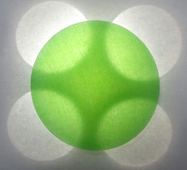
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**POLYMER & NANOCOMPOSITES**

**SYMPOSIUM AND SEMINAR**

**Multi-Scale Self-Healing Nanocomposite Shielding Material, Tubitak 1001 Project-Project No: 115r017**

**Book of Abstracts**

<http://innovationorbit1.itu.edu.tr>

Istanbul Technical University (ITU) ARI 6 Seminar Hall & Energy Institute Prof. Dr. Nejat Aybers Seminar Hall Ayazaga Campus, Istanbul, TURKEY

Editor: Prof. Dr. Nilgun D. Baydogan

Co-Editors: Assoc. Prof. Dr. Birgul Benli, Assoc. Prof. Dr. Nesrin Koken, Dr. Tayfun Bel, PhD-Candidate Osman Urper

**Dear Colleagues,**

We gladly announce International Symposium on Multi-Scale Self-Healing Nanocomposite Shielding Material named “Kendini Çok Yönlü Onarabilen Nanokompozit Geliştirilmesi ve Zırh Malzemesi Olarak Mekanik Davranışlarının İncelenmesi” with TÜBİTAK 1001 115R017 project number, to be held Istanbul Technical University, Energy Institute in 21-22 February 2018. This symposium aims to bring together academicians, researchers and industry. This high profile delegates try to exchange and discuss the original research results, practical development experiences and technological advancements of future applications.

This symposium will be provided a privilege to participants and to discuss the advantages and opportunities involved in sustainability of innovation in Polymers and Nanocomposites with respect to current industrial and academically researches.

One of the main objectives of this symposium is to provide a common platform from various disciplines and sectors. It will be a perfect opportunity for Academicians, Researchers, Investors and Students to express their innovative and unique researches at this symposium. The interaction will be provided from various disciplines.

Looking forward to welcoming you at the Symposium

**Prof. Dr. Nilgün BAYDOĞAN**

Symposium Chair

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* Hüseyin KIZIL, Associate Prof.Dr., Istanbul Technical University, Faculty of Chemical and Metallurgical Engineering Istanbul TURKEY
* İskender REYHANCAN, Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY Istanbul TURKEY
* Kaiying WANG, Prof. Dr., University College of South East, NORWAY
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* Mehmet Ali GÜRKAYNAK, Prof.Dr., İÜ Mühendislik Fakültesi, Istanbul TURKEY
* Murat CELEP, PhD., TUBITAK MAM, Kocaeli, TURKEY
* Mustafa BAKKAL, Associate Prof.Dr., Istanbul Technical University, Engineering Faculty Istanbul TURKEY
* Namık Serkan TAŞKIRAN, PhD., TUBITAK MAM, Kocaeli, TURKEY
* Nesrin ALTINSOY, Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY, Istanbul TURKEY
* Nesrin KÖKEN, Associate Prof.Dr., Istanbul Technical University, Faculty of Arts and Sciences Istanbul TURKEY
* Nevin TAŞALTIN, Associate Prof.Dr., TÜBİTAK MAM, Kocaeli, TURKEY
* Nilgün Baydoğan, Prof.Dr., Istanbul Technical University, Energy Institute
* Nilgün KIZILCAN, Prof.Dr., Istanbul Technical University, Faculty of Arts and Sciences Istanbul TURKEY
* Nilgün YAVUZ, Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY Istanbul TURKEY
* Noorhana YAHYA, Prof. Dr., Universiti Teknologi PETRONAS, MALAYSIA
* Nuray UÇAR, Prof.Dr., University Faculty of Textile Technologies and Design, Istanbul TURKEY
* Ömer Berk BERKALP, Prof. Dr. Istanbul Technical University Faculty of Textile Technologies and Design, Istanbul TURKEY
* Ömer Suat TAŞKIN, Assist. Prof.Dr., Istanbul University, Marine Sciences and Management Institute, Istanbul TURKEY
* Pelin SARITEPE OTANSEV, Assist. Prof.Dr., Istanbul University,Science Faculty Istanbul TURKEY
* Rüstem ARSLAN, Prof. Dr. Istanbul Technical University, Faculty of Aeronautics and Astronautics, Istanbul TURKEY
* Said SABBAGH, PhD., Istanbul Technical University, Energy Institute, Istanbul, TURKEY
* Sema AKYIL ERENTÜRK, Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY Istanbul TURKEY
* Sema MEMİŞ, Dr. TUBITAK MAM, Kocaeli, TURKEY
* Senem ŞENTÜRK LÜLE, Assist. Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY Istanbul TURKEY
* Serço Serkis YEŞİLKAYA, Associate Prof. Dr., Yıldız Technical University, Faculty of Arts and Sciences, Istanbul TURKEY
* Sevilay HACIYAKUPOĞLU, Associate Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY Istanbul TURKEY
* Svetlana M. DANİLOVA-TRETİAK, PhD., A.V. Luikov Heat and Mass Transfer Institute,   
  the National Academy of Sciences of Belarus, Minsk, REPUBLIC OF BELARUS
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* Şinasi EKİNCİ, Associate Prof. Dr., Çekmece Nuclear Research and Training Center, TAEK, Istanbul TURKEY
* Tuğrul HAKİOĞLU, Prof. Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY, Istanbul TURKEY
* Üner ÇOLAK, Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul TURKEY
* Liu ZIYUAN, PhD., Tokyo University, Tokyo, JAPAN
* Zuhal ER, Assist. Prof.Dr. Istanbul Technical University, Faculty of Arts and Sciences Istanbul TURKEY

**Organizing Committee**

* Abdulehad ÖZDEMİR, PhD. Candidate , TUBITAK MAM
* Ahmet GÜLTEKİN, Research Assistant, PhD. Candidate Istanbul Technical University, Energy Institute
* Birgül BENLİ, Associate Prof.Dr., Istanbul Technical University, Faculty of Mines
* Bülent BÜYÜK, PhD, Istanbul Technical University, Energy Institute
* Cihat TAŞALTIN, PhD., TUBITAK MAM
* Cüneyt ARSLAN, Prof.Dr., Istanbul Technical University, Faculty of Chemical and Metallurgical Engineering
* Doğukan ÇETİNER, Research Assistant, PhD Candidate Istanbul Technical University, Faculty of Chemical and Metallurgical Engineering
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* Görkem MEMİŞOĞLU, PhD., VESTEL Electronics, İstanbul, TURKEY
* Hande SESİGÜR, PhD., ŞİŞECAM, İstanbul, TURKEY
* Hasan GÖKÇE, PhD., Istanbul Technical University, Prof.Dr. Adnan Tekin Materials Science and Production Technologies Applied Research Center (ATARC)
* M. Sahip KIZILTAŞ, Specialist, PhD.. Candidate., Istanbul Technical University, Energy Institute
* Mahmut MUHEMMETTURSUN, PhD. Candidate, Istanbul Technical University, Graduate School of Science Engineering and Technology.
* Melis TÜRKER, East Marmara Development Agency, Kocaeli Support Office, Value

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* Mustafa Serdar ŞALCI, GERSAN Elektrik Tic. ve San. A.Ş.
* Murat CELEP, PhD., TÜBİTAK MAM
* Namık Serkan TAŞKIRAN, TÜBİTAK MAM.
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Arts and Sciences

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**Participant List**

* Abdulehad ÖZDEMİR, PhD. Candidate, TUBITAK MAM
* Abdulrahman ABDUL-HADI, PhD., University of Damascus, Damascus, SYRIA
* Afza SHAFIE, PhD., Universiti Teknologi PETRONAS, MALAYSIA
* Ahmet GÜLTEKİN, Research Assistant, PhD. Candidate Istanbul Technical University, Energy Institute
* Ahmet Togo GIZ, Prof.Dr., Istanbul Technical University, Faculty of Arts and Sciences Istanbul TURKEY
* Ali BAYGELDİ, Head of Satellite Design and Integration Department, T Ministry of Transport Maritime Affairs and Communications Directorate General of Aeronautics and Space Technologies
* Ali Erdem EKEN PhD., ASELSAN, Electronics Industry and Trade, Inc., Ankara, TURKEY
* Andy AUGOUSTI, Prof.Dr., Kingston University, London, UNITED KINGDOM
* Aref CEVAHİR, PhD., ŞİŞECAM, Research Center, ÇAYIROVA, KOCAELİ
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  UNITED KINGDOM
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* Görkem MEMİŞOĞLU, PhD., VESTEL Electronics, İstanbul, TURKEY
* Gülşah KAHRAMAN, PhD., ŞİŞECAM, Research Center, ÇAYIROVA, KOCAELİ
* Hande SESİGÜR, PhD., ŞİŞECAM, Research Center, ÇAYIROVA, KOCAELİ
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* Murat CELEP, PhD., TUBITAK MAM, Kocaeli, TURKEY
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* Selim Dinçer, TAI - Turkish Aerospace Industries, Inc., Ankara, TURKEY
* Selim ERTÜRK, PhD., Istanbul Technical University, Prof.Dr. Adnan Tekin Materials Science and Production Technologies Applied Research Center (ATARC)
* Sema AKYIL ERENTÜRK, Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY Istanbul TURKEY
* Sema MEMİŞ, PhD, TUBITAK MAM, Kocaeli, TURKEY
* Senem ŞENTÜRK LÜLE, Assist. Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY Istanbul TURKEY
* Serço Serkis YEŞİLKAYA, Associate Prof. Dr., Yıldız Technical University, Faculty of Arts and Sciences, Istanbul TURKEY
* Sevilay HACIYAKUPOĞLU, Associate Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY Istanbul TURKEY
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* Svetlana M. DANİLOVA-TRETİAK, PhD., A.V. Luikov Heat and Mass Transfer Institute,   
  the National Academy of Sciences of Belarus, Minsk, REPUBLIC OF BELARUS
* Şafak Nur ERTÜRK BOZKURTOĞLU, Assist. Prof.Dr, Faculty of Naval Architecture and Ocean Engineering, Istanbul TURKEY
* Tayfun BEL, PhD, Istanbul Technical University, Prof.Dr. Adnan Tekin Materials Science and Production Technologies Applied Research Center (ATARC)
* Tuğçe Köröğlu, MSc, Istanbul Technical University, Graduate School of Science Engineering and Technology.
* Tuğrul HAKİOĞLU, Prof. Dr., Istanbul Technical University, Energy Institute, Istanbul, TURKEY, Istanbul TURKEY
* Türkan DOĞAN, PhD. Candidate, Istanbul Technical University, Energy Institute
* Utku CANCİ MATUR, Lecturer, PhD., İstanbul Gedik Üniversitesi
* Üner ÇOLAK, Prof.Dr., Istanbul Technical University, Energy Institute, Istanbul TURKEY
* Yakup YÜREKTÜRK, Research Assistant PhD. Candidate, Istanbul Technical University, Faculty of Chemical and Metallurgical Engineering
* Yunus Emre DOĞAN, BSc. Candidate, Istanbul University, Science Faculty
* Zeynep CAMTAKAN, Specialist, PhD. Candidate., Istanbul Technical University, Energy Institute
* Zineb Benzait, PhD. Candidate, Istanbul Technical University, Graduate School of Science Engineering and Technology.
* Zuhal ER, Assist. Prof.Dr. Istanbul Technical University, Faculty of Arts and Sciences Istanbul TURKEY

**Location: Istanbul Technical University (ITU) ARI 6 Seminar Hall**

**February 21, 2018; Wednesday**

**PROGRAM**

**SEMINAR: 9:00-9:25**

***Presentation on MULTI-SCALE SELF-HEALING NANOCOMPOSITE SHIELDING***

***MATERIAL, TÜBİTAK 1001 Project with No:115R017***

**Prof.Dr. Nilgün Baydoğan, Project Coordinator  
Istanbul Technical University (ITU), Energy Institute,**

**SYMPOSIUM**

**Symposium Program – 1. Day**

**Opening Statement: 9:25-9:30**

|  |  |  |
| --- | --- | --- |
| **Chair:** Prof.Dr., Sema AKYIL ERENTÜRK, Istanbul Technical University, Energy Institute | | |
| Ayben KİLİSLİOĞLU, Prof. Dr., | Istanbul University,  Engineering Faculty | 9:30 – 9:45 |
| Yusuf YAĞCI  Prof. Dr. | Istanbul Technical University,  Faculty of Arts and Sciences | 9:45-10:00 |
| Nuray UÇAR,  Prof. Dr., | Istanbul Technical University Faculty of Textile Technologies and Design | 10:00 - 10:15 |
| Mustafa BAKKAL,  Associate Prof. | Istanbul Technical University,  Engineering Faculty | 10:15 - 10:30 |
| Ali Erdem EKEN  PhD., | ASELSAN  Electronics Industry and Trade, Inc. | 10:30 - 10:45 |
| Cihat TAŞALTIN, PhD., | TUBITAK MAM | 10:45 - 11:00 |
| Beril TUĞRUL,  Prof. Dr., | Istanbul Technical University,  Energy Institute | 11:00 - 11:15 |

**Coffee Break: 11.15 - 11.30**

|  |  |  |
| --- | --- | --- |
| **Chair:** Prof. Dr., Hüseyin ÇİMENOĞLU,Istanbul Technical University, Faculty of Chemical and Metallurgical Engineering | | |
| Esra ÖZKAN ZAYİM  Prof. Dr., | Istanbul Technical University,  Faculty of Arts and Sciences | 11:30 - 11:45 |
| Hüseyin KIZIL  Associate Prof. Dr. | Istanbul Technical University,  Faculty of Chemical and Metallurgical Engineering | 11:45 - 12:00 |
| Gülşah KAHRAMAN | ŞİŞECAM | 12:00-12:15 |
| Nursev ERDOĞAN,  PhD., | TAI- Turkish Aerospace Industries, Inc. | 12:15-12:30 |

**Location: ITU Energy Institute Prof. Dr. Nejat Aybers Seminar Hall**

**February 21, 2018; Wednesday**

**Lunch Time 12:30– 14:00**

|  |  |  |
| --- | --- | --- |
| **Chair:** Prof.Dr. Nilgün BAYDOĞAN,  Istanbul Technical University, Energy Institute | | |
| Levent TRABZON  Prof. Dr., | Istanbul Technical University,  Engineering Faculty | 14:00 - 14:15 |
| Nilgün YAVUZ  Prof.Dr., | Istanbul Technical University,  Energy Institute | 14:15 - 14:30 |
| Hülya CEBECİ  Associate Prof. Dr. | Istanbul Technical University,  Faculty of Aeronautics and Astronautics | 14:30 - 14:45 |
| Namık Serkan TAŞKIRAN  PhD., | TÜBİTAK MAM | 14:45 - 15:00 |
| Görkem MEMİŞOĞLU,  PhD. | VESTEL Electronics | 15:00 - 15:15 |

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| **Chair:** Prof.Dr. Nilgün YAVUZ,  Istanbul Technical University, Energy Institute | | |
| Emine ÇOKGÖR  Prof. Dr., | Istanbul Technical University,  Civil Engineering Faculty | 15:45 - 16:00 |
| Tuğrul HAKİOĞLU  Prof. Dr. | Istanbul Technical University,  Energy Institute | 16:00 - 16:15 |
| Aylin KARAHAN TOPRAKÇI  Assist. Prof. Dr. | Yalova University,  Engineering Faculty | 16:15-16:30 |
| Pelin SARITEPE OTANSEV  Assist. Prof. Dr. | Istanbul University,  Science Faculty | 16:30-16:45 |

**Coffee Break: 15:15 - 15:45**

**Discussions & Think Tank Questions**

**16:45-17:30**

**Finish for 1. Day of Symposium**

**Location: Istanbul Technical University (ITU) ARI 6 Seminar Hall**

**Symposium Program – 2. Day**

**February 22, 2018; Thursday**

|  |  |  |
| --- | --- | --- |
| **Chair:** Assoc. Prof. Dr. Sevilay HACIYAKUPOĞLU, ITU, Energy Institute | | |
| Nilgün KIZILCAN  Prof. Dr., | Istanbul Technical University,  Faculty of Arts and Sciences | 9:45 - 10:00 |
| Ömer Suat TAŞKIN  Assist. Prof.Dr. | Istanbul University,  Marine Sciences and Management Institute | 10:00 - 10:15 |
| Tayfun BEL  PhD. | Istanbul Technical University,  Prof.Dr. Adnan Tekin Materials Science and Production Technologies Applied Research Center (ATARC) | 10:15 - 10:30 |
| Emine TEKİN, Assoc. Prof.Dr | TÜBİTAK MAM | 10:30 - 10:45 |
| Melis TÜRKER | East Marmara Development Agency,  Kocaeli Support Office, Value Chain Analyst. | 10:45-11:00 |

**Coffee Break: 11.15 - 11.30**

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| **Chair:** Prof. Dr., Beril TUĞRUL Istanbul Technical University, Energy Institute | | | |
| Birgül BENLİ  Associate Prof. Dr., | Istanbul Technical University, Faculty  Of Mines | 11:30 -11:45 | |
| Zuhal ER  Assist. Prof. Dr. | Istanbul Technical University,  Faculty of Arts and Sciences | | 11:45 12:00 |
| Sevilay HACIYAKUPOĞLU Associate Prof. Dr. | Istanbul Technical University,  Energy Institute | | 12:00-12:15 |
| Sema AKYIL ERENTÜRK Prof. Dr., | Istanbul Technical University,  Energy Institute | | 12:15-12:30 |

**Lunch Time 12:30– 14:00**

|  |  |  |
| --- | --- | --- |
| **Chair:** Prof. Dr. İskender REYHANCAN, Istanbul Technical University, Energy Institute | | |
| Esra GENCELİ Assist. Prof.Dr., | ITU, Civil Engineering Faculty | 14:00-14:15 |
| Neslihan YUCA, PhD., | ENWAIR Energy Technology Company, | 14:15-14:30 |
| Said SABBAGH, Dr. Lecturer | ITU, Energy Institute | 14:30-14:45 |
| Utku CANCİ MATUR,  PhD., Lecturer | Istanbul Gedik University | 14:45-15:00 |
| Zeynep CAMTAKAN  Specialist, PhD. Candidate | ITU, Energy Institute | 15:00-15:15 |

**Location: Istanbul Technical University (ITU) ARI 6 Seminar Hall**

**Symposium Program – 2. Day, February 22, 2018; Thursday**

**Coffee Break: 15:15 - 15:45**

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| --- | --- | --- |
| **Chair:** Dr. Neslihan YUCA,  ENWAIR Energy Technology Company | | |
| Hasan GÖKÇE,  PhD. | Istanbul Technical University,  Prof.Dr. Adnan Tekin Materials Science and Production Technologies Applied Research Center (ATARC) | 15:45 - 16:00 |
| Selim ERTÜRK  PhD. | Istanbul Technical University,  Prof.Dr. Adnan Tekin Materials Science and Production Technologies Applied Research Center (ATARC) | 16:00 - 16:15 |
| Aysun EKİNCİ,  PhD. Candidate | Yalova University  Polymer Engineering | 16:15-16:30 |
| M. Sahip KIZILTAŞ  Specialist, PhD. Candidate | Istanbul Technical University,  Energy Institute | 16:30-16:45 |

**Discussions & Think Tank Questions**

**16:45-17:30**

**Poster Presentations**

**February 21, 2018 Saat: 10:00-16:45**

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| Nesrin KÖKEN  Associate.Prof. Dr. | Istanbul Technical University, Faculty of Arts and Sciences |
| Charif TAMİN  PhD. Candidate, | Université des Sciences et de la Technologie d'Oran Mohamed Boudiaf, Oran, ALGERIA |
| Türkan DOĞAN  PhD. Candidate, | Istanbul Technical University, Energy Institute |
| Mahmut MUHEMMETTURSUN  PhD. Candidate, | Istanbul Technical University, Graduate School of Science Engineering and Technology |
| Songül ULAĞ  PhD. Candidate, | Marmara University, Institute of Pure and Applied Sciences |
| Hanife ÇAKAR  MSc. Candidate, | Istanbul Technical University, Energy Institute |
| Osman ÜRPER  Research Assistant, PhD. Candidate | Istanbul Technical University, Energy Institute |

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**ABSTRACTS**

**SYNTHESIS AND USED OF MICROCAPSULES WITH FIRE RETARDANT PROPERTIES FOR POLYURETHANE FOAMS**

***Nesrin Köken1, Görkem Ülkü2,***

1 Istanbul Technical University, Faculty of Science, Department of Chemistry, Maslak, 34467, İstanbul, Turkey

2 Istanbul Technical University, Graduate School of Science Engineering and Technology, Polymer Science and Technology Department, Istanbul, 34469, Turkey

nesrin@itu.edu.tr

**ABSTRACT**

Polyurethanes are organic polymers that contain the urethane group in the structure. They are typically made by the reaction of a polyol with a diisocyanate. Microencapsulation is a technique which provides entrapping to various chemicals as a small solid particle or a liquid droplet; such as drugs, proteins, flame retardants, antimicrobials, dyes or cosmetics in a suitable shell stated liquid, gas or solid in micron diameter size. Core is the encapsulated material and the coating material is called shell or wall material [1]. Tris-(2-chloropropyl)- phosphate (TCPP) is one of the organophosphorus esters that has been widely used as flame retardants in polyurethane foams [2]. The aim of this work, by encapsulation with melamine- formaldehyde resin, to decrease the rate of diffusion out of toxic TCPP from Polyrethane foam during usage. Microcapsules were synthesized via suspension polymerization [3]. At first, Melamine formaldehyde resin was synthesized as shell material. Next, TCPP is added as an aqueous solution containing Sodium Dodecyl Benzenesulfonate (SDBS) and Polyvinyl Alcohol (PVA) for emulsion formation. Microcapsules of TCPP was added into polyol component with 20% and mixed with a stirrer for about 15 minutes then mixed with isocyanate component to produce poyurethane foam.

SEM results showed that the morphology of the foam was not effected significantly by adding microcapsules. Diffusion of TCPP from microcapsules in PU foam is expected to be much slower due to being in microcapsules during usage and will be released to act as fire-retardant during fire by decomposition of the shell of microcapsules. Besides, Melamine shell structure has also positive effect to the fire retandant performance of PU.

**References**

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[2] Meng, L. M. (2010). A dual mechanism single-component self-healing strategy for polymers. Journal of Material Chemistry, 20(29), 5969-6196.

[3] W.Föllmann, J.Wober ‘’ Investigation of cytotoxic, genotoxic, mutagenic, and estrogenic effects of the flame retardants tris-(2-chloroethyl)-phosphate (TCEP) and tris-(2-chloropropyl)-phosphate (TCPP) in vitro ‘’ Toxicology Lett-ers,161 (2006) 124-134

**CLAY MODIFIED NANO COMPOSITE KETONIC RESINS AS FIRE RETARDANT POLYOL FOR FOAM POLYURETHANE**

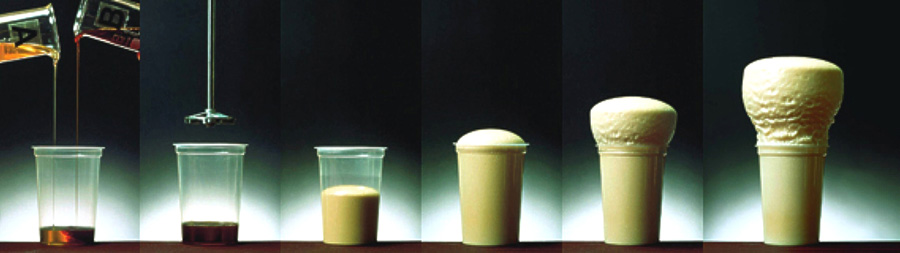
***1 Nilgün Kızılcan***

[kizilcan@itu.edu.tr](mailto:kizilcan@itu.edu.tr)

1\*Istanbul Technical University, Faculty of Science, Department of Chemistry, 34469-Maslak, Istanbul, Turkey

**ABSTRACT**

In this study, in situ modified cyclohexanone formaldehyde resin (CFR) was prepared from clay (montmorillonite/MMT) and sepiolite in the presence of base catalyst. Different clay contents (from 0,5 to 5 wt%) were used to produce clay modified nanocomposite ketonic resins(MM-CFR and Sep.-CFR). The polymeric nanocomposite material prepared by this method is directly synthesised in one step. These nanocomposites were characterized with Fourier Transform Infrared Spectroscopy (FTIR-ATR), Nuclear Magnetic Resonance Spectroscopy (NMR), X-ray Diffractometer (XRD) for structural analysis, Differential Scanning Calorimetry (DSC) and Thermogravimetric Analyzer (TGA) for thermal analysis. The obtained samples were also characterised morphologically by Scanning Electron Microscope (SEM). Then, clay modified nanocomposite resins were used for the synthesis of fire resistant polyurethane foam.



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**References**

1. Kızılcan, N.; Akar, A. *J. Appl. Polym Sci.* **2005**, *98*, 97.

2. Kızılcan, N. and Mermutlu, M. *J. Appl. Polym.Sci.*, **2014,** 131(6), 2506-2517.

**ELECTRICAL PROPERTIES OF A SINGLE NANOFIBER OF SEPIOLITE CLAY BY ATOMIC FORCE MICROSCOPY CONDUCTIVY MODE**

**TEK BİR SEPİYOLİT NANOFİBERİNİN ELEKTRİKSEL ÖZELLİKLERİNİN**

**ATOMİK KUVVET MİKROSKOBU İLE İLETKENLİK ÖLÇÜMLERİ**

***Birgül BENLİ***

aIstanbul Technical University, Mining Faculty, Mineral Processing Engineering, Maslak,

34469, Istanbul, Turkey

**Abstract:** Sepiolite is a fibrous type of clay consists of hydrated magnesium silicates. After sufficiently liberated and modified with metal ions such as Ag+ and Cu2+, sepiolite can be used for the potential of producing antimicrobial and conducting fillers for several applications such as medicals, next-generation drugs, sensor and active implantable devices. In this study, electrical conductivity measurements on a single sepiolite nanofiber is investigated by AFM conductivity modes (I-AFM) and electrostatic force microscopy (EFM). According to their adsorption isotherms, optimum metal uptakes of the beneficiated fibers were determined as 50 mg/g of Ag+ and 80 mg/g of Cu2+. The results show that the electrons were transferred rapidly to the surface of silver loaded fibers compared to the copper ones. However, there are no electrical properties seen on raw sepiolite which is expected. Finally, we compared the electrical properties with antibacterial properties of the fibers and provide comparative understandings of how antibacterial fillers behave in biodegradable innovative clay thin ﬁlms, coatings and their applications.

**Keywords**: *AFM, electrical conductivity, antibacterial clay, sepiolite*

**PROMPT GAMMA ACTİVATİON ANALYSİS AND POSİTRON ANNİHİLATİON SPECTROSCOPY İN POLYMER AND NANOCOMPOSİTES**

***Sevilay Hacıyakupoğlu***

Energy Institute, Istanbul Teknical University, 34469 Maslak, Istanbul

**ABSTRACT**

Usage of polymer and nanocomposite materials increase with developments in scientific and technological activities. Prompt Gamma Activation Analysis (PGAA) and Positron Annihilation Spectroscopy (PAS) can be count on important nuclear methods. This study presents briefly review of this methods.

**CU2ZNSNS4 THİN FİLMS DEPOSİTED BY DİP COATİNG TECHNİQUE FOR SOLAR CELLS APPLİCATİON**

***Charif Tamina, Nilgün Baydoğanb, Mohamed Adnane***

aDépartement de Technologie des Matériaux, Faculté de physique, Université des Sciences et de la Technologie d’Oran Mohamed Boudiaf, El M’naouar BP 1505 Bir El Djir 31000 Oran, Algérie.

aEnergy Institute, Istanbul Teknical University, 34469 Maslak, Istanbul

**ABSTRACT**

Due to the global shortage of "fossil energy", new sources of energy are needed. However, the design of low-cost, recyclable, environmentally friendly and easy-to-use solar cells is a major challenge for researchers worldwide. The quaternary materials based on copper, zinc, tin and sulfur noted Cu2ZnSnS4 (or CZTS) is a P-type semiconductor with an optical gap of 1.5eV and an absorption coefficient greater than 104cm-1. These optical properties make it a good candidate for absorber layer in solar cells. Comparing this material with CdTe and CIGS we find it less expensive because it is composed of materials that are abundant in nature and non-toxic. In addition to inexpensive material, cheap means of production are needed to make the material suitable for the solar cells of the future.

This work deals with the elaboration and characterization of Cu2ZnSnS4 thin films (CZTS) by a simple and economical technique using chemical processes.

In this research, the CZTS thin films were derived from sol-gel dip coating method. Then, we have studied the effect of annealing on the optical properties of CZTS thin films using UV/Visible spectrophotometer. The optical gap varied between 1,61eV and 1,67eV. The SEM images show a homogeneous zone with the presence of crack on the surface.

**Keywords**: CZTS, Thin films, Sol-gel, Solar cells

**APPLICATIONS OF POLYMER AND COMPOSITE MATERIALS IN CONSUMER ELECTRONICS**

***1Gorkem Memisoglu***, 2***Burhan Gulbahar***

1Vestel Electronics Inc., Organize Sanayi Bolgesi, 45030, Manisa, Turkey E-mail: [gorkem.memisoglu@vestel.com.tr](mailto:gorkem.memisoglu@vestel.com.tr)

 2Department of Electrical and Electronics Engineering and Applied Research Center of Technology Products, Ozyegin University, 34794, Istanbul, Turkey E-mail: [burhan.gulbahar@ozyegin.edu.tr](mailto:burhan.gulbahar@ozyegin.edu.tr)

**ABSTRACT**

At the beginning of the 1900's, modern synthetic plastics and in the middle of that century, polymer composites began to be developed. Over the last few decades, advanced composite materials have expanded their application areas, and their tendency to improve new product development and manufacturing technology has increased. Depending on the application area, polymer composites can be selected according to their properties, such as nanoscale or microscale dimensions, strength, flexibility, lightness, resistance to environmental conditions (such as; humidity, sun rays), impact resistance, hardness, thermal expansion coefficients, cracking-, fracture-, tensile- or bending- strengths. Thanks to properties of composite materials, they are utilized in diverse set of application areas. Today, engineering, space, aerospace, automotive and consumer electronics sectors are the major shareholders in the use of advanced engineering materials. In this study, basic fundamentals and application areas related to the use of polymer matrix composites in consumer electronics are presented and discussed.

**FABRİCATİON AND CHARACTERİZATİON OF ULTRA-HİGH PERFORMANCE CONDUCTİVE NANOCOMPOSİTE FİLAMENTS FOR ADDİTİVE MANUFACTURİNG**

Özge Kaynan, Alptekin Yıldız, Elif Özden-Yenigün, Hülya Cebeci\*

\*ITU Aerospace Research Center, Maslak, Istanbul

**ABSTRACT**

Additive manufacturing (AM), also known as three-dimensional printing (3DP), is a method that creates parts by material extrusion from the bottom-up one cross-sectional layer at a time. This manufacturing technology provides fast, flexible, easy production of 3D objects which can be either simple or complex geometries where CNC may not be an option. Also, 3DP eliminates the additional post-processes for finishing. Ultra-high performance thermoplastic filaments are promising raw materials to produce proper structural and/or interior applications for aerospace by using 3D Printers. In this study, nanocomposite filaments were fabricated by high-performance thermoplastic matrix polyetherimide (PEI) with multi-walled carbon nanotubes (MWNTs) at various weight fractions. The nanocomposite filaments are produced by twin and single screw extrusion processes respectively without using any solvents or additives. As a result, MWNTs/PEI filaments demonstrated two-fold improvement in tensile strength and enhancement in electrical conductivity compared to neat PEI filaments. With this multifunctionality, MWNTs/PEI nanocomposite filaments are a promising candidate for challenging in aerospace applications.

IMPROVING GLASS FIBER-POLYMER INTERFACIAL BOND STRENGTH USING NANO-CLAY PLATELETS

***Gülşah Kahraman\*, Dr. Aref Cevahir, Şener Yılmaz, Prof. Selim Kusefoğlu,***

**Dr. Vedat Sediroğlu**

Atmospheric Coating Technologies Management, Türkiye Şişe ve Cam Fabrikaları A,Ş. Science &Technology Center

Cumhuriyet Mah. Şişecam Yolu Sokak, No.2 41400 Gebze –Kocaeli Turkey

E-mail address: gkahraman@sisecam.com

Phone: +90-850-2060468, Fax: +90-262-6782453

**ABSTRACT**

Glass-reinforced polymer composites made with thermoplastic polymers are prefered over thermosets by virtue of their recyclability. The broader use of thermoplastics and the pressing need for products with higher added value accelerated the development efforts for innovative glass fiber products based on Polypropylene(PP) and Polyamide(PA) polymers.

Towards this goal, montmorillonite clay, which was intercalated with a suitable quaternary ammonium salt was incorporated in a glass fiber sizing. This sizing was then used to prepare glass fibers by the conventional process. The expectation is that the clay additives shall exfoliate to form nano platelets, induced by the shear stress of the extruder when mixed with PP or PA during the part manufacturing process. This way, clay platelets with 5-15 nm thickness form a very thin nano-composite film at the thermoplastic/glass fiber interface. While many examples of nanoclay reinforced thermoplastics can be found in the literature, this is the first work that places the nano clay reinforcement specifically at the fiber-matrix interface.

We provide evidence for improved mechanical strength due the extra surface area and bonds established between the matrix and the fiber phases once nano-clay has been introduced. The presence of nano-sized clay at the interface also serves to improve the flame retardancy characteristics of the final composite.

**Keywords**: Nanoclay, composite, thermoplastics, glass fiber, glass-polymer interface

**PROPERTİES OF THE İRRADİATED GREEN PVC AND İTS APPLİCATİONS İN İNDUSTRY AND ENVİRONMENT**

***Said SAbbagh***

Nuclear Researches Division, Energy Institute, Istanbul Technical University *(ITU).*

**ABSTRACT**

PVC free from the hazardous materials is the golden goal in the Plastic Business. The future of the PolyVinyl Chloride PVC industry is under investigation, because of the recycling problems, the heavy metals contamination, like Lead, Cadmium, Mercury, Arsenic, Antimony, organochlorines, and the Lower-molecular-weight phthalates.

In this review, the use of Pb, Hg, Cd, Hexavalent chromium, As, Sb, and the phthalates (PBB), (PBDE), (DEHP), (BBP), (DBP), and (DIBP) in PVC`s industry was analysed. The restriction of DEHP, BBP, DBP and DIBP in the medical devices was also reviewed. In addition, Influence of Gamma and Electron Beam Irradiation (X-rays) on The mechanical properties of the new or green PVC is important for health and industry. The PVCs materials used in the nuclear power plants (NPP) should be investigated in advance, and replaced after certain time. The importance of knowledge about the heavy metals, for PVC producers is vital for the future.

**Keywords:** Heavy metals, PVC, plastic, Industry, green products, phthalates, Enivronment.

**APPLİCATİON OF MULTİWALL CARBON NANOTUBES (MWCNTS) AS A FİLLER INTO PMMA POLYMER MATRİX**

***Songül ULAG1, Nilgün BAYDOGAN2***

1Marmara University, Institute of Pure and Applied Sciences

*2*Istanbul Technical University, Energy Institute, Maslak, 34467, İstanbul, Turkey

**ABSTRACT**

Carbon nanotubes are separated two parts that are single wall and multi wall carbon nanotubes. Multiwall carbon nanotubes (MWCNTs) are bigger than 100nm scale. Carbon nanotubes based PMMA polymer have significant importance in many applications such as aerospace, solar cell. They improve poor properties of PMMA effectively. In this study, we studied with multi-wall carbon nanotubes (MWCNTs). They consist of multiple layers of graphite rolling in themselves. MWCNT’s outer diameter is smaller than 8 nm, inner diameter is between 2 to 5 nm. Besides, the length of the MWCNT is range from 10 µm to 30 µm (Yetim, 2011). The interlayer distance is approximately 0.34 nm (Ruoff et al., 2003). There are many polymerization techniques, which are radical polymerization, emulsion polymerization, solution polymerization, anionic polymerization, and bulk polymerization. Atom transfer radical polymerization (ATRP) is the one of the polymerization methods that provides producing well-defined polymers easily. ATRP is the effective method to preparation of polymers with controlled functionalities, topologies and. PMMA was produced via ATRP technique. MWCNTs nanofiller was dispersed by in situ polymerization method because it was the most efficient method to produce homogeneous dispersion.

**APPLICATION OF GRAPHENE NANOPLATELETS AS A FILLER**

Maihemuti Maimaitituersun1, Ahmet Togo Giz1, Nilgün Baydogan2

1Istanbul Technical University,Department of Physics, Maslak, 34467, İstanbul, Turkey

*2*Istanbul Technical University, Energy Institute, Maslak, 34467, İstanbul, Turkey

**SUMMARY**

GNPs (Graphene Nanoplatelets ) added polymer multifunctional nanocomposites had sparked a widespread attention of the composite research field. The mechanical, thermal, and electronic properties of a polymer nanocomposite can be improved significantly by adding Nano-fillers. Therefore, GNPs is ideal nanofiller for enhancing the properties of host polymers and achieving the desired quality for practical applications. The large-scale production availability and excellent properties of GNPs made it an outstanding candidate for in the preparation of polymer nanocomposites. The addition of GNPs into polymer matrix increased mechanical properties, enhanced electrical and thermal conductivities, improved barrier properties, resulting in the polymer matrix with multiple enhanced characteristics. Compare to traditional polymer nanocomposites, GNPs nanocomposites with a very low loading concentration show noticeable enhancements in their multifunctional aspects.

This research was performed to enhance the properties of PMMA polymer by adding GNPs nanofiller with different concentration. PMMA was produced via ATRP technique. GNPs nanofiller was dispersed by in situ polymerization method because it was the most efficient method to disperse the layered GNPs nanomaterial.

**THE EFFECT OF BUBBLES ON POLY(METHYLMETHACRYLATE) POLYMER**

**T. Bel1, Hanife Cakar2, N. Yahya3, C. Arslan1, N. Baydogan2**

1Department of Metallurgical and Materials Engineering, Istanbul Technical University, Istanbul, Turkey

2Energy Institute, Istanbul Technical University, 34469, Istanbul, Turkey,

3Universiti Teknologi PETRONAS, Department of Fundamental and Applied Science, Malaysia

**ABSTRACT**

The modification of PMMA materials was provided by the application of a suitable degass process to obtain the porous structure. The application of a suitable of degass process has enhanged the affordable weight reduction. Gamma transmission technique was used in order to examine the details on high precision processing and fabrication of the modified PMMA polymer as the affordable weight reduction of PMMA polymer supported for their use in high-volume vehicles and components.

**HYDROPHOBIC PROPERTIES OF ZnO COATED POLYMER NANOCOMPOSITES**

Osman Urper, Nilgun Baydogan

Istanbul Technical University, Energy Institute, Ayazaga Campus, Maslak, 34469, Istanbul, Turkey

**ABSTRACT**

Several researches have been performed in various experiments on different geometrical shapes containing polymer nanocomposites as their different geometrical shapes gained them significant physical properties such as electrical, optical and water repellency. Due to the intensive demand for the development of hydrophobic surfaces on polymer surface applications, hydrophobic researches on ZnO layers has exponentially grown at last decade. One of the main advantages of the ZnO materials is relatively controllable and easiness to produce various surface morphologies on wetting property. Although the various synthesis approaches of ZnO materials are available (such as thermal oxidization, hydrothermal method, chemical etching, spray coating technique, the electrochemical method, and others), dip coating technique is the easiest and cheapest technique for ZnO layersynthesis. This examination is a representation of the recent achievement on ZnO superhydrophobic surfaces.

***Keywords:*** *Hydrophobic, ZnO, nanocomposite, dip coating, polymer*

**NANOPARTIKÜL (GÜMÜŞ, TİTANYUM), CNT VE İLETKEN POLIMER (PANI) KATKILI NANOLİF, MİKROLİF VE UYGULAMA ALANLARI**

***Nuray UÇAR***

İstanbul Teknik Üniversitesi, tekstil Mühendisliği Bölümü, Taksim, İstanbul, TÜRKİYE

ucarnu@itu.edu.tr

**ÖZET**

Kompozit nanolif veya mikrolifler başta tekstil ve teknik tekstil olmak üzere pekçok kullanım alanına sahiptir. Bu noktada pekçok nano partiküller ve fonksiyonel polimerler katkı maddesi şeklinde yapı içerisine katılarak, mevcut matriks polimerin özelliği ve fonksiyonelliği geliştirilmektedir. Nao veya mikro lifi, mukavemet ve modülüs yönünde güçlendirme, güç tutuşur kılma, antistatik malzeme haline getirme, elektromanyetik kalkanlama özelliğini kazandırma, antimikrobiyel özellik kazandırma, kendikendini temizleme özelliğini kazandırma vb. ana hedeflerden birkaçını oluşturmaktadır. Bu makalede gümüş nitrat tuzu (AgNO3), Titanyumdioksit (TiO2), Karbonnanotüp (CNT) nano partikülleri ve iletken polimer polianilin (PANI) ile katkılanmış, fonksiyonelliği geliştirilmiş Poliakrilonitril (PAN) nanolif ve mikro liflerin üretimi ve özellikleri üzerine çalışma sonuçları sunulacaktır

**RADYASYON ZIRHI AMAÇLI NANOKOMPOZİTLER**

## Beril TUĞRUL

İstanbul Teknik Üniversitesi – Enerji Enstitüsü Ayazağa Kampüsü – 34469, Maslak –İSTANBUL

[beril@itu.edu.tr](mailto:beril@itu.edu.tr)

**ÖZET**

Nükleer enerjinin barışcıl amaçlı kullanımında önemli bir husus nükleer güvenlik olup, çalışılan radyasyon tipine uygun ve radyasyon şiddetine karşı yeterli nitelikte radyasyon zırhı kullanılarak ilgili nükleer uygulama faaliyetlerinin yapılması esas olmaktadır. Farklı radyasyon tipleri için esas itibariyle farklı radyasyon zırhı elemanlarının kullanılması söz konusu olmaktadır.

Bu çalışmada, öncelikle girici radyasyona karşı nanoteknoloji bağlamında geliştirilen radyasyon zırhı elemanlar hakkında bilgi verilmektedir. Takiben, özgün bir çalışma bağlamında geliştirilmiş özel bir kompozit malzeme olan mikro ve nano boyutluTiB2 katkılı B4C-SiC kompozit malzeme tanıtılmakta ve mikro ve nano boyutta katkı elemanın kullanılmasıyla imal edilen ve ileri teknoloji nükleer reaktörlerde zırh elemanı olarak kullanılabileceği düşünülen radyasyon zırh malzemesinin girici radyasyonu zırhlama özelliği yapılan deneysel çalışmaların sonuçları verilerek irdelenmektedir.

**Anahtar Kelimeler:** Girici radyasyon, Kompozit malzemeler, Nanomalzemeler,

Radyasyon Zırh malzemesi,

**NANOSELÜLOZİK ELYAF TAKVİYESİ İLE YENİLENEBİLİR KAYNAKLI POLİMER NANOKOMPOZİTLERİN GELİŞTİRİLMESİ**

***Aysun Ekinci, Gülay Bayramoğlu1***

1Polimer Mühendisliği Bölümü, Mühendislik Fakültesi, Yalova Üniversitesi, 77100, Yalova, Türkiye

[ekinci\_aysun@hotmail.com](mailto:ekinci_aysun@hotmail.com)

**ÖZET**

Son yıllarda, çevresel ve ekonomik kaygıların artış göstermesi nedeniyle yenilenebilir kaynaklı malzemeler üzerine akademik ve endüstriyel alanda yapılan çalışmaların sayısında önemli artışlar görülmektedir. Yenilenebilir kaynaklardan elde edilen polimerler, düşük maliyet, çevre dostu ve kolay ulaşılabilir hammadde kaynağı olma gibi avantajlar sağlamaktadır. Bu bağlamda bitkisel yağlar, kaynak bitki çeşitliliği ve bitkiye göre yapısal çeşitlilik gibi avantajlarına bağlı olarak polimerlerin üretilmesinde büyük potansiyel sergilemektedir. Bitkisel yağların yapısında yer alan çift bağların epoksidasyonu ile elde edilen epokside bitkisel yağlar, oluşturulan oksiran halkalarının modifikasyonu ile doğrudan kaplama malzemesi olarak kullanıldığı gibi polimer kompozitler/ nanokompozitler için matris olarak kullanılabilmektedir. Epoksidasyon reaksiyonu sonucu epoksi fonksiyonu kazandırılmış yağlar çeşitli polimerizasyon yöntemleri ile bitkisel yağ esaslı epoksi reçine, poliüretan ve akrilik reçine olarak farklı uygulamalarda kullanılmaktadır. Bitkisel yağlara benzer şekilde yenilenebilir kaynaklardan üretilen nanoselülozik elyaflar, kompozit/nanokompozit uygulamalarında toksik olmaması, biyo-bozunur ve biyo-uyumlu olması gibi üstün özellikleri sayesinde giderek daha çok tercih edilmektedir. Bu çalışmada, sürdürülebilir kaynaklar kullanılarak yeni tür nanokompozitlerin üretilmesi hedeflenmiştir. Bu amaçla takviyelendirici olarak tarımsal atıklardan nano selüloz elyaflar üretilirken bitkisel yağlardan da polimerik matris olarak epokside yağlar sentezlenmiştir. Sentezlenen epokside yağlar diizosiyanat bileşikleri kullanılarak kürlenmiş ve farklı nanokompozit formülasyonları geliştirilmiştir. Hazırlanan nanokompozitlerin termal kararlılıkları TGA, morfolojileri SEM ve kürlenme davranışları FTIR ile incelenmiştir.

**Anahtar kelimeler:** epokside yağ, nanokompozit, nanoselüloz

**Teşekkür:** TÜBİTAK tarafından 114M828 nolu proje kapsamında desteklenmiştir.

**İNCE FILM GÜNEŞ HÜCRELERI VE POLIMER NANOKOMPOZIT TAŞIYICILAR**

***Utku CANCİ MATUR1,2\*, Nilgün BAYDOĞAN1***

1Enerji Enstitüsü, Istanbul Teknik Üniversitesi, 34469, Istanbul, Türkiye

2Gedik Meslek Yüksekokulu, Gedik Universitesi, 34906, Istanbul, Türkiye

\*utku.canci@gedik.edu.tr

ÖZET

Teknolojinin gelişmesi ile beraber enerji ihtiyacının artışı, alternatif enerji kaynaklarına ilgiyi artırmıştır. Alternatif enerji kaynaklarından olan güneş enerjisi, tükenmez, kirlilik içermeyen, elektriksel verimliliği yüksek, gelecekteki enerji ihtiyacını, daha yaygın bir şekilde karşılayabilecek düzeye ulaşabilecek, cazip bir kaynaktır. Güneş pili, güneş enerjisini doğrudan elektrik enerjisine dönüştüren, yarıiletken bir diyot gibi çalışan, taşıma kayıpları ve masrafı az olan yenilenebilir enerji kaynaklarımızdan biridir. Güneş pilleri, tek kristal ve çok kristalli silisyum güneş pilleri, ince film güneş pilleri, yoğunlaştırıcı sistemli pilleri olmak üzere üç farklı fotovoltaik teknoloji ile üretilirler. Kristal silisyum güneş pilleri birinci nesil güneş pili teknolojisi olarak bilinmektedir. İkinci nesil güneş pilleri denildiğinde ise, amorf silisyum (a-Si), kadmiyum tellür (CdTe), bakır indiyum galyum diselenit (CIGS) ve ince film kristal silisyum gibi ince film güneş pilleri ifade edilmektedir. İnce film güneş pillerinin üretimine başlanmasındaki en büyük sebep, daha düşük üretim maliyetleriydi. Silisyum güneş pili panelleri 100 cm2 alana sahip bağımsız güneş gözelerinden meydana gelirken, ince film güneş pilleri ise çok daha geniş alanlarda üretilebilmekte, bu da büyük ölçekli üretimler için maliyeti düşüren bir faktördür. Bu çalışma kapsamında ince film güneş pillerinden, radyasyon dayanımı ve soğurma katsayısı yüksek CIGS ince film güneş pilleri incelenmiştir.

İnce film güneş pilleri yapılarına ve kimyasal içeriklerine bağlı olarak farklı taşıyıcılar üzerine kaplanabilmektedir. İnce film güneş pillerinde altlık olarak soda kireç cam (SLG), paslanmaz çelik, titanyum (Ti), alüminyum (Al) ve poliimid malzemeler kullanılmaktadır. CIGS ince film güneş pilleri esnek özelliğe sahip oldukları için SLG ve paslanmaz çelik altlıkların yanısıra polimer folyo üzerine püskürtme, elektron demeti buharlaştırma ve sol-jel daldırma tekniği gibi farklı metodlarala kaplanabilmektedirler. Esnek altlıklar, polimer ve metal levha olmak üzere iki ayrı kategoride incelenmektedir. Altlık olarak kullanıcak olan polimer özel olarak ısıya dayanıklı olabilecek şekilde seçilmelidir. Polimer altlıklar en yüksek 450° C-500° C sıcaklık değerlerine kadar dayanabilmekte olup bu değer normal şartlarda sıklıkla kullanılan cam altlıklar üzerine kaplama yöneteminden ~100 K kadar düşüktür. Altlık olarak kullanılan metal levhalar herhangi bir bozulmaya uğramadan yüksek sıcaklıklara kadar dayanabilmektedir fakat bu tip altlıklarda güneş pilinin fotovoltaik özelliklerini negatif yönde etkileyen altlıktan soğurucu tabakaya kirliliklerin taşınması gibi problemler gözlemlenebilmektedir.

**ANAHTAR KELİME–** İnce film güneş pilleri, CIGS ince film, Altlık.

**İNCE FİLM NANOKOMPOZİT İNCE BOŞLUKLU (HOLLOW FİBER) NANOFİLTRASYON MEMBRANLARIN ÜRETİMİ VE İÇME SUYU ARITIMI AÇISINDA DEĞERLENDİRİLMESİ**

Esra Ateş Gencelib,c\*, İsmail Koyuncub,c, Reyhan Şengür-Taşdemira,b, Melike Ürperb,c , Türker Türkenb,c,

aİstanbul Teknik Üniversitesi, Nanobilim Nanomühendislik Programı, 34469, Maslak, İstanbul, Türkiye

bProf. Dr. Dincer Topacık Ulusal Membran Teknolojileri Araştırma Merkezi, MEMTEK, İstanbul Teknik Üniversitesi, 34469, İstanbul, Türkiye

cİstanbul Teknik Üniversitesi, Çevre Mühendisliği Bölümü, 34469, Maslak, İstanbul, Türkiye

**ÖZET**

Nanofiltrasyon membranların içme ve atıksu arıtımında kullanımı gün geçtikçe yaygınlaşmaktadır. Bunun nedeni standartlara getirilen sınırlamaların artması ile konvansiyonel sistemlerin bu sınırlamaları sağlamakta zorlanması ve membran prosesler ile elde edilen suyunyüksek çıkış suyu kalitesine sahip olmasıdır. Nanoteknolojideki gelişmeler ile nanokompozit malzemelerin membran üretiminde kullanılması, membranların geçirgenlik, seçicilik ve mekanik dayanım özelliklerinde olumlu gelişmeler yaşanmasına neden olmuştur. Nanofiltrasyon membranlar, ultrafiltrasyon membranlar ile ters osmoz membranlar arasında yer almaktadır. Nanofiltrasyon membranlar düşük enerji tüketimi ve yüksek akılar nedeni ile su arıtımında tercih edilmektedirler. Bu çalışmanın amacı arayüzey polimerizasyonu ile üretilen nanokompozit katkılı ince film kaplama (İFNK) ince boşluklu (hollow fiber) nanofiltrasyon membranların üretimi, karakterizasyonu ve organik madde giderim performansının belirlenmesidir. İnce film nanokompozit kaplama çalışmalarında nanoparçacık olarak 3 farklı konsantrasyonda (0,01; 0,05; 0,2) TiO2 kullanılmıştır. Çalışma sonucu nanoparçacık katkılı membranların akısında artış belirlenmiştir. Elde edilen sonuçlar nanoparçacık katkısız membrana göre standardize edildiğinde, organik madde giderimi açısından en iyi performansın %0,2 TiO2 nanoparçacık ile üretilen İFNK membranlarda elde edildiği belirlenmiştir.