



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. Kasim 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 Scientist 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 <i>Rector, Toros University</i>
09:15-09:20		Prof. Dr. Adnan MAZMANOĞLU <i>Dean of Engineering Faculty, Toros University</i>
Session I-Invited Speakers <i>Chair, Prof. Dr. Adnan MAZMANOĞLU, Scientific Organization Committee</i>		
I1	09:20-09:55	Biomimetic approaches in nanomaterial design: Engineering strategies for an eff. artificial leaf Prof. Dr. Kasım OCAKOĞLU <i>Department of Engineering Natural Sciences, Faculty of Engineering, Tarsus University</i>
I2	09:55-10:30	Acoustic metamaterials for aeronautic applications: a review Prof. Dr. Amirullah M. MAMEDOV <i>Honor Scientist of Azerbaijan, State Prizes Winner, Senior Researcher Nanotechnology Research Center, Bilkent University</i>
Coffee Break /Poster Session <i>Assist. Prof. Dr. Merve ÖZCAN, Vice Chair of Scientific Organization Committee</i>		
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 <i>Plant and Animal Production Department, Cal Vocational High School, Pamukkale University</i>
P2		Functionalization of thin films prepared for cosmetic applications with honey bee products Begüm ARSLAN, Fatma UYSALOĞLU, Bensu YEŞİLHÜYÜK, Atakan TOKLU, Assist Prof. Dr. Didem DEMİR <i>Dept. of Chemistry and Chemical Proces. Technologies, Tech. Sci. Voc. High Sch., Tarsus University</i>
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 GÜLTEKİN <i>Department of Medical Services and Techniques, Health Vocational School, Toros University</i>
P4		Frequency Dependent Dielectric Properties of PA 66 Polyamide Composites with Graphene Nanoplatelets for Aerospace Applications Mehmet KURUCAN¹, Assoc. Prof. Dr. İbrahim KARTERİ^{1,2} <i>¹Department of Enrgy Sys.Eng., Faculty of Elbistan Engineering, K. Maraş İstiklal University ²Department of Materials Sci. & Eng., Institute of Graduate Education, K. Maraş İstiklal University</i>
P5		Graphite Doped Engineering Plastic Composites: A Novel Material for Aero-space Applications Mehmet KURUCAN¹, Assoc. Prof. Dr. İbrahim KARTERİ^{1,2}, Muhammet KARATAŞLI³ <i>¹Department of Enrgy Sys.Eng., Faculty of Elbistan Engineering, K. Maraş İstiklal University ²Department of Materials Sci. & Eng., Institute of Graduate Education, K. Maraş İstiklal University ³Department of Elect. & Com. Eng., Faculty of Engineering and Architecture, Beykent University</i>
P6		Optical, structural, and morphological properties of SnS thin film by chemical bath deposition Mohamed El Moustapha ABD DAYEM¹ Lec. Sevda İldan ÖZMEN² Prof. Dr. Hülya Metin GÜBÜR¹ <i>¹Department of Physics, Mersin University, Mersin, Turkey ²Advanced Technology Education Research and Application Centre, Mersin University, Mersin, Turkey</i>
P7		New Water-Soluble Phthalocyanine Derivatives for Photodynamic Therapy Applications Perihan K. DEMIRCIOĞLU¹, Şifa DOĞAN¹, Assist. Prof. Dr. Abdulcelil YÜZER³, Assoc. Prof. Dr. Derya YETKİN³, Prof. Dr. Mine İNCE¹, Furkan AYAZ⁴ <i>¹Department of Natural and Mathematical Sciences, Faculty of Engineering, Tarsus University ²Dep. of Elect. and Auto., Voc. School of Tech. Sci. at Mersin Tarsus Org. Ind. Zone, Tarsus University ³Mersin University, Advanced Technology Education Research and Application Center ⁴Mersin University, Department of Biotechnology, Faculty of Arts and Science</i>

Session II-Invited Speakers <i>Chair, Prof. Dr. Zehra YEĞİNGİL, Scientific Organization Committee</i>		
I3	11:00-11:35	Geopolymer: A Novel Functional Material <i>Assist. Prof. Dr. Evren ARIÖZ</i> Department of Chemistry Engineering, Faculty of Engineering, Eskisehir Technical University
I4	11:35-12:10	Hybrid Imaging Technology and Materials <i>Prof. Dr. Sefa ERTÜRK</i> Department of Biophysics, Faculty of Medical, Niğde Ömer Halisdemir University
12:10-13:00		Lunch
Session III-Plenary Speakers <i>Chair, Assist. Prof. Dr. Cevher AK, Scientific Organization Committee</i>		
O1	13:00-13:20	A Novel Microwave energy-based approach towards hybrid nanomaterial preparation for energy storage applications <i>Assoc. Prof. Dr. Selçuk POYRAZ</i> Department of Textile Engineering Faculty of Engineering, Adiyaman University
O2	13:20-13:40	Production and Characterization of Polyvinyl Alcohol (PVA) Chitosan (CH) Wound Dressings Enriched with Hypericum perforatum L. extract <i>Assist. Prof. Dr. Evren ARIÖZ, Assist. Prof. Dr. Suzan AY, Duygu ERKMEN</i> Department of Chemistry Engineering, Faculty of Engineering, Eskişehir Technical University
	13:40-14:00	The use of acrylic sheets in strain measurement <i>Assoc. Prof. Dr. İbrahim YILDIZ</i> 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), Ti₆Al₄V and copper (Cu) materials <i>Assoc. Prof. Dr. Hüseyin Furat KAYIRAN</i> Department of Agriculture and Rural Development Support (ARDSI)
O4	14:20-14:40	Melt quality assessment in casting of AA6082 alloy <i>Bilgehan TUNCA¹, Prof. Dr. Levent Cenk KUMRUOĞLU¹, Prof. Dr. Derya DIŞPINAR²</i> ¹ Dep. of Metallurgy and Mat. Engineering Facu. of Eng. and Nat. Sci. Iskenderun Technical University ² R&D Department, Foseco, Enschede, The Netherlands
O5	14:40-15:00	Design and production of new type reinforced U-profile composite panels <i>Merve USLU¹, Prof. Dr. Mete Onur KAMAN¹, Assist Prof. Dr. Cenk YANEN¹, Lecturer Dr. Mustafa ALBAYRAK², Prof. Dr. Serkan DAĞ³, Assist. Prof. Dr. Serkan ERDEM¹, Prof. Dr. Kadir TURAN⁴</i> ¹ Department of Mechanical Engineering, Engineering Faculty, Firat 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
15:00-15:20		Coffee Break
Session IV-Plenary Speakers <i>Chair, Assoc. Prof. Dr. Çağdaş ALLAHVERDİ, Scientific Organization Committee</i>		
O6	15:20-15:40	Exploring the effects of Pb substitution on the structure, magnetic and magnetocaloric properties of La_{1.96}Pb_{0.04}NiMnO₆ <i>Arda KANDEMİR¹, Assoc. Prof. Dr. Ali Osman AYAŞ², Prof. Dr. Ahmet EKICIBİL¹</i> ¹ Department of Physics, Faculty of Science and Letter, Cukurova University ² Department of Physics, Faculty of Science and Letter, Adiyaman University
O7	15:40-16:00	Contribution of artificial intelligence and computer architecture to materials science <i>Assoc. Prof. Dr. Hüseyin Furat KAYIRAN¹, Oğuz Kağan BİLİCİ, Dt. Eşref KAYIRAN</i> 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 <i>Derya KAYA, Research Assist. Dr. Rukan Suna KARATEKİN, Prof. Dr. Meltem Kahya DÜDÜKÇÜ</i> Department of Chemistry, Faculty of Science and Letter, Mersin University

O9	16:20-16:40	<p>Tensile properties of carbon nanotubes reinforced high density polyethylene nanocomposite materials Lecturer Murat MIRIK¹, Prof. Dr. Necmettin TARAKÇIOĞLU², Prof. Dr. Levent Cenk KUMRUOĞLU³ ¹Department of Motor Vehicles and Transportation Technology Rail Systems Machine Technology Program Sivas Vocational School of Technical Sciences Sivas Cumhuriyet University ²Department of Metallurgy and Materials Engineering Technology Faculty Selcuk University ³Dep. of Metallurgy and Mat. Engineering Facu. of Eng. and Nat. Sci. Iskenderun Technical University</p>
O10	16:40-17:00	<p>Investigation of Luminescence Properties of Baddeleyite Doped Dy³⁺ Assist. Prof. Dr. Özlem YIĞIT¹, Assist. Prof. Dr. Şenel ÇOBANER², Prof. Dr. Kasım KURT³ ¹Aydıncık Vocational of School, Mersin University ²Nanotechnology and Advanced Materials, Mersin University ³Science Faculty, Physics Department, Mersin University</p>
O11	17:00-17:20	<p>Investigation of Radioluminescence of Natural Fluorites Collecting from Kırşehir Region Saadet Özdemir ARSAKAY¹, Assist. Prof. Dr. Özlem YIĞIT², Prof. Dr. Kasım KURT³ ¹Mersin Vocational of School, Mersin University ²Aydıncık Vocational of School, Mersin University ³Science Faculty, Physics Department, Mersin University</p>
Closing Ceremony		
17:20	<p>Assoc. Prof. Dr. Ali Kemal HAVARE Chair of Scientific Organization Committee, Toros University</p>	

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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
Assist. Prof. Dr. Merve ÖZCAN

Chair of the Organizing Committee
Assoc. Prof. Dr. Ali Kemal HAVARE

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ORAL PRESENTATIONS

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

Selçuk POYRAZ

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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, Raman), 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 Methods

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 purification 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 $\text{Fe}(\text{CO})_5$ 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 $\text{Fe}(\text{CO})_5$ 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/ $\text{Fe}(\text{CO})_5$ 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).

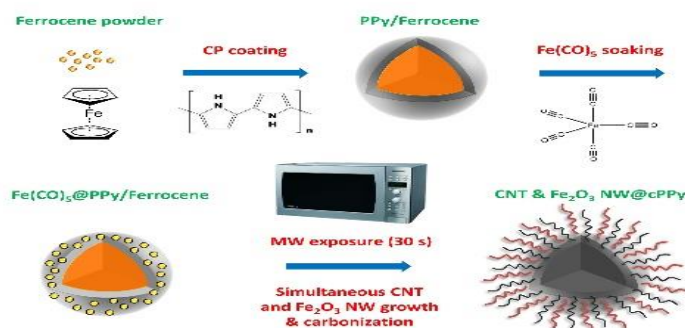


Figure 1. Schematic illustration of the combined approach towards HNM preparation

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.

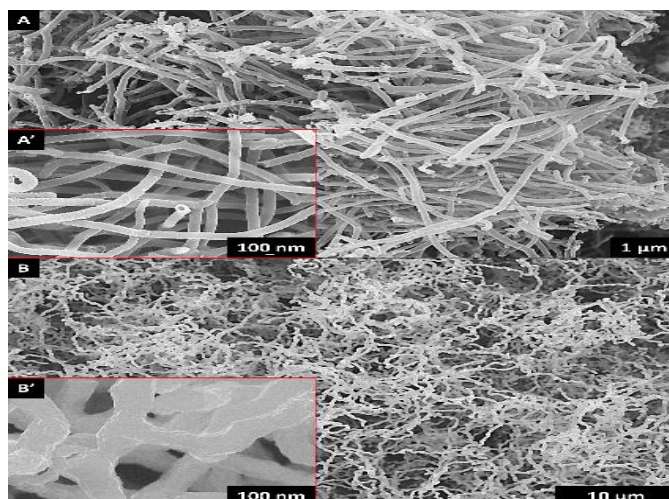


Figure 2. SEM images of the; (A, A') CNTs, and (B, B') MONWs grown on the surface. Here, a few μm long, uncooked spaghetti-like CNTs with an average diameter of ~ 200 nm (Figure 2A, A'), as well as uncooked noodle-like MONWs longer than $10 \mu\text{m}$ in length, and a diameter distribution range of 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.

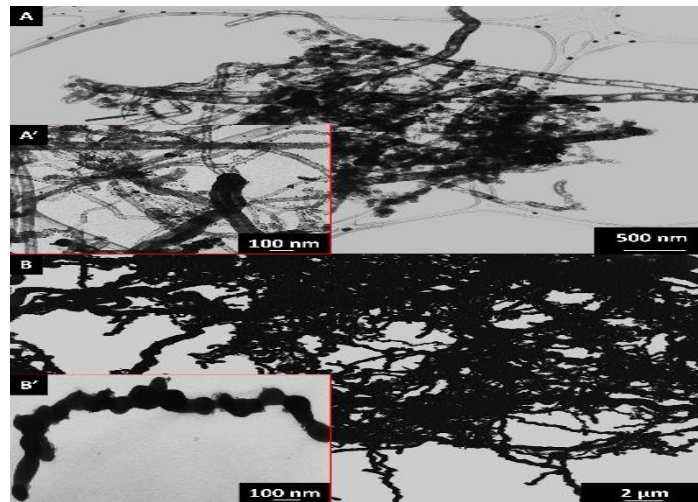


Figure 3. TEM images of the; (A, A') CNTs, and (B, B') MONWs grown on the surface

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 Fe_2O_3 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.

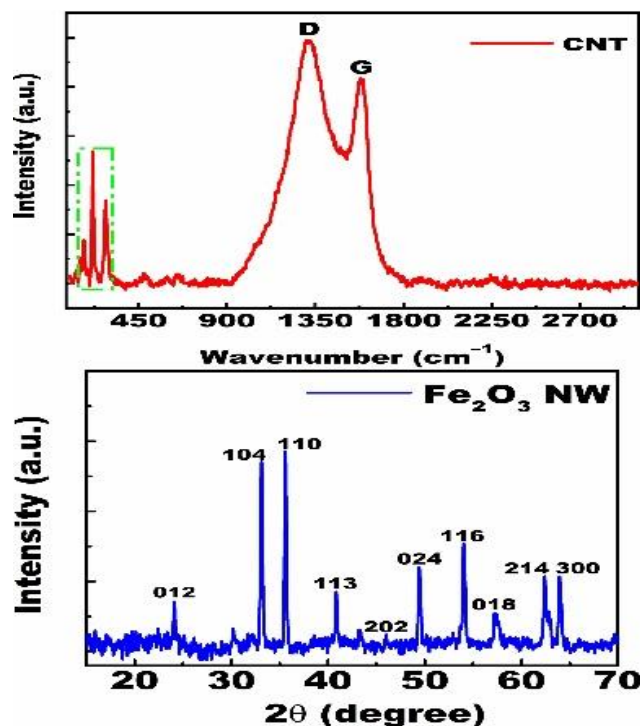


Figure 4. The as-grown CNTs' Raman spectrum (top), and MONWs' XRD diffractogram (bottom) on HNM sample surfaces

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 $2\theta = 24.2^\circ, 33.4^\circ, 35.7^\circ, 41.2^\circ, 49.8^\circ, 54.3^\circ, 62.8^\circ,$ 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.

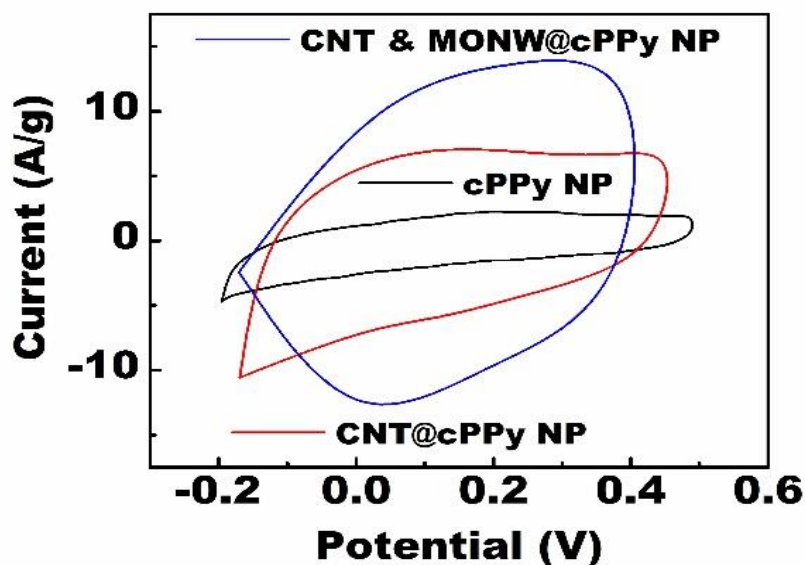


Figure 5. CV voltammograms of; cPPy NP, CNT@cPPy NP, and CNT&MONW@cPPy NP samples

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: Artificial Intelligence, Computer Architecture, Materials Science

1.Introduction

Artificial intelligence (AI) is applicable in every field today. Recently, it has played a facilitating role in materials science, healthcare, and the legal sector. A general literature review has revealed the following findings: Materials science typically works with large and complex datasets. AI techniques provide powerful tools for analyzing these data and obtaining meaningful results. For example, deep learning algorithms are used for the automatic recognition and classification of material microstructures [1]. Additionally, AI-assisted modeling techniques are used for the design of new materials and the improvement of existing

materials' performance [2]. Computer architecture also makes significant contributions to materials science. High-performance computers allow for more efficient and faster execution of complex material simulations. These simulations are used to model and predict the behavior of materials at the atomic level. For example, quantum mechanics simulations are critical for understanding the electronic and optical properties of materials [3]. Just as AI is used in various fields, it is also preferred in the healthcare sector, such as in dentistry, due to the advancements in materials science. When a literature review on studies in this field is conducted, it is found that AI has brought revolutionary innovations in dentistry, as in many other fields. In dentistry, AI is used in various areas such as diagnosis, treatment planning, patient management, and education. This article also discusses how AI is used in the fields of engineering, healthcare, and dentistry. While AI is preferred in the field of dentistry, in some sections: **Diagnosis and Imaging:** AI plays a significant role in the analysis of radiographic images in dentistry. Machine learning algorithms have high accuracy rates in detecting cavities, cysts, tumors, and other pathologies in dental X-rays. This provides a significant advantage in early diagnosis and treatment planning. For example, deep learning algorithms have shown to achieve over 90% accuracy in detecting cavities in dental X-rays. **Treatment Planning:** AI is also used in planning dental treatments. Especially in orthodontic treatment planning, AI algorithms analyze patients' digital models to determine the most appropriate treatment methods. This can reduce treatment time and costs [4]. For example, AI-assisted systems have been reported to provide faster and more accurate results in orthodontic treatment planning. **Patient Management**:** AI is used in patient management and the digitization of patient records. AI-based systems can analyze patients' past treatment records to offer personalized treatment recommendations. Additionally, it provides efficiency in administrative tasks such as appointment scheduling and patient follow-up [5]. For example, AI-based patient management systems have been noted to increase clinical efficiency and improve patient satisfaction.

Education and Simulation:** In dental education, AI-based simulations and virtual reality applications play a significant role in providing students with practical experience and clinical skills. These technologies offer students realistic and repeatable learning opportunities [6]. For example, AI-supported simulations have been shown to be effective in skill acquisition for dental students [7]. In general, AI provides significant benefits in many areas such as diagnosis, treatment planning, patient management, and education in dentistry. The use of AI technologies reduces the workload of dentists, increases treatment accuracy, and improves patient satisfaction. In the future, the use of AI in dental applications is expected to become even more

widespread.

2. Artificial Intelligence and its Branches

Artificial Intelligence (AI) and computer architecture have provided significant innovations and advancements in the field of materials science in recent years. Materials science is a discipline that examines the structure, properties, and performance of materials. AI and computer architecture make important contributions to this field by enhancing data analysis, modeling, and simulation capabilities [8]. This review study examines the contributions of computer architecture to materials science. AI can also be described as a branch of computer science that deals with the development of systems and algorithms aimed at mimicking human intelligence. AI has the ability to perform various tasks through data analysis, learning, and decision-making capabilities. Within this study, the nature of AI and its different types are explained in detail with references. Below, Figure 1 provides a visual representation of AI.

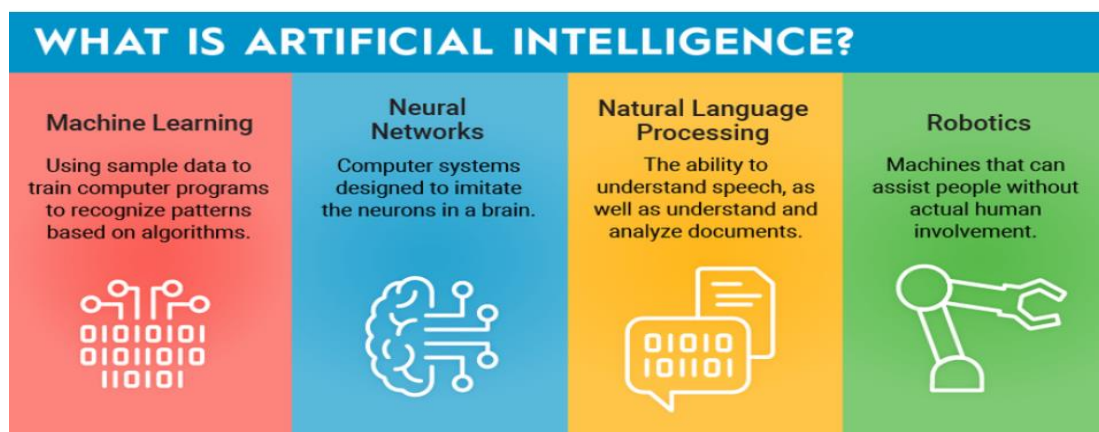


Figure 1. Visual Representation of Artificial Intelligence [9].

Artificial Intelligence (AI) aims to enable computers and machines to exhibit human-like intelligent behaviors. These behaviors include learning, problem-solving, perception, and language understanding. AI is typically achieved through techniques such as machine learning and deep learning [10].

- **Narrow AI (ANI):** These systems work in a specific task or narrow application area. Examples include a chess program or voice assistants (Alexa, Siri).
- **General AI (AGI):** These systems can mimic all aspects of human intelligence. AGI works similarly to humans in learning, understanding, and application. It has not been fully developed yet, but research is ongoing.

- Super AI (ASI): These systems surpass human intelligence. ASI has the potential to be superior in all human capabilities and is theoretically possible in the future.

Table 1. Branches of Artificial Intelligence [11].

Annealing Simulation (Simulated Annealing)
Expert Systems (Expert Systems)
Computer Vision (Computer Vision)
Speech Recognition (Speech Recognition)
Artificial Neural Networks (ANN: Artificial Neural Networks, Fuzzy Logic (Fuzzy Logic)
Genetic Algorithms (Genetic Algorithms)

Machine learning has been shown to accelerate simulations in materials science. In this context, an example figure is provided below. Accuracy at the DFT level has been achieved for various materials and under specific conditions, such as reproducing the RDF of a silicon melt at 3000K.

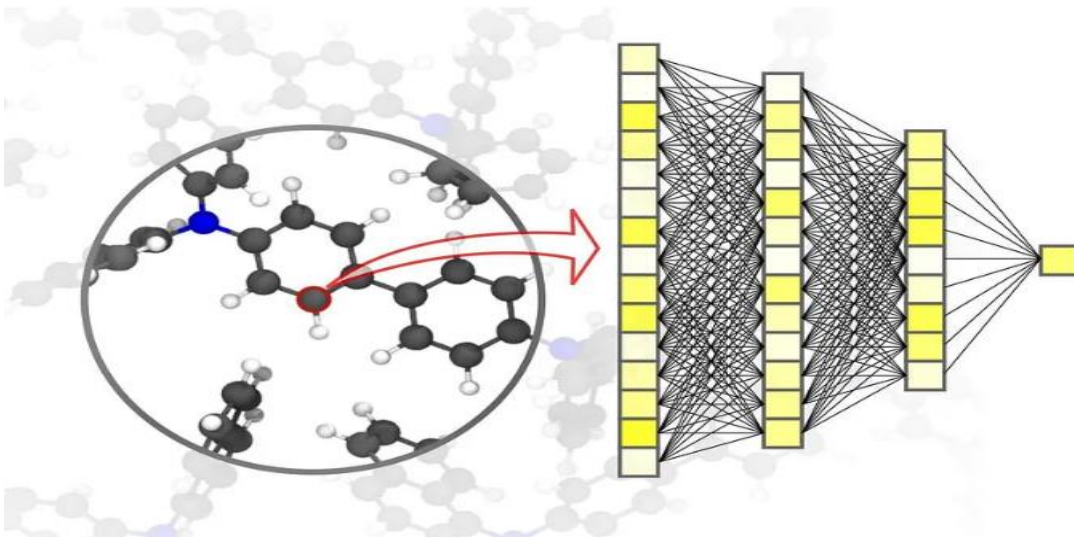


Figure 2. An Example of Machine Learning Accelerating Simulations in Materials Science [12].

2. AI and its Subfields

The reliable prediction of material properties could significantly accelerate the development of new products across a wide range of industries. Reviews to date have shown that machine learning methods have been successful in predicting various material properties, including mechanical properties such as mass and shear modulus, thermal properties like conductivity, and electrical properties including band gaps, topological states, and superconductivity [13].

2.1. Annealing Simulation (Simulated Annealing)

Simulated annealing is an optimization technique inspired by nature. This method is used to find the solution to a problem in a manner similar to the annealing process used in metallurgy. During thermal processes, the temperature of a metal is gradually lowered to allow atoms to settle into lower energy levels. Similarly, the simulated annealing algorithm begins by accepting higher-energy (worse) solutions and progressively prefers lower-energy (better) solutions over time [14].

2.2. Expert Systems

Expert systems are AI systems that mimic problem-solving and decision-making processes using expert knowledge and rules in a specific field. These systems consist of two main components: a knowledge base and an inference engine. The knowledge base contains information and rules obtained from experts, while the inference engine uses this information to produce logical conclusions. Expert systems are widely used in areas such as medical diagnosis, engineering design, and financial analysis [15].

2.3. Computer Vision

Computer vision is the ability of computers to extract meaningful information by analyzing digital images and videos. This field includes applications such as image processing, object recognition, facial recognition, and motion tracking. Computer vision technologies are used in many areas, including autonomous vehicles, security systems, medical diagnostics, and industrial automation [16].

2.4. Speech Recognition

Speech recognition is the ability of computers to recognize and understand human speech. This technology converts sound waves into words and sentences by analyzing them. Speech recognition is accomplished using natural language processing and machine learning techniques. This technology is used in many applications, such as voice assistants (e.g., Siri, Alexa), dictation software, and call center automation [17].

2.5. Artificial Neural Networks (ANN)

Artificial neural networks (ANN) are computational models that mimic biological neural networks and can perform tasks such as learning, recognition, and classification. ANNs consist of an input layer, one or more hidden layers, and an output layer. These structures are used to

learn and generalize data. Deep learning, a subfield of ANNs with many hidden layers, has been successful in complex tasks such as image recognition, natural language processing, and gameplay [18].

2.6. Fuzzy Logic

Fuzzy logic is an AI method used to solve problems involving uncertainty and ambiguity. Unlike classical logic, fuzzy logic uses degrees of truth instead of a binary true/false approach. This approach is closer to human thinking and decision-making processes. Fuzzy logic is widely used in areas such as control systems, decision support systems, and data analysis [19].

2.7. Genetic Algorithms

Genetic algorithms are an optimization method inspired by evolutionary processes in nature. These algorithms create populations and apply genetic operators such as selection, crossover, and mutation to these populations. Genetic algorithms can provide effective solutions to complex and multidimensional optimization problems [20].

These definitions summarize the fundamental principles and application areas of AI branches. Each field makes significant contributions to various industries and research topics. Below, Figure 3 provides an example visual representation of the branches and application areas of AI.

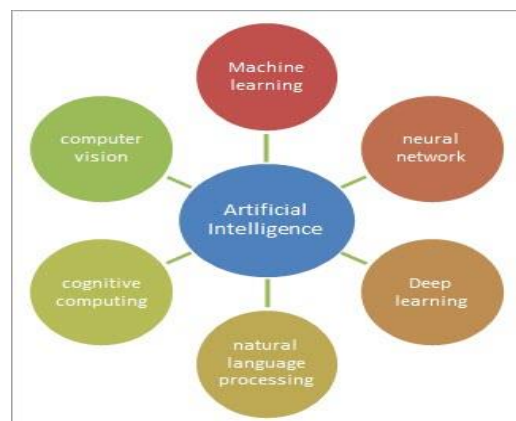


Figure 3. Example Visual Representation of AI Branches and Application Areas [21].

3. Materials and Methods

In this study, material science research conducted using artificial intelligence (AI) and computer architecture has been reviewed considering the current literature sources. Within the scope of the research, articles published from the history of AI to the present were sampled and scanned

from various databases (Google Scholar, ScienceDirect). The examined articles focused on AI algorithms, computer simulations, and the applications of these techniques in materials science.

4.Results and Discussion

In this study, the definition of artificial intelligence (AI) has been provided. The subfields of AI have been outlined, and it is suggested that AI can be applied in the mentioned areas. A series of academic studies have been conducted on the presence of AI. The contributions of AI and computer architecture to materials science are profound and multifaceted. While AI accelerates material discovery and design, advancements in computer architecture enhance the scale and accuracy of simulations. The integration of these technologies is poised to enable further breakthroughs by developing innovative materials applicable in various industries, such as electronics and energy. Given that AI is also related to computers, it is evident that computer engineering, healthcare, the dental sector, and cancer screening will become increasingly important with the development of programming and products. AI and computer architecture have provided revolutionary advancements in the field of materials science. These technologies have accelerated material research, supported the discovery and development of new materials, and optimized the performance of existing materials. In the future, it is expected that more advanced studies in materials science will be conducted using AI and computer architecture. AI has a significant impact on the modern technology and scientific world. Various categories of AI, ranging from narrow AI to super AI, have the potential to facilitate human life and develop smarter systems. This paper has explained the basic definition and types of AI.

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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 bağı 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 değıştirilerek 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

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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 in-creased 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

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: Fluorite, Luminescence, Crystal Deffects

Investigation of luminescence properties of baddeleyite doped Dy³⁺

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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 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.

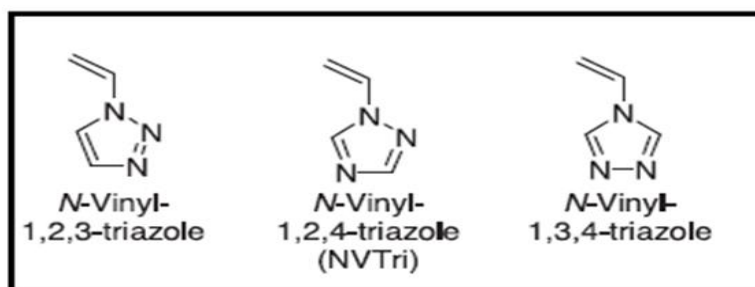


Figure 1. Structures of 1 -vinyl-triazole derivatives

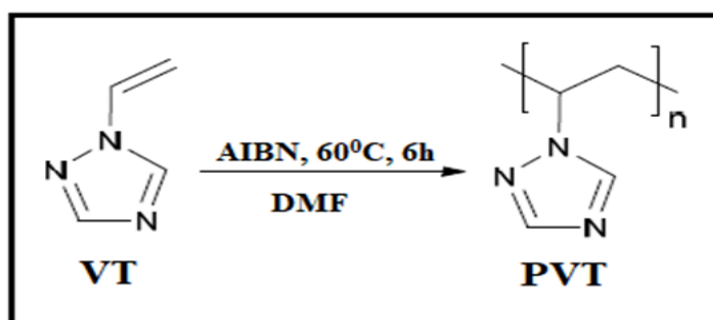


Figure 2. Polymerization of N -vinyl-1,2,4-triazole (VT)

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].

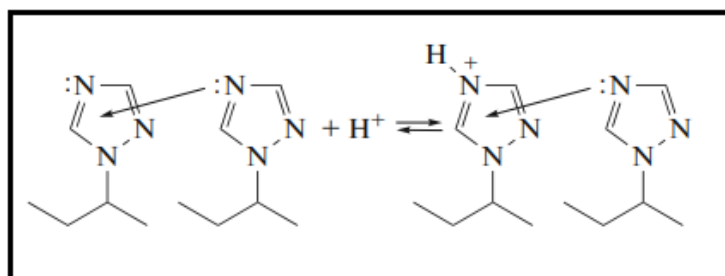


Figure 3. Structure of the polymer formed through the vinyl group and triazole ring

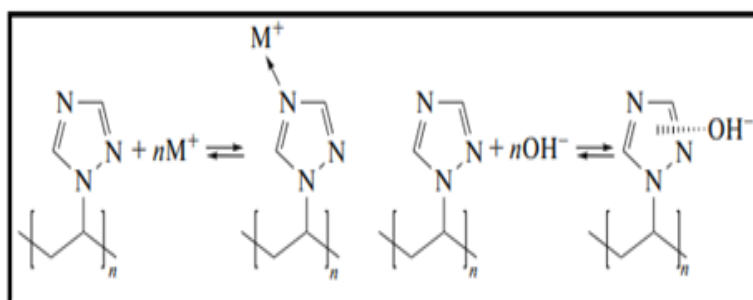


Figure 4. Schematic representation of the interaction of triazole rings with cations and anions of dissociated hydroxides

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-visible 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 103°C (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].

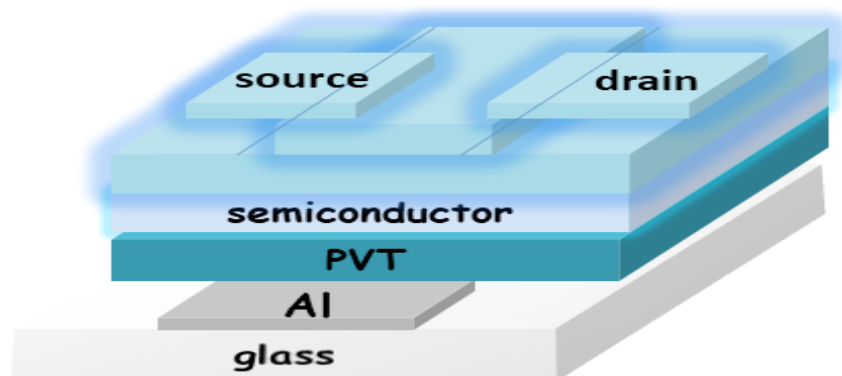


Figure 5. Device structure of OFET with anodized AlO_x for low voltage operation devices and gate dielectric layer

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 λ_{max} : 210 nm, associated with π - α^* transitions of the C=N group of the triazole ring [48,51].

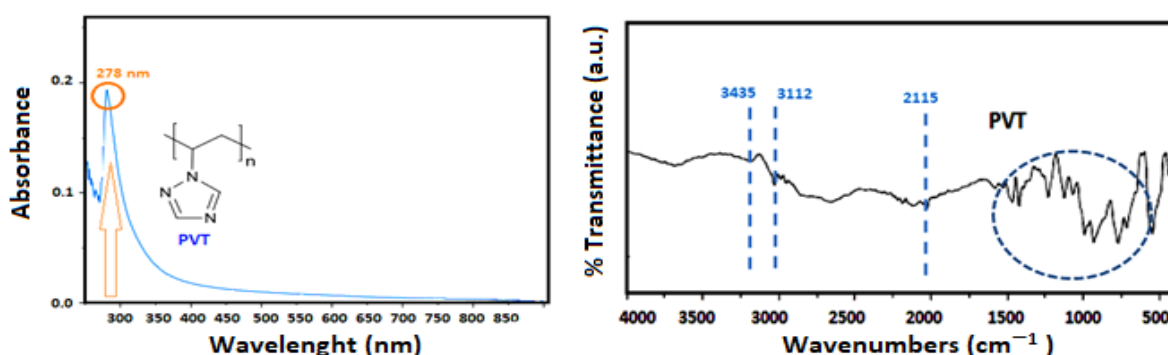


Figure 6. UV-vis spectra and FT-IR spectra of the homopolymer PVT

The FT-IR spectra of the PVT is shown in Figure 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.

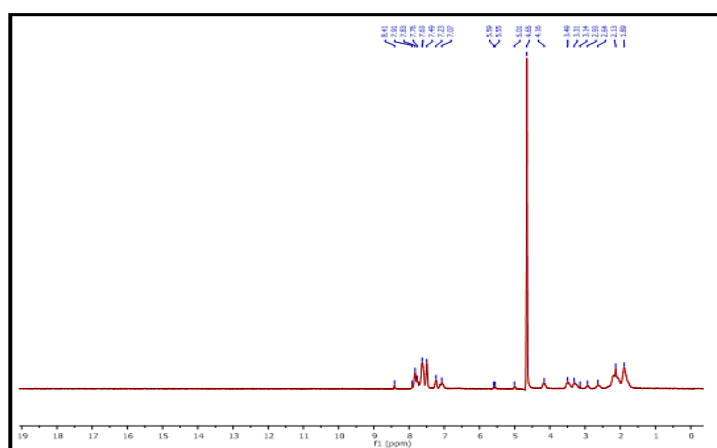


Figure 7. ¹H NMR spectra of PVT in D₂O

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 transistor 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 anti-bacterial. 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 ($\tan\delta$) 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 morphological 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 ($>10^4$ 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)