i.e., CNTs and MONWs, SEM images.

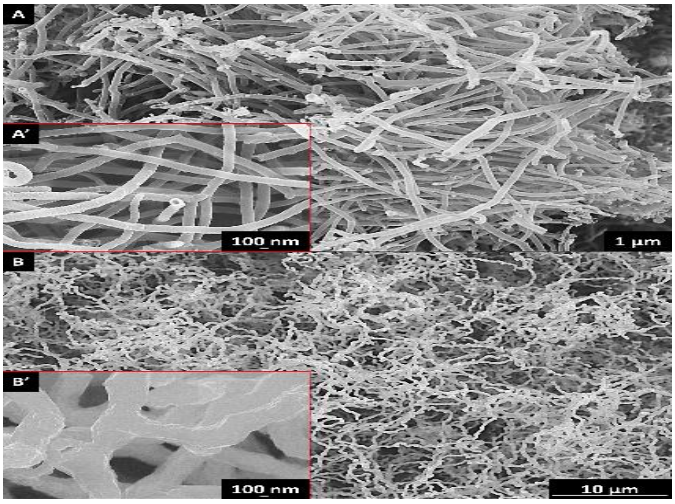

Figure 2. SEM images of the; (A, A’) CNTs, and (B, B’) MONWs grown on the surface Here, a few µm long, uncooked spaghetti-like CNTs with an average diameter of ~200 nm (Figure 2A, A’), as well as uncooked noodle-like MONWs longer than 10 µm in length, and a diameter distribution range of 300-700 nm (Figure 2B, B’) can be observed on these images.

Figures 3A, A’ and 3B, B’ exhibit the results after TEM was used to find out the as-obtained HNM samples’ morphological features in details.

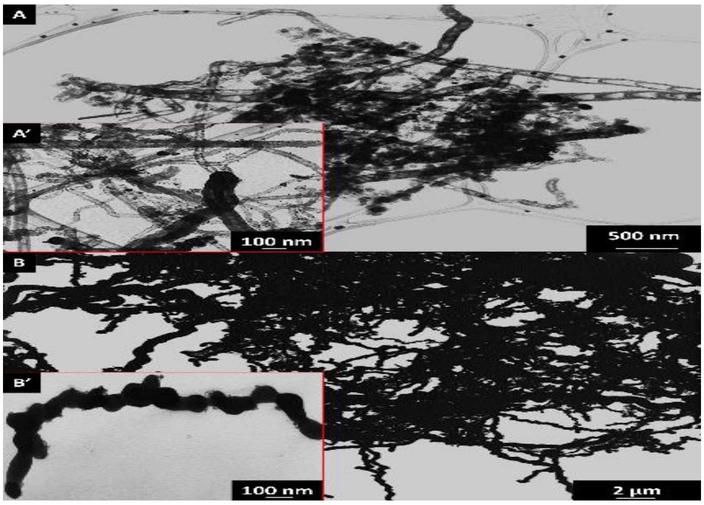

Figure 3. TEM images of the; (A, A’) CNTs, and (B, B’) MONWs grown on the surface

As shown in Figure 3, catalyst Fe NPs are encapsulated in the hollow centers of the as-grown CNTs. Such finding provides significant information about the CNTs’ structure as they were grown stepwise in a bamboo shoot-like pattern, and this morphological phenomenon occurs as a result of a typical bottom-up tip-growth process. In addition, although seems not to be clearly separated like pearls in a necklace, Figure 3B’ shows the as-grown MONWs that are consist of core-shell NP units with Fe2O3 cores encapsulated inside thin graphitic shells. Based on the measurements taken from this figure, such nodules seem to have diameters between 50-150 nm.

Raman and XRD analyses were also conducted either to verify CNTs’ and MONWs’ presence on the as-prepared HNM samples or to provide detailed information regarding both their crystallinity and their spectroscopic characters, as shown in Figure 4.

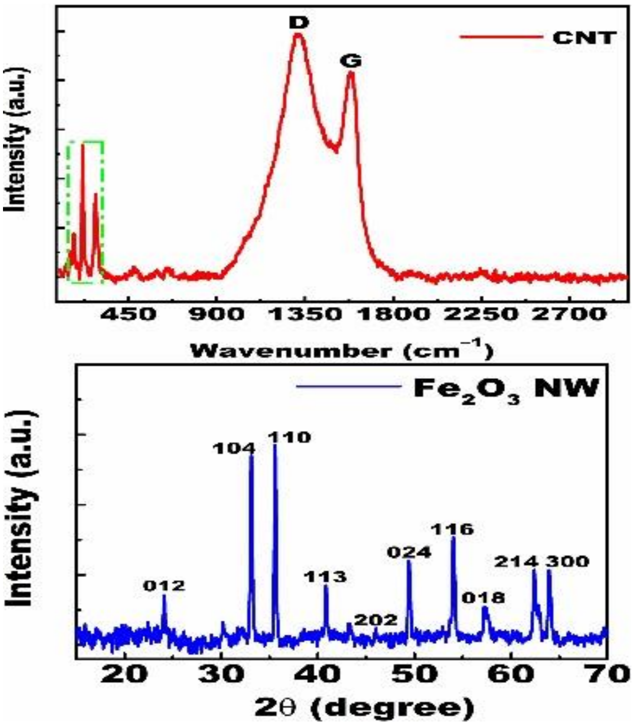

Figure 4. The as-grown CNTs' Raman spectrum (top), and MONWs' XRD diffractogram (bottom) on HNM sample surfaces

As can be seen in Figure 4, CNTs are observed in radial breathing mode (RBM) as represented by the sharp peaks appear between 150-300 cm-1 in the Raman spectrum. Moreover, the as-grown CNTs' multi-walled graphitic character, bamboo shoot-like morphology, and their structural defects are demonstrated with two distinct peaks located at 1320 cm-1, and at 1580 cm-1, respectively. Additionally, the HNM sample's XRD diffractogram emphasizes the fact that MONWs are present in its structure, as illustrated by the characteristic peak positions at 2θ = 24.2°, 33.4°, 35.7°, 41.2°, 49.8°, 54.3°, 62.8°, and 64°, respectively. These peaks closely match with those of Fe2O3 hematite crystal (JCPDS: 33-0664), having α-Fe2O3 character, and dominant (110) plane.

Finally, Figure 5 shows the CV test results conducted to assess the as-prepared HNM's electrochemical energy storage capabilities in comparison with other electrode materials.

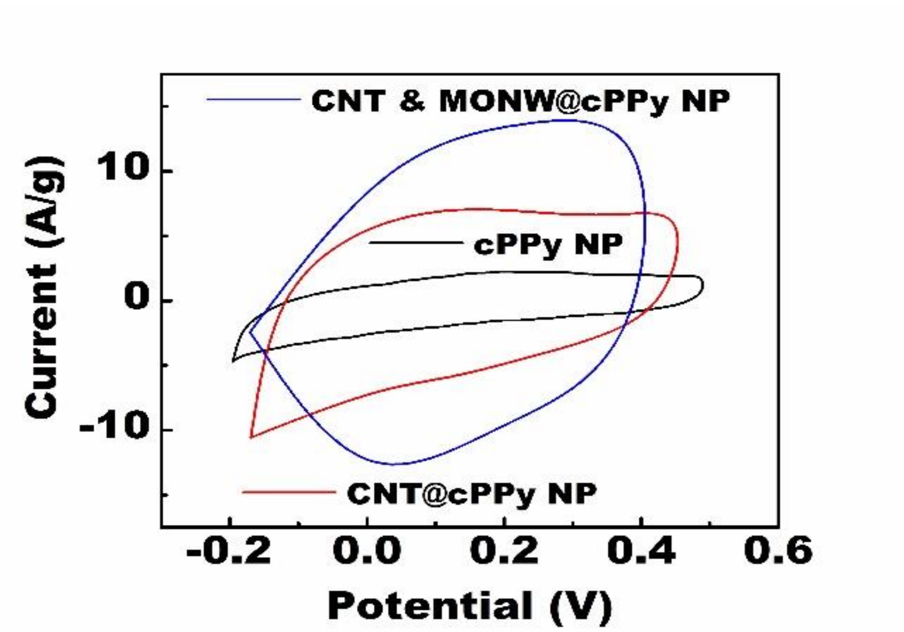

Figure 5. CV voltammograms of; cPPy NP, CNT@cPPy NP, and CNT&MONW@cPPy NP samples

Due to large amount of C in its carbonized structure, cPPy NP samples' CV voltammogram demonstrates prominent electric double-layer capacitor (EDLC)-based electrochemical behavior. Thus, its electrochemical capacitance depends on the formation of double layers at the electrode's interface with the electrolyte. Because of their ultra-high graphitic surface area and high abundance, CNTs' presence in CNT@cPPy NP sample significantly enhances the relevant electrode's double-layer formation ability with the electrolyte. As for the CNT&MONW@cPPy NP sample applied electrode's voltammogram, it seems approximately two times larger than that of the previous one. Here, both enhanced electron diffusion and rapid ion transfer between the electrolyte and MONW are enabled through the pores both within and among CNTs in this sample. Considering the HNM's synergistic 3D composition, it is reasonable to interpret such result as this structure majorly consists of both highly capacitive amorphous carbon from cPPy, and highly conductive graphitic carbon from CNTs, respectively. Moreover, CNTs' high mesoporosity, and Fe2O3 NWs' high pseudocapacitance are also ubiquitously available within the sample structure. As a result, the as-prepared HNM turns out to simultaneously exhibit several beneficial capacitive properties of its compounds such as high energy and power densities, high rate performance, and long-term stability.

4. Conclusion

In this study, two well-organized processes, namely the in-situ PPy NP coating on metallocene precursor (ferrocene), and the ex-situ MW energy-based heating, were systematically combined to produce HNMs. The as-prepared HNMs, which are composed of CNT and MONW decorated cPPy NPs, were proven to have promising potential for the electrochemical energy storage applications according to several material characterization test results along with previous literature data that provide insights into the structural and electrochemical properties of this material. As a result of the accomplishments in this study, it can be predicted that the as-obtained HNMs would soon become preferred materials and would be in efficient use for various advanced applications such as electrochemical energy storage, MRI, water treatment, and so on.

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Melt quality assessment in casting of AA6082 alloy

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Abstract

In this study, it was aimed to examine the metallurgical structures of AA6082 alloys after the casting and homogenization process. During the casting of AA6082 alloys, porosity was determined by the solidification test method at reduced pressure. While examining the porosity, density indices (%ID) and hydrogen content (%H2 rate ppm) were calculated and the bifilm index was examined. After the product was casted, the homogenization process was carried out and grain sizes, microstructures and percentage homogeneity rates were examined. In addition, SEM and EDS examinations were carried out and AlFeSi and MgSi coarse precipitate formations were observed. In line with their outputs, it was determined that the degassing processes in liquid metal were incorrect, and the porosity rate and hydrogen amount were reduced by improving the method. During this process, the quality of nitrogen gas given to the liquid metal was increased and its flow rate was reduced, and the use of flux was increased and oxide layer removal was increased. Likewise, by conducting time and temperature studies in the homogenization process, solid precipitates (MgSi and AlFeSi) in the microstructure were reduced, and finer precipitate formation was observed as desired. In this context, improvements have been made in the production of 6082 alloy in liquid and solid states.

Keywords: Aluminium, Melt Quality, 6082 Alloy, Microstructure, SEM

Contribution of Artificial Intelligence and Computer Architecture of Materials Science

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In this study, computer architecture and artificial intelligence are discussed. Artificial intelligence can be called a technology that allows creative work to be entrusted to computer algorithms. Today, artificial intelligence can be used in unmanned airspace vehicles, UAVs, UAVs, space technology and many other fields. With the help of Artificial Intelligence, we can analyze large amounts of data and create texts, images, music and videos and different forms. In general, businesses can also choose artificial intelligence to make their operations more efficient or save on labor costs. Algorithms can be designed to solve existing problems in science: Predicting the properties of chemical compounds, optimizing molecular geometry, designing new connections can be done with artificial intelligence. It is very important to research computer architecture and its contribution to science. It is obvious that associating material science with artificial intelligence will also contribute to the development of science. In this study, The definition of artificial intelligence, its history, the branches used and its impact on materials science were investigated, and the findings obtained at the end of the literature review were shared at the end of this study.

Keywords: Artifical Intelligence, Computer Architecture, Materials Science

Tensile properties of carbon nanotubes reinforced high density polyethylene nanocomposite materials

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Abstract

In this study, Multiwall Carbon Nanotubes (MWNTs) reinforced High Density Polyethylene (HDPE) materials were used. HDPE was mixed at wt. with 1%, 3% and 5% MWNTs. Firstly, HDPE and MWNTs were mixed with a mixer, then a hot mixture was made with an extruder, and finally, the material was cut into small pieces to obtain small granules. Sheets were produced by hot hydraulic press and test specimens were obtained from this sheet. Tensile properties of the specimens reinforced with Carbon Nanotubes were investigated. According to the ASTM D638 standard, the specimens were tested and their tensile properties were found. Thermogravimetric Analyses (TGA) was performed for and MWNTs within the HDPE. It was observed that tensile strength increased with increasing carbon nanotube reinforcement amount. The tensile strength of reinforced specimens produced by hot press was increased by 10.35% compared to specimens produced from HDPE. It was seen in the TGA results that mass loss temperature and melting point temperature increased by MWNTs ratio in the composite specimens.

Keywords: HDPE, MWNTs, Nanocomposite, Tensile, TGA

1. Introduction

Carbon nanotubes (CNT) are near ideal whiskers consisting of folded graphene layers with cylindrical hexagonal lattice structure. Recent theoretical and experimental studies suggest that this cylindrical hexagonal lattice structure of CNT gives them remarkable mechanical and electrical properties [1,2].

Since the documented discovery of carbon nanotubes (CNTs) in 1991 by Iijima [3] and the realization of their unique physical properties, including mechanical many investigators have endeavored to fabricate advanced CNT composite materials that exhibit one or more of these properties [4]. For example, as conductive filler in polymers, CNTs are quite effective compared to traditional carbon black microparticles, primarily due to their large aspect ratios [5]. The main focus of this paper, however, will be on the use of CNTs as discontinuous reinforcement for polymer matrices. The CNT can be thought of as the ultimate carbon fiber with break strengths reported as high as 200 GPa, and elastic moduli in the 1TPa range [6,7].

Carbon nanotubes (CNTs) are graphitic sheets rolled into seamless tubes (i.e., arrangements of carbon hexagons into tubelike fullerenes) having a diameter ranging from about a nanometer to tens of nanometers with lengths up to centimeters. Both theoretical and experimental studies have shown CNTs to have extremely high tensile moduli (>1 TPa for single walled carbon nanotubes, SWCNTs) and tensile strengths of the order of 500 GPa [8,9]. Carbon nanotubes are thermally stable up to over 2400˚C in vacuum, have a thermal conductivity along their principal axes about double than that of diamond and electric-current-carrying capacity up to 1000 times higher than copper wire. Due to their extraordinary mechanical, electrical and optical properties together with their low density (1.3-2.4 g/cm3), CNTs have attracted great attention in recent years in the field of composites materials. As the structure and properties of the CNTs have been understood, there is a pressing need to transfer their outstanding properties from nano to micro/macro-scales. One essential step towards this goal is their processing, which often involves dispersing them in a polymeric matrix to form complex materials such as polymer-CNTs nanocomposites. These composites represent the first realized major commercial application of CNTs [10].

The promising area of composite research involves an enhancement of mechanical properties of polymer using CNTs as a reinforcing material. Although several studies have been focused on producing nano-composites, many practical challenges concerning their fabrication still remain, compromising the full realization of their enormous potential. Dispersing nanotubes individually and uniformly into the polymer matrix seems to be fundamental when producing composites with enhanced and reproducible properties. To utilize and enhance the properties of HDPE, especially to improve its rigidity, CNT–HDPE composites are prepared and the effect of CNT loading on mechanical properties is investigated. As the modulus and toughness are the most influenced properties by the crystallinity, thermal analysis of composites is also carried out [11].

The addition of nanostructured materials, such as carbon nanotubes (CNTs), to polymers offers a viable means of altering the mechanical [12,13] properties of polymer-based composite materials. The resulting properties include tensile strengths of 100–600 GPa, a density of around 1.3 g/cm3, elastic moduli of 200–5000 GPa and fracture strains of 10–30% [14,15]. CNTs have desirable mechanical properties that make them particularly attractive for strengthening polymers [16,17].

2. Materials and Methods

2.1. Material

In this section, MWNTs within HDPE to be formed into a composite material and the composite material forming the experiments. Properties of carbon nanotube are given at Table 2.1.and properties of thermoplastic matrix are given at Table 2.2.

Table 2.1. The physical properties of MWNTs

Average Diameter	10-40 nm
Length	1-25µm
Purity	Min. % 93
Specific Surface Area	150-250 mm^2

Table 2.2. The properties of HDPE

Melt Flow Rate (g/10dk)	0,04
Density (g/cm^3)	0,956
Pour in the tensile strength (MPa)	22,555
Tensile Strength at Break (MPa)	29,420
Elongation at Break (%)	> 500
Melting Point (°C)	131

The specimens used in this study, is available from Fibermax Composites MWNTs with PETKİM Petrochemical Holding CO. is located in Izmir Aliaga. Quality Control and Technical

Services Manager facilities are connected to the work done, again obtained from PETKİM F00556 combined with HDPE was granulated.

Specimens to be applied tensile properties according to ASTM D638 standard within the desired size was produced. The granules were pressed in hot press and pleated on the substrate with a cutting pattern specimen. These specimens were subjected to tests according to ASTM D638 standard. Thermogravimetric analysis (TGA) was performed according to the ASTM E1131 standard.

2.2. Preparation of Specimens

0,001 grams of the specimen primarily Sartorius BP 310 S type having sensitivity in a sensitive balance accurately weighed in a beaker. About 2500 grams specimen from each specimen were considered.

As seen in Figure 2.1, wt. 1%, 3% and 5% MWNTs mixed in HDPE with a mixer with the help of mixed extruder with a hot mix made and then the specimen cutting machine to cut the desired state has received.

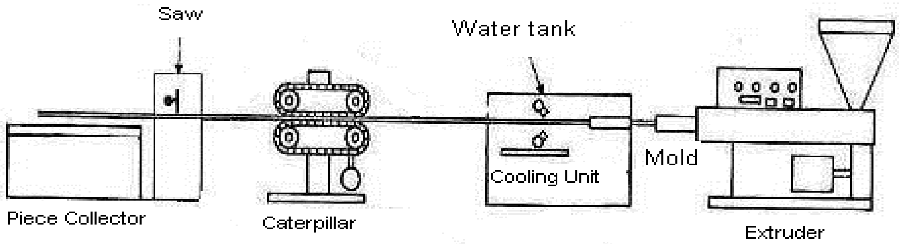
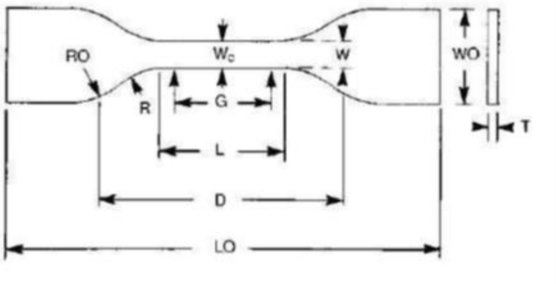


Figure 2.1. Extrusion Process

MWNTs and HDPE was stirred by HENSCHEL Mischer FM10C Type double blade mixer at 525 rev/min speed at room temperature for 10 minutes. Temperature of the mixture before the mixture 10 minutes starting from 27ºC to 47ºC were reached at the end.

MWNTs and HDPE mixture was supply to a BRABENDER PLASTI-CORDER PL2000 model twin screw extruder with an L/D ratio of 18 and an output speed of 50 rpm. 4 heating zones having extruder, respectively 170ºC, 190ºC, 200ºC and 190ºC in the heating Extruders who left the melt composite mixture of a water-cooled thermostat connected to the unit the water from the pool through the temperature was lowered and a mechanical crusher refracted by small pieces granules were obtained.

Granular specimens prepared in a hot press at 190±3°C for 6 minutes without pressure preheater is heated. Second heating for 4 minutes specimens taken 40 kg/cm2 pressed hot pressing for 5 minutes at 27±3°C was removed by being 150 kg/cm2. Becoming 150X150X3 mm size from sheets in accordance with ASTM D638 standards is cut of seen in Figure 2.2 test specimens was obtained.



W= 6 ± 0,5 mm L= 33 ± 0,5 mm
W0= 19 mm L0= 115 mm
G= 25 mm D= 65 ± 5 mm
R= 14 ± 1 mm R0= 25 ± 1 mm

Figure 2.2. Tensile Test Specimen Dimensions

SEM images are given in the Figure 2.3.

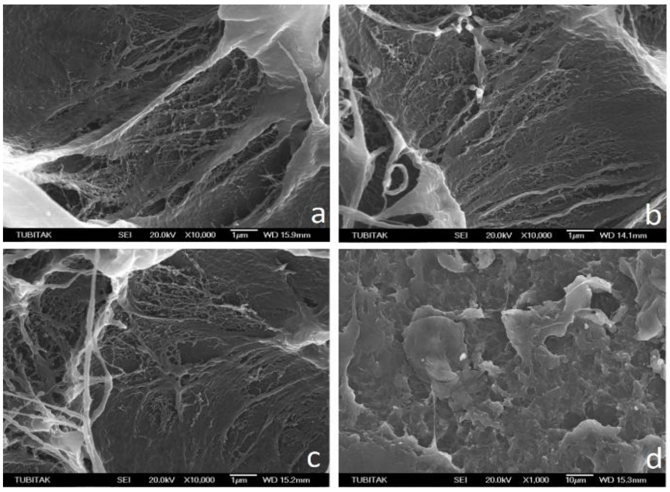


Figure. 2.3. SEM images; a) %0 MWNTs-%100 HDPE, b) %1 MWNTs-%99 HDPE, c) %3 MWNTs-%97 HDPE, d) %5 MWNTs-%95 HDPE

3. Results and Discussions

3.1. Tensile Test

The tensile tests according to ASTM D638 standard was used KOSGEB Konya Laboratory were performed using 600 kN capacity Universal Dartec Tester M9000 model type device. The tensile tests were performed tensile tests at (25±1)°C at a crosshead speed of 50 mm/min. The experimental results in Figure 3.1 and Table 3.1. are given.

The variation of tensile strength for HDPE/MWNTs nanocomposites is shown as a function of MWNTs content. MWNTs reinforcement is generally provides increased strength. This increase is primarily due to MWNTs can be distributed homogeneously in the matrix. In addition, MWNTs were transferred their individual strength to composite materials via taking over the load applied to the matrix material. MWNTs prevent the proliferation of cracks to grow by in the matrix stripping situations and formed by bridging their movement. This situation is also supported by the literature [18, 19, 20].

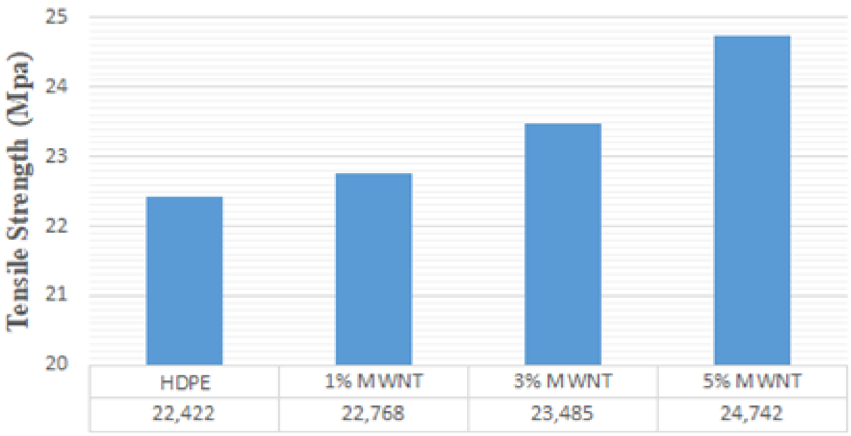


Figure 3.1. Tensile test results graph of specimens.

Table 3.1. Tensile test results table of specimens.

SPECIMEN	%100 HDPE	% 1 MWNTs %99 HDPE	% 3 MWNTs % 97 HDPE	% 5 MWNTs % 95 HDPE
Maximum Force (F_{max}) (N)	375.725	331.514	378.962	384.650
Area (A) (mm^2)	16.757	14.561	16.136	15.547
Ultimate Tensile Strength (σ_{max})(Mpa)	22.422	22.768	23.485	24.742
% Change compared to HDPE	0%	% 1.54	% 4.74	% 10.35

3.2. Thermogravimetric Analysis (TGA)

TGA analyzes were according to ASTM E1131 standard by METTLER brand TGA/STG 851 E instrument 10°C/min heating rate to 1000°C by gas of nitrogen and atmospheric air was used in Petkim Petrochemical Holding AS R & D Laboratory. As the crystallinity of the polymer composites is having influence on Young’s modulus and toughness, it was decided to study thermal analysis of the composites, i.e. DSC and TGA. In the case of DSC curves, which are shown in Figure 3.2., the addition of MWNTs in HDPE increases the total enthalpy of crystallization. The melting point of composites occurred at about 137°C indicating the degree of polymer crystallinity in all composites. The reinforcement of MWNTs in HDPE is not affected the melting point of the composites.

In case of TGA curves which are shown in Figure 3.3, thermal stabilization of MWNTs–HDPE composites and the fraction of volatile components are observed with an atmosphere of air. It is observed that the onset temperatures of these composites are 405,76°C, 417,50°C, 420,05°C and 430,32°C for HDPE, 1%, 3% and 5% MWNTs, respectively. It is observed that onset temperature decreases with an addition of chemically treated MWNTs due to amorphous carbon present in the MWNTs and other carbonaceous impurities that oxidize at temperature lower than that of MWNTs. The oxidation temperature of composites, thermal stability of the composites, is found by differentiating the percentage of weight loss curve with temperature which is shown in Figure 3.4. The temperatures at which the maximum rate of oxidation is taking place are 492,28˚C, 493,02˚C, 488,78˚C and 481,56˚C for 5%, 3%, 1% and HDPE, respectively. It is observed that the oxidation temperature of the composite is not much affected by the addition of MWNTs, which may be due to very low fraction of MWNTs in the composites. The secondary additional peaks observed in Figure 3.4 are due to the functional groups attached in the nanotubes.

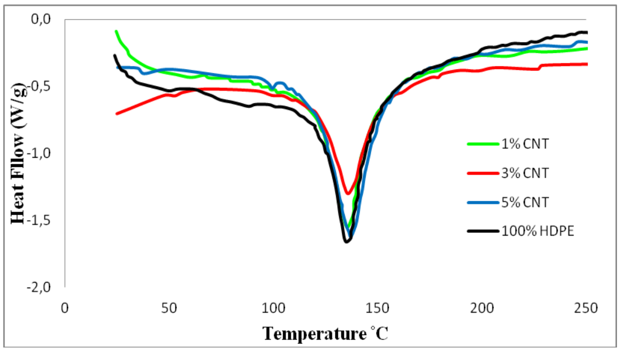


Figure 3.2. DSC curves of MWNTs–HDPE composites.

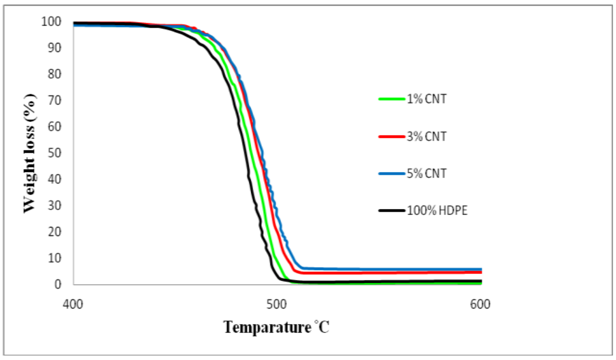


Figure 3.3. TGA curves of MWNTs–HDPE composites

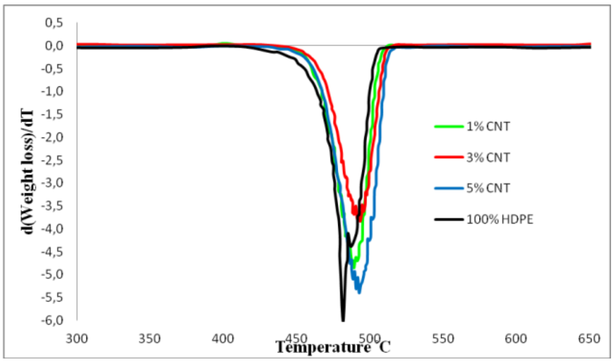


Figure 3.4. d(TGA)/dT curves of MWNTs–HDPE composites.

4. Conclusion

HDPE into a wt. 1%, 3% and 5% participating MWNTs, making itself after the hot press sheets specimens production methods tensile properties how to alter examined. However, the outcomes and recommendations are:

1) MWNTs with HDPE in a mixture of primarily mechanical mixture directly without the use of any chemical substance mixed with granules were obtained in the extruder. We have tried to provide practicality and advantages for mass production.

2) Granules were produced in hot press sheets and specimens were created by cutting them from these produced sheets. [21]

3) The weight ratio of the composite increases tensile strength increase of MWNTs material was transformed into a strength structure. Compared to 100% HDPE, the tensile strength increased by 1.54% with 1% MWNTs additive, 4.74% with 3% MWNTs additive and 10.35% with 5% MWNTs additive. According to these results is the value of the good ultimate tensile strength of 5% MWNTs addition (24.742 MPa).

4) When this production method is compared with the test results of specimens produced by plastic injection; It was observed that the ultimate tensile strength of the specimens cut from the plate produced by hydraulic hot press was low. It is thought that the reason for this is that there are micro voids in the plate produced by hydraulic hot press, and as a result, the tensile strength is low. [21]

5) TGA analysis of the composite by weight ratio increases MWNTs distortion temperature increased mass loss. Depending on the temperature, the lowest value of the mass loss rate of 3% mass loss rate value in the MWNTs is additive. This increased ratio of the weight of the material MWNTs mass loss temperature and a melting point to reduce the rate of melting temperature was found to slightly increase.

6) HDPE into a more homogeneous dispersion of MWNTs tensile strength by working to reach a higher value.

7) By examining the microstructure of the fracture surfaces of tensile specimens, it can be examined what effect they might have on the fracture properties of MWNTs.

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Organik temelli CdS elektrodunun fotoelektrokimyasal aktivitesinin incelenmesi

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Özet

Bu çalışmada fotoelektrokimyasal olarak suyun ayrıştırılması ile H2 üretimi için sentezlenen politiyofen (ptyf) katkılı CdS elektrodun fotoelektrokimyasal aktivitesi incelenmiştir. Öncelikle politiyofen kimyasal olarak sentezlenmiştir. Sentezlenen ptyf dört farklı derişimde kadmiyum asetat çözeltisine eklenip SILAR metod ile CdS/ptyf elektrodu hazırlanmıştır. Ptyf derişimine bağlı olarak dört farklı elektrot elde edilmiş, elektrotların fotoelektrokimyasal performansları lineer taramalı voltametri ve amperometrik yöntem ile incelenmiştir. Bu yöntemler ile optimum ptyf derişimi ve SILAR metottaki döngü sayısı değiştirilerek optimum döngü sayısı belirlenmiştir. Optimum koşullar belirlendikten sonra en iyi fotoelektrokimyasal aktivite gösteren CdS/Ptyf elektrodu ile aynı döngü sayısında sentezlenmiş CdS elektrodunun fotoelektrokimyasal aktivitesi kıyaslanmıştır. Elde edilen sonuçlar doğrultusunda ptyf varlığında CdS' ün fotoakımının 2,5 kat arttığı belirlenmiştir. Hazırlanan katalizörlerin karakterizasyonu Uv-vis, XRD ve SEM cihazları ile gerçekleştirilmiştir.

Anahtar Kelimeler: Polythiophene, CdS, fotoelektrokimyasal reaksiyon

*Bu çalışma, Mersin Üniversitesi Bilimsel Araştırma Projesi Koordinasyon Birimi (***MEÜ, BAP, Proje No: 2023-1-TP2-4825***) tarafından desteklenmiştir.*

Investigation of Radioluminescence of natural fluorites collecting from Kırşehir region

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Abstract

The study focused on the radioluminescence properties of natural CaF2 collected from the Bayındır Region of Kaman District in Kırşehir Province. Measurements were performed with a Qe-Pro spectrometer coupled to a homemade radioluminescence device at room temperature. The luminescence intensity spectrum was recorded from 200nm to 1000nm. Natural CaF2 in powder and bulk form in three different colours: white, purple and green, was used in the study. The luminescence spectrum of powder and bulk samples was classified according to XRF results. Two of the samples exhibit a luminescence ranging from 200 nm to 900 nm. The prominent peaks are at 286 nm and 316 nm, resulting in white and green colours, respectively, but the purple sample luminescence spectra ended at 450nm. White and green samples have sharp peaks after 400nm, which belong to REE ions in that spectral range. Possible luminescence transitions of REE ions were determined. The study's findings, which are compatible with the existing literature, underscore its contribution to the field.

Keywords: Floruite, Luminescence, Crystal Defects

Investigation of luminescence properties of baddeleyite doped Dy^{3+}

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Abstract

The importance of green technology is increasing due to today's need for alternative energy sources. One of the areas of use of rare earth elements is green energy technologies. As an impurity, Rare Earth elements in luminescence materials have been documented to increase luminescence efficiency and improve durability. It is among the luminescence radiations formed by doping Dy3+, one of the successful rare earth elements, into Baddeleyite (ZrO2). In the study, Baddeleyite monoclinic crystals with various Dy3+ contents (0.01%, 0.02%, 0.05% and 0.1%) were prepared by the solid-state method and their luminescence properties were created. According to the radio luminescence spectrum measurements obtained, the luminescence emission is from 370nm to 800nm. When Dy3+ was doped to Baddeleyite, there was no change in the radioluminescence spectrum, but a significant increase in the luminescence intensity was observed. In Radio-Thermo-Luminescence (RLTL) measurements, it was noted that the intensity of luminescence decreased exponentially, starting from room temperature to 400oC. In addition, XRD and SEM images of the samples and the properties of crystal pieces and surfaces were investigated.

Keywords: Rare Earth Elements, Luminescence, Thermoluminescence, 8YSZ

POSTER PRESENTATIONS

Synthesis and characterization of poly 81-vinyl-1,2,4-triazole) as dielectric layer for organic field effect transistors

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Abstract

In this study, 1-vinyl-1,2,4-triazole (VT), which is a nonconjugated 1-vinyl monomer having a basic aromatic heterocycle, was synthesized poly-1-vinyl-1,2,4-triazole (PVT) by free radical polymerization using the monomer 1-vinyl-1,2,4-triazole and the initiator azobisisobutyronitrile (AIBN) in toluene as solvent. Thus, the synthesized water-soluble PVT as a novel dielectric layer for organic field effect transistor is studied. In this study, it was investigated that both n-channel and p-channel organic field effect transistors can be produced using PVT as the dielectric layer in order to have device performance with low leakage current, hysteresis, very low threshold voltages and high on/off ratios

Keywords: Free Radical Polymerization, Polymer, Poly-1-vinly-1,2,4-triazole, Dielectric, Transistor

1. Introduction

Triazoles are stable heterocyclic compounds with nitrogen atoms bonded to form hydrogen bonds or metal ion coordination. Therefore, π-π tends to interact. Different polymers with triazole moieties in the side chains are available and different vinyl-triazole derivatives can also be diversified. These derivatives are mostly preferred to be obtained by radical polymerization [1,2]. With the development of polymer technology, a lot of research has begun to be done on functional polymers created with triazole derivatives. Among these polymers, N-vinyl-1,2,4-triazole (NVTri) is a water-soluble polymer and has accelerated research as a pioneer for others. Poly(NVTri) has also been reported to be biocompatible, thermally stable, non-toxic, and easily soluble in water/polar solvents [3,4]. Poly(NVTri) has been focused on application areas such as controlled release, especially in medical and biomedical research fields [5,6]. Their potential applications involve dielectric layer for organic field effect transistor, [7–10] polymer matrixes for nanoparticles based composites,[11,12] proton-conducting electrolytes, [12,13] polycations to form complexes with anionic polyelectrolytes, [14,15] and energetic polymer salts. [16,17]

The solubility of poly(vinylazole) compounds, including poly(vinyltriazole), poly(vinyltetrazole) and poly(vinyldiazole) compounds, tends to form hydrogen bonds with the water compound present in the structure in the reaction. This tendency has been reported to be related to the presence of pyridine-based nitrogen atoms in the heterocyclic structure [2,18]. The advantage of water solubility of poly(NVTri) compound is that the isolated pyridine compound in the heterocyclic structure has nitrogen atoms and dissolves in water. Poly(N-vinyl-1,3,4-triazole) and poly(N-vinyl-1,2,3-triazole) compounds contain more than two nitrogen atoms in the heterocyclic structure, so poly(vinylazole) compounds are insoluble in water. Chemical structures of PVT are given in Figure 1 and Figure 2. The poly(NVTri) compound has the nitrogen atoms in the pyridine compound in the heterocyclic structure. However, their polymers and cationic polyelectrolyte compounds are soluble in water [19]. In previous studies, it was found that PVT nanoparticles containing silver, gold and iron have good antimicrobial activity, are water soluble, and act as a stabilizing matrix against temperature and external factors [20,21]. Mostly organic polymeric materials are used when manufacturing organic optoelectronic devices. These materials have a great potential for application in the electronics field due to their low cost, easy processability and stability. The technological development of this potential means the development of all future plastic electronics [22–24]. Organic field effect transistors (OFETs) are one of the focal points of developments in the theological field. They have been extensively studied as a fundamental component of all electronic devices. In

OFET devices, the dielectric insulating layer affects the efficiency and the success of the application.

Information of OFET configuration, it is important to develop this device by comparing the source-drain current versus gate voltage values with structures with inorganic materials such as amorphous silicon, which have less trap-free dielectric/semiconductor interfaces and low hysteresis. It is necessary to take into account some factors such as transistors operating at high voltage and the electronic devices consisting of layers used generally having relatively low charge carrier mobility, and precautions must be taken for these disadvantages. These active layers must be optimized to achieve lower operating voltages [25,26] For OFETs, optimizing the device by adding a thin organic insulating film on the gate may offer a good solution. However, the passivation layer must be very thin. In this way, a capacitance similar to the oxide layer is obtained. Some of the polymeric semiconductors are used for inclusion in transistors. Most of the polymers used are soluble in non-polar organic solvents [27,28].

In electronic devices prepared in solution, it is desirable to avoid dissolution of the substrate. Those with NH groups in their structure, such as PVT, are generally highly soluble in polar, protic solvents such as water and have poor solubility in non-polar solvents. For this reason, there is a need for organic dielectrics that are highly soluble in protic solvents such as water and have poor solubility in non-polar organic solvents. One of the organic dielectric materials is Poly(vinyl alcohol) (PVA) compounds. PVT compounds, one of the water-soluble polymers, have a high dielectric constant and excellent film-forming properties, making them one of the most studied dielectric layers [29,30]. One of the problems encountered in OFET devices built with PVA is hysteresis [31]. In order for the logic circuit applications of OFETs to be successful, they must have a hysteresis-free characteristic. It becomes difficult to apply hysteresis behavior to the memory elements in these structures [32,33]. The effect of charge confinement and mobile ions on hysteresis in transistors has been investigated in detail and the factors that can positively benefit this effect have been investigated in detail [34–36]. For this reason, the dielectric properties of water-soluble PVA or similar polymers for transistors need to be investigated in detail. Among these polymers, PVT has recently been proposed as a non-toxic, environmentally friendly and biocompatible polymer [10,12].

In the field of nanotechnology, it has been suggested that PVT-based salts can be used as energetic polymers as reliable binders in propellants and explosives, and different nanoparticles can be incorporated into this matrix [37–41]. By adding acid to the PVT compound, proton exchange membrane fuel cells are produced and these cells have been examined as proton-conducting polymer electrolytes [34,42,43].

In this study, a water-soluble Poly(1-vinyl-1,2,4-triazole)(PVT) compound used as a dielectric for OFETs was synthesized and characterized. The chemical structures of PVT compound were were confirmed **by** means of UV-visible spectroscopy, FT-IR spectroscopy, and 1H NMR spectral data. Its technical properties show that PVT can be an excellent polymer dielectric for OFETs.

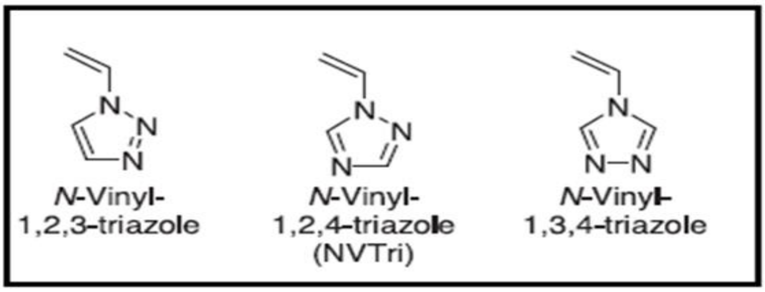


Figure 1. Structures of 1 -vinyl-triazole derivatives

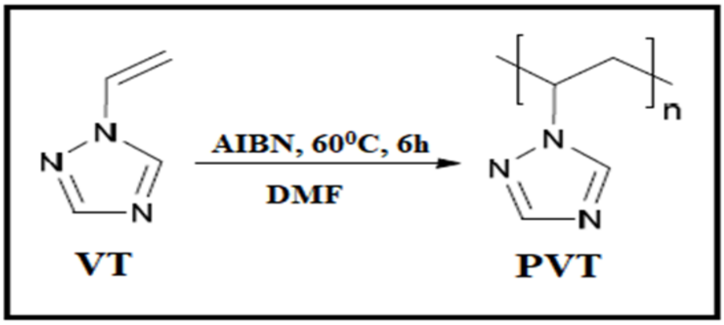


Figure 2. Polymerization of N -vinyl-1,2,4-triazole (VT)

1.1. Properties of Poly(1-Vinyl-1,2,4-Triazole) (PVT)

Poly(1-vinyl-1,2,4-triazole)(PVT) is in the hydrophilic group among polymers, and when its dissolved solutions in water are examined, it has high thermodynamic flexibility in water and is associated with a strong electrostatic interaction with H2O molecules [24,44]. Hydrogen bonds are formed involving the unshared electron pairs of the N2 atoms of the VT rings, and this is probably caused by the exothermic heat effect. The mechanism of solvent interaction can be explained by the fact that PVT interacts more easily with other structures and all processes are controlled by the interactions of electrons [44]. PVT acts as a donor in water. However, it is insoluble in solvents such as acetonitrile, acetone, tetrahydrofuran, diethyl ether and dichloroethane [45].

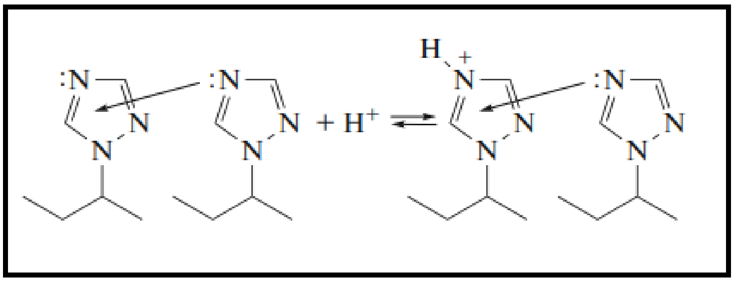


Figure 3. Structure of the polymer formed through the vinyl group and triazole ring

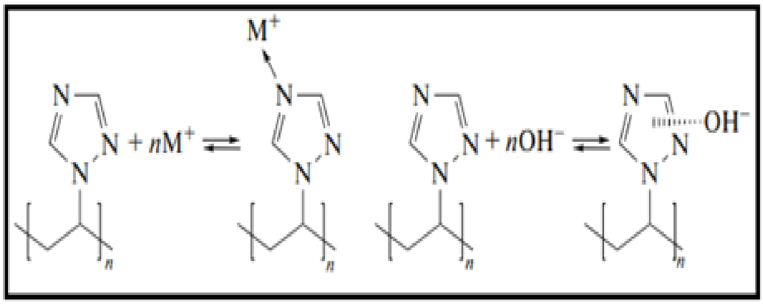
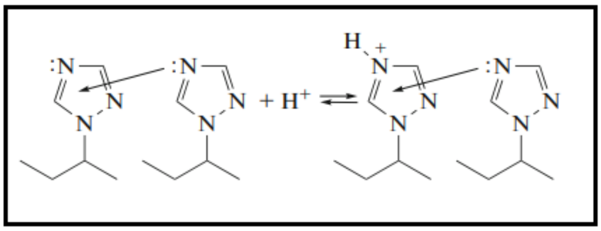


Figure 4. Schematic representation of the interaction of triazole rings with cations and anions of dissociated hydroxides

In Figure 3 and Figure 4 show dissociated hydroxides of triazole rings. The interactions between the anions and cations of these hydroxides can be explained as follows:

A small amount of acid is added to the solution and the non-negative charge on the PVT chain



increases. The bonds between the triazole moieties are broken and thus the basicity suddenly decreases. A small amount of acid is added to the solution and the non-negative charge on the PVT chain increases. The bonds between the triazole moieties are broken and thus the basicity suddenly decreases [34,44,46].

2. Materials and Methods

2.1. Materials

The initial monomer 1-vinyl-1,2,4-triazole (VT) was synthesized according to the method in [23,24]. Azobisisobutyronitrile (AIBN) (99%) and other all chemicals/reagents used for the synthesis were obtained from commercial sources and were used as received without further purification. AIBN was used as radical initiator, benzene as solvent and CCl4 as chain transfer agent. H2O was used as deionized and degassed.

2.2. Method

The absorption spectrum was recorded using a UV-31100PC-shimadzu double beam UV–visble spectrophotometer in 10 mm matched quartz cells. Fourier transform infrared (FT-IR) spectrum was recorded with a Nicolet 5700 FT-IR spectrometer. 1H NMR measurements were performed using a Bruker 400 MHz NMR spectrometer.

2.2.1. Synthesis of 1-Vinyl-1,2,4-triazole monomer (VT)

VT was prepared by a literature procedure [47,48]. A colorless oil is obtained, 90% yield, bp 1030C (15 Torr).

2.2.2. Synthesis of Poly(1-vinyl-1,2,4-triazole) (PVT)

Polymer poly (1-vinyl-1,2,4-triazole) have been synthesized via free radical polymerization using the monomer 1-vinyl-1,2,4-triazole and the AIBN (5 mol %) as an initiator. The monomer weight concentration is 10%, with respect to DMF as solvent. The reaction mixture was heated at 60°C for 24 h under nitrogen atmosphere [18,48].

As shown in Figure 5, OFET architecture containing PVT polymer has been adopted to demonstrate advanced organic electronic devices with new functionalities such as a fast non-volatile memory,vertical complementary inverter circuits, or vertical organic light-emitting transistors [49].

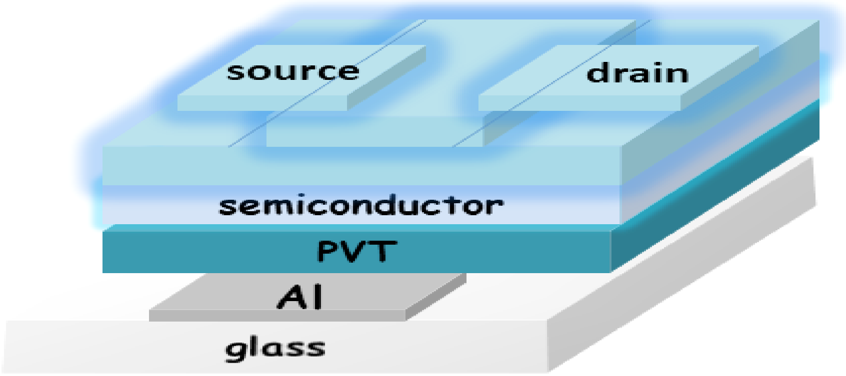


Figure 5. Device structure of OFET with anodized AlOx for for low voltage operation devices and gate dielectric layer

3. Results and Discussion

Fourier Transform-Infrared and Ultraviolet-visible (UV) Spectroscopy (FT-IR) are a reliable and cost-effective analytical tool for identification of polymers. 1,2,3-Triazole is an interesting N-heterocyclic framework which can act as both a hydrogen bond donor and metal chelator. The FT-IR spectra of PVT in the 4000−500 cm−1 region are shown in Figure 6. The PVT shows medium or strong peaks ring stretching (C-N, C=N) vibrations in the 1430–1650cm-1 range. The triazole ring shows an additional peak at 1270 cm−1 which is attributed to the N–N stretching. The peak at 1281 cm−1 is attributed to the characteristic peak of the ring N−N bond; the peak at 1455 and 1662 cm−1 is attributed to the characteristic peaks of C−N and C=N bonds [40,50]. As shown in Figure 6, displays absorbance maximum λmax: 210 nm, associated with π-α* transitions of the C=N group of the triazole ring [48,51].

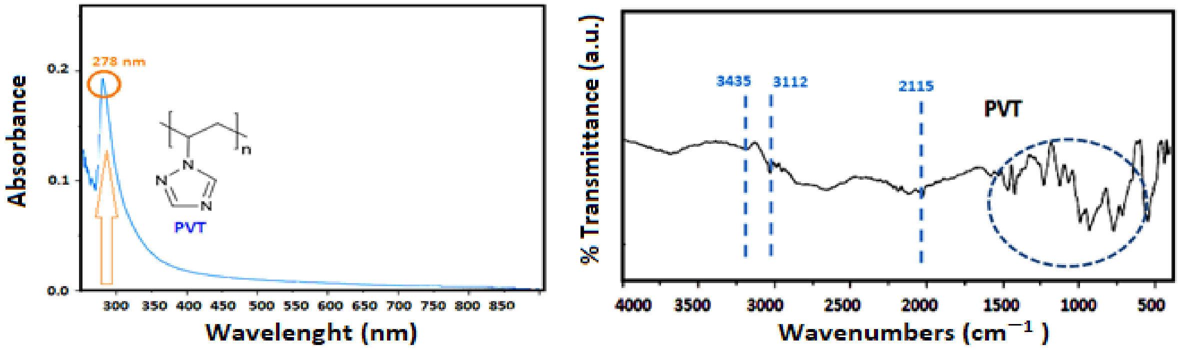


Figure 6. UV-vis spectra and FT-IR spectra of the of the homopolymer PVT

The FT-IR spectra of the PVT is shown in Fgure 1. The FT-IR spectrum of PVT contains characteristic absorption bands corresponding to the stretching and bending vibrations of the triazole ring at 3433, 3115, 3009 cm−1 (C-H), 2642, 1759, 1553 cm−1 (C=N), 1435 cm−1 (C-N), 1386, 1324, 1275 cm−1 (N-N), 1205, 1137, 1101 cm−1 (C-H), 957, 900, 711, 683, 672, 620 cm−1(C-N), and characteristic absorption bands of the polymer chain at 2940 cm−1 (CH,CH2).

The synthesized PVT was characterized by 1H NMR spectroscopy. The 1H NMR spectrum of the poly(1-vinyl-1,2,4-triazole) obtained at [AIBN] in DMF is shown in Figure 7.

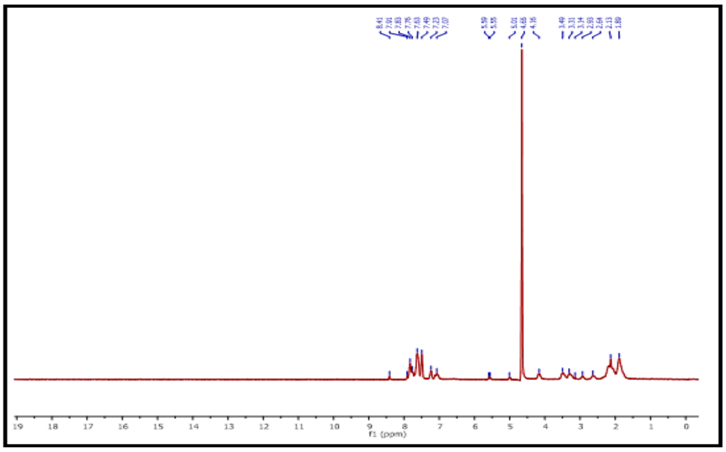


Figure 7. ^{1}H NMR spectra of PVT in D2O

The absence of the signal characteristic of the vinyl group in the monomer at 5.70-5.11 ppm in PVT is confirmed by 1H NMR and is compatible with previous literature data where the polymer is formed. The signals at 7.67–7.39 ppm are attributed to the VT ring [45]. When these spectra are examined, the NMR data confirm that poly(1-vinyl-1,2,4-triazole) was successfully formed [45].

4. Conclusion

In this study, poly(1-vinyl-1,2,4-triazole) (PVT) was synthesized by free radical polymerization of **1-vinyl-1**,**2**,**4-triazole**. This report could lead to new possibilities for improving efficiency in transistor manufacturing. It is emphasized here that monomers are soluble and can be processed in solution, while PVT polymer is water-soluble, easily synthesized and therefore low-cost materials. For future transitor studies, it can be recommended that hysteresis-free transmission and low threshold voltages can be achieved when PVT is added as a dielectric layer. Considering all these advantageous electronic properties, it shows that PVT can be an excellent water-soluble polymer dielectric for OFETs.

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Functionalisation of thin films prepared for cosmetic applications with honey bee products

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Abstract

Flexible and adhesive thin films are cheap and easily available biomaterials that show potential for use in cosmetic applications including acne-patches, anti-aging and moisturizing masks. They are generally obtained by casting a homogeneous solution prepared by dissolving polymers in a suitable solvent. Studies in recent years have focused on the functionalization of these films prepared on the basis of biopolymers in the presence of drugs, plant extracts, essential oils and bioactive agents. In this context, in our study, we aimed to add different bee products such as honey, pollen and propolis into thin films prepared on the basis of gelatin and pectin and to characterize the resulting composite films. The morphological structure of the films was determined by scanning electron microscope and light microscope images, and the chemical structure was determined by Fourier Transform Infrared Spectroscopy. In addition, contact angle measurement and water retention capacity were determined for surface properties. The biodegradability of the composite films was calculated based on weight loss in water. Preliminary optimization results obtained from the study show that bee products were successfully integrated into the film structure and have potential to be used in cosmetic applications.

Keywords: Pollen, Propolis, Honey, Polymer, Thin Films, Cosmetic

Theoretical and experimental investigation of the radiation shielding and anti-microbial properties of ZnO doped Pbo glass materials

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Abstract

In our study, mass attenuation coefficient (MAC) values for radiation shielding properties were calculated using Geant4-GATE and XCOM simulations, and the results were compared with experimental data. Calculations were made at energies of 511, 662, 1173, 1274 and 1332 keV. The colony counting method was used to determine an-tibacterial. The antibacterial activity of Pb-doped ZnO was tested against Staphylococcus aureus (ATCC 25923) and Escherichia Coli (ATCC 25922) bacteria. Looking at the results, it was found that the ZnO additive reduced radiation absorption and was antimicrobial only against Staphylococcus aureus bacteria.

Keywords: ZnO, theoretical, experimental

Frequency dependent dielectric properties of PA 66 polyamide composites with graphene nanoplatelets for aerospace applications

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Abstract

In this study, Graphene Nanoplatelets (GNPs) doped PA 66 Polyamide (PA) composite materials were produced. PA66-Graphene composite materials were obtained using an injection molding machine by adding 0.5 and 1 wt% GNPs to the produced PA engineering plastic material. An impedance analyzer was used to determine the dielectric properties of the PA66-Graphene composite materials. The frequency dependence of the dielectric properties of PA66-graphene composites was determined by capacitance, dielectric constant (ε‘), dielectric loss (ε’’), and dielectric loss angle (tanδ) between 100 kHz and 2 MHz at room temperature. The dielectric constant values at a constant frequency of 1 MHz for the PA66-Graphene composite materials produced at room temperature with 0, 0.5, and 1 wt% GNPs were found to be 3.85, 3.92, and 4.04, respectively. The obtained results clearly show that the dielectric parameters are frequency dependent. The dielectric properties of PA66-Graphene composite materials are important to investigate for electromagnetic shielding applications. These dielectric properties can be critical for shielding high-performance electronic systems from electromagnetic interference and for the development of ghost aircraft, especially in the aerospace and aerospace defence industry.

Keywords: Composite Materials, Graphene, Dielectric Properties

Graphite doped engineering plastic composites: a novel material for aerospace applications

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Abstract

In this study, graphite doped engineering plastic composites were produced. In the experiments, undoped, 0.5, 1 and 3 wt% graphite doped PC-ABS plastic engineering materials were obtained. The obtained PC-ABS-Graphite composite materials were produced using extruder and injection moulding machines. The mechanical and thermal properties of the produced composites were investigated. It was found that at the second heating value of the PC-ABS-Graphite composite material, undoped ABS and undoped PC material affected the change in Tg value. When the mechanical test results were examined, it was observed that the hardness value of PC-ABS-Graphite composite materials increased with the increase in graphite ratio and the graphite additive had an effect on hardness. These innovative PC-ABS-Graphite composite materials can offer a new material for aerospace fields. The increased hardness and thermal resistance provided by graphite doping may make these materials particularly suitable for lightweight and durable aerospace structures.

Keywords: Composite Materials, Graphene, Aerospace

Optical, structural and moorphological properties of SnS thin film by chemical bath deposition

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Abstract

Tin sulfide (SnS) is an important semiconductor belonging to the II-VI group compound family. It has a direct optical band gap of 1.30 eV and exhibits a high absorption coefficient (>104 cm-1) in the visible spectrum. SnS is used in various applications such as solar cells, photodetectors, and gas sensors. In this study, the SnS thin film was deposited on the glass substrate by chemical bath deposition (CBD), a simple and inexpensive technique, at 60 °C. The optical properties of the SnS film were investigated by transmission-wavelength graph obtained by UV-visible (UV-vis) spectrophotometer and the optical band gap was determined. The crystal structure of the SnS thin film were examined by the X-ray diffraction (XRD) technique, and the morphological properties were field emission-scanning electron microscopy (FE-SEM) technique.

Keywords: SnS, Thin Film, Chemical Bath Deposition

New water-soluble phthalocyanine derivatives for photodynamic therapy applications

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Abstract

In this study, non-toxic substances that are selectively activated by a specific wavelength of light were used in photodynamic therapy (PDT), in contrast to conventional chemotherapeutic applications. PDT applications employ localized and controlled activation of the therapeutic molecules to counteract the side effects of treatment. In our study, we synthesized a special collection of water soluble Pht-halocyanine (Pc) molecules to make them biocompatible. These compounds' anti-cancer qualities were also evaluated from a number of angles. As a result of the evaluations, it was determined that the synthesized molecules could find application against colon, lung, breast and prostate cancer.

Keywords: Cancer, Photodynamic Therapy (PDT), Phthalocyanine (Pc)