25-28 March 2015

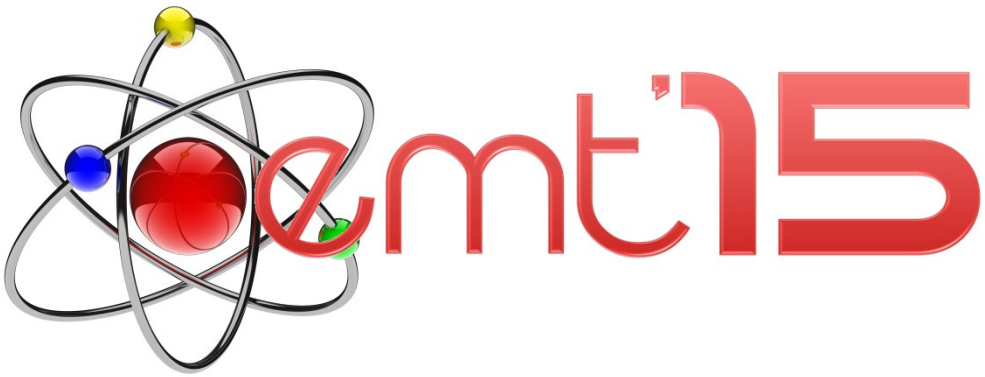
Elazig/TURKEY

# ABSTRACTBOOK

## OEMT'2015

1st International Conference on

**Organic Electronic Material Technologies**

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# BOOK OF ABSTRACTS

1st İnternational Conference on Organic Electronic Material Technologies

OEMT'2015

25-28 March 2015, Elazig, Turkey

Firat University Congress Center

23119, Elazig, Turkey

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# FOREWORD

It is a pleasure for us to offer you this Book of Abstract for 1st International Conference on Organic Electronic Material Technologies; 2015 (OEMT2015).

Our goal was to create an **organic electronics** platform that introduces the newest results on internationally recognized experts to local students and colleagues and simultaneously displays relevant Turkish achievements to the world.

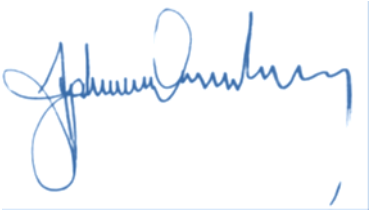
The positive feedback of the community encouraged us to proceed and transform a single event into a conference series. Now, OEMT2015 is honored by the presence of over 200 colleagues from various countries. Six inviting speakers, three Trainers for Winter School, 60 oral presentation and 150 posters are in the program. We stayed true to the original OEMT2015 concept and accepted contributions from all fields of organic electronic technology to promote multidisciplinary discussions. The focal points of the conference emerged spontaneously from the submitted abstracts: organic energy applications, advanced organic materials, organic electronics and optoelectronic devices. Further fields of interest include e.g. new organic materials, organic nanocomposites, organic semiconductors, organic conducting polymers, photonics, functional organic materials, and more. This is a first time when OEMT2015 is organized as a regular conference with a registration cost. However, it is also the first time when we can offer free publishing of all peer-reviewed papers in international journals Polymers For Advanced Technologies, Journal of Nanoelectronics and Optoelectronics, Organo Optoelectronics and provide the participants with all the commodities of a world – class conference.

Therefore, we hope that getting first-hand access to so many new results, establishing new connections and enjoying the Elazig, Turkey ambience will make you feel that your resources were spent well in OEMT2015.

Our warmest thanks go to all invited speakers, authors, and contributors of OEMT2015 for accepting our invitation, visiting Elazig and using OEMT2015 as a medium for communicating your research results.

We hope that you will enjoy the conference and look forward to meeting you again in one of the forthcoming OEMT2015 event.

**Prof. Dr. Fahrettin Yakuphanoglu**
**Conference Chair**



# INVITED SPEAKERS

# Carbon Quantum Dots: New Perspectives in Nanotechnology

Marco Antonio Schiavon

*Materials Chemistry Research Group – (GPQM), Departamento of Natural Science, Federal University of São João del-Rei, Campus Dom Bosco, 36301-160, São João del-Rei, MG, Brazil.*

E-mail: schiavon@ufsj.edu.br

Carbon nanomaterials have generated much excitement for a wide variety of promising applications in energy conversion, biosensing, and drug delivery [1]. Carbon quantum dots (CQDs), a younger small member of the carbon nanomaterial family [2], were first obtained in 2004 during purification of single-walled carbon nanotubes derived from arc-discharge soot by electrophoretic methods [3]. CQDs are a class of 'zero-dimensional' structures, usually referred to as *quasi*-spherical graphitic nanoparticles, of about 10 nm in size, consisting of single-, bi- or multi layers of $sp^2$-hybridized carbon atoms arranged in six-membered ring constituting a graphitic core and having abundant functional groups on their surfaces.

Compared to traditional organic fluorescent agents and semiconductor quantum dots, CQDs have unique advantages in cost reduction, robust chemical inertness, easy functionalization, photoluminescence stability, tunable photoluminescence, low toxicity, biocompatibility, and as electron donors and electron acceptors [4].

Various techniques have been employed to prepare CQDs, including laser ablation, pyrolysis, electrochemical synthesis, supported synthesis, acid oxidation, microwave assisted synthesis, hydrothermal synthesis, and other chemical methods. The developed synthetic methods can be classified as either ''top-down'' or ''bottom-up'' methods, according to the precursors used. We will discuss about this exciting new materials, regarding their synthesis, properties and their new perspectives in nanotechnology.

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# Enhanced performance in dye-sensitized solar cells via laser generated metallic nanoparticle treatment of photoelectrodes

Muhammad Hassan Sayyad

*Faculty of Engineering Sciences, Ghulam Ishaq Khan Institute of Engineering Sciences and Technology Topi, District Swabi, Khyber Pakhtunkhwa, 23640, Pakistan*

E-mails: sayyad@giki.edu.pk; hsayyad62@gmail.com
Website: http://www.giki.edu.pk/Faculty/Prof-Dr-M-Hassan-Sayyad

Effect of silver and gold nanoparticles in dye-sensitized solar cells (DSSCs) is studied. The photoelectrodes were treated with nanoparticle dispersions of silver and gold generated using pulsed laser ablation. The DSSCs were fabricated using metallic and organic dyes. The I-V, C-V and electrochemical impedance studies were carried out. These studies have revealed enhanced performance of the DSSCs using nanoparticles treated photoelectrodes. This enhanced performance of DSSCs may be for several reasons, such as, decrease of the probability of charge recombination and plasmonic enhanced absorption of radiation by the dye.

# High-performance organic materials development for optoelectronic applications

Hakan Usta[1*] Antonio Facchetti[2,3], Murat Citir[1], Unal Sen [1]

[1]*Abdullah Gül University, Department of Materials Science and Nanotechnology Engineering, Kocasinan, Kayseri, 38039, Turkey*
[2]*Polyera Corporation, Illinois Science and Technology Park, Skokie, IL, 60077, USA*
[3] *Northwestern University, Department of Chemistry, Evanston, IL, 60208, USA*

E-mail: hakan.usta@agu.edu.tr

The theoretical design and synthetic development of functional materials based on organic pi-conjugated sytems have been the focus of scientific and technological research over the past two decades. Thin films prepared by these materials form favorable nanostructures, which can be used in a variety of optoelectronic applications such as organic photovoltaic cells (OPVs), thin-film transistors (OTFTs), and organic light-emitting transistors (OLETs). Compared to inorganic-based electronics, these materials enable proper ink formulations for low-cost, high-throughput printing processes on large-area, light-weight, and flexible plastic subtrates. Owing to their unique features, they are envisioned as essential components of next-generation optoelectronic devices such as flexible displays, low-cost solar panels, electronic papers, printable RFID tags, and sensors. These new technologies will revolutionize the role of electronics in our daily lives and compliment current inorganic-based optoelectronic devices, which greatly impacted our society starting from the second half of the 20th century. This study demonstrates theory-aided rational design, synthesis, and characterization of a "library" of functional organic materials as novel n-type, p-type, and ambipolar semiconductors [1-4]. Solution-processed thin films of these semiconductors yield OTFTs with extremely high hole/electron mobilities of > 0.5-1.0 $cm^2/V{\cdot}s$ and $I_{on}/I_{off}$ ratios of $10^7$ – $10^8$, one of the highest device performance reported to date. We also report the first examples of polymeric and molecular ambipolar semiconductors in the literature to function in air. Furthermore, significant correlations are established between molecular/polymeric structures, physicochemical properties, and device performances, providing detailed insight into charge transport characteristics and ambient stability. The advances we have made toward realizing truly high-performance and air-stable optoelectronic devices affirm the possibility of achieving low-cost microelectronic devices through rational materials development.

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# Highly transparent quasi-solid state dye-sensitized solar cells and modules made with advanced nanocomposite materials and inkjet printers.

E. Stathatos[1,*], D. Sygkridou[2,1], and A. Rapsomanikis[1]

[1]*Department of Electrical Engineering, Technological-Educatuional Institute of Western Greece, 26334 Patras, Greece*
[2]*Department of Physics, University of Patras, 26500 Patras, Greece*

E-mail: estathatos@teiwest.gr

Dye sensitized solar cells (DSSCs) have attracted substantial interest as a low-cost alternative to conventional silicon-based solar cells owing to the simplicity of their fabrication procedures, practically under ambient conditions with mild chemical processes. The overall efficiency ~12% (for laboratory small size cells) placed DSSCs as potential inexpensive alternatives to solid state devices. DSSCs are placed in the category of third generation photovoltaics where new trends and materials in the photovoltaic technology are applied. Third generation solar cells, are based on nanostructured (mesoscopic) semiconductors and they are made of purely organic or a mixture of organic and inorganic components, thus allowing a vast and inexhaustible choice of materials. Because of their mesoscopic character, it is possible to make transparent solar cells, which can be used as photovoltaic windows. Photovoltaic windows can be functioned by front-face light incidence but also by diffuse light and even by back face light incidence. A large volume of the recent works on DSSC's is devoted to the study of structural properties of the inorganic semiconductor as negative electrode and the physicochemical state of the electrolyte. Especially for the electrolyte the extensive concern is dictated by the poor long term photochemical stability of the devices due to leakage of the electrolyte caused by sealing problems as well as poor stability and durability of liquid electrolytes.At the present work, we demonstrate comparative electrical studies for transparent dye sensitized solar cells fabricated with thin $TiO_2$ films which are prepared according to sol-gel method using inkjet printing. We demonstrate the case of highly durable solar cell and modules made with nanocomposite materials and quasi-solid electrolytes avoiding any problem of leakage and solvent evaporation (Fig.1).Furthermore, series of quasi-solid state electrolytes prepared with different hybrid organic/inorganic materials bearing silicon alkoxide moieties are examined and fully characterized. In particular, polypropylene or polyethylene of different oligomer chain length/$SiO_2$ hybrid materials can be efficiently host redox couples to compose quasi-solid state electrolytes for increased performance of the solar cells.Finally, outdoor performance of visible transparent dye sensitized solar cell modules with nanocomposite films and electrolytes will be also presented.

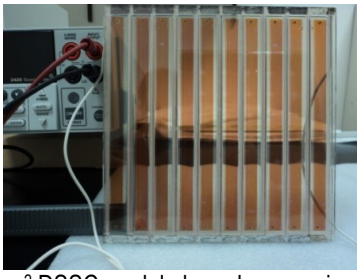

**Figure 1:** A 20x20 $cm^2$ DSSC module based on quasi-solid state electrolyte.

# New insight on the abundances of metal-bearing molecules in the circumstellar gas

Mario Hernandez Vera[1,2], Fabien Dumouchel[1], Jacek Klos[3] and François Lique[1*]

[1]*LOMC-UMR6294, CNRS - Université du Havre, Le Havre, France*
[2]*InSTEC, Quinta de Los Molinos, La Habana, Cuba*
[3]*Department of Chemistry and Biochemistry, University of Maryland, College Park, USA*

E-mail : francois.lique@univ-lehavre.fr

Metal cyanides/isocyanides are the most common metal-bearing molecules in the circumstellar gas. Heavy metals in the gas phase are important in controlling the ionization of a cold dark cloud and then the chemistry and the cloud evolution. In addition, observations of metal-bearing molecules can deliver important information on depletion into dust grains. Modelling of these molecules abundances relies on accurate determination of molecular stabilities, reaction probabilities as well as radiative and collisional excitations.

We present the computation of structural and spectroscopic properties of a series of metal cyanide / isocyanide species containing Mg, Al and Si atoms using highly correlated *ab initio* calculations [1]. Isomerization pathways and transitions states are detailed. We also present the calculations of new collisional rate coefficients for the rotational (de-)excitation of AlCN, AlNC, MgCN, MgNC, SiCN and SiNC molecules by collisions with He, as a model of $H_2$ [2,3]. This is the first time that rotational excitation of metal cyanides and isocyanides has been studied using quantum approach. We have found that these isomers present significant differences in their excitation processes.

As an application, we simulate the excitation of these metal-bearing molecules in the circumstellar gas. We perform radiative transfer calculations for typical physical conditions encountered in the circumstellar gas and we obtain brightness and excitation temperatures of selected lines frequently observed. We find that local thermodynamic equilibrium (LTE) conditions are not fulfilled for these species and that radiative transfer calculations are needed in order to accurately determine their abundances. The calculations also show that the estimations of the cyanides/isocyanides abundance ratios deduced from line intensities ratios lead to large differences compared to exact radiative transfer calculations. We found that AlCN and MgCN are significantly less abundant than AlNC and MgNC respectively [3]. Surprisingly, SiCN and SiNC are almost equally abundant whereas SiCN is more stable than SiNC [3].

**References:**

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*[4] Hernandez Vera & Lique, MNRAS in press (2015)*

# ORAL PRESENTATIONS

# The Optical and Electrical Activity of Novel Pyridine Substitue Hydrazinecarbothioamide and 1,2,4 Triazole Derivatives

M. Soylu,[1*] Z. Şerbetci[2] and A. Çetin[3]
[1]*Physics Department, Bingol University, Bingol, Turkey*
[2]*Chemistry Department, Bingol University, Bingol, Turkey*
[3] *Chemistry Department, Bingol University, Bingol, Turkey*

*Corresponding Author: soylum74@yahoo.com

**Abstract—** The organic films having different functional groups were identified using the UV–visible measurements.The samples which show high transmittance exhibit lower reflectance and smaller refractive index, indicating potential for the high-reflector coating which can be used to obtain efficient optics. The NPH, NMH, PPT and MPT/n-Si structures show rectifying behavior. The organic samples have wide optical band gap of 4.01–4.09 eV. The optical and electrical activity of these samples promotes them to be a suitable candidate for organic based devices in electronic applications.The optical and electrical properties of a many of organic materials uncover the physical basis for organic optoelectronic device industry and new generation of lighting sources [1-3]. 2-isonicotinoyl-*N*-phenyl hydrazinecarbothioamide (NPH), 2-isonicotinoyl-*N*-(4-methylphenyl)hydrazinecarbothioamide (NMH), 4-phenyl-5-pyridin-4-yl-4*H*-1,2,4-triazole-3-thiol (PPT) and 4-(4-methylphenyl)-5-pyridin-4-yl-4*H*-1,2,4-triazole-3-thiol (MPT) organic compounds are new synthesis materials [4-6]. Fig. 1 shows their molecular structures, respectively.

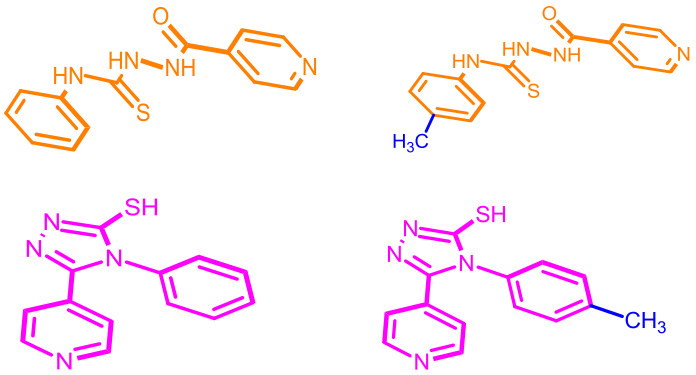


**Figure-1:** Description of molecular structure of organics

The organic/inorganic semiconductor (IO) (Al/organics/n-Si) heterojunction structures exhibit rectifying behavior. AFM microphotographs in 5x5 and 1x5 μm$^2$ area of organic NPH are shown in Fig. 2. The structure is formed by nanoparticles.

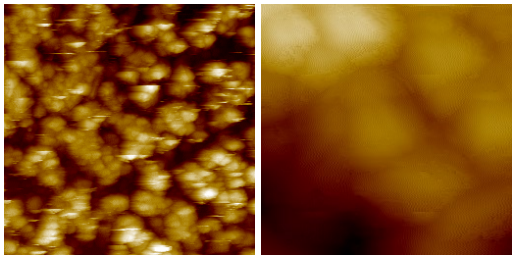

**Figure-2:** AFM microphotographs in 5x5 and 1x1 μm$^2$ areas of organic NPH

The plots of transmittance vs. wavelenght for organic films are shown in Fig. 3. The films are highly transparent almost 80% in the visible region.

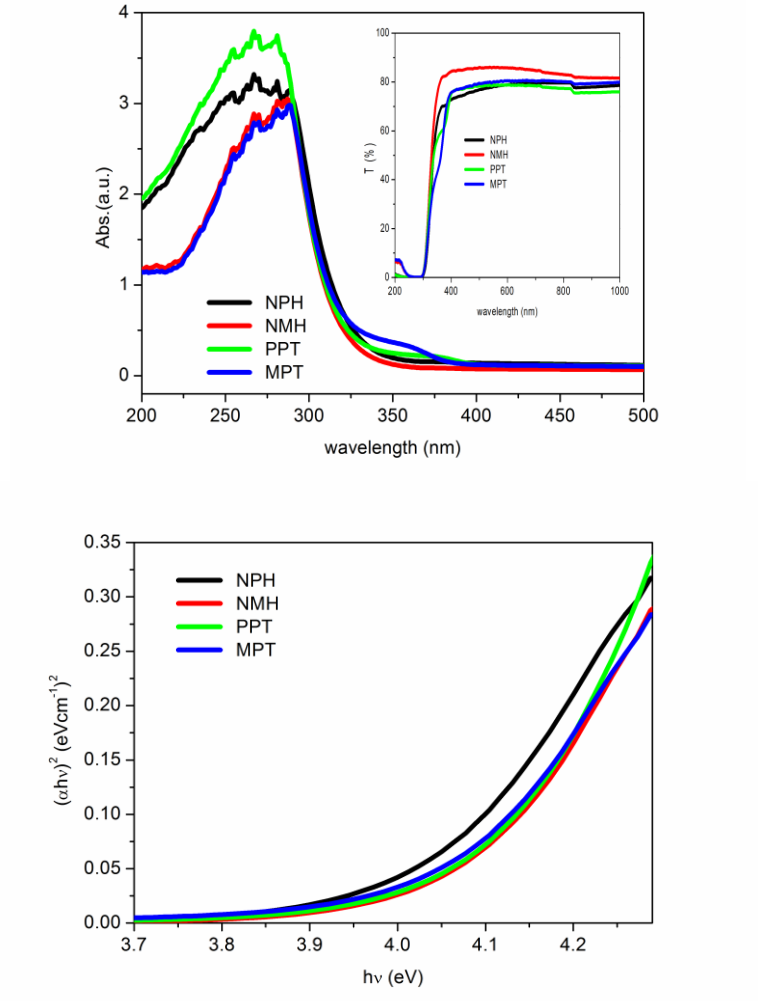


**Figure-3:** Absorption spectra of NPH, NMH, PPT and MPT organic thin films. (inset shows transmittance spectra)

The information about novel pyridine substitue hydrazinecarbothioamide and 1,2,4 triazole derivatives will help in the synthesis of new materials for high-performance organic optoelectronic devices in the near future.

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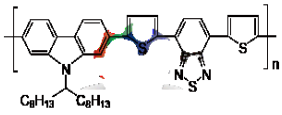
# PCDTBT:PC71BM based Organic Solar Cells with a power conversion efficiency more than 9%: Stability issues

Shahino Mah Abdullah, Zubair Ahmad and Khaulah Sulaiman*

*Low Dimensional Materials Research Centre (LDMRC), Department of Physics, Faculty of Science, University Malaya, 50603 Kuala Lumpur, MALAYSIA*

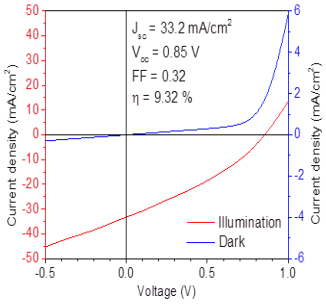
*Corresponding Author : khaulah@um.edu.my

**Abstract—** Organic solar cell (OSC) is thought to be one of the most promising energy harvesting devices that could be fabricated by easier means in large scale, and required low production cost [1]. The stability of the OSCs should be taken into account not only for medium term but also for long term applications [2]. Both active materials, poly[N-9'-heptadecanyl-2,7-carbazole-alt-5,5-(4',7'-di-2-thienyl-2',1',3'-benzothiadiazole)] or (PCDTBT), (see Figure 1(a)) and (6,6)-Phenyl C71 butyric acid methyl ester or (PC71BM) (see Figure 1(b)) have been purchased from Lumtec and used without further purification. Poly(3,4-ethylenedioxythiophene) polystyrene sulfonate solution or PEDOT:PSS has been deposited onto the cleaned substrates by a spin coater. Then, the PCDTBT and PC71BM blend solution has been spin coated on the PEDOT:PSS films layer at 2000 rpm for 20 s to form 70 nm thick layers. The PCDTBT:PC71BM active layer for the first type of devices has been dried at room temperature in vacuum for four hours before the Al deposition without undergo any annealing process. The second types of devices have been annealed once at 70 ºC for 30 min just before the deposition of Al. While for the third types of devices, the active layers have been annealed twice at the same condition before and after the deposition of Al. Finally, all the OSCs were encapsulated by using encapsulation epoxy and encapsulation glass slides.




(a) PCDTBT

(b) PC71B




(c) Photovoltaic effect of Device 1

**Figure-1:** (a) Molecular structures of PCDTBT, (b) Molecular structures of PC71BM, (c) The IV characteristics of an organic solar cell.

Device 1 was fabricated without any thermal treatment whereas in the case of the Device 2 the PCDTBT:PC71BM film was annealed prior to the deposition of top Al electrode. Device 3 was

annealed two times during fabrication procedure, once before top electrode deposition and once post fabrication. The typical IV characteristic of the OSC is shown in Figure 1(c). For Device 1, a high short circuit current of 33.2 mV/cm$^2$ leads to a high efficiency of 9.32%, but it decreases with the passage of time, where finally the efficiency reached at 0.11% within 48 hr. For the Device 2, 4.89 % efficiency has been achieved. Its efficiency is considerably good but lower than the Device 1. The stability of the OSC under such annealing treatment can be far longer than the previous type as discussed in literatures [3]. The third sample of Device 3 has been thermally treated twice and achieved 2.32 % efficiency as show. The stability of this type of OSC devices is very stable even after a week and still capable of giving 1.54 % efficiency after next two weeks. The post annealing process is also reported to cause a coarse phase-separation in amorphous PCDTBT polymer structure as a reason for lower efficiency. Table 1 shows the photovoltaic parameters of the devices.

**Table-I** The performance of three different devices.

| Device | Annealing (Active layer) | Post-Annealing | Jsc (mV/cm$^2$) | Voc (V) | Efficiency (%) |
|---|---|---|---|---|---|
| Sample 1 | No | No | 33.2 | 0.85 | 9.32 |
| Sample 2 | Yes | No | 17.2 | 0.82 | 4.89 |
| Sample 3 | Yes | Yes | 12.1 | 0.75 | 2.32 |

Here it is important to mention that the thermal annealing of the PCDTBT:PC71BM layer in the OSCs is very crucial for stable efficiency of OSC in order to ensure its morphological stability [4]. The instability issue which is believed to be due to the recombination of carriers in disordered PCDTBT:PC71BM blend. Therefore, if this drawback can be overcome by the enhancement of charge carrier dissociation without non-geminate recombination, a stable OSC with high efficiency could be possibly attained.

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# Solvent Sensing from Capacitance Based on Interdigitated Microelectrodes

Ismail Bilican[1,2] ,Mustafa Tahsin Guler[1*] ,Mustafa Yuksel[3], Sedat Agan[1] and Caglar Elbuken[4]

[1]*Department of Physics,Kirikkale University, Kirikkale 71450, Turkey*
[2]*Science and Technology Application and Research Center, Aksaray University, Aksaray 68100, Turkey*
[3]*Department of Audiology, School of Health, Turgut Ozal University, Ankara 06800, Turkey*
[4]*Institute of Materials Science and Nanotechnology, National Nanotechnology Research Center (UNAM), Bilkent University, Ankara 06800,Turkey*

*Corresponding Author : bilicanismail@gmail.com

**Abstract—** We were able to differentiate dielectric properties of solvents such as DI water, isopropyl alcohol, and acetone using interdigitated microelectrodes (IMEs). IMEs were fabricated using conventional micro fabrication techniques. The fabricated IMEs were dipped into the solution of interest, and the dielectric property of the medium was measured. We analyzed the capacitance value using a simple parallel capacitance and resistance model which gave very consistent results. We explained our results with an analytical model and found out that the theoretical results were in good agreement with the experimental results. The presented sensors provide a simple and inexpensive method for determining solvent type and concentration for several applications.

Capacitive sensing has been exploited for several applications [1]. Some of these applications are displacement sensors [2], humidity sensors [3], and acceleration sensors [4]. These systems utilize electrodes as sensing elements in order to detect the dielectric properties of the near electrode medium.

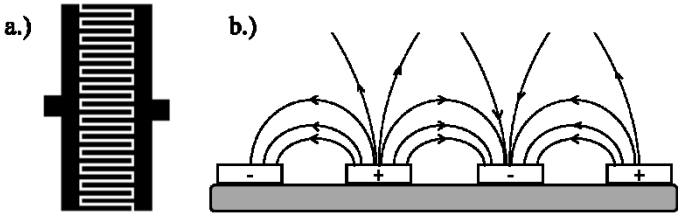


**Figure-1:** a) A representative top-view of interdigitated microelectrode (IME). b) Cross-sectional view of IME with electric field lines through the sensing surface.

Interdigitated microelectrodes (IMEs) can be used as capacitive sensors. IMEs have advantage of its design. Its surface can be used for sensing application. The top view of an IME and the electric field lines between each fingers are presented in Figure-1 Electric field lines emanating from the surface of the microelectrodes provide a platform to measure capacitance change due to the change in dielectric properties on top of the surface. In general, impedance can be used for sensing applications. IMEs can be used for sensing applications in many different ways. There are gas sensing systems exploiting resistivity with surface functionalization of IME [5] DNA chips integrated with microfluidics channels [6]. There are also several works in the literature using IMEs for biological applications using impedance change. IMEs are especially very effective when the surface is functionalized with a recognition layer [7-10].
There is another study for capacitive detection of solvents which makes the detection with low sample consumption [11]. In this study, various commonly used solvents were detected,

measuring the capacitance changes depending on their different dielectric constants. Conventional micro fabrication techniques were employed to produce sensors, and detection could be made using any device to measure high frequency capacitance values.

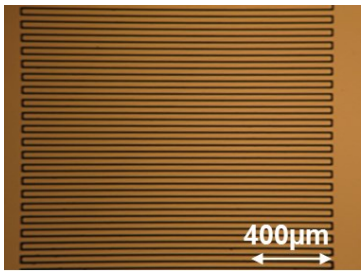


**Figure-2**: Image of a micro fabricated IME sensor.

In this study, different solvents were tested to be distinguished taking the advantage of their different dielectric coefficients using interdigitated microelectrode. A standard fabrication process and very simple yet effective measurement and calculation methods were used. This IME sensor was found to be useful tool which was able distinguish acetone and IPA having relatively small dielectric constant difference. Moreover, different electrode geometries were tested in order to have higher repeatability and higher sensitivity. We believe this type of IMEs can be used for the sensing of different solvents in a simple way.

**Acknowledgment:**
This project was supported by The Scientific and Technological Research Council of Turkey (TUBITAK project no. 112M944) and European Union FP7 Marie Curie Career Integration Grant (no. 322019).

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# Electronic Properties of Copolymers of Novel Methacrylic and Styrenic Monomer Based on the Thiophene

Necati Başman,[1] Rukiye Uzun[1], Öznur, Arslan[2], İbrahim Erol[2], Güven Çankaya[3], Orhan Uzun[4]

[1] *Electrical and Electronics Engineering, University of Bülent Ecevit, Zonguldak, Turkey*
[2] *Department of Chemistry, University of Afyon Kocatepe, Afyonkarahisar, Turkey*
[3] *Department of Materials Engineering University of Yıldırım Beyazıt, Ankara, Turkey*
[4] *Department of Metallurgical and Materials Engineering University of Bülent Ecevit, Zonguldak, Turkey*

*Corresponding Author : nbasman@gmail.com

**Abstract—**2-oxo-2-(2-thienylmethoxy)ethyl-2-methylacrylate (TMOEM) and 2-thienylmethyl 4-vinylbenzyl ether (TMVBE) are new methacrylic and styrenic monomer with side chain thiophene. In this study, seven copolymers of these monomers with different mol fractions were prepared and, were used to fabricate Ag/copolymer/*p*-Si Schottky metal-interlayer-semiconductor (MIS) diodes. The obtained diodes presented a good rectifying behavior and a sufficient reverse bias saturation. By using the forward bias *I–V* characteristics, the ideality factor *(n)* and barrier height $(\Phi_b)$ of Ag/copolymer/*p*-Si structure were found. The effect of copolymer composition on the diode parameters were revealed.

# Lifetime and Efficiency Improvement of P3HT:CdS QD Hybrid Solar Cell

Farzaneh Arabpour Roghabadi[1], Mehrdad Kokabi[1*], Vahid Ahmadi[2], Gholamreza Abaeiani[3]

[1] *Polymer Engineering Department, Tarbiat Modares University, Tehran, Islamic Republic of Iran.*
[2] *Faculty of Electrical and Computer Engineering, Tarbiat Modares University, Tehran, Islamic Republic of Iran.*
[3] *Laser and Optic School, Tehran, Islamic Republic of Iran.*

*Corresponding Author : mehrir@modares.ac.ir

**Abstract—**In this work, the lifetime and efficiency of hybrid solar cell based on P3HT:CdS nanocrystals are improved by in-situ synthesis of ZnO nanoparticles as an electron injection layer (EIL). The short circuit current density ($J_{sc}$) of device shows 35% enhancement in presence of ZnO EIL. Moreover, the device with EIL keeps more than 85% of its photovoltaic efficiency after storing in laboratory condition for more than 90 days.

Hybrid solar cells based on conjugated polymers and quantum dot (QD) nanocrystals have been recently receiving much attention because of their light weight, low cost [1], spectral tuneability [2], and high dielectric constant [3]. In this work, hybrid solar cell with glass/ITO/PEDOT:PSS/P3HT:CdS/Al structure is fabricated. The device performance is significantly improved using ZnO nanoparticles layer as an electron transport layer (ETH). As shown in Fig.1, the photocurrent density ($J_{sc}$) and fill factor increase from 3.51mA/cm$^2$ and 40% to 4.8mA/cm$^2$ and 43%, respectively.

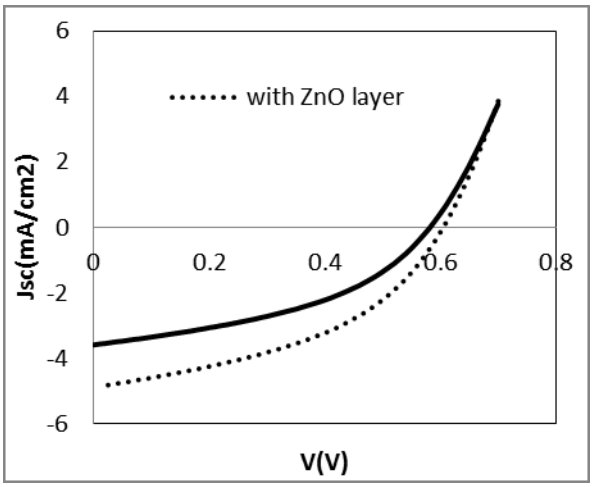


**Figure 1** : J-V curve of hybrid cells with and without ZnO EIL.

Besides, the solar cell lifetime improves significantly after using EIL. The device with in-situ synthesis of EIL keeps more than 85% of its efficiency after 90 days exposing to air without any encapsulation, Table 1. EIL works as a barrier for moisture diffusion into the active layer and improve cells lifetime.

**Table 1 :** Photovoltaic performance of hybrid solar cells versus time.

| cells | time | $V_{oc}$ | $J_{sc}$ | FF | $E_{ff}$ |
|---|---|---|---|---|---|
| P3HT:CdS | Fresh | 0.59 | 3.51 | 40 | 0.86 |
| | 7hr | 0.1 | 0.01 | 21 | 0.0002 |
| P3HT:CdS/ZnO | Fresh | 0.6 | 4.8 | 43 | 1.25 |
| | 7hr | 0.6 | 4.8 | 43 | 1.25 |
| | 90days | 0.58 | 4.5 | 41 | 1.07 |

In-situ synthesis of EIL causes homogeneous distribution of ZnO nanoparticles on the surface of active layer and adjusts its roughness to have better contact with Al cathode (Fig.2). The average roughness of thin film after ZnO deposition is 20 nm, while the hybrid film without ZnO shows 25 nm.

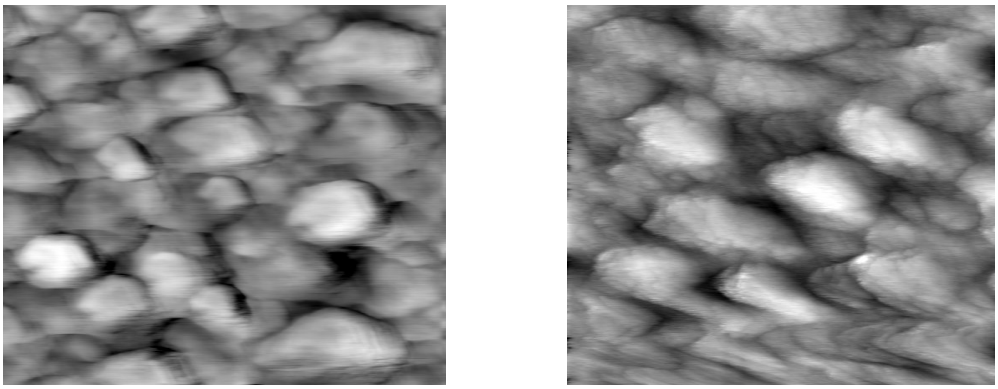

**Figure 2** : AFM topography of hybrid P3HT:CdS films (a)with and without (b) ZnO EIL.

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# Electrical Detection of Microbeads in Dry Medium

Mustafa Tahsin Guler[1*], Ismail Bilican [1,2], Turgay Tekinay[3,4], Sedat Agan[1] and Caglar Elbuken [5]

[1] *Physics Department, Kirikkale University, Kirikkale 71450, Turkey*
[2]*Science and Technology Application and Research Center, Aksaray University, Aksaray 68100, Turkey*
[3]*Department of Medical Biology and Genetics, Faculty of Medicine, Gazi University, Ankara 06500, Turkey*
[4]*Life Sciences Application and Research Center, Gazi University, Ankara 06830, Turkey*
[5]*Institute of Materials Science and Nanotechnology, National Nanotechnology Research Center (UNAM), Bilkent University, Ankara 06800,Turkey*

*Corresponding Author : gulermt@gmail.com

**Abstract—** In this study, electrical detection of poly styrene micro beads is shown. Interdigitated microelectrodes are fabricated with conventional micro fabrication techniques in clean room. Micro beads are pipetted on the electrodes and left to dry. Microbeads replace with air on the surface which changes the dielectric constant of the medium. Hence, the presence of the microbeads is measured via capacitance change.

Electrical detection of the particles is an old and reliable method [1]. The systems consist of electrodes and an impedance analyzer. Advancements in micro fabrication methods enable large scale integration of chips and electrodes which make electrical detection methods a promising tool for low cost and easy applications.

In this study, we introduced capacitive detection of 5.9 µm diameter polystyrene (PS) micro beads in air medium. The critical achievement of this work is the detection of the microbeads in air medium. Conventional electrical detection of the particles are made in wet medium due to biological applications [2,3]. But, wet medium adds noise and decreases the sensitivity. Hence, the possibility of the dry detection would increase the performance of the sensors.

Interdigitated micro electrodes (IMEs) were employed as the electrical sensing element. IMEs were fabricated in class 100 clean room on a standard glass slide. 15 nm chromium and 50 nm gold were thermally evaporated respectively. IMEs were achieved with lift off method after metallization process leaving the chip in acetone overnight. The IME's finger width and the gap between fingers was equally 5 µm which formed high performance sensor because of small size.

The sensor was cleaned with acetone IPA, DI water and dried with nitrogen flux and then baked on a 120$^{o}$C hot plate for 10 min to evaporate of every water molecule on the surface. The sensor was probed with Cascade probe station and capacitance measurement was realized with Keithley 4200 SCS semiconductor parameter analyzer. This cleaning and measurement was repeated several times for consistency.

The PS micro beads were pipetted on the sensor surface and left to dry in room temperature for 1 hour. Results are shown in figure 1.

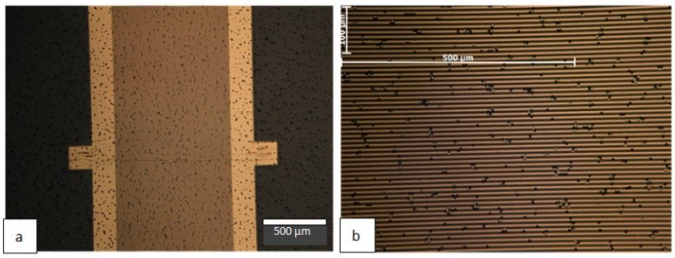


**Figure-1:** Optical microscope image, a. IME coated with micro beads, b. Closer view of IME.

The sensor was probed again and capacitance measurement was done at 100 $mV_{rms}$ excitation voltage scanning the frequency range between 500 kHz and 6 MHz which are the most stable frequencies. A significant capacitance increase was seen as shown in Figure 2.

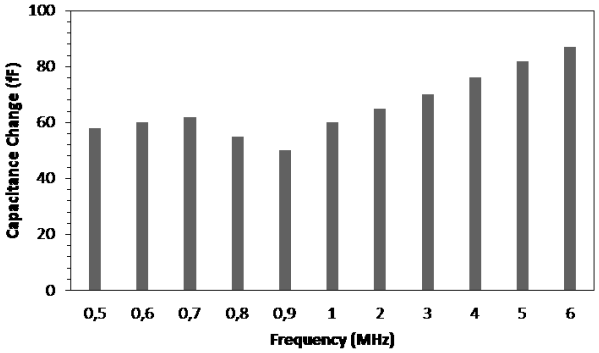


**Figure-2:** Effect of microbeads on capacitance

To ensure that the capacitance change arose from the presence of the microbeads, sensor surface was washed with DI water and cleaned with the same procedure as described above. Optical microscope imaging proved the cleaning of the surface such that all the microbeads were removed from the surface. A new capacitance measurement was done and it was noted that the capacitance decreased to the original value. It was clearly proved that the capacitance change was due to the microbeads.Total number of beads was estimated according to the 100 µm x 500 µm rectangular area in the figure 1.b. Hence, nearly 5000 microbeads made a 60 fF capacitance change on the surface at 1 MHz.

**Acknowledgement:**
This project was supported by The Scientific and Technological Research Council of Turkey (TUBITAK project no. 112M944) and European Union FP7 Marie Curie Career Integration Grant (no. 322019).

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# Photodynamıc effect of NiO İn HepG2 cellular model

Muhammad Fakhar-E-Alam[1], Muhammad Nadeem Shakoor[1], Muhammad Hammad Aziz[2,3], Najeeb Abbas[1], M. Atif [4,5,*], W. Aslam Farooq[4]

[1]*Department of Physics, Faculty of Science and Technology, GC University, Faisalabad, Pakistan*

[2]Department of Physics, College of Science in Zulfi, Majmaah University, Saudi Arabia

[3]*COMSAT Institue Technology, Lahore, Pakistan*

[4]*Department of Physics and Astronomy, King Saud University, Riyadh, Saudi Arabia*

[5]*National Institute of Laser and Optronics, Nilore, Islamabad, Pakistan*

*Corresponding Author: atifhull@gmail.com

**Abstract—** Nanomaterials are emerging milestones in Photodynamic Therapy (PDT) and ongoing research with tremendous clinical applications, diagnostic as well as antitumor, microbial nonmicrobia treatment purposes and are front runners due to their high quantum yield, size dependent tunable emission of wavelength over wide spectrum of light. Nano-dependent PDT technique involving nanoparticles (NPs) is simple, biologically safe, biocompatible in absence of UV light, enhances endogenous fluorescence, noninvasive, fast with their least permeability in normal cells. But nickel oxide nanoparticles (NiO NPs) with high surface to volume ratio show maximum toxicity can be used as an efficient photosensitizer carrier system and at the same time providing intrinsic white light needed to achieve cancer cell necrosis. The main focus of our research is to improve the effectiveness of PDT by using malignant cell line as biological model. In the present study, NiO NPs were synthesized by using precipitation technique. After successful growth NPs are characterizated and also toxicity of NiO will be tested in hepatocellular model (HepG2 cell line). Main objective was to determine the actual cell killing effects (via apoptosis and necrosis) and relevant parameters relationship with loss in cell viability using HepG2 as an experimental biological model. After successful investigation of biotoxicity of HepG2 cellular model the author will be able to quote the protocol for real treatment of liver cancer patients.

**Keywords:** NiO nanoparticles, Photodynamic Therapy (PDT), human hepatocellular (HepG2 cell line) model, Biotoxicity.

# Initial rotational effect on the N+H2 reaction

Emine Tanış[1*] , Niyazi Bulut[2] And Ezman Karabulut[3]

*[1]Ahi Evran University, , Kaman Vocational School, 40100 Kirsehir, Turkey*
*[2]Firat University, Department of Physics, 23119 Elazig,Turkey*
*[3] Bitlis Eren University, Vocational School of Health Services, 13000 Bitlis, Turkey*

*Corresponding Author: emineaslan@ahievran.edu.tr

**Abstract—**In this work, total reaction probabilities, integral cross sections and rate constants were calculated for selected initial rotational states of the $H_2$ molecule in the $N(^2D)$ + $H_2$ reaction. Time dependent wave packet method combined with Centrifugal Sudden approximation was used and followed by a flux analysis on recently developed $NH_2$ $(1^2A'')$ global potential energy surface (J. Phys. Chem. A 2013, 117, 3-8). We also investigated the effect of the projection quantum number of the initial rotational state on the reactivity. Total reaction probabilities were calculated for all values of the total angular momentum, J, in the range from 0 to 40. The effects of the initial rotational excitation of the $H_2$ reactant and of its projection quantum number on the behavior of rate constants were studied. The reaction rate constants are compared with previously published experimental and theoretical results. It was found that the initial rotation and its projection have a big effect on the integral cross sections.

**Acknowledgement :**
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# Thermoelectric Properties of $SrYO_3$ ( Y = V, Nb and Ta ) : First Principles Calculations

A. Aykara[1*], H. Kara,[1,2] and K. Ozdogan [1]

[1] *Physics Department, Yildiz Technical University, İstanbul, Turkey*
[2]*Physics Department, Necmettin Erbakan University, Konya, Turkey*

*Corresponding Author: ayhanaykara@gmail.com

**Abstract—** In this report, we have studied the thermoelectric properties of $SrYO_3$ (Y = V, Nb and Ta ) by using density functional theory on packet programme WIEN2k [1]. We used PBE-GGA (Perdew-Burkew-Ernzerhof96) exchange correlation potential for the lattice parameters calculations [2]. For thermoelectric properties; Seebeck coefficient, thermal conductivity, electrical conductivity, Hall coefficient and thermoelectric figure of merit were calculated at different temperatures by using BoltzTraP code which works compatible with WIEN2k interface [3]. We concluded that Hall coefficients showed almost a constant value for each compound. Conversely, Absolute Seebeck coefficients increase with increasing temperature.

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# Optical Properties of Brilliant Green Dye and Au/Organic dye/n-Si heterojunction diode application

Ahmet TOMBAK[1,*], Tahsin KILIÇOĞLU[1,2], Yusuf Selim OCAK[3],

[1]*Department of Physics, Faculty of Science & Art, Batman University, Batman, Turkey*
[2]*Department of Physics, Faculty of Science, Dicle University, Diyarbakır, Turkey*
[3]*Department of Science, Faculty of Education, Dicle University, Diyarbakır, Turkey*

*Corresponding Author: tahmet@yahoo.com

**Abstract—** In this study, optical properties of brilliant green dye and the current-voltage (*I–V*) characteristics of Au/Organic Dye/n-Si heterojunction diode were investigated. It is clear from *I–V* plot that Au/ Organic Dye /n-Si showed a good rectifying behavior with a rectification ratio of 3644 at 1 V. Some basic parameters of the diode such as ideality factor, barrier height and series resistance were determined. Some optical properties of organic dye such as absorbance and transmittance were analyzed. The ideality factor values were found to be 1.40 and 1.42 and the barrier height values were obtained from the *I–V*, Cheung and Norde method and were found to be 0.80, 0.79 and 0.89 eV respectively. Series resistance was determined from *I–V* measurement and was found to be 129 Ω from Norde method.

**Keywords:** Brilliant Green, barrier height, optical absorbance, organic-inorganic heterojunction

# High mobility Copper (II) Phthalocyanine Based Field Effect Transistors with organic /inorganic bilayer gate dielectric

Serif Ruzgar*[1], Mujdat Caglar[1]

[1]*Department of Physics, Anadolu University, Eskisehir, Turkey*

*Corresponding Author: serifruzgar@anadolu.edu.tr

**Abstract—**Organic materials suggest numerous advantages for easy processing (e.g., evaporation, spin coating, printing), good suitability with a variety of substrates including flexible plastics and great opportunities in structural modifications. Among the wide range of organic semiconductors considered, metal phthalocyanines are one of the most promising candidates to be used in the fabrication of such organic devices [1]. Phthalocyanines are small organic molecules characterized by high symmetry, planarity and electron delocalization. Otherwise, Phthalocyanines can be easily sublimed in high vacuum systems resulting in high-purity thin films with excellent growth properties and chemical stability, taking into account that the use the sublimation technique allows the deposition of thin films with controlled thickness and structural properties [2].

In this study, Copper(II) Phthalocyanine (CuPc) based organic field effect transistors (OFET) with top contacts bottom gate configurations were fabricated. Initially aluminum gate contact of thickness of 100 nm was deposited on pre cleaned glass surfaces. A part of Al film was then anodized to form Alumina ($Al_2O_3$) layer to be used a gate dielectric layer. In order to achieve a smooth interface between gate dielectric and organic channel, we spin-coated Polyvinyl alcohol (PVA) layer on $Al_2O_3$ surface. As an active layer CuPc thin-film with 50 nm thickness was evaporated on PVA dielectric layer by using thermal evaporation method (Vaksis PVD Handy-MT/101T, Turkey). The grained structure of CuPc film is shown in Fig. 1. After the deposition of the CuPc film, finally the source and drain electrodes were prepared by evaporating a 125 nm Au layer through a shadow mask. The channel width and length of the transistor are 1000 µm and 50 µm, respectively.

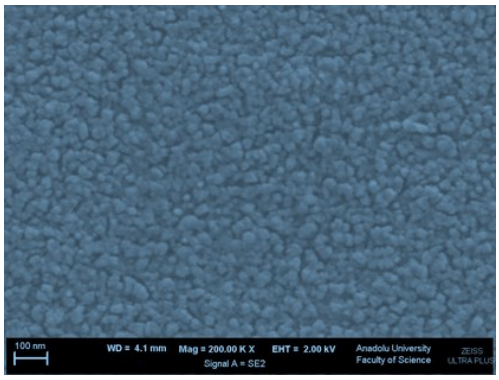


**Figure 1.** SEM micrograph of CuPc film.

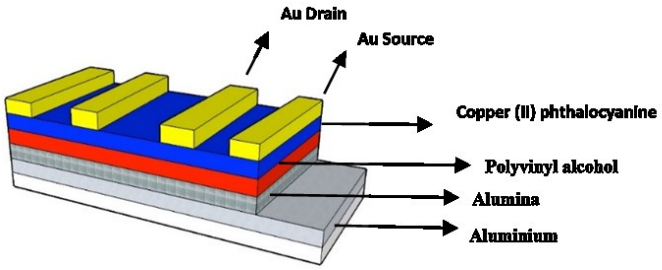


**Figure 2.** Schematic structure of CuPc based-FET

Fig. 2 shows the schematic structure of CuPc based-FET. The electrical measurements of CuPc based-FET were performed using a KEITHLEY 4200 SCS/CVU semiconductor characterization system with connected SIGNATONE Semi-Atomatic Probe Station at room temperature under dark condition. The CuPc based-FET exhibited a p-channel behavior (Fig. 3). The mobility, $I_{on}/I_{off}$ ratio and threshold voltage for this device were found to be $6\times10^{-2}$ $cm^2$ $V^{-1}$ $s^{-1}$, ~ $10^3$ and -3 V, respectively.

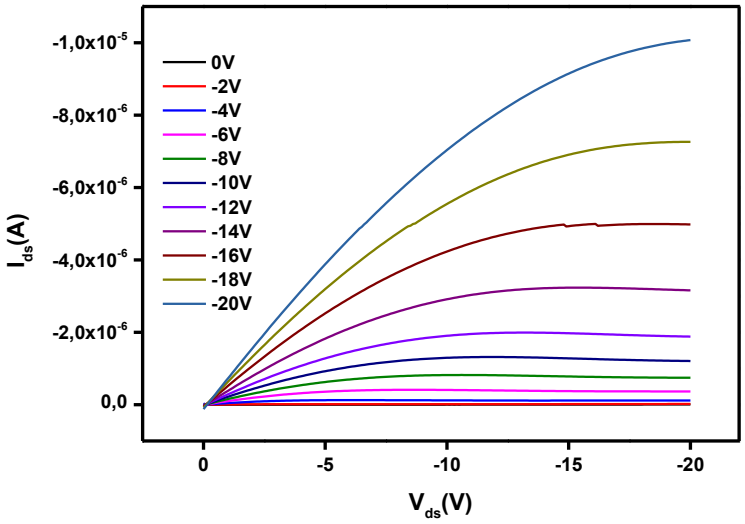


**Figure 3.** Output characteristics of CuPc- based-FET

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# Negative Capacitance Effect in $V_2O_5$/c-Si Structure

Ayşe Evrim Saatci,[1*] F. Pınar Gökdemir, [1] Orhan Özdemir [1] and Kubilay Kutlu [1]

[1] *Physics Department, Yildiz Technical University, İstanbul, Turkey*

*Corresponding Author : bulgurcu@yildiz.edu.tr

**Abstract—** $V_2O_5$ thin film was produced with organic sol by sol-gel method on n-c-Si substrates and investigated through I-V and admittance analysis at room temperature and under dark/illuminated ambient. Structural and optical properties were investigated via TG-DTA, FTIR and UV-Vis spectrophotometry. As to the experiments, a thin insulating layer was existed between $V_2O_5$ and n-c-Si semiconductors and so, structure turned into semiconductor-insulator-semiconductor [SIS] where one of the semiconductors was a wide band gap semiconductor. Additionally, negative capacitance was observed in the present device at large reverse bias under low frequency. Mobility of injected carriers followed the Poole-Frenkel type conduction mechanism and distinguished in the frequency range due to the difference of transit times in admittance measurement. The proposed analytical model for admittance, derived for the frequency dependent space charge limited behavior leading negative capacitance issues, was applied on the measured data for the present device.

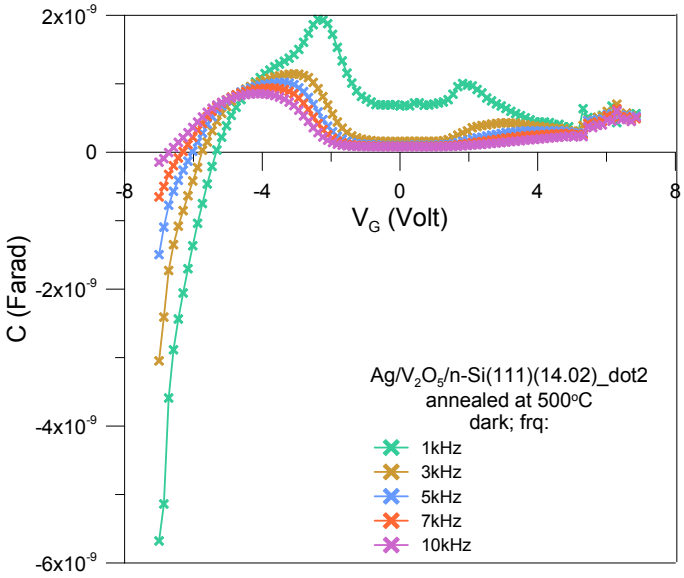


**Figure-1**: Capacitance-Voltage plot of Ag/$V_2O_5$/n-Si(111) structure at room temperature,within the 1-10 kHz frequence interval under dark ambient.

# Fabrication and Electrical Characterization of Organic-Inorganic Device Based on Quinoline Yellow

Ali Ugur,[1] Arife Gencer Imer [1,*] and Yusuf Selim Ocak [2,3]

[1]*Department of Phyics, Yuzuncu Yil University, 65080, Van, Turkey*
[2]*Department of Science, Dicle University, 21280, Diyarbakir, Turkey*
[3]*Scie. & Technol. Appl. and Res. Cen., Dicle University, 21280, Diyarbakir, Turkey*

*Corresponding Author: gencerimerarife@gmail.com

**Abstract—** An organic-inorganic contact was fabricated by coating a thin film of Quinoline yellow dye (QY) on a p-Si. The current-voltage *(I-V)* and capacitance- voltage *(C-V)* measurements of Al/QY/p-Si heterostructure were applied in dark and room temperature to calculate the characteristic parameters of diode like ideality factor, barrier height and series resistance. Also, *I-V* measurements of Al/QY/p-Si/Al were taken under illumination between 40 and 100 mW/cm$^2$. It was observed that reverse bias current of the device increased with light intensity. Thus, the heterojunction had a strong response to the light and it can be suitable for electrical and optoelectronic applications like photodiode.

Organic materials have been attractive in resent studies for the fabrication of electronic and optoelectronic devices due to the possible capability of an alternative to inorganic counterparts [1,2]. This interest has mainly arisen from their inexpensive and simple preparation methods in the fabrication of devices compared with them [2-4]. Namely, many studies have been focused on the electrical and optoelectrical properties of organic/inorganic devices including photodiodes, photovoltaic cells and Schottky diodes [1-5]. The aim of this study is to construct Al/QY/p-Si heterojunction, investigate the influence of the organic interfacial layer on the electrical characteristics of device, and examine some electrical parameters such as barrier height and series resistance of the heterostructure. For this purpose, an Al/QY/p-Si structure has been fabricated forming an interfacial layer of QY on a p-Si substrate by a spin coating technique, to determine the electrical parameters of the heterojunction from *I-V* and *C-V* measurements at room temperature.

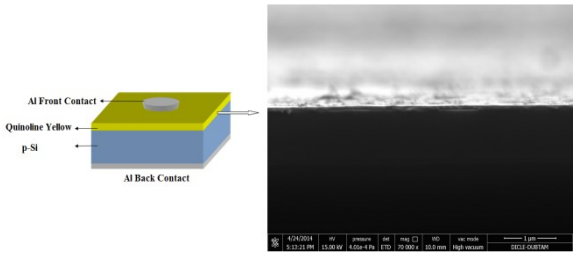


**Figure-1**: The cross-section view and SEM image of the Al/QY/p-Si structure

After standart cleaning procedure, the ohmic back contact was formed by evaporation of Al metal on the unpolished side of the cleaned wafer, followed by annealing treatment at 570 $^o$C for 3 min in $N_2$ atmosphere. A thin QY layer was coated on front of p-Si by using a spin coater. After that,

Al metal was evaporated through a shadow mask in vacuum system at ~$10^{-6}$ Torr. Fig. 1 shows the cross-section view and SEM image of the Al/QY/p-Si structure.

The forward and reverse bias ln*I*-*V* plots of the Al/QY/p-Si structure at room temperature in the dark and under light with the illumination range 40-100 mW/cm$^2$ at steps of 20 mW/cm$^2$ are presented in Fig. 2. As can be seen from the figure, the device shows a good rectification in the dark. Ideality factor and barrier height values were found as 1.23 and 0.87 eV, respectively. The series resistance value of the device was determined as 1.8 kΩ by using modified Norde function. The *C*-*V* measurements were carried out at different frequencies and it was seen that capacitance value decreased with increasing frequency.

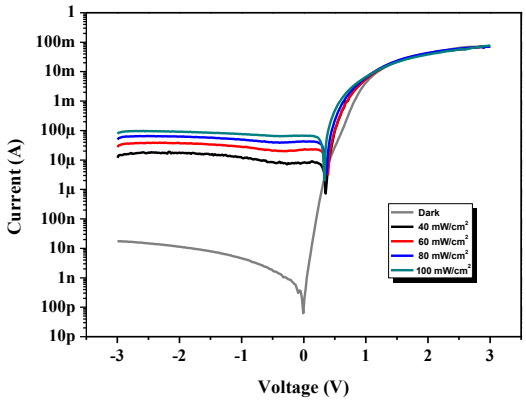


**Figure-2**: The forward and reverse bias ln*I*-*V* plots of the Al/QY/p-Si structure at room temperature in the dark and under illumination between 40 and 100 mW/cm$^2$.

In conclusion, the Al/QY/p-Si/Al structure was fabricated by coating a QY thin organic film as an interlayer between the metal and semiconductor. The device shows a good rectifying characteristic. Moreover, energy distribution of interface states ranges from 2.00 x $10^{13}$ cm$^{-2}$eV$^{-1}$ at (0.88-$E_v$) eV to 4.79 x $10^{14}$ cm$^{-2}$eV$^{-1}$ at (0.42-$E_v$) eV for Al/QY/p-Si heterostructure, which was extracted by from *I*-*V* characteristic. The obtained results show that QY organic layer strongly modifies the electrical parameters of Al/p-Si diode, and the Al/QY/p-Si/Al structure can be used as optoelectronic application such as photodiode.

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# PVDF/Topological Insulator Solar Cell Light Trapping Using Photonic Crystals

O.Oltulu[1*], A. Gunes[1],S. Simsek[2], A.M. Mamedov[3,4], E. Ozbay[3]

[1] *Department of Physics, Harran University, Sanliurfa, Turkey*
[2]*Material Science and Engineering Department, Hakkari University, Turkey*
[3]*Nanotechnology Research Center (NANOTAM), Bilkent University, Ankara, Turkey*
[4]*International Scientific Center, Baku State University, Baku, Azerbaijan*

*Corresponding Author : oltulu@harran.edu.tr

**Abstract—**In the last decade, development of photonic crystals in the field of polymer materials gained much interest due to their high potential for possible applications such as photovoltaic polymeric solar cells, photonic and electronic devices. In addition to ordered structruces to some extent as in the case of polymeric liquid crystals, polymer materials with full periodic structures open up an opportunity to many applications for photonics in several ways. Creation of periodicity topographically in systems will cause the light to be reflected at specific wavelengths depending on periodicity. By changing the composition of the system refractive index contrast can be altered by adding high/low refractive index material. Since the purpose of studies in periodic structures is the manipulation of light`s path new periodic patterns and new materials with low cost are basically needed. For all applications regarding photonic crystals a fascinating feature is that they exhibit a highly fragmented energy spectrum in certain directions of space. Their dispersive behavior due to multiple scatterings and angular stop bands as well as frequency stop bands are material and geometry dependent properties.

In this study, we have proposed a system composed of a narrow band semiconductor GeTe with a ferroelectric polyvinylidene fluoride (PVDF) polymer material to identify forbidden energy bands within the photonic crystal structure. It is well known that GeTe is an exceptionally good electrical electrical conductor and also GeTe is transparent to IR light, which we know as heat. While about half the solar energy that hits the Earth comes in the form of IR light, few of today's solar cells are able to collect it. The new PVDF/GeTe structure could get around that problem and allow cells to harvest more of the Sun's spectrum of wavelengths.

The suggested photonic band structure involving a polymer material PVDF of a one dimensional solid crystal structure is studied numerically by utilizing Bloch theorem based on the plane wave expansion (PWE) method. Assuming an infinite periodic media, band gaps of the PVDF/GeTe system is to be found and another major method known as finite difference time domain technique (FDTD) is to be used to simulate light transmission through PVDF/GeTe periodic structure. All calculations will be carried out by Optiwave FDTD software for the band gaps and the transmittance of light propagating through the crystal structure with a wavelength of 1.550 μm. This study can have potential applications in solar photonics.

# Electrical and Mechanical Properties of PANI / LDPE Composites

Ü. Alkan[1], M. Kılıç[2], Y. Karabul[2], H. B. Yamak[3], M. Okutan[2] and O. İçelli[2],

[1] *Department of Computer Engineering, Gelişim University, İstanbul, Turkey*
[2]*Department of Physics, Faculty of Science and Letters, Yıldız Technical University, Istanbul, Turkey*
[3]*Department of Metallurgical and Materials Engineering, Faculty of Chemistry- Metallurgical, Yıldız Technical University, Istanbul, Turkey*
*Corresponding Author : oicelli@yildiz.edu.tr

**Abstract—** Studies of low density polyethylene (LDPE) materials and their composites with the organic or inorganic additives are motivated, in part, by their technological applications owing to its good electrical properties, environmental stability, low production cost, and ease of synthesis [1]. In addition this, Special interest was focused on polyaniline (PANI) due to its low production cost, relatively high level of electrical conductivity, and good environmental stability [2, 3, 4].PE/PANI blends and composites have already been obtained using different methods [2, 5, 6]. However, few studies have focused on PANI/ PE composites obtained by the hot pressing method. In this study, PANI doped LDPE in different concentrations composite films were obtained by the hot pressing method (15 MPa, 418 K, 10 min).These composites were characterized by FTIR spectroscopy, differential scanning calorimetry (DSC), stress-strain measurements, and electrical measurements.

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# Novel Synthesis, optical and photoluminescence properties of $Zn_{2-x}SnO_4$ nanoflowers

Farid El-Tantawy[1]*, Ahmed A. Al-Ghamdi[2]*, , F. Yakuphanoglu[3]

[1]*Department of Physics, Faculty of Science, Suez Canal University, Ismailia, Egypt*
[2]*Department of Physics, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia*
[5]*Department of Physics, Faculty of Science, Firat University, Elazig, Turkey*

*Corresponding Author : faridtantawy@yahoo.com

**Abstract—** Novel flower - like hierarchical nanostructures consisting of $Zn_{2-x}Sn_xO_4$ semiconductors were successfully synthesized by a simple hydrothermal technique. X-ray diffraction results indicate that the $Zn_{2-x}Sn_xO_4$ samples are single hexagonal phase. The grain morphology and spatial compositions of $Zn_{2-x}Sn_xO_4$ nanoflowers were systematically observed by filed emission scanning electron microscopy (FE-SEM), transmission electron microscopy (TEM) and energy dispersive X-ray (EDS) analysis. The UV-visible (UV-Vis) absorption spectra show that the band gap of $Zn_{2-x}Sn_xO_4$ nanoflowers can be readily tuned by optimizing the molar ratio of Sn precursors. The photoluminescence (PL) line shapes of the $Zn_{2-x}Sn_xO_4$ samples of Sn composition ranging from 0 up to 0.25 at % were found to exhibit the inherent doping broadening, which masks the excitonic emissions. These nanostructures may be used for various optoelectronic nanodevices owing to its low cost and easy scaling up.

**Keywords:** $Zn_{2-x}Sn_xO_4$ alloy nanoflowers, hydrothermal synthesis, nanostructures, optical properties

# Graphene based Hybrid Organic Semiconductor Photodiodes

M. E. Aydin[1*], H. Tuncer[b], Ahmed A. Al-Ghamdi[c], A. Dere[d], S.Yol[b], F. Yakuphanoglu[c,d]

[a]*Department of Physics, Faculty of Science, Dicle University, Diyarbakır, Turkey*
[b]*Department of Chemistry, Faculty of Science, Firat University, Elazig 23169, Turkey*
[c]*Department of Physics, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia*
[d]*Department of Physics, Faculty of Science, Firat University, Elazig 23169, Turkey*

*Corresponding Author : fyhan@hotmail.com

**Abstract—**We have fabricated Ag/GO-NiPc/p-Si contacts with various molar ratios of GO-NiPc. The graphene oxide–Nickel based phthalocyanine (GO-NiPc) film were formed by doping different molar ratios of NiPc with ratios of 0.2, 06 and 0.8 to graphene oxide and depositing on top of the p-Si by dip coating method. We have measured the electrical parameters of the contacts by C-t,I-V,C-V,I-t,Rs-V characteristics. I-V characteristics of these contacts have shown rectification behaviour and they have shown photovoltaic characteristics. By increasing the molar ratio of GO-NiPc at Ag/p-Si interface the optimum value of molar ratio of contacts for photoresponse was obtained as 0.4 molar and the best rectification was obtained for the contact with 0.8 molar ratio.

# Effect of Laser Annealing on the Structural and Optical Properties of nano $V_2O_5$ films Grown by Thermal Evaporation

Amanullah Fatehmulla[1*], M Aslam[1], W A Farooq[1], Syed Mansoor Ali[1], M Atif [1], A M AlDhafiri[1] and F Yakuphanoglu[2]

*[1]Department of Physics & Astronomy, College of Science, King Saud University, Riyadh, Saudi Arabia*
*[2] Physics Department, Firat University, Elazığ, Turkey*

*Corresponding Author: aman@ksu.edu.sa

**Abstract—**Nano crystalline films of vanadium pentoxide ($V_2O_5$) with orthorhombic structure grown by thermal evaporation have been subjected to laser annealing keeping in view of the material by selective tailoring for device applications. XRD and SEM results show an increase of grain size with the increase of laser intensities. Redshift of the fundamental absorption edge is noticed as a function laser annealing with different intensities indicating the decrease in the band gap.PL peaks also substantiate the optical absorption data. The nanostructure of the laser treated films along with hole trapping and oxygen sensitizing capabilities make $V_2O_5$ material distinct as compared to other metal oxides. All the investigated results have been explained.

**Keywords:** Nano $V_2O_5$, Laser annealing, Thermal evaporation, Bandgap tailoring

# Thermoelectric Properties of Cubic Perovskites $SrYO_3$ ( Y = Ti, Zr and Hf )

A. Aykara[1*], H. Kara,[1,2] and K. Ozdogan [1]

[1] *Physics Department, Yildiz Technical University, İstanbul, Turkey*
[2]*Physics Department, Necmettin Erbakan University, Konya, Turkey*

*Corresponding Author: ayhanaykara@gmail.com

**Abstract—**Over the last decade, energy consumption and production fairly gained importance depending on decreasing energy sources in the world. Without greenhouse gas emissions , one of the solutions way could be recycling waste heat into electricity through the thermoelectric power of solids with the aid of thermoelectric generators. Especially, thermoelectric perovskite oxides are preferred because of their low manufacturing costs, environmentally friendly and nontoxic character, availability in nature, and high service temperatures [1]. In this study, we investigated the electronic structures of some perovskites $SrYO_3$ (Y = Ti, Zr and Hf ) by using density functional theory on packet programme WIEN2k [2]. For thermoelectric properties; Seebeck coefficient, thermal conductivity, and electrical conductivity were calculated at different temperatures by using BoltzTraP code [3]. We concluded that when the temperature increased, Seebeck coefficients decreased for $SrTiO_3$ and $SrZrO_3$ but for $SrHfO_3$ it increased interestingly according to their positions in periodic table. Hall coefficients showed decrease when the temperature increased for Sr(Ti, Zr, Hf)$O_3$. Figure of merit for all compounds showed similar behaviour.

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# The Effects of vitamin E and C added to the ration of freshwater crayfish (Astacus leptodactylus, Esch. 1823) in moulting period

Özden Barım-Öz[1*] Mustafa Karatepe[2]

[1]Fisheries Faculty, Firat University, 23119, Elazig, TURKEY
[2]Department of chemistry, Fırat University, 23119, Elazığ, TURKEY

*Corresponding Author : obarimoz@hotmail.com

**Abstract—**In the present study, we examined the effects of dietary antioxidant (vitamin E (VE), vitamin C (VC)) supplementation on oxidative stress and vitamins A, E, C, β-carotene and astaxanthin in the hepatopancreas, muscle and gills tissues of the freshwater crayfish, *Astacus leptodactylus* during moulting. The VE and VC were added the control diet for preparation of experimental diet. The study was carried out for 66 days. *A. leptodactylus* with these diet were fed with 2% of their total weight daily. The results of the study showed that the supplemental of VE and VC in diet of *A. leptodactylus* decreased malondialdhyde levels in the hepatopancreas, muscle and gills tissues. However, vitamins A, E, C, β-carotene and astaxanthin levels changed according to tissue specific.

**Keywords:** A. leptodactylus, Vitamin E, C, MDA

# Hybrid Solar Cell with Screen Printed Active Layer

Y. Hames*, E. Aslan, T. Ozdal

*Department of Electrical-Electronics Engineering, Engineering Faculty, Mustafa Kemal University, Hatay, Turkey*

*Corresponding Author : yhames@mku.edu.tr

**Abstract—**Silicon solar cells are still the leader of the photovoltaic industry due to their efficiency extending beyond 20% but widely usage of these solar cells is hampered by the expensive manufacturing processes. One of the approaches to lower the cost is the organic and hybrid solar cell concept [1]. Over the last 30 years, great effort has been shown to improve the efficiency of these solar cells because these types of solar cells have the possibility to be flexible and also can be produced by cheap methods as screen printing and roll to roll printing method [2, 3].

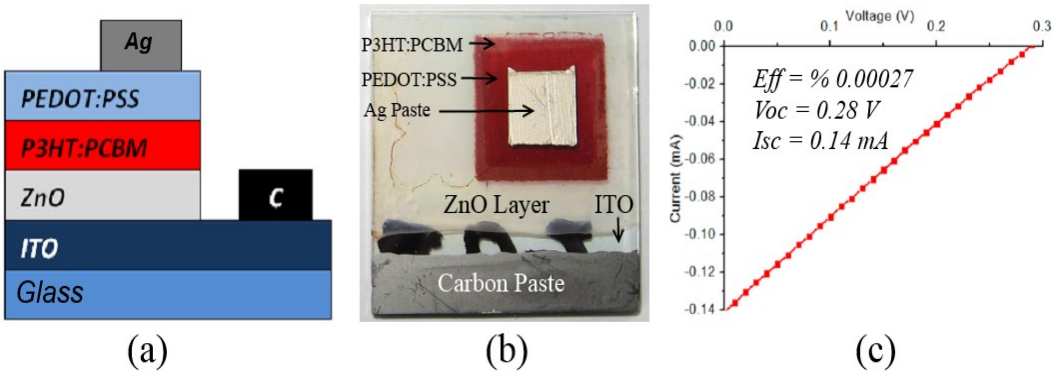


**Figure 1**. **(a)** The architecture, **(b)** image, **(c)** I-V curve of the produced hybrid solar cell.

In this study, a hybrid bulk heterojunction organic solar cell which have P3HT:PCBM active layer, PEDOT:PSS buffer layer and zinc oxide (ZnO) n-type inorganic layer have been produced (Figure 1(a)-1(b)). Inorganic ZnO layer was deposited by electrochemical deposition method. ZnO is one of the most promising semiconductor materials for manufacturing optoelectronic devices because it is a non-toxic, cheap wide band gap natural n-type semiconductor [4]. Carbon and Ag pastes were used as contact electrodes. The produced sample and the measured I-V characteristic of the device are shown in the Figures 1(b) and 1(c), respectively. The obtained efficiency is very low as compared with silicon solar cells but this study can be seen as a prove of the concept of the production of the hybrid and organic solar cells by screen printing method.

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# Negatronic device properties in hybrid nano-composite materials

L. El Mir[1,2,*]

[1]*Al Imam Mohammad Ibn Saud University (IMSIU), College of Sciences, Department of Physics, Riyadh 11623, Saudi Arabia.*
[2]*Laboratory of Physics of Materials and Nanomaterials Applied at Environment (LaPhyMNE), Gabes University, Faculty of Sciences in Gabes, Gabes, Tunisia.*

*Corresponding Author : lassaad.ElMir@fsg.rnu.tn

**Abstract—**Carbon-nickel composites (C/Ni) were prepared by sol-gel method after the incorporation of nickel oxide nanoparticles in organic matrix based on pyrogallol-formaldehyde. The composites heated under inert atmosphere, were characterized by various techniques such as X-ray diffraction, scanning electron microscopy, transmission electron microscopy. The X-ray diffraction spectra indicated the presence of nickel phase in amorphous carbon matrix at low pyrolysis temperature, while at 1000 °C a graphite structure lines were observed. The transmission electron microscope micrographs show the presence of nanocrowns and multiwall carbon nanotubes around nickel nanoparticles for the composite treated at 1000 °C. From electrical analysis, a huge variation of the direct current conductivity was observed depending on pyrolysis temperature. This behavior was related to the presence of a percolation phenomenon. I(V) characteristics indicate the presence of a negative differential resistance phase (NDR) in some C/Ni nanocomposites for a wide range of measurement temperatures. The electronic conduction was found to be dominated by hopping mechanism for dc and ac conductivities and not affected by NiO nanoparticles content. The obtained materials are promising for negatronic device applications.

**Keywords***:* Hybrid nano-composites; Nano particles; Electrical properties, Sol-gel technique.

# Structural and electrical characterization of Copper modified Calcium Titanate Ceramic

Mehboob Nagarbawadi[1*], Sohail Bagwan[2]

[1]*Dept. of Physics, Poona College of Arts, Science and Commerce, Camp, Pune - 411 001, India*
[2]*Dept. of Physics, Abeda Inamdar Senior College, Camp, Pune-411001, India*

*Corresponding Author : dr.mehboobn@gmail.com

**Abstract—**Special physical properties of ferroelectric ceramic prepared by double sintered Solid State Reaction method studied for a series ($Ca_{100-x}Cu_xTiO_3$) of Copper doped Calcium Titanate such as XRD, dielectric hysteresis loop, dc electrical conductivity and pyroelectric measurement over a range of temperature including their phase transition temperature. The XRD analysis showed that samples belong to the orthorhombic system, there is no appreciable variations in lattice parameter of doped samples but a change in density and a non linear variations in average grain size is observed. The hysteresis study revealed that the width of the loop remains almost constant and phase transition temperature decreases as compared with undoped samples, which was confirmed by dc electrical conductivity and pyroelectric measurement study.

**Keywords**: $CaTiO_3$, conductivity, hysteresis, pyroelectric current, phase transition temperature, CuO, XRD

# The effect of thermomechanical cyclic on shape memory behaviour of porous NiTi alloy

Mehmet Kaya[1*], İbrahim Karaman[2], Nuri Orhan[3]

[1]MMetalurgy and Material Engineering, Adıyaman University, Adıyaman 02040, Turkey
[2]Mechanical Engineering, Texas A&M University, MS 3123, College Station, TX 77843, USA
[3]Metallurgy and Material Engineering, Fırat University, Elazığ 23119, Turkey

*Corresponding Author : mehmetkaya75@hotmail.com

**Abstract—**We focus on the effect of thermomechanical cyclic on shape memory behaviour of porous NiTi alloy. Shape memory and phase transformation behaviour of porous NiTi alloy is dependent on phases, and mechanical or thermal background. The desired phases such as B2(NiTi) and B19'(NiTi) for biocompatibility were dominant but the second phases such as $Ni_4Ti_3$ and $NiTi_2$ phases were also seen in small amount in the microstructure of porous NiTi. The amount of Ni in main matrix (NiTi) affect such as phase transformation temperature and kinetics and it also affect shape memory behaviour. The amount of Ni can be easily change with solution heat-treatment and aging and occurring Ni4Ti3 phase. Full recoverable shape memory behaviour was observed during thermomechanical cycle of 5 MPa.

**Keywords:** NiTi; Porous materials; Thermomechanical cyclic, Shape Memory Behaviour

# Synthesis of $Co_3O_4$ / Reduced Graphene Oxide Nanocomposites for Li Ion Batteries

M. Sasmaz* and F.Yakuphanoglu

*Department of Physics, Faculty of Science, Firat University, Elazig, Turkey*

*Corresponding Author : merivansasmaz@gmail.com

**Abstract—**Reduced graphene oxide was synthesized by Hummers method. The $Co_3O_4$/ reduced graphene oxide (RGO) nanocomposites were synthesized with various RGO contents via a route which includes ultra-sonication, evaporation with microwave and centrifuge. Energy disperse X-Ray (EDX) results confirmed the chemical compositions of the composites. Typical scanning electron microscopy (SEM) images were carried out to investigate the microstructure of pure and graphene doped nanocomposites. Fourier transform infrared spectroscopy (FTIR) measurements of nanocomposites are shown in Figure. 1. C-O epoxy groups, tertiary C-OH groups and C=O stretching of carbonyl and carboxyl groups were observed by FTIR spectra. The obtained FTIR bands are in agreement with the results obtained in literature [1,2].

**Keywords:** Reduced graphene oxide, nanocomposites, FTIR.

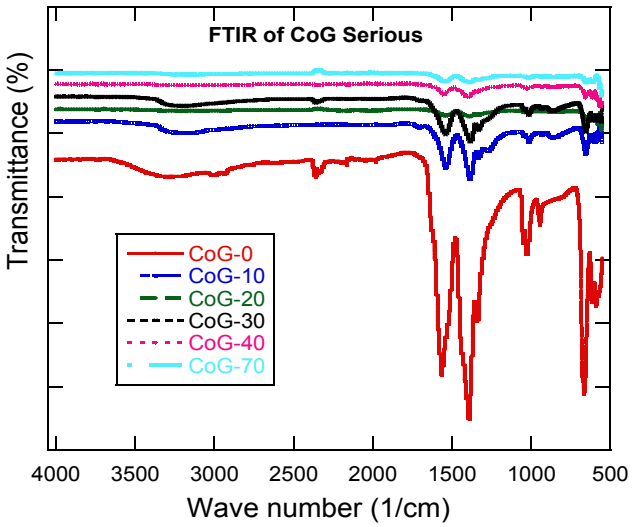


**Figure 1.** FTIR spectrums of all nanocomposites

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# The effect of TCO layer on enhancement of light trapping on silicon thin film solar cells

İsmail Kurt [1*] ,Sadık Güner[1], and Osman Gürbüz [2]

[1] *Physics Department, Fatih University, İstanbul, Turkey*
[2]*Physics Department, Yıldız Technical University, İstanbul, Turkey*

*Corresponding Author : ikurt@fatih.edu.tr

**Abstract—**Effective light trapping is an essential requirement for the design of thin film solar cells as this can increase the optical path length of the incident light and enhance the absorption of the intrinsic layer [1, 2]. Currently, the most wide spread TCO materials are tin oxide (SnO2), indium-tin oxide (ITO) and zinc oxide (ZnO). Aluminum-doped zinc oxide (ZnO: Al) thin films as the TCO layers, which are prepared by magnetron sputtering system.In present work, the effects of Al-doped ZnO (AZO) as front contact layer on the performance of the inverted silicon based thin film solar cells have been investigated. Front contact of AZO, together with a reflective back electrode provides efficient light-trapping, inducing further light absorption in the active layer. AZO films in silicon thin-film solar cells allow the determination of the relationship between the front-contact carrier concentration and the short circuit current density. The surface morphology of the films was observed by Jeol 7001 scanning electron microscope (SEM). As shown Figure-1, SEM studies indicated that the cross-sectional image of Si solar cells.

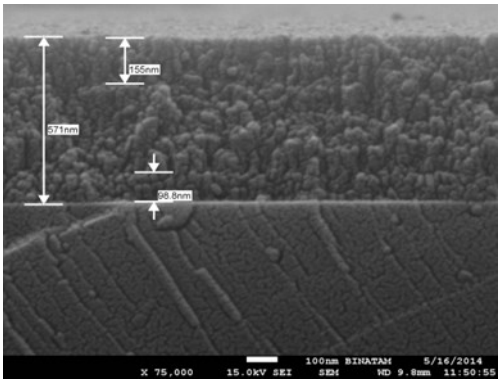


**Figure-1:** SEM Picture of p-i-n Si solar cells

The AZO films provide efficient light-trapping as a result of light scattering and multiple reflections, increasing the optical path length in photoactive layer as depicted Figure-2.

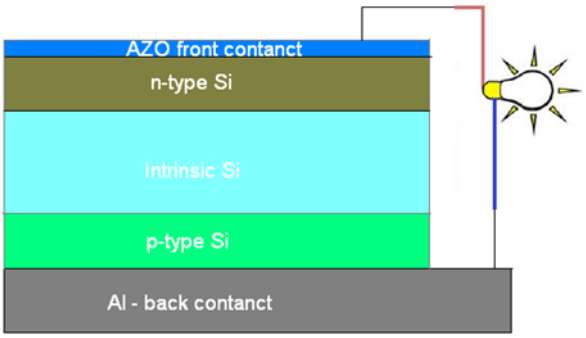


**Figure-2:** Schematic view of Si based thin film solar cell structure with front contact AZO layers.

The solar cell thin films were characterized with respect to their morphology, optical and electrical properties. Power conversion efficiency is increased substantially since without loss in the fill factor and open circuit voltage.

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# Polymer Nanospheres Formed by a Microfluidic Technique with Evans Blue Dye

I.Kucuk [1,2*]

[1]Department of Metallurgical and Materials Engineering, Faculty of Engineering, Firat University, Elazig, 23279, Turkey.

*Corresponding Author : ikucuk@firat.edu.tr

**Abstract—**In this work, the V-shaped microfluidic junction (VMJ) device technique was used to prepare textured polymer nanospheres from bubble bursting for drug delivery. The polymer - dye solution, N2 gas and a volatile liquid, perfluorohexane (PFH), were simultaneously fed using the tubes into the VMJ device (Figure 1). A pressure ejection of N2 gas in a suitable solvent, PFH, into ethanol where the nanospheres calve from a mother bubble of mesoscale proportions. The mechanism by which the collection temperature and N2 gas pressure are stated to be critical to nanosphere formation. In addition, the volatile liquid, PFH, is described as a significant surface modifier. The influence of the N2 gas pressure, collection temperature and the volatile liquid flow rates on nanospheres size distribution and surface roughness was examined using scanning electron microscopy, which showed that N 2 gas pressure and collection temperature are crucial in tailoring the size distribution of the nanospheres and that the nanospheres textured with PFH had a remarkably rougher surface. Nanospheres containing Evans blue dye were also prepared and those collected in high temperature exhibited a very different dye release profile compared with those
collected in lower temperatures.

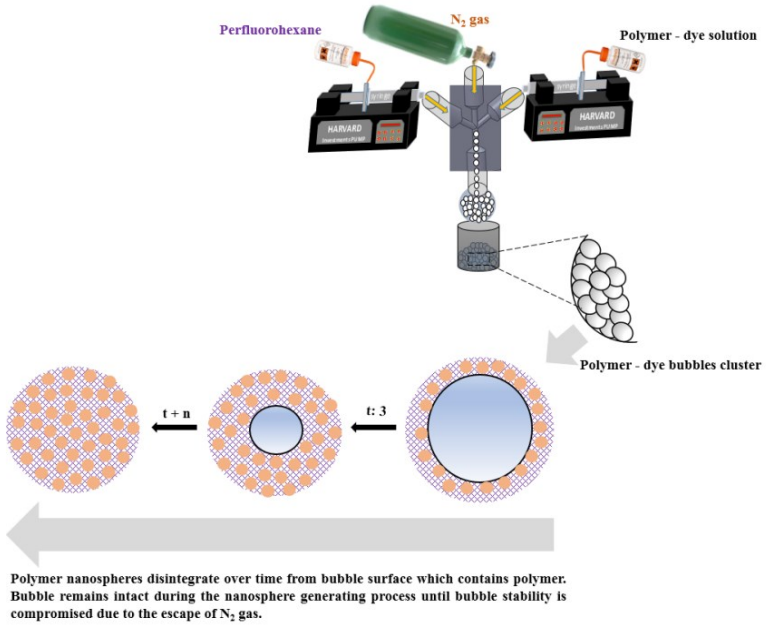



**Figure 1:** Schematic illustration of preparation of dye encapsulated polymer nanospheres from bubble bursting using a
V-shaped microfluidic junction device.

# Improvement of device performance of organic light emitting diodes via ITO surface modification using different SAM molecules

Ahmet Nuri Özcivan[1] , Ömer Mermer[2*] , Eyup Yalcın[3], Koray Kara[4], Mahmut Kuş[4,5] ,Cem Tozlu[6] and Mustafa Can[3*]

[1]*İzmir Katip Çelebi University, Department of Electrical and Electronics Engineering,35620, Izmir, Turkey*
[2]*Ege University, Department of Electrical and Electronics Engineering,35100, Izmir, Turkey*
[3]*İzmir Katip Çelebi University, Department of Engineering Science,35620, Izmir, Turkey*
[4]*Selcuk University, Advanced Research and Application Center,19100, Konya, Turkey*
[5]*Selcuk University, Chemical Engineering,19100, Konya, Turkey*
[6]*Karamanoglu Mehmet Bey University, Department of Energy System Engineering,35160, Karaman,Turkey*

*Corresponding Author: omermermer@gmail.com

**Abstract—**Indium tin oxide (ITO) has been widely used for organic light emitting diodes (OLED) applications, because of its good electrical conductivity, high transmittance in the visible region. In OLED applications, organic molecules are direct contact with the ITO as a result of these matching between ITO and organic layers are of great importance. ITO has relatively low work function compared with the organic layers. Electrode modification in organic semiconductor devices has attracted much attention in last decade. Among these studies, ITO (Indium Titanium Oxide) as an electrode is widely used in organic light emitting diode (OLED) due to its relatively low resistance and high transparency. On the other hand, it has rough surface and low work function compared to the organic molecules used in OLEDs. Recently, self-assembled mono layer (SAM) technique has gained much importance in organic electronic because of the ease of processing and low cost. Since surface roughness limits the hole injection from anode into the hole transport layer (HTL), we have tuned OLED performance by means of two different ferrocenecarboxylic acid (FCA) and ferroceneboronic acid (FBA) SAM layers through adjusting the interface between ITO and the organic layer. The improvements in current, luminescence and device efficiency of OLED using SAM modified ITO were obtained comparing to OLED devices with bare ITO as anode. This enhancement on device performance is attributed by better hole injection and smoothness of the layer between ITO and organic layers.

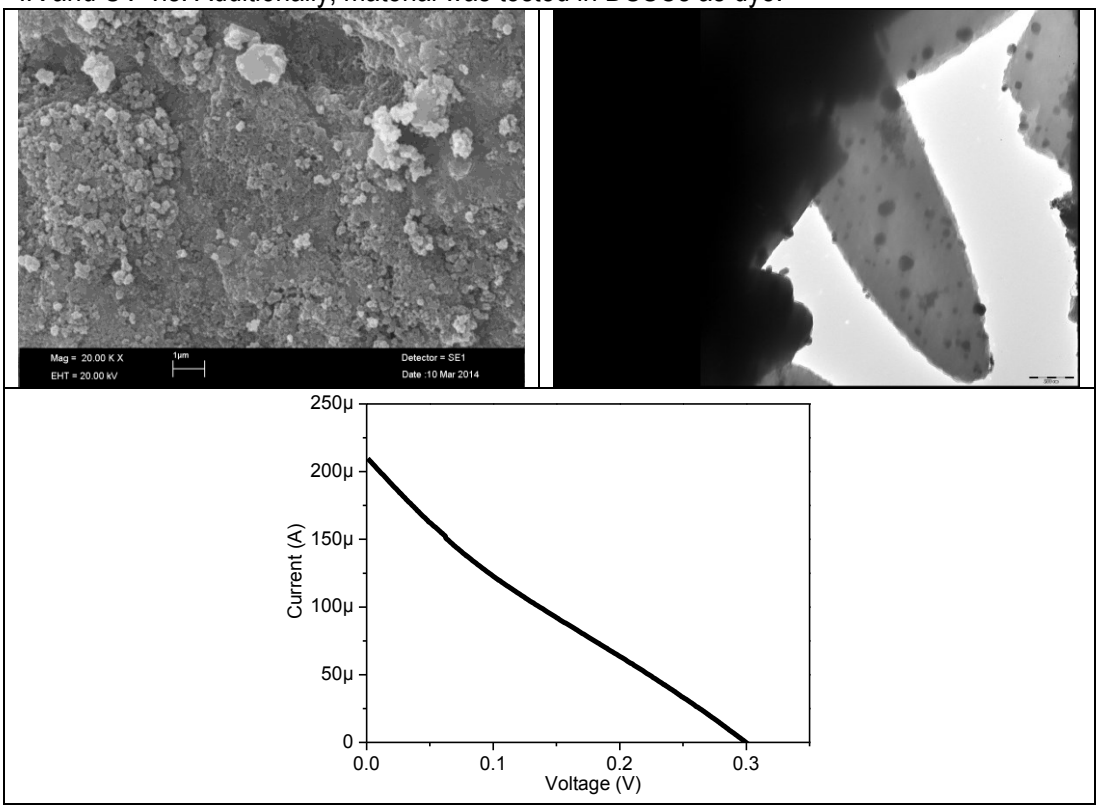
# Ruthenium nanoparticles supported on 2,6-bis(2-benzimidazolyl)pyridine: A new dye for DSSCs

O. Dayan[1*], A. Bilici[1], Z. Şerbetci[2],F. Yakuphanoğlu[3] and N.Ozdemir[4]

[1]*Department of Chemistry, Faculty of Sciences and Arts, Çanakkale Onsekiz Mart University, Çanakkale, Turkey*
[2] *Department of Chemistry, Faculty of Sciences and Arts, Bingol University, Bingol, Turkey*
[3]*Firat University, Faculty of Arts and Sciences, Department of Physics, Elazig, Turkey*
[4]*19 Mayıs University, Samsun, Turkey*

*Corresponding Author : osmandayan@comu.edu.tr

**Abstract—**Dye sensitized solar cells (DSSCs) have been under extensive research because of low-cost manufacturing process. In this work, we prepared a new ruthenium dye from the reaction of 2,6-bis(2-benzimidazolyl) pyridine and ruthenium(III)chloride in the presence of sodium borohydride. This material characterized with different techniques such as XRD, SEM/EDX, TEM, IR and UV-vis. Additionally, material was tested in DSSCs as dye.




**Acknowledgement** .:
This research has been supported by The Scientific and Technical Research Council of Turkey (TUBİTAK) (Project No: 114Z439).

# Electrical and optical study of PLED & OLEDS structures.

Bouanati Sidi Mohammed [1*], N.E. Chabane Sari [2], Mostefa Kara Selma [3]

*Research Unit of Materials and Renewable Energies URMER, Abou bakr belkaid University, Tlemcen, Algeria*

*Corresponding Author : bouanatidz@yahoo.fr

**Abstract—**Organic electronics mean the domain where the components and circuits are made of organic materials. This new electronic help to realize an electronics and optoelectronics devices on flexible substrates.In recent years, organic materials replace conventional semiconductors in many electronic components such as OLEDs, OFETs and OPV. It is well known that organic light emitting diodes OLEDs have many advantages in comparison with inorganic LED such as low price of manufacturing, large area of electroluminescent display and emit uniformly and require less power [1].In OLEDs both operating voltage and luminance efficiency of the devices strongly depends on effective charge injection from the electrodes to the organic medium and charge transport in the organic materials. In general, to achieve the lowest possible voltage it is necessary to have Ohmic interfaces between the organic layers and the charge-injecting contacts and to maximize the drift mobility of both types of carriers [2].The aim of this paper is to modeling monolayer PLEDs and OLED made with small molecules for comparing the electrical and optical characteristics.The simulation structures used in this paper are a three layer device; typically consisting of the poly(2-methoxy-5(2'-ethyl)hexoxy-henylenevinylene) (MEH-PPV) polymer or *tris(8- hydroxyquinolinato)aluminum (*Alq3) sandwiched between an anode with a high work function, usually an indium tin oxide (ITO) substrate, and a cathode with a relatively low work function, such as Al. Electrons will then be injected from the cathode and recombine with electron holes injected from anode, emitting light.We choose MEH-PPV because of its solubility in common organic solvents, in conjunction with a low operating voltage for light emission and relatively high conversion efficiency and Alq3 because it is one of the most important host materials used in OLEDs [3]. In this simulations, the Poole-Frenkel- like mobility model and the Langevin bimolecular recombination model have been used as the transport and recombination mechanism. These models are enabled in ATLAS -SILVACO [4]. The influence of doping and thickness on I(V) characteristics and luminescence, are reported .

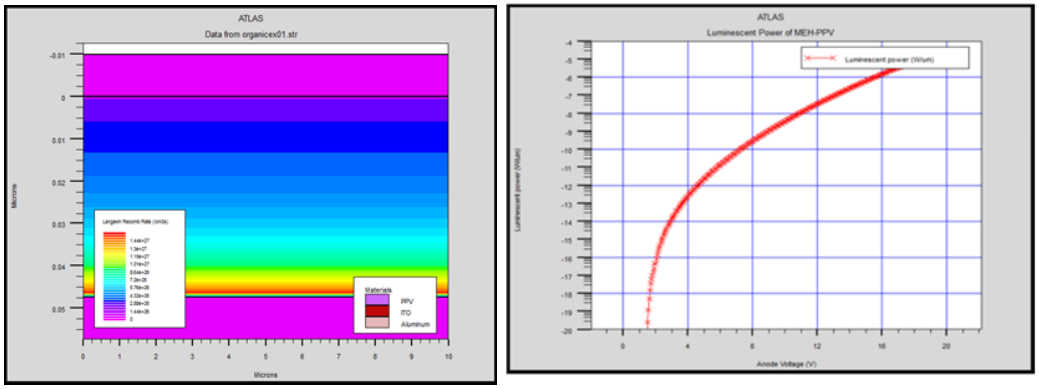



**Figure-2.** Luminiscence of MEH-PPV simulation with Silvaco

## References:

*[1]Morten Arnfeldt hygum, characterisation of semiconducting polymers and fabrication of OLEDs.*
*[2] J. Chan, Device optimization of tris-aluminum (Alq3) based bilayer organic light emitting diode structures.*
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*[4] Simulating the Device Characteristics of MEH-PPV Polymer Light Emitting Diodes Using ATLAS.*

# Efficient Perovskite Solar Cells With Additives in Various Concentrations Using Double Layer Architecture

F.M.Coşkun[1*], F. Değirmenci[2], M.E.Köse[2] and Abdülmecit TÜRÜT[1]

[1]*Department of Engineering Physics, İstanbul Medeniyet University, Faculty of Science, İstanbul, Turkey*
[2]*Materials Institute, Marmara Research Center TÜBİTAK, Gebze Kocaeli, Turkey*

*Corresponding Author : fatih.coskun@medeniyet.edu.tr

**Abstract—**Efficient Perovskite photovoltaics with metylamoniumchloride (MACL) and amoniumchloride (ACL) are presented and reported in this study. The basic materails such as Metylamoniumiodide (MAI) and the additives were synthesized by our group. The devices, which have a structure of Al/BCP/$C_{60}$/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/ITO were fabricated by double-layer method in a glove-box and characterized by a solar simulator which has a lamb of 100 mW/cm$^2$ intensity. The light-absorbing perovskite layer without any additive does not work efficiently. However when $NH_4Cl$ and $CH_3NH_3Cl$ additives are used in the active area, they show high crystallinity and better morphology[1]. In our study we performed the fabrication by spinning in two step and annealling processes. Also we used different concentrations of additives while preparing the Metylamoniumiodide solution and among the various percentages we got the highest efficiency of 6,47 in $CH_3NH_3I$ with $CH_3NH_3Cl$ (10% wt). In an other study with $CH_3NH_3Cl$, we obtained a current density ($J_{sc}$) of 21,15 mA/cm$^2$, which is the same as the current density records in perovskite solar cells.

**References:**

*[1] Zuo, C. and Ding, L., 2014. An 80.11% FF record achieved for perovskite solar cells by using the $NH_4Cl$ additive, Nanoscale Comm.6, 9935-9938.*

# Controlling the electrical characteristics of Au/n-Si structure with biphenyl-CoPc and OHSubsZnPc and without interfacial layer

Nalan Baraz[1*], İbrahim Yücedağ[2], Ahmet Demir[3], Gülçin Ersöz[2], Şemsettin Altındal[3], Mehmet Kandaz[5]

[1]*Department of Electric and Energy, Gölyaka Vocational High School,Düzce University, 81800, Düzce, Turkey*
[2]*Department of Computer Engineering, Technology Faculty, Düzce University, 81620, Düzce, Turkey*
[3]*Department of Physics, Faculty of Sciences, Düzce University, 81620, Düzce, Turkey*
[4]*Department of Physics, Faculty of Sciences, Gazi University, 06500, Ankara, Turkey*
[5]*Chemistry Education Department, Faculty of Sciences, Sakarya University, 54140, Sakarya, Turkey*

*Corresponding Author :nalanbaraz@duzce.edu.tr

**Abstract—**In this study, our main goal is fabricated with and without interfacial layer of Au/n-Si Schottky barrier diodes (SBDs) to explain whether or not the interfacial layer is effective on performance in respect to zero bias barrier height ($\Phi_{B0}$), ideality factor (n), reverse saturation current ($I_0$), rectifying rate (RR), series and shunt resistances ($R_s$ and $R_{sh}$) at room temperature. The forward bias semi-logarithmic I-V plots have linear range in the large bias voltage. The $I_o$, n and $\Phi_{B0}$ values were found from the intercept and slope of these plots for each sample and compared each other. The energy density distribution profile of interface states ($N_{ss}$) was also found for each sample by taking into account the voltage dependent effective barrier height ($\Phi_e$), ideality factor and $R_s$. In addition, the voltage dependent $N_{ss}$ and resistance ($R_i$) was determined from the low-high frequency capacitance method and Ohm's Law, respectively. The concave curvature in the forward bias I-V plots were attributed to only the existence of $R_s$, but the high value of n was attributed both $N_{ss}$ and native or deposited interfacial layer. Experimental results confirmed that especially the OHSubsZnPc interfacial layer is considerably increase of the diode performance.

# POSTER PRESENTATIONS

# Synthesis of chalcone Based Hydrogen Bonded Side Chain Liquid Crystalline Polymer

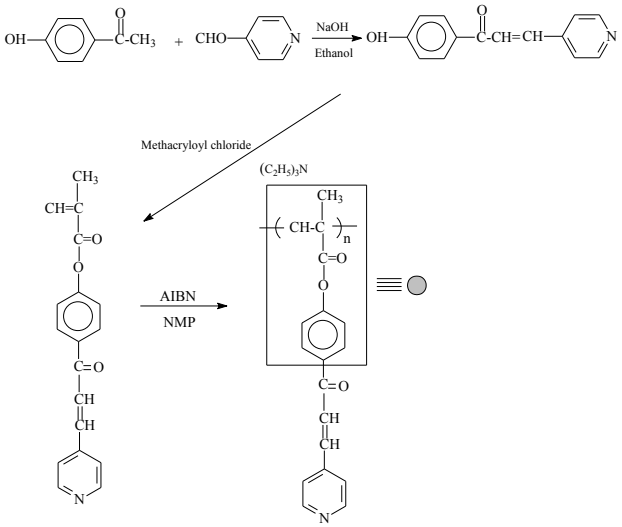
Burak Korkmaz[1], Yesim Gursel[1], B.Filiz Senkal[1*], Mustafa Okutan[2]

[1]*Istanbul Technical University, Department of Chemistry, Maslak, İstanbul, Turkey*
[2]*Yıldız Technical University, Department of Physics, Davutpaşa, Istanbul, Turkey*

*Corresponding Author : bsenkal@itu.edu.tr

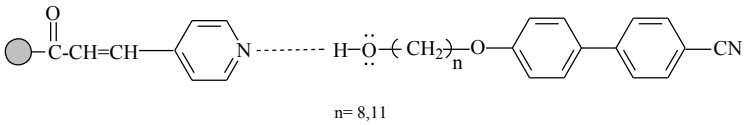
**Abstract—**α,β unsaturated carbonyl group is a chalcone group and it has excellent photoreactivity. The technological applications of photosensitive polymers are applied in the fields of microlithography, photoconductors, nonlinear optical materials, energy exchange materials, liquid crystalline display etc. [1].The hydrogen-bonding interaction is one of the most important and widely used non-covalent interactions in the design and construction of functional materials because biopolymers such as nucleic acids, polypeptide, and cellulose have hydrogen bonding groups. The formation and dissociation of hydrogen bonds for these polymers play key roles in biological processes [2].

A new chalcone based polymer was prepared starting from synthesis of chalcone based monomer reaction with 3-aminoacetophenone and 4-carboxypyridine. This compound was reacted with methacryloyl chloride to obtain chalcone based monomer (scheme 1).




**Scheme 1.**Preaparation of the chalcone based polymer

The monomer was polymerized free radical polymerization method Chalcone based side chain liquid crystalline polymer (HB-PLC) was prepared from pyridine group in the polymer as a hydrogen bond acceptor and 11-(4-cyanobiphenyl-4'-oxy) undekan-1-ol (LC11) by molecular self-assembly processes via hydrogen bond formation between nitrogen of PVP and hydroxyl group of the LC11(scheme 2).




**Scheme2.** Preparation of side chain liquid crystal polymer

The formation of H-bond was confirmed by using FTIR spectroscopy. The liquid crystalline behavior of the HB-PLC was investigated by differential scanning calorimeter (DSC) and polarized optical microscopy (POM).

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*[2] X. Han, S. Zhang, R. A. Shanks, D. Pavel, Reactive & Functional Polymers 68 1097–1102*

# Electrical properties of Au/n-6H-SiC/Au Schottky Barrier Diode in wide temperature range

Tamer Güzel, Metin Özer*

*Physics Department, Faculty of Sciences, Gazi University, Beşevler 06500 Ankara Turkey*

*Corresponding Author : metinoz@gazi.edu.tr

**Abstract—**Metal-semiconductor (MS) structures are important research tools in the characterization of semiconductor materials. The fabrication of these structures play an crucial role in constructing many useful devices in electronic technology. The performance and reliability of the MS device is influenced by the quality of the contact beetween metal and the semiconductor. The Schottky barrier height (SBH) is very important in point of the charge carrier transport across the MS interface. Under different conditions of bias and temperature, the barrier height and ideality factor tend to vary as were observed by many researchers. The performance of the MS devices are also depent on the formation of an insulative layer, which can strongly influence the device parameters. Silicon carbide (SiC) of the 4H or 6H polytype has received much attention the past few years, when bulk material became available in quantity. The main advantage over silicon is the higher critical breakdown field, about 8 to 10 times that of silicon, which allows the depletion region of the blocking pn junction to be the same factor thinner and the doping concentration in the drift region to be 60 to 100 times higher. This allows devices of both higher blocking voltage and lower on-resistance to be fabricated. SiC also has the advantage of a high heat conductivity, three times that of silicon, and the wide bandgap of around 3 eV assures that junction leakage currents are low even at temperatures around 300$^{o}$C.

In this study, the temperature dependent current-voltage(I-V) characteristics of Au/6H-SiC/Au Schottky barrier diode is investigated and analyzed in the temprerature range of 80-400K. The barrier height($\Phi_B$) and the ideality factor(n) are found 0.682 eV and 2.1 at room temperature, respectively and it has been observed that, while the $\Phi_b$ decreases, the n increases with the degreasing temperature. The barrier height and ideality factor derived by using thermionic emission theory are found to be strongly temperature dependent.

# Synthesis and investigation of aggregation and fluorescence behaviors of monophthalocyanines with four imidazoles and N-alkylated imidazoles

Ebru Yabaş*

*Chemistry Department, Cumhuriyet University, Sivas, 58140, Turkey*

*Corresponding Author : eyabas@cumhuriyet.edu.tr

**Abstract—**Phthalocyanines have been intensively investigated in especially health areas due to the properties such as used as photosensitizers in photodynamic cancer therapy [1-3] and antioxidant activity [4,5].Phthalocyanines with four imidazoles (2, 3, 4) and N-alkylated imidazoles (2a, 3a, 4a) have been synthesized and characterized by elemental analysis and $^1$H-NMR, UV-Vis, IR spectra. Aggregation behaviors of these compounds have been investigated in different solvents (THF, $CHCl_3$, $CH_2Cl_2$, MeOH, DMF and DMSO) and different concentrations in DMF ($10x10^{-6}$, $8x10^{-6}$, $6x10^{-6}$, $4x10^{-6}$, $2x10^{-6}$ M). There is no aggregation of the synthesized phthalocyanines. Fluorescence behaviors of these compounds were also studied.

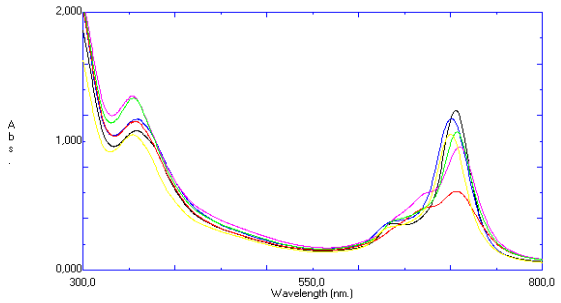



**Figure-1:** UV-Vis spectrum of 4a in DMSO (—), DMF (—), THF (—), $CHCl_3$ (—), $CH_2Cl_2$ (—), MeOH (—).

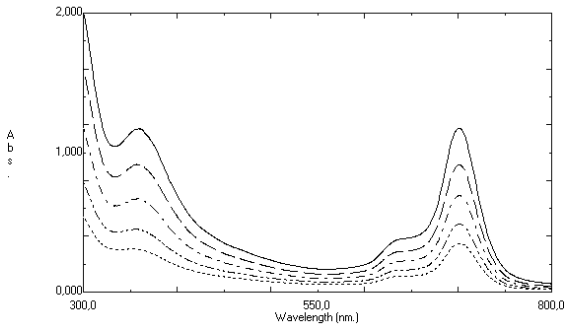
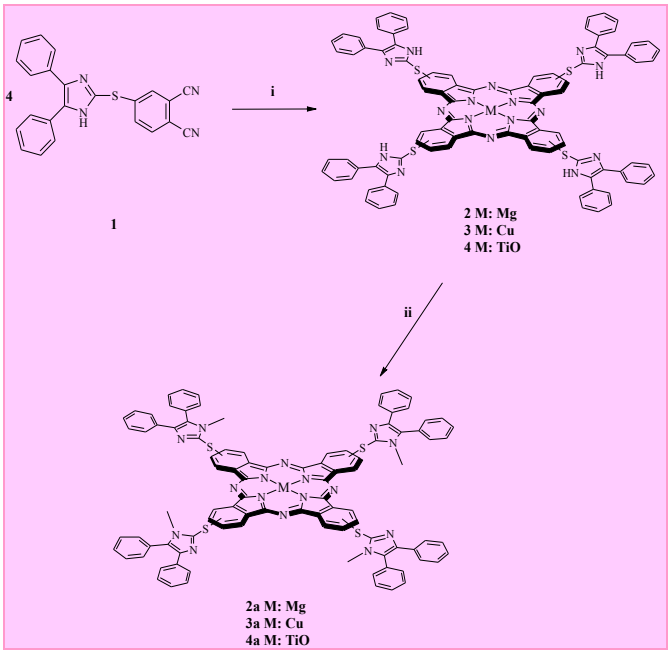



**Figure-2:** UV-Vis spectrum of 4a in different concentrations ($10x10^{-6}$, $8x10^{-6}$, $6x10^{-6}$, $4x10^{-6}$, $2x10^{-6}$ M).




**Scheme-1:** Synthesis of phthalocyanine compounds (i) Metal salts, DBU, DMF; (ii) $CH_3I$, THF.

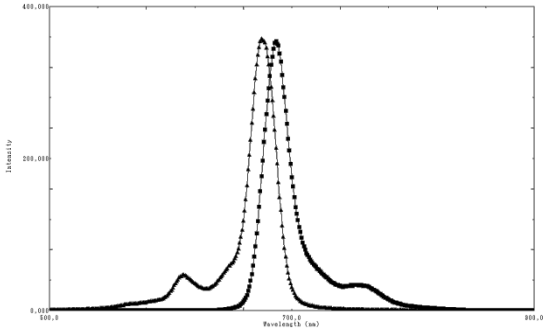


**Figure-3:** Excitation (■) and Emission (▲ ) spectrum of 2.

## References :

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*[2] J.T.F. Lau et al., Chem. Commun., 47, 9657 (2011).*
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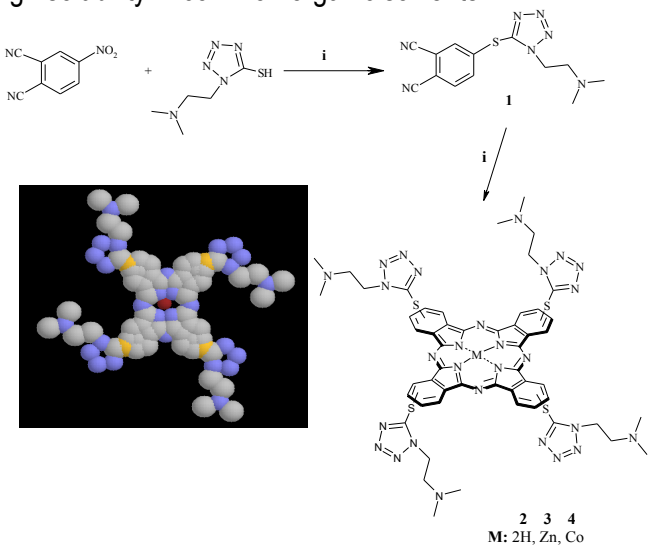
# Synthesis and characterization of 1-[2-(dimethylamino)ethyl]-1H-tetrazole substituted monophthalocyanines

Ebru Yabaş*

*Chemistry Department, Cumhuriyet University, Sivas, 58140, Turkey*

*Corresponding Author : eyabas@cumhuriyet.edu.tr

**Abstract—**1-[2-(dimethylamino)ethyl]-1H-tetrazole substituted phthalonitrile 1 has been prepared by the reaction of 4-nitrophthalonitrile and 1-[2-(dimetilamino)etil]-1H-tetrazol-5-tiyol in DMSO in the presence of $K_2CO_3$. Metal-free phthalocyanine 2 and metallophthalocyanines 3 and 4 has been synthesized by tetramerization of compound 1. The new compounds were obtained in sufficient purity after successive washing with different solvents and were characterized by elemental analysis and $^1$H-NMR, $^{13}$C-NMR, UV-Vis, IR spectra. The synthesized compounds have been showed high solubility in common organic solvents.




**Scheme-1:** Synthesis of phthalocyanine compounds.

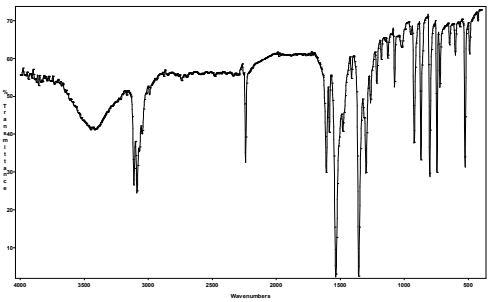


**Figure-1:** IR spectrum of compound 1.

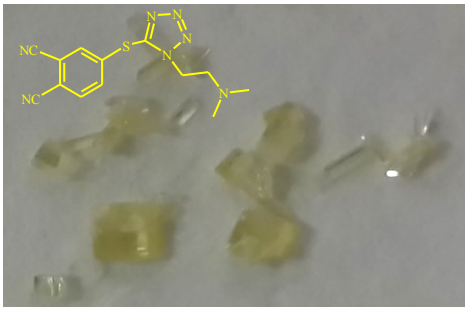


**Figure-2:** Crystals of compound 1.

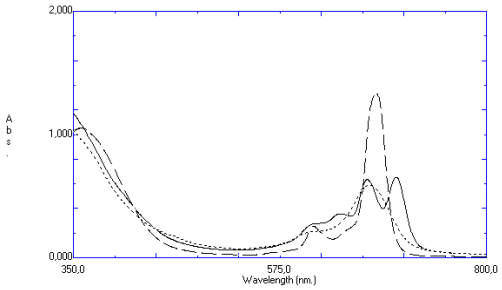



**Figure-3:** UV-Vis spectrum of compounds 2, 3 and 4.

## References:

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# Optoelectronic properties of Cr doped ZnO thin films

Osman Gürbüz[1]* ,Sadık Güner [2] and İsmail Kurt [2]

[1]*Physics Department, Yıldız Technical University, İstanbul, Turkey*
[2]*Physics Department, Fatih University, İstanbul, Turkey*

*Corresponding Author: osmangurbuzytu@gmail.com

**Abstract—**Wide band gap II–VI semiconductors have been the focus of interest of many research groups during the past few years due to the possibility of their applications in light-emitting diodes (LEDs), sensors and laser diodes. Among the II-VI functional semiconductor materials, zinc oxide (ZnO) has attracted significant interest because of its wide band gap, large exciton binding energy, high chemical stability, and environment friendly applications [1]. Due to their catalytic, optical, electrical, optoelectronic, gas sensing,Piezoelectric, and photo-electrochemical properties, ZnO is not only attractive for fundamental research but also for practical applications [2]. The doping by various metal atoms introduces new magnetic, optical, electronic, photo-physical, or chemical properties to this semiconductor, which has further increased their contribution in the research areas such as spintronics, optoelectronics, quantum computing, photocatalysis, and luminescent materials [3]. Apart from the various optical and optoelectronic applications, ZnO is also used widely as a cosmetic and antibiotic material. The effect of Cr doping on the structural and optoelectronic properties of Cr:ZnO thin films were investigated. The elemental composition of virgin and doped films was determined by Inca model Energy Dispersive X-ray Spectroscopy (EDS) system. EDS spectra confirmed the presence of Zn, O and Cr in near stoichiometry (Figure 1 and Table-I).

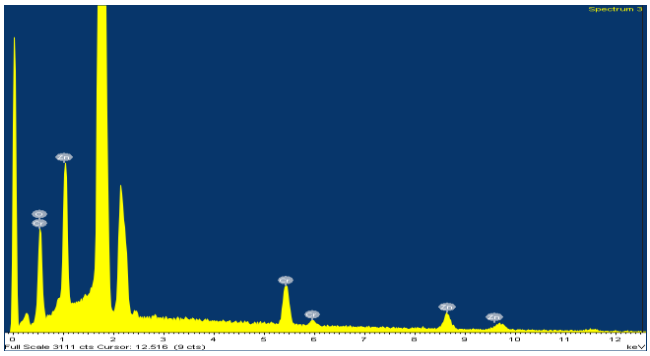

**Figure -1:** EDS spectrum recorded from ZnO:Cr-3. It includes 13.10 at. % Cr.

| Sample Name | Cr at. % | ZnO at. % | Ar (sccm) | Temperature (⁰C) |
|---|---|---|---|---|
| ZnO | 0 | 100 | 15 | 27 |

| | | | | |
|---|---|---|---|---|
| CrZnO-1 | 10.74 | 89.26 | 15 | 27 |
| CrZnO-2 | 11.67 | 88.33 | 15 | 27 |
| CrZnO-3 | 13.10 | 86.90 | 15 | 27 |
| CrZnO-4 | 17.88 | 82.12 | 15 | 27 |
| CrZnO-5 | 21.96 | 78.04 | 15 | 27 |

**Table-I** Cr and ZnO concentration rates, gas pressure, and substrate temperature of fabricated ZnO:Cr films.

The crystal structure analyses were carried out by Rigaku SmartLab diffractometer that uses CuKα radiation (λ = 1.5406˚A). All measurements were performed by using the same input parameters, such as 2θ range of 20–60◦. Further, it is observed that the doped films show a preferential orientation along the c-axis (100), which is perpendicular to the substrate. XRD patterns revealed that particles of pure and CrZnO-1 samples were crystallized in single phase rutile type hexagonal crystal structure of ZnO, the other samples weren't crystallized. The peak positions with Cr concentration shifted to higher 2θ values and highly doped Cr concentration peaks were decreased and destroyed as depicted Figure-2.

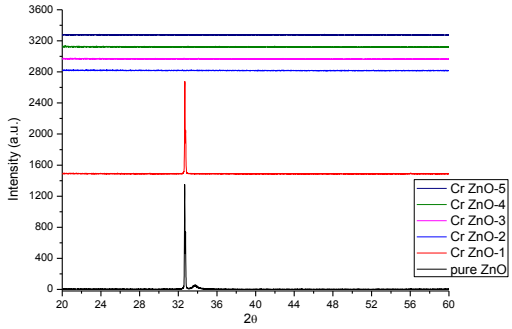


**Figure -2:** θ–2θ X-ray measurements of ZnO and all ZnO:Cr films on silica substrates

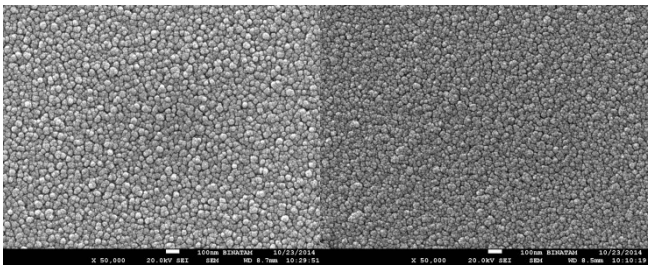

**Figure -3:** SEM micrographs belong to (a) ZnO: Cr-1 (13.10 at. % Cr), (b) ZnO: Cr-5 (21.96 at. % Cr)

The surface morphology of the films was observed by Jeol 7001 scanning electron microscope (SEM). As shown Figure-3, SEM studies indicated that the particle size is in the range of 18–25 nm.

Optical properties of the films were studied by transmittance measurements using a UV–Vis spectrophotometer. Figure 4 show that the analysis of the optical transmittance spectra indicated that the transmittance edge of the bulk ZnO film decreased upon Cr deposition.

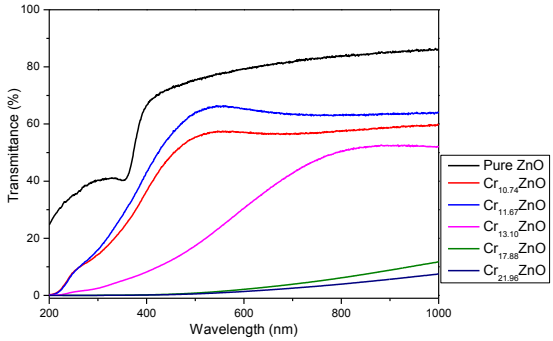


**Figure- 4:** Absorbance spectra of ZnO and all ZnO:Cr films deposited at room temperature.

In I–V studies, we conducted in-plane bulk resistivity measurements by applying the FPP method. Cr-doping was found to reduce the rectifying behavior in the Cr: ZnO which is useful for field effect transistor (FET) and solar cell applications. With these excellent properties, Cr-doped ZnO can be used in nanopiezoelectronics, charge storage and ferroelectric applications.There are so many literatures reported on structural and magnetic properties of Cr doped ZnO nanostructures [4–7]. But only few detailed and comprehensive informative literatures reported about the optical and dielectric properties of the Cr doped ZnO nanoparticles at room temperature. Therefore, in this study, a detailed study of the optoelectronic properties of ZnO: Cr thin films as a function of Cr concentration are reported. Structural and optoelectronic properties of the ZnO thin films were investigated using scanning electron microscopy, energy dispersive spectroscopy, X-ray diffraction, and current–voltage characteristics.

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# Magnetic Properties of Peripheral and Nonperipheral Alkyl-thia Substitue Phthalocyanines

Tülin Ateş [1*], Sibel Tokdemir Öztürk [2], Osman Gürbüz[1] and Yusuf Yerli [1]

[1] *Physics Department, Yildiz Technical University, Istanbul, Turkey*
[2]*Physics Department, Gebze Technical University, Istanbul, Turkey*

*Corresponding Author: tulinates@hotmail.com.tr

**Abstract—**Phthalocyanines (Pcs) have been studied widely because of their importance in application. Their optical and electronic properties have been exploited in various applications for example pigments in paints and printing inks, infrared security devices, information storage and computer disk writing, in photodynamic therapy of cancer. (1-3). Many of these applications are based on the magnetic and electrical properties of these materials, and detailed understanding of the same requires an accurate knowledge of molecular structure. The rich coordination chemistry of phthalocyanines, gave the researchers the opportunity to find special products, which provide some particular desired properties. The metal ions that are located in the center and peripheral or non-peripheral substituents are two important variables. The opportunity of locating several different metal ions at the center, together with unlimited number and types of side groups, increases the number of new and interesting product types. Phthalocyanine molecule has a square planar structure as is illustrated in Figure 1. Metallophthalocyanine (MPc) complexes consist of a Pc ring that incorporates a transition metal ion in its center. In Figure 1 (a) and (b) peripheral and non-peripheral phthalocyanine is shown, respectively. We have used $Cu^{2+}$ and $Co^{2+}$ ions as metal center.

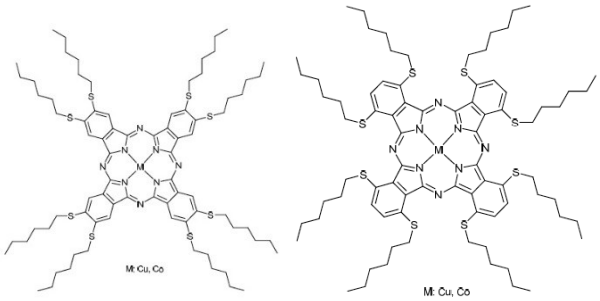


**Figure-1:** Scheme of the chemical structure of metallophthalocyanine molecules a) peripheral b)non-peripheral positions.

In this study, first phthalocyanine molecules were synthesized which include copper and cobalt at peripheral and non-peripheral positions. After then, for each molecule, magnetization measurements were done by using VSM (vibration sample magnetometer) when the magnetic field intensity was constant. ESR (electron spin resonance) measurements were done at room temperature.

As a result of VSM measurements, for each molecule shows Curie-Weiss behavior, and Curie and Weiss constants are calculated from fit of experimental data. It is observed that non-peripheral copper phthalocyanine structure has TIP (temperature independent paramagnetism)

and weak antiferromagnetic intermolecular interaction is identified between metal centers of these molecules. In peripheral copper phthalocyanine structure, diamagnetic contribution and weak ferromagnetic intermolecular interaction between metal centers of these molecules are observed.Finally, type of the metal and position of substituent group affects magnetic properties of phthalocyanine molecules.

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# *Helicobacter pylori* infections among children in developed and developing countries

Gokben Ozbey[1*] Hanafiah Alfizah [2]

[1] *Vocational School of Health Services, Firat University, 23119, Elazig, Turkey*
[2] *Department of Medical Microbiology and Immunology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Cheras, Kuala Lumpur, Malaysia*

*Corresponding author: gokben.ozbey@yahoo.com

**Abstract—***Helicobacter pylori* infection is a global public health problem causing gastrointestinal diseases in children, especially in developing countries. This review article aims to determine the gaps in the knowledge of the epidemiology and diagnostic tests of the *H. pylori* infection among children in developed and developing countries. It is necessary to carry out future studies to develop new technologies including diagnostic tests for detection of *H. pylori* infection among children.

# Prevalence of *Helicobacter pylori* in children in eastern Turkey and molecular typing of isolates

Gokben Ozbey [1*], Yasar Dogan [2], Kaan Demiroren [3] and Ibrahim Hanifi Ozercan [4]

[1] *Vocational School of Health Services, Firat University, Elazig, Turkey*
[2] *Department of Pediatric Gastroenterology, Faculty of Medicine, Firat University, Elazig, Turkey*
[3] *Department of Pediatric Gastroenterology, Dursun Odabaş Medical Center, Yüzüncü Yıl University, Van, Turkey*
[4] *Department of Pathology, Faculty of Medicine, Firat University, Elazig, Turkey*

*Corresponding author: gokben.ozbey@yahoo.com

**Abstract—**The aims of this study were to investigate *Helicobacter pylori* via culture, polymerase chain reaction and histopathological diagnosis in 101 children ranging in age from 4 to 18 years and to determine the correlation among restriction fragment length polymorphism types and clinical outcome. *Helicobacter pylori* was detected in 30.7% (31 of 101), 66.3% (67 of 101) and 63.2% (60 of 95) of children by culture method, PCR and histological examination, respectively. *Helicobacter pylori* isolates with RFLP types I and III showed the most common isolates infected children with antral nodularity. However, RFLP types II and IV were the least identified types. Furthermore, all isolates from peptic ulcer patients were belong to type III. Although our results show a high prevalence of *H. pylori* infections in the pediatric population in eastern Turkey, no correlation was identified between *H. pylori* infection with antral nodularity and recurring abdominal pain. This study showed low genetic diversity among *H. pylori* isolates from children and no correlation among RFLP types and antral nodularity ($P$>0.05).

**Key words:** children, culture, *Helicobacter pylori*, PCR-RFLP.

# Dielectric properties of POLYTHIOPHENE/COPPER (II) ACETYLACETONATE composites

Seda Erdönmez [1*], Ersel Özkazanç [2], Osman Gürbüz[1]

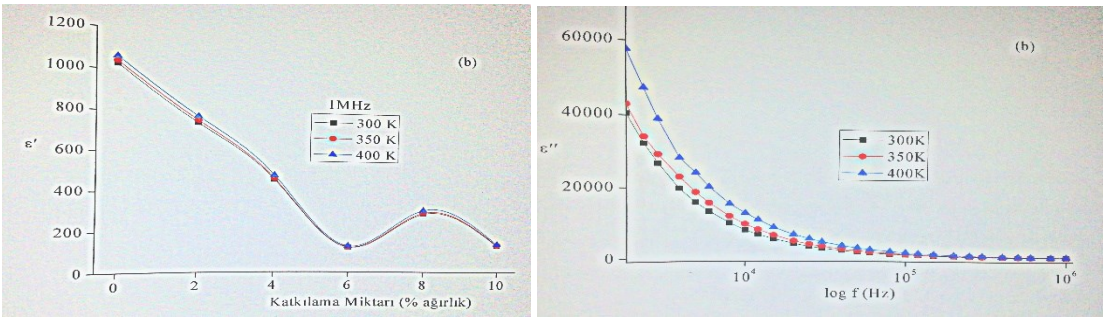
[1] *Physics Department, Yıldız Technical University, İstanbul, Turkey*
[2]*Physics Department, Kocaeli University, Kocaeli,, Turkey*

*Corresponding Author: sedaerdonmez@gmail.com.tr

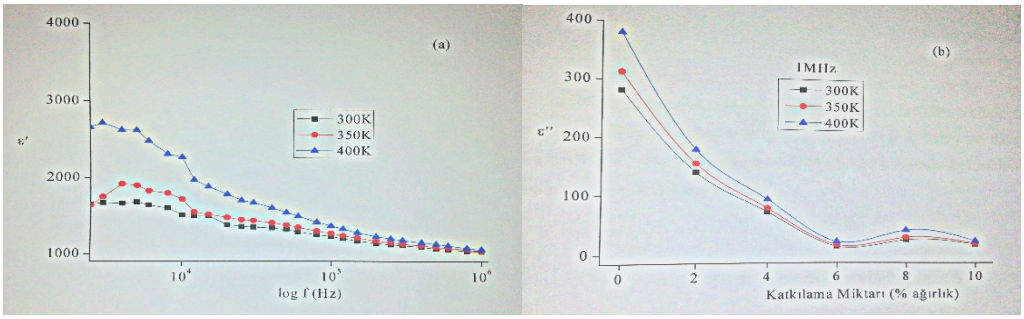
**Abstract—**In this study, various amounts of copper (II) acetylacetonate (Cu (acac) 2) salt were doped onto chemically synthesized polythiophene (PT) by using again chemical polymerization method. Dielectric properties were investigated by LCR meter measurements depending on temperature. The dielectric properties of solid materials depend on frequency of applied electric field, temperature, and other parameters. In present study, we investigated our results with frequency and temperature. The dielectric constant can be described by expressing the relative dielectric constant as a complex quantity made up of a real part and an imaginary part, i.e.,

$$\varepsilon^* = \varepsilon' - i\varepsilon'' \quad (1)$$

where $\varepsilon'$ and $\varepsilon''$ are the real and imaginary part of dielectric constant, signifying the amount of energy stored in a dielectric material as polarization and the dissipated energy respectively under applying an electric field. The dielectric properties of investigated via usually dielectric constant ($\varepsilon^* = \varepsilon' - i\varepsilon''$) with real ($\varepsilon'$) and imaginary ($\varepsilon''$). In our studies, we get various results, depends on experimental and methods for synthesized the morphology of PT. Therefore, we investigated the dielectric properties of pure PT which depends on temperature and frequency.




The Figure 1 and 2 show that the real and imaginary parts were shift with high temperature, this is already the characteristic of polymer. Also, at the high frequency the total dipole moments were decreased. As depicted Figure 3 and 4, the real and imaginary parts were changed with doped Cu (acac) $_2$ into PT. The real part with doping was decreased either high frequency or low frequency. However, imaginary part was not changed as real part.




It has real part ($\varepsilon'$) that determines the charge storage ability and an imaginary part ($\varepsilon''$) that determines the energy losses in material as a result of polarization mechanism. Real part ($\varepsilon''$) represents a relation b/w AC signal transmission speed and dielectric material's capacitance. Imaginary part determines energy power dissipation per unit volume as heat from an AC signal by $E^2\omega\varepsilon_0\varepsilon''$.

$$\varepsilon' = \varepsilon/\varepsilon_0 \qquad (2)$$

In summary, we have successfully synthesized the polythiophene (PT) by using again chemical polymerization method. The dielectric constant ($\varepsilon'$ and $\varepsilon''$) and dielectric loss (tanδ) decreases with increase in frequency and also dopant concentration. The ac conductivity also shows the frequency and composition dependent behavior. It increases with the increase in frequency and decreases with dopant concentration.

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# Frequency and voltage dependent profile of dielectric properties, electric modulus and ac electrical conductivity in the MS structure with GO-doped PBCoO calcined interfacial layer at room temperature

A. Kaya [1*], S. Demirezen[2], Ş. Altındal [2], İ Uslu[3]

[1] *Department of Opticianry, Vocational school of Medical sciences, Turgut Özal University, Ankara, TURKEY*
[2]*Department of Physics, Faculty of Sciences, Gazi University, Ankara, TURKEY*
[3]*Department of Chemistry, Faculty of Science and Arts, Gazi University, Ankara, Turkey*

*Corresponding Author:ahmetkaya0107@hotmail.com

**Abstract—**In this study, Graphene oxide-doped praseodymium barium cobalt oxide nanoceramic interfacial layer was sandwiched between Au and n-Si. The frequency and voltage dependence of dielectric constant (ε'), dielectric loss (ε''), loss tangent (tanδ), the real and imaginary parts of electric modulus (M' and M'') and ac electrical conductivity (σac) of GO-doped GO-doped PBCoO calcined structures have been investigated in detail by using experimental voltage dependent capacitance (C-V) and condunctance (G-V) measurements in the wide frequency range of 2 kHz - 2 MHz at room temperature. These parameters were found quite sensitive to frequency and applied bias voltage, especially at low frequencies. These changes in dielectric parameters can be attributed to the interfacial layer, interface polarization and a continuous density distribution of interface states and their relaxation time at metal/semiconductor interface. It can be concluded that the interface polarization can occur more easily at low frequencies with the number of interface states located at the metal/semiconductor interface. The decrease in ε' and ε'' with increasing frequency indicated that the interfacial dipoles have less time to orient themselves in the direction of the alternate field. While the value of M' increase with increasing frequency and M'' shows a peak and the peak position shifts to higher frequency with increasing applied voltage. The ln(σac) vs ln(ω) plot of the structure has three linear regions with different slopes. Such behavior indicated that there are three different conduction mechanisms in the GO-doped PBCoO calcined structure at room temperature. It has found that the values of ε', ε''and tanδ values decrease while an increase the values of σac, M' and M''. Such behavior of peak can be attributed to the particular distribution of interface states located at interface and interfacial polarization. It can be concluded that the interfacial polarization and the charge at interface can be easily follow ac signal at low frequencies.

**Keywords:** MS structure with GO-doped PBCoO calcined, dielectric properties, frequency and voltage dependence

# Pressure-Induced Structural Phase Transformation in Antiferromagnetic $NiF_2$

C. Kurkcu[1,2*], H. Ozturk[1], and Z. Merdan[3]

[1]*Department of Physics, Faculty of Arts and Sciences, Ahi Evran University, Kirsehir, 40100, Turkey*
[2]*Department of Physics, Institute of Sciences, Gazi University, Ankara, 06500, Turkey*
[3]*Department of Physics, Faculty of Sciences, Gazi University, Ankara, 06500, Turkey*

*Corresponding Author: cihan.kurkcu@gazi.edu.tr, ckurkcu@ahievan.edu.tr

**Abstract—**We have studied the structural properties of the antiferromagnetic $NiF_2$ in tetragonal structure with $P4_2/mnm$ symmetry using density functional theory (DFT) under rapid hydrostatic pressure up to 200 GPa. The $AF_2$-type compounds crystallize in rutile-type structure at ambient conditions. The $NiF_2$ compound undergoes a phase transformation from the tetragonal structure to orthorhombic structure with Pnnm symmetry at 152 GPa. This phase change is also studied by total energy and enthalpy calculations. ecause of the novel phase transitions and geophysical importance, the difluoride compounds have been studied under the influence of temperature and pressure [1-9]. The $NiF_2$ compound crystallizes in a tetragonal rutile-type structure ($P4_2/mnm$,Z=2) at ambient conditions. This compound is known as antiferromagnetic at 0 K. The high-pressure phase transition in $NiF_2$ was first studied in 1969, by Austin [1] up to 9 GPa. He observed an orthorhombic phase with space group Pnnm for $NiF_2$.

In this study the tetragonal rutile-type structure of $NiF_2$ was firstly equilibrated at zero pressure and pressure was gradually increased up to 200 GPa with an increment of 8 GPa. The structure of $NiF_2$ transforms from rutile-type structure with space group $P4_2/mnm$ to $CaCl_2$-type structure with space group Pnnm at 152 GPa. These structures are depicted in Fig. 1 and their calculated density and porosity data are given in Table 1.

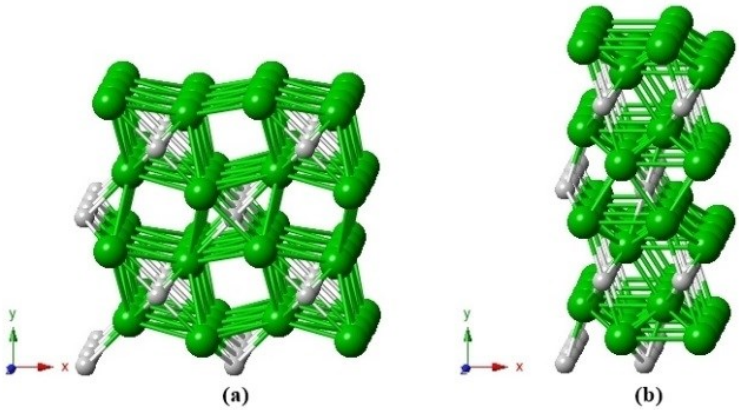


**Figure 1.** (Color on-line) Crystal Structures of $NiF_2$ (a) at zero pressure and (b) at 152 GPa.

**Table I.** The calculated density and porosity data of $P4_2/mnm$ and Pnnm phases of $NiF_2$ compound.

| Phase | Calculated density ($kg/m^3$) | Unit cell Volume ($Å^3$) | Atom density ($atoms/Å^3$) | Filled space ($Å^3$) | Void Space ($Å^3$) |
|---|---|---|---|---|---|
| $P4_2/mnm$ | 2257.4810 | 2257.4810 | 0.0422 | 497.736 | 1778.681 |
| *Pnnm* | 3638.3357 | 1412.4497 | 0.0680 | 480.390 | 932.060 |

The structural properties of the tetragonal $NiF_2$ compound are investigated in the local density approximation of density functional theory with the functional of Ceperley and Adler (CA) [10] using the ab-initio program SIESTA [11]. The self-consistent "norm-conserving" pseudopotentials are generated using the Troullier–Martins scheme [12]. For the Brillouin zone (BZ) integration, we use the Monkhorst–Pack (MP) [13] mesh 6x6x8 for rutile-type structure and 8x10x12 for $CaCl_2$-type structure. The simulation cells consist of 96 atoms with periodic boundary conditions. Pressure was applied via the method of conjugate-gradient to the system and increased with an increment of 8 GPa for $NiF_2$. In order to analyze each minimization step we use the KPLOT program and RGS algorithm [14-15] that give elaborated knowledge about cell parameters, atomic positions and space group of an analyzed structure.

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# Current-Voltage Characteristics of Ag/organic interlayer/*p*-Si sandwich device

Necati Başman[1*] ,Rukiye Uzun[1], Öznur, Arslan[2], İbrahim Erol[2], Güven Çankaya[3], Orhan Uzun[4]

[1] *Electrical and Electronics Engineering, University of Bülent Ecevit, Zonguldak, Turkey*
[2] *Department of Chemistry, University of Afyon Kocatepe, Afyonkarahisar, Turkey*
[3] *Department of Materials Engineering University of Yıldırım Beyazıt, Ankara, Turkey*
[4] *Department of Metallurgical and Materials Engineering University of Bülent Ecevit, Zonguldak, Turkey*

*Corresponding Author: nbasman@gmail.com

**Abstract—**1-[4-(prop-2-yn-1-yloxy)phenyl]ethanone-O-methacryloyloxime (POEMO) is a new methacrylic monomer with side chain alkyne. In this study, Ag/ POEMO/*p*-Si Schottky metal-interlayer-semiconductor (MIS) diode was fabricated and its electrical properties investgated. It was seen that the POEMO organic monomer on the p-Si substrate showed a good rectifying behavior and a sufficient reverse bias saturation. The ideality factor ($n$) and the barrier height ($\Phi_b$) from the I–V characteristics were calculated.

# On the temperature and voltage dependence of electrical and dielectric properties of the Au/$Bi_3Ti_4O_{12}$/n-Si (MFS) structure in the temperature range of 120-380 K

C. Şahin*, P. Durmuş Ş. Altındal

[1] *Physics Department, Gazi University, Ankara,, Turkey*

*Corresponding Author: canansahiin@gmail.com

**Abstract—**Electrical and dielectric properties of metal/ferroelectric/semiconductor (MFS) structure were investigated in detail by using experimental capacitance-voltage (C-V) and conductance-voltage (G/ω-V) measurements at 500 kHz in the temperature range of 120-380 K and voltage range of (-4V)-(+7V). The reverse bias $C^{-2}$-V plots shows a good linear behavior, thus the values of donor concentration atoms ($N_D$) and barrier height ($\Phi_B$(C-V)) were obtained from the slope and intercept of these plots for each temperature, respectively. Whereas $\Phi_B$(C-V) decreases with increasing temperature, $N_D$ exhibits an increasing trend. The negative temperature coefficient of $\Phi_B$(C-V) was found as $-14.5\times10^{-4}$ eV/K and it is close to negative temperature coefficient of forbidden band-gap for Si ($-4.73\times10^{-4}$ eV/K).

The values of dielectric constant (ε'), dielectric loss (ε"), dielectric loss tangent (tan δ), the real and imaginary parts of electric modulus (M' and M"), and the ac electrical conductivity ($\sigma_{ac}$) of the Au/$Bi_3Ti_4O_{12}$/n-Si (MFS) structure were also obtained using the C and G/ω data. These parameters were found to be strong functions of temperature and applied bias voltage. $\sigma_{ac}$ increases almost exponentially with temperature. ln($\sigma_{ac}$)-q/kT plot shows a linear behavior for high forward bias voltage in the temperature range of 280-380 K and then it deviates from linearity at low temperatures. The value of activation energy ($E_a$) for linear region was obtained as 184 meV.

**Keywords:** Au/$Bi_3Ti_4O_{12}$/n-Si (MFS) structure; Electrical and dielectric properties; Temperature and voltage dependence; Activation energy and Arrhenius plot.

# Structural phase transitions in TiC: An *ab initio* molecular dynamics study

Hülya Öztürk[1*] ,Cihan Kürkçü,[1,2] Ebru Karataş,[1] Yusuf Hafızoğlu [1] and Fatma Cüceömeroğlu[1]

[1] *Physics Department, Ahi Evran University, Kırşehir 40100, Turkey*
[2] *Institute of Sciences, Gazi University, Ankara 06500, Turkey*

*Corresponding Author: hozturk@ahievran.edu.tr

**Abstract—**We investigate the pressure-induced phase transition in the TiC using a constant-pressure *ab initio* technique. Two high-pressure phases of TiC are successfully observed through constant pressure simulations. TiC undergoes a phase transformation from the rocksalt structure to a rhombohedral structure at 100 GPa. Another phase transformation from the rhombohedral structure to the triclinic structure occurs at 200 GPa. We also study these phase transformations of TiC from the enthalpy calculations in order to compare the results of this study with the corresponding experimental or theoretical findings.

Carbides of transition metals are very remarkable technological materials owing to their outstanding physical and chemical properties such as wear and corrosion resistance, extreme high melting temperature, electrical and thermal conductivity, extreme hardness and stability. Such exclusive characteristics let for their wide use in cutting tools and wear-resistant parts of miscellaneous mechanisms functioning at high temperatures and pressures. Thus, carbides of transition metals are widely studied both theoretically and experimentally [1–7].

The transition-metal carbides generally crystallize in the rocksalt structure (NaCl). It is interesting that properties interrelated with covalent bonding are found in a set of systems which exhibit a crystal structure normally interrelated with ionic bonding. This blend of properties has made the carbides significant in a wide range of technological applications and the light weight of TiC has made it especially attractive for aerospace applications [8].

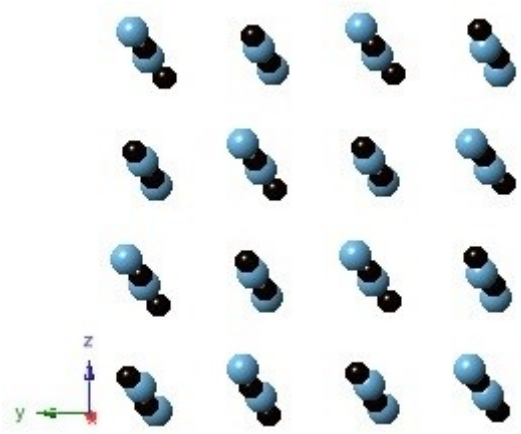


**Figure-1:** Rocksalt structure of TiC relaxed at zero pressure

In this study, the density functional calculations were carried out within the generalized gradient approximation (GGA) [9] using the ab-initio program SIESTA [10]. Conjugate-gradient method was used to apply pressure to the system. The system was relaxed at zero pressure and the obtained rocksalt structure of TiC was shown in Fig.1.

Transition pressures obtained in constant-pressure simulations are generally overvalued. When the restrictive conditions such as deficiency of defect in simulation cells and limited size of these cells are used, such high transition pressures are found. Additionally, the lack of thermal motion in these simulations changes the phase transformation pressures to greater pressures. On the other hand, the thermodynamic theorem does not take into account the thermal motion and the probable occurrence of an activation barrier separating the two structural phases. Consequently, as a next step, we consider the energy-volume calculations to work out the stability of high-pressure phases of TiC.

We have also studied the atomic movements throughout the phase transformations to shed light on the mechanism of phase transitions. Reliable dynamical simulations are required due to the hardships in working out the atomistic motions while accomplishing the experiments. These simulations may clarify the microscopic nature of transformation mechanisms of phases for each applied pressure.

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# Electrical characteristics of GaAs/AlGaAs Structures in the wide Frequency and applied bias voltage ranges at room temperature

M. Gunes[1], B. Sarikavak-Lisesivdin[2*], E. Pesen[1], M. Henini[3], Ş. Altindal[2]

[1] *Department of Materials Engineering, Adana Science and Technology University, Seyhan, Adana , 01180, Turkey*
[2] *Faculty of Science, Department of Physics, Gazi University, Ankara , 06500, Turkey*
[3] *Nottingham Nanotechnology and Nanoscience Center, University of Nottingham, Nottingham, NG7 2RD, UK*

*Corresponding Author: beyzas@gazi.edu.tr

**Abstract—**Electrical characteristics of GaAs/AlGaAs structures have been investigated in the frequency and applied bias voltage range of 7 kHz-700 KHz and (-18 V) - (+16 V), respectively, by using admittance measurements technique which is including various capacitance-voltage (C-V) and conductance-voltage (G/w-V) measurements. The C and G/w values are found a strong function of frequency and voltage. The C-V plots show two peaks which are corresponding to the inversion and accumulation regions. The first peak was attributed to the particular density distribution of surface states/interface states ($N_{ss}$) localized at metal/semiconductor interface. Second peak which is called anomalous peak and its magnitude decreases with increasing frequencies and it can be attributed to the series resistance ($R_s$), $N_{ss}$, and interfacial layer native or deposited. Therefore, the voltage dependent profile of $N_{ss}$ was obtained using the low-high frequency capacitance ($C_{LF}$-$C_{HF}$) technique. $N_{ss}$-V plot shows two distinctive peaks at about -10 V and 0 V, respectively, and $6.7x10^{10}eV^{-1}.cm^{-2}$ and $3.5x10^{12}eV^{-1}.cm^{-2}$ peak values. The $N_{ss}$ value was also obtained using Hill-Coleman technique for each frequency and the value of Nss decreases with increasing frequency. Voltage dependent resistance ($R_i$) profile of the structure was also obtained using Nicollian-Brews technique. The experimental results confirmed that both the values of $N_{ss}$ and $R_s$ are considerably effect on the admittance measurements in the GaAs/AlGaAs structures.

**Keywords:** GaAs/AlGaAs structures; Frequency and voltage dependence; Voltage dependent surface states and series resistance; Forward bias C-V peak.

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# Two diodes model in the forward bias current-voltage (I-V) characteristics of $Al_{0,33}Ga_{0,67}As$/ n-GaAs at room temperature

M. Gunes[1], B. Sarikavak-Lisesivdin[2*], M. Henini[3], Ş. Altindal[2]

[1] *Department of Materials Engineering, Adana Science and Technology University, Seyhan,Adana, 01180, Turkey*
[2]*Physics Department, Gazi University,Faculty of Science, Ankara 06500, Turkey*
[3] Nottingham Nanotechnology and Nanoscience Center, University of Nottingham, Nottingham, NG7 2RD, United Kingdom

*Corresponding Author: beyzas@gazi.edu.tr

**Abstract—**The forward and reverse bias I-V characteristics of the fabricated $Al_{0,33}Ga_{0,67}As$/n-GaAs (311) semi-insulating multi-quantum well (MQW) substrate have been investigated at room temperature. The semi-logarithmic LnI-V plot show double exponential behavior which are corresponding to low and intermediate bias region, respectively. Such behavior of LnI-V plot can be explained two-parallel diode model. For two regions, the main diode parameters such as reverse-saturation current ($I_s$), ideality factor (n), and zero-bias barrier height ($\Phi_{bo}$) were found from the linear part of the LnI-V plots as $7.64x10^{-9}$ A, 4.477, 0.706 eV for region I and $3.411x10^{-12}$ A, 1.679, 0.902 eV for region II, respectively. The double logarithmic forward bias I-V plot was drawn to determine the dominant current mechanism in the whole forward bias region and it shows three distinct linear regions with different slopes that obey $I \alpha V^m$ change, that is, the current is directly proportional to applied bias voltage. The energy density distribution profile of surface states ($N_{ss}$) also extracted from the forward bias I-V data by taking the voltage dependence of effective barrier height ($\Phi_e$) and series resistance ($R_s$) for $Al_{0,33}Ga_{0,67}As$/ n-GaAs diode. The exponential growth of the $N_{ss}$ from midgap toward the top of the valance band is very apparent. Both the values of $R_s$ and shunt resistance ($R_{sh}$) were also obtained from Ohm's Law. The high value of n for region I, was attributed to the particular density distribution of $N_{ss}$ at metal/semiconductor interface and the in-homogeneities of barrier height.

**Keywords:** AlGaAs/GaAs multi Quantum Well; I-V characteristics; surface states; effective barrier height; ideality factor; two-parallel diode model.

# Investigation of Optical Properties of the β-$Si_3N_4$ structure doped with some Group IIIA Elements

P. Narin[1*], E. Kutlu[1], G. Atmaca[1], B. Sarikavak-Lisesivdin[1], S. B. Lisesivdin[1]

[1] *Physics Department, Gazi University, Science Faculty, 06500, Teknikokullar, Ankara, Turkey*

*Corresponding author: polatnarin0@gmail.com

**Abstract—**In this study, effect of In, Al and Ga impurity atoms have been investigated on optical properties of the β-$Si_3N_4$ crystal. These calculations have been investigated by the first principle pseudopotential method using the density functional theory (DFT) with the local density approximation (LDA). Optical properties such as static dielectric constant, refractive index, extinction coefficient, reflectivity and absorption by using real and imaginary parts of dielectric function have been calculated in the lowest energy state of the β-$Si_3N_4$. The change optical properties of β-$Si_3N_4$ have been discussed in details. Change in the anisotropic optical properties can be important in terms of building possible optical devices in future.

**Acknowledgements :**
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# First Principle Calculations of Electrical Properties of Insulator Wurtzite the □-$Si_3N_4$ with the Aluminum, Indium and Gallium Impurities

E.Kutlu[1], P. Narin[1*], G. Atmaca[1], B. Sarikavak Lisesivdin[1], S.B. Lisesivdin[1]

[1] *Physics Department, Gazi University, Science Faculty, Teknikokullar, Ankara, 06500, Turkey*

*Corresponding Author: polatnarin0@gmail.com

**Abstract—**Wurtzite the □-$Si_3N_4$ crystal are usually used to be gate dielectric and surface passivation of GaN-based High Electron Mobility Transistor (HEMTs). In this study, the electrical properties of wurtzite □-$Si_3N_4$ crystal with Al, In and Ga impurities have been investigated using the Density Functional Theory (DFT) with the Local Density Approximation (LDA). Band structure, Density of states (DOS) and Total energy per atoms have been calculated for each the impurity atoms. Results show some impurity inclusions in the crystal induce very deep states with very high densities just at the middle of bandgap. This causes a decrement in the effective bandgap values, which is a highly unwanted behavior for the usage of any passivation or gate dielectric applications.

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This work is supported by the projects TUBITAK under project no: 113F364.

# Conductivity Mechanism of Smectic A Liquid Crystal ENBC

Nimet Yilmaz Canli[1], Alptekin Yildiz[1,2*], Gürkan Karanlık[3], Belkız Bilgin Eran[3], Mustafa Okutan[1]

[1]*Yildiz Technical University, Department of Physics, 34210 Istanbul, Turkey*
[2]*Istanbul Technical University, Department of Physics Engineering, 34469 Istanbul, Turkey*
[3]*Yildiz Technical University, Department of Chemistry, 34210 Istanbul, Turkey*

*Corresponding Author: alptekin.yildiz@itu.edu.tr

**Abstract—**In this study, AC conductivity and electronic properties of the Ethyl-4-(7,7,8,8,9,9,10,10,10-nonafluorodecyloxy) biphenyl-4'-carboxylate (ENBC) have been analyzed by means of dielectric and impedance spectroscopy measurements. The frequency dependence of ac conductivity ($\sigma_{ac}$) of the ENBC has been analyzed by means of frequency exponent parameter, s. It has been revealed that applying magnetic field to the ENBC changes the conductivity mechanism of material. From this point of view, applying magnetic field to the liquid crystal material may be proposed as a new wanted material for electro-magnetic applications.

# Calamitic Liquid Crystals as Additive Materials to the Organic Solar Cells

N. Yilmaz Canli[1*], M. Safak Boroglu[2]

[1]*Yildiz Technical University, Department of Physics, 34210 Istanbul, Turkey*
[2]*Istanbul University, Fac. of Engineering, Chemistry Engineering Department, Istanbul, Turkey*

*Corresponding Author: niyilmaz@yahoo.com

**Abstract—**A bilayer polymer solar cell is showed with the device configuration ITO/PEDOT:PSS/P3HT(poly(3-hexylthiophene))/C60/Al. This work has demonstrated that calamitic liquid crystalline organics can be used for interesting and optoelectronic applications and covers the use of soluble small molecules (calamitic Lsc) as the additive materials to P3HT in bilayer heterojunction organic solar cells. Based on current-voltage characteristics, the photovoltaic properties of bilayer solar cells with and without liquid crystals (LC1 and LC2) additives are compared.

**Keywords:** P3HT:C60, Organic photovoltaic (OPV), Solar cells, LC, Power conversion efficiency (PCE).

# Facile rapid synthesis of microwave assisted Pd nanoparticles for non-enzymatic hydrogen peroxide sensor

Hilal Çelik Kazıcı,[1*] Orhan Alal[1], Dilan Atbaş[1], Hilal Demir Kıvrak[1] and Özlem Gökdoğan Şahin[2] and Arif Kıvrak[2]

[1] *Chemical Engineering Department, Yüzüncü Yıl University, Van, Turkey*
[2] *Chemical Engineering Department, Selcuk University, Konya, Turkey*
[3] *Department of Chemistry, Yüzüncü Yıl University, Van, Turkey*

*Corresponding Author: hcelik@eng.ankara.edu.tr

**Abstract—**Pd/C (20 wt%) catalyst was synthesized using microwave-assisted polyol method and employed for non-enzymatic hydrogen peroxide ($H_2O_2$) sensing activity and its activity compared to Pd/C (20 wt%) catalyst prepared by polyol method. The structure and morphology of these catalysts were examined via X-ray diffraction (XRD), x-ray photo electron spectroscopy (XPS). Furthermore, and cyclic voltammetry (CV) results demonstrated that Pd/C (20 wt%) catalyst prepared via microwave assisted polyol method exhibited excellent electrocatalytic activity to the reduction of $H_2O_2$. Amperometric response results indicated that Pd/C (20 wt%) catalyst prepared via microwave assisted polyol method displayed a fast response and relatively low detection limit. In addition, the Pd/C (20 wt%) catalyst prepared via microwave assisted polyol method Pt/GN/GCE showed good selectivity for $H_2O_2$ detection in the presence of several interfering species as ascorbic acid and uric acid.

Rapid and accurate determination of hydrogen peroxide ($H_2O_2$) is of practical importance in various fields such as food, clinical and environmental analyses. Recently, it is of great interest to develop an enzyme-less electrochemical sensor with high sensitivity, fast response time, and long-term stability. In particular, electrochemically active nanomaterials consisting of metals [1–2] have been extensively studied for non-enzymatic electrochemical sensors, because they have large surface-to-volume ratio and increased catalytic activities. To date, $H_2O_2$ detection has been mainly studied using spectrometry [3], fluorescence [4] and electrochemistry [5-6]. Compared with the electrochemical methods [7-8] all the above mentioned methods are more expensive and time consuming. Beside this, the simplicity, intrinsic sensitivity and high selectivity recommend the electrochemical techniques among the most promising options for $H_2O_2$ detection.

In this work for fabricating a new electrochemical sensor is synthesized by assisted microwave irradiation using polyol process. This study emphasizes the importance of the applied microwave heating technology for the synthesis of the catalyst. The most important objective of this study demonstrates the impact of microwave affect and the advantages of this new technique are to reveal against other conventional methods.

Electroanalytical methods (cyclic voltammetry and chronoamperometry) were used to evaluate the electrocatalytic activities of the prepared electrodes towards hydrogen peroxide oxidation. Fig.1. shows the cyclic voltammograms of Pd/C (microwave-assisted polyol method) and Pd/C (polyol method) modified electrode in phosphate buffer solution containing 0 and 5 mM $H_2O_2$. Pd/C (microwave-assisted polyol method) shows higher oxidation activity towards $H_2O_2$ compared with Pd/C (polyol method) catalyst. Further studies performed with chronoamperometric methods indicated that microwave asssisted Pd electrode exhibited higher sensitivity than Pd/C (polyol method) electrode toward hydrogen peroxide.

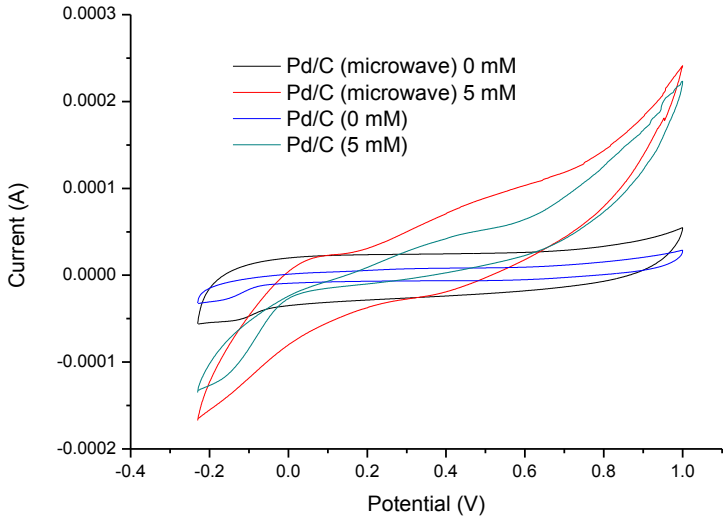


**Fig.1.** Cyclic voltammograms of Pd/C (microwave-assisted polyol method) and Pd/C (polyol method) in 0.1M PBS (pH 7.4) (absence and presence of $H_2O_2$ (5 mM))

Moreover, the prepared sensor exhibited good performance for $H_2O_2$ detection with simple electrode, preparation procedure, low working potential, high sensitivity, good reproducibility, acceptable long-term stability and high selectivity.

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# Structural, Morphological and Electrical Properties of Undoped and Sb Doped ZnO Films

Gonca Ilgu[1], Yasemin Caglar[2*], Saliha Ilican[2], Mujdat Caglar[2], Serif Ruzgar[2] and Abdulmecit Turut[3]

[1]*Graduate School of Sciences, Anadolu University, Eskisehir, Turkey*
[2]*Department of Physics, Anadolu University, Eskisehir, Turkey*
[3]*Department of Engineering Physics, Istanbul Medeniyet University, Istanbul, Turkey*

*Corresponding Author: yasemincaglar@anadolu.edu.tr

**Abstract—**In this work, undoped and Sb doped ZnO nanostructure films were deposited onto ITO substrates by the sol–gel method using a dip-coating technique. The effect of Sb incorporation on structural and morphological properties of ZnO films was investigated. X-ray diffraction (XRD) measurements showed that the ZnO films were crystallized in the hexagonal wurtzite phase and presented a preferential orientation along the c-axis. The scanning electron microscopy (SEM) images clearly show that there are variations in the surface morphology of ZnO films depending on the Sb content. Sb doped ZnO films show p-type conduction properties whereas the undoped ZnO film shows n-type.

ZnO is considered as a promising material for ultraviolet light-emitting diodes, laser diodes and photodetectors due to its many advanced physical properties, such as a wide band gap of 3.37 eV and a large exciton binding energy of 60 meV at room temperature. Undoped ZnO is usually n-type conductive, which is associated with the presence of native point defects (e.g., oxygen vacancies) and interstitial zinc, but the fabrication of stable and reproducible p-type ZnO has been difficult due to the self-compensation and low solubility of acceptor dopants.

In this work, undoped and Sb doped ZnO nanostructure films were deposited onto ITO substrates by the sol–gel method using a dip-coating technique. Zinc acetate dihydrate [$Zn(CH_3COO)_2.H_2O$] was used as a starting material. 2-methoxyethanol ($C_3H_8O_2$), monoethanolamine ($C_2H_7NO$, MEA) and antimony chloride ($SbCl_3$) were used as a solvent, stabilizer and dopant source, respectively. Sb content was increased from 0,6% to 1% in increments of 0,1. The cleaned ITO substrate was placed on the sample holder and was dipped at withdrawn speed of 8 mm/min. The dip coated films were preheated at 300$^oC$ for 10 min in a furnace. This coating/drying procedure was repeated ten times, before the films were annealed at 600$^oC$ in air for 60 min. The crystalline structure and orientation of the films have been investigated using XRD patterns. Surface morphology of the films has been also analyzed by a SEM. Fig. 1 shows SEM micrographs of the undoped and 1% Sb doped ZnO nanostructure films. These SEM images reveal that the surface morphologies of the films are affected by the concentration of Sb. The electrical transport characteristics (hall mobility and electron concentration) were measured by a Hall measurement system using the Van der Pauw configuration under 0.55T magnetic field at room temperature. It was determined that undoped ZnO film n-type; Sb doped ZnO films p-type shows conduction properties.

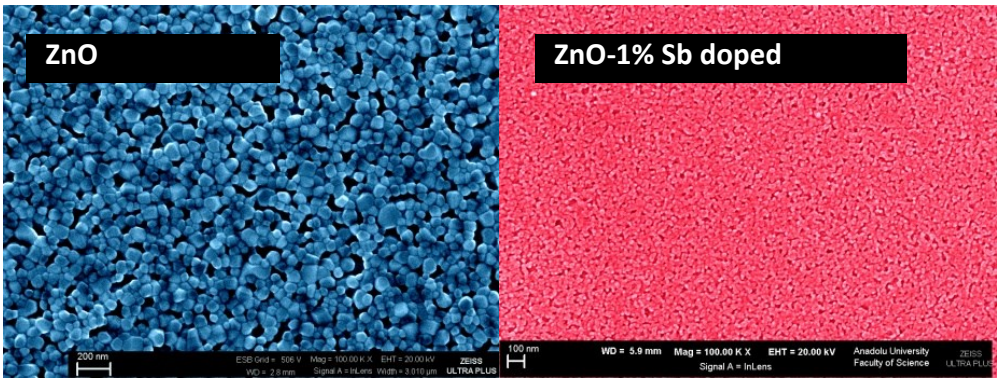


**Fig. 1.** SEM micrographs of undoped and 1% Sb-doped ZnO films.

**Acknowledgement:**
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# Structural, Magnetical and Electrical Properties of Magnetite Doped Polyaniline

E. Ahlatçıoğlu[1,3], A. Çelik Bozdoğan[2*] A. Bozdoğan[2], B. Filiz Şenkal[1], and M. Okutan[2]

*[1] Chemistry Department, Istanbul Technical University , İstanbul, Turkey*
*[2]Physics Department, Yıldız Technical University, İstanbul, Turkey*
*[3]Department of Technical Programs, Istanbul Technical University, İstanbul, Turkey*

*Corresponding Author: celikay@gmail.com

**Abstract—**In this work, the magnetic nanoparticles were synthesized by mixing a water solution of $FeCl_2.4H_2O$ (1.0 M) and $FeCl_3.6H_2O$ (1.5 M). Composites of poly (aniline) and magnetite were prepared by using oxidative polymerization of aniline in the presence of different weight percentage of magnetite (2%, 5% and 10%). Scanning electron microscopy and Fourier transform infrared spectroscopy analyses were performed to understand the structure of PANI-Magnetite composites. The magnetic and electric properties of undoped PANI, magnetite, magnetite doped PANI were investigated by electron paramagnetic resonance and impedance spectroscopy techniques, respectively. Analysis of powder paramagnetic resonance (EPR) spectra for magnetite doped polyaniline were recorded X-band spectrometer (9.8 GHz) with 100 kHz magnetic field modulation. EPR results illustrated that the paramagnetic behavior of PANI-Magnetite composites. Also, dielectric properties were investigated by impedance spectroscopy for undoped PANI, magnetite and different weight percentage of magnetite doped Poly(aniline)–magnetite composites. All PANI-Magnetite composites show dc conductivity behavior in the low frequency regions and two different conductivity regions at the high frequencies that s parameter value correlated Barrier Hoping (CBH) Mechanism.

# Electrical mechanism of Basalts with Polyaniline (pani) composites

Yaşar Karabul [1*], Mehmet Akif Yılmaz [1], Cenk Denktaş [1], Mustafa Okutan [1] and Orhan İçelli [1]

[1] *Physics Department, Yıldız Technical University, İstanbul, Turkey*

*Corresponding Author: karabulyasar@gmail.com.tr

**Abstract—**Polyaniline (PANI) different weight percentage of volcanic basalt rocks (10%, 25%, 50%) composites were measured by impedance spectroscopy. Also, electrical characterizations of the composites have been investigated by dielectric spectroscopy. We have been understood that doping different basalt to PANI increases dielectric strength with the weight percentage.

Basalt is a very common volcanic rock that is dark colored and relatively rich in iron and magnesium almost located each country in the world. Basalt is used for a comprehensive variety of purposes. These rocks have been used in the refused rock industry, to produce building tiles, construction industrial, highway engineering. Powders and fibers of basalt rocks are widely used of radiation shielding, thermal stability, heat and sound insulation [1-3]. Polyaniline (PANI) has attracted much attention due to its controllable conductivity, environmental stability and rather simple synthesis [4–7]. Additionally, PANI is frequently available in low-molecular weights, which in turn affects the elasticity of its solutions for electrospinning [8].

In this study, basalt samples which were erupted from extensional fractures in different periods of time in the Pliocene to Quaternary is obtained from different parts of Van, Turkey. Volcanology and petrology of these volcanic areas are studied in detail by Oyan [9,10] A general study about the electrical properties for three different basalt samples (KYZ-24, KYZ-13 and CM1) , composite with PANI has been presented.

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# The Electrical Properties of Au/P3HT/n-type Si Schottky Barrier Diode

Asimov[1], M. Ahmetoğlu[1], A. Kırsoy[2*], M. Özer[1] and M. Yasin[3]

[1] *Department of Physics, Uludag University, 16059, Bursa, Turkey*
[2] *Turkish Air Force Academie, İstanbul, 34149, Yeşilyurt, Turkey*
[3] *Department of Physics, Gebze Institute of Technology, 41400, Gebze, Turkey*

*Corresponding Author: admkirsoy@yahoo.com

**Abstract—**We investigated the electrical properties of the Au/P3HT/n-Si Schottky diode. The ideality factor n and barrier height Φb0 values of the diode were found to be 3.40 and Φb0 = 0.71 eV, respectively. n ideality factor greater than unity indicates that the diode exhibits non-ideal current–voltage behavior. This behavior results from the effect of series resistance and the presence of an interfacial layer. The values of the ideality factor, series resistance and barrier height obtained from Cheung and Norde method were compared, and it was seen that there was an agreement with each other. We obtained that the high frequency capacitance does not make an important contribution to the total capacitance. Also we have been determined barrier heights increasing with increasing frequency.

# The Effect of Microwave Power on the Structural and Morphological Properties of ZnO Films by Microwave Assisted Chemical Bath Deposition Method

Sibel Yurtsever[1], Kamuran Gorgun[2], Yasemin Caglar[3], Saliha Ilican[3] and Mujdat Caglar[3*]

[1] *Graduate School of Sciences, Anadolu University, Eskişehir, Turkey*
[2]*Chemistry Department, Eskişehir Osmangazi University, Eskişehir, Turkey*
[3] *Physics Department, Anadolu University, Eskişehir, Turkey*

*Corresponding Author: mcaglar@anadolu.edu.tr

**Abstract—**In this study, microwave-assisted chemical bath deposition (MW-CBD) method was used to prepare nanostructure ZnO films. Characterization of these films carried out with X-ray diffaction (XRD) and field emission scanning electron microscopy (FESEM) techniques. The structural parameters such as crystallite sizes, lattice parameters and texture coefficient values of all the films were determined by using XRD patterns. The FESEM images reveal that the surface morphologies of the films are affected by microwave power.

Zinc oxide (ZnO) has attracted a lot of research interests due to its distinctive properties, such as lower cost, wide availability, non-toxicity, material stability, high transparency, wide direct band gap ($E_g$ = 3.37 eV at 300 K), large exciton binding energy (60 meV) at room temperature. This material has an interesting optical and electronic property and therefore it is used in a wide variety of applications such as chemical and gas sensors, dye sensitized solar cell, light emitting diodes and UV lasers. ZnO films have been produced using various methods, such as sol-gel synthesis, chemical vapor deposition, spray pyrolysis, molecular beam epitaxy, chemical bath deposition and microwave assisted chemical bath deposition technique. A rapid synthesis technique, known as, MW-CBD has become an attractive method for the preparation of the films due to several advantages compared to other techniques, low temperature, short deposition time and the use of the interaction of the MW electromagnetic field with the substrate.

In this study, MW-CBD method was used to prepare nanostructure ZnO films. The effect of MW power (300, 600, 900, 1200 W) on the structural and morphological properties of ZnO films were investigated. To investigate the crystalline structure and the orientation of the films XRD patterns were used. These patterns of all the films are shown in Fig.1. The preferred orientation of the films was changed from (100) to (002) incerasing with MW power. The crystallite sizes, lattice parameters and texture coefficient values of the films were determined. The surface morphology of the films was analyzed by using a field emission scanning electron microscopy (FESEM).

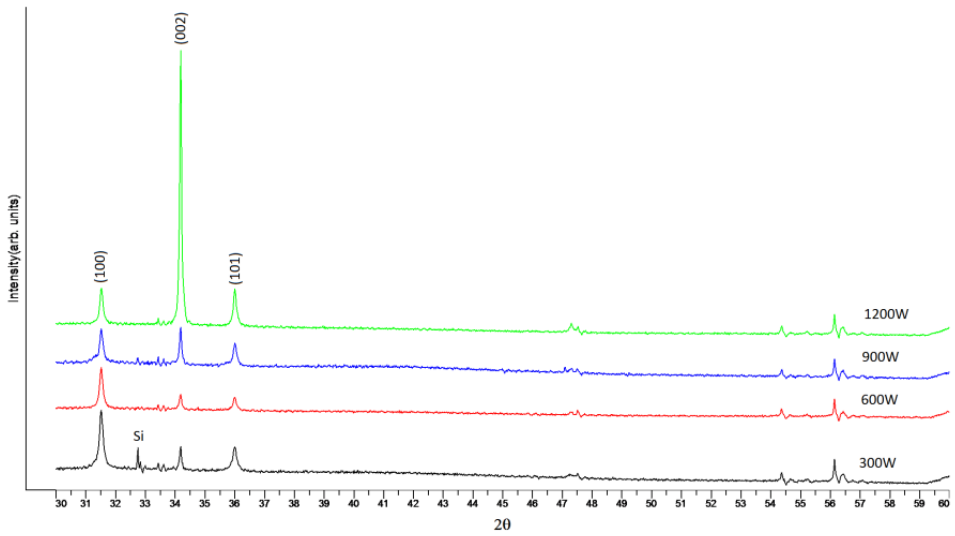


**Figure 1.** XRD patterns of the ZnO films

**Acknowledgement:**
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# Effects of different PEDOT:PSS layers on photovoltaic performance of organic solar cells

Mehmet Kazici[1], Anil Günbatti[1], Fatih Ongul[1*], Sureyya Aydin Yuksel[1], Sinem Bozar[1] and Serap Gunes[1]

[1] *Physics Department, Yildiz Technical University, Istanbul, Turkey*

*Corresponding Author: fatihongul@gmail.com

**Abstract—**In this study, the effects of various types of PEDO:TPSS with different conductivity formulation used as a hole transport layer in P3HTP:CBM bulk heterojunction solar cells on the photovoltaic parameters of organic solar cells was aimed to investigate. It was observed that the photovoltaic performances of devices enhanced when PH1000 used as a HTL instead of PH between active layer and anode ITO electrode.

In recent years, organic solar cells have attracted great attention due to their many advantages, such as low light weight, flexibility, low-cost and large scale production. However, organic solar cells still have low power conversion efficiencies for commercial use [1-3]. Many researchers have made a great effort to improve the power conversion efficiencies of OPV. To improve device performance, the hole transport layer (HTL) placed between the active layer and the anode has been used in photovoltaic devices due to avoid exciton recombination at the interface and allow passing only holes.Poly(3,4ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS) is one of the most commonly used hole transport layer in OPV because of its high transparency, good conductivity, smooth morphology and high work function [4]. This study compared the performances of five commercially available PEDOT:PSS formulations in photovoltaic devices.

Indium tin oxide (ITO) substrates from Kintec Company were patterned by first etching with an acid mixture of HCl:$HNO_3$:$H_2O$ and then substrates were cleaned in an ultrasonic bath. An aqueous solutions of filtered different PEDOT:PSS formulations based on commercially available Clevios FET, Clevios PH1000, Clevios PH500 Clevios PT2 with various additives and Clevios PH were deposited on top of the ITO and glass by spin coating. To remove any residual moisture from the PEDOT:PSS layers these were annealed in oven at 150 °C for 4 min in air. Poly(3-hexylthiophene) (P3HT) as electron-donor materials blended with [6,6]-phenyl C61-butyric acid methyl ester (PCBM) as an electron acceptor material with 1:0.55 weight ratios in 1 ml of chlorobenzene was used as active layer which has been the mostly investigated for BHJ organic solar cells. The P3HT:PCBM solution was coated by spin cast method on the PEDOT:PSS films and then annealed in oven at 120 °C for 3 min. On top of prepared devices, an aluminum (Al) electrode with thickness of 100 nm used as a cathode was coated by thermal evaporation technique in vacuum system ($1 \cdot 10^{-5}$mbar).

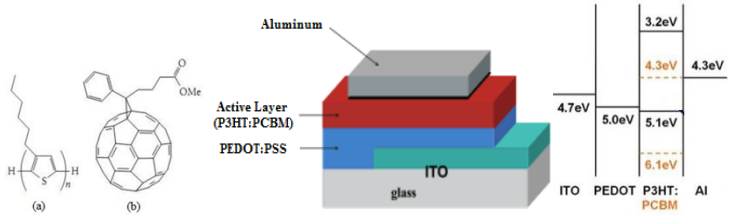


**Figure-1:** Chemical structure of (a) P3HT and (b) PCBM [2], and (c) schematic description and (b) energy level diagram for BHJ solar cells [3]

The optical transmission spectra of PEDOT:PSS films and the absorption spectrum of the P3HT:PCBM film were obtained using a spectrometer in the wavelength range of 300–1100 nm. The resistivity of FET, PT2, PH1000, PH500 and PH films coated on glass were determined with two probe method as $1.15x10^{-3}$, 5, 14.3, 50 and 125 Ω.cm,
respectively. Photovoltaic performance of OPVs was measured using a Kithely 2400 sourcemetre under 100 mW/cm$^2$

AM1.5G illumination. Photovoltaic parameters such as short-circuit current density $J_{sc}$ (mA/cm$^2$), open-circuit voltage $V_{oc}$ (V) and fill-factor FF were determined from the current density-voltage (J-V) characteristic. The incident photon-to-current conversion efficiency (IPCE) spectra were obtained using New Port Quantum Efficiency Systems. Photovoltaic performances of devices with different conductivity PEDOT:PSS used as a HTL were shown Figure 2 and Table1.

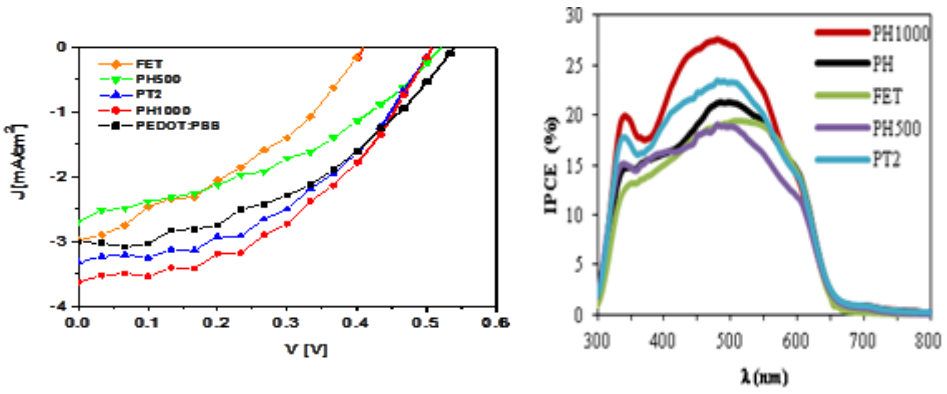


**Figure-2:** The J–V characteristics (a) and the IPCE spectra (b) of organic photovoltaic devices

**Table-I** Photovoltaic parameters of devices

| | FET | PH500 | PT2 | PH1000 | PH |
|---|---|---|---|---|---|
| $V_{oc}$ (mV) | 410 | 520 | 510 | 510 | 540 |
| $J_{sc}$ (mA/cm$^2$) | 2.95 | 2.73 | 3.32 | 3.63 | 3.10 |
| FF | 0.36 | 0.38 | 0.43 | 0.44 | 0.42 |
| n | 0.43 | 0.54 | 0.75 | 0.82 | 0.71 |
| $J_{IPCE}$ (mA/cm$^2$) | 2.63 | 2.5 | 3.02 | 3.34 | 2.79 |

When PH1000 has been used as hole transport layer in BHJ solar cell compared to reference cell, short-circuit current density increased from 3.1 mA / cm$^2$ to 3.63 mA / cm$^2$, open circuit voltage decreased from 540 mV to 510 mV, fill factor (FF) increased from 0.42 to 0.44 and also efficiency increased from 0.71.to 0.82.

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# Effect of Fluorine Dopant on the Structural and Morphological Properties of ZnO coating by Cyclic Voltammetry Method

Pınar Bilgic Ozden[1*], Andac Arslan[2], Seval Aksoy[3], Evrim Hur[4], Mujdat Caglar[3], Yasemin Caglar[3] and Saliha Ilican[3*]

[1]*Graduate School of Sciences, Anadolu University, Eskişehir, Turkey*
[2]*Graduate School of Sciences, Eskişehir Osmangazi University, Eskişehir, Turkey*
[3]*Physics Department, Anadolu University, Eskişehir, Turkey*
[4]*Chemistry Department, Eskişehir Osmangazi University, Eskişehir, Turkey*

*Corresponding Author: silican@anadolu.edu.tr

**Abstract—**In this study, effect of fluorine (F) doping concentration on the structural and morphological properties of zinc oxide (ZnO) coatings were investigated. Undoped and F doped ZnO coatings were cyclic voltammetry method. To investigate the crystalline structure and the orientation of the films, X-ray diffraction (XRD) patterns were used. The surface morphology of the films were analyzed by using a field emission scanning electron microscopy (FESEM). Zinc oxide (ZnO) is an n-type semiconductor, having wide band gap and hexagonal wurtzite structure. Numerous growth techniques can be used, like solution based, physical vapor deposition or epitaxial growth techniques. Among these, there is a few study conducted on cyclic voltammetry (CV).

In this study, effect of F dopant on the structural and morphological properties of ZnO. Flourine doped ZnO (ZnO:F) coatings were electrodeposited in a solution consist of 0.01M of hexamethylenetetramine (HMTA, $C_6H_{12}N_4$, ≥%99.5) and 0.01M zinc nitrate hexahydrate ($Zn(NO_3)_2.6H_2O$, ≥%99.0) and solution temperature was kept at 90$^oC$. Coatings were grown between -1.4 and -0.7 V vs Ag/AgCl reference electrode, scan rate was 100 mV/s and 120 cycles had been used. p-type silicon (p-Si) substrate and a Pt wire were used as working electrode and counter electrode, respectively. Doping concentration was choosen to be 1 to 6%. (Sample names: F1, F2, F3, F4, F5, F6). Characterization of these coatings carried out with XRD and FESEM techniques. The microstructures of the films consist of hegzagonal ZnO rods. F3 and F4 shows better surface coverage among others. It is also observed that flower like hegzagonal rods had been formed but rod diameters and shapes are changing regardless of doping concentration. X-ray difractograms of the samples are given in Fig.-1. All of the coatings are (100) oriented, except F3 which is (002) oriented.

**Acknowledgement:**
This work was supported by Anadolu University Commission of Scientific Research Project under Grant No: 1207F118.

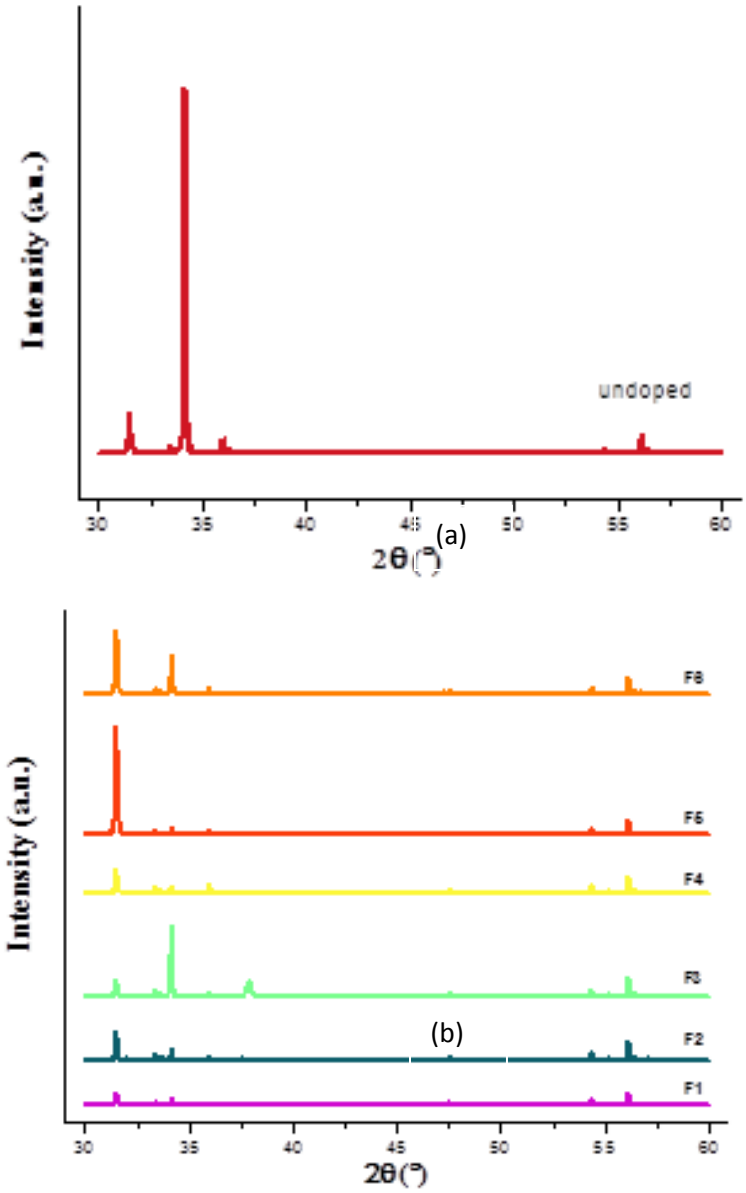



**Figure-1:** X-ray difractograms of electrodeposited of undoped (a) and F doped ZnO (b).

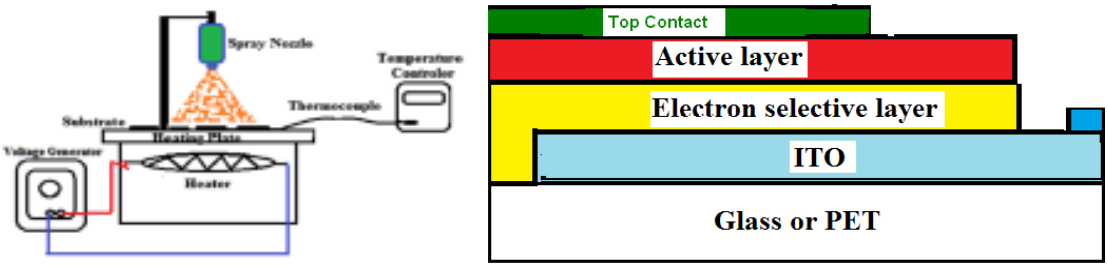
# Application of $Cd_{1-x}Zn_xS$ Thin Film Layer in Inverted Solar Cell as Electron Selective Layer

Sinem Bozar[1], Süreyya Aydin Yüksel[1*], Fatih Ongül[1], Mehmet Kazici[1], Hasan Yüksel Güney[2], Serap Günes[1]

[1] *Physics Department, Yildiz Technical University, Istanbul, Turkey.*
[2] *Physics Department, Kocaeli University, Kocaeli, Turkey.*

*Corresponding Author: sureyya.aydin@gmail.com

**Abstract—**In this study, $Cd_{1-x}Zn_xS$ thin films were deposited on ITO substrates via spray pyrolysis technique for manufacture inverted type ITO/$Cd_{1-x}Zn_xS$/P3HT:PCBM/PEDOT:PSS/Ag solar cells which were purposely fabricated to have different Zn concentration the first time in the literature. The highest efficiency, ~1.1%,was achieved on the cell with x=0.2 Zn concentration film as the cathode buffer layer. It was proposed that, compared with the case of CdS film, the Zn doped film leading to power conversion efficiency enhancement resulted from the efficient charge separation introduced by increasing the interface area between an active layer and $Cd_{1-x}Zn_xS$ films.Organic photovoltaics (OPVs) based on polymers and fullerenes have attracted remarkable interest during the last decade and high power conversion efficiencies [1]. However air stability of the cells are very poor. The conventional geometry of OPVs uses easy oxidizing metal as top contacts like Aluminum. These metals are easily oxidized in air resulting in rapid decrease of PCE if cells are not perfectly encapsulated. Using a thin electron-selective layer on ITO substrate such as $TiO_x$, CdS, ZnO, CdSe [1-4], enables fabrication of solar cells in a so-called inverted geometry. In this geometry noble metals (Ag or Au) can be used as top contacts which are less sensitive to ambient oxygen. Thus air stability of these solar cells is significantly improved. The aim of this study, fabricated the inverted type organic solar cell with new electron selective layer, $Cd_{1-x}Zn_xS$ first time in literature.$Cd_{1-x}Zn_xS$ thin films were deposited on ITO substrate with different Zn concentration (x, 0 to 1) using spray pyrolysis technique substrate temperature at about 550K. Where x represented the Zn concentration in spraying solution. Aqueous solution of $CdCl_2$, $ZnCl_2$ and thiourea were used as source for Cd, Zn, and S, respectively. A conventional spray system was used to deposit $Cd_{1-x}Zn_xS$ thin film (Figure-1a) P3HT Poly(3-hexylthiophene) as electron-donor materials blended with PCBM ([6,6]-phenyl C61-butyric acid methyl ester) as an electron acceptor material with 1:0.55 weight ratios in 1 ml of chlorobenzene was used as active layer. The P3HT:PCBM blended was coated by drop cast method on the $Cd_{1-x}Zn_xS$ films and hole collector layer PEDOT:PSS was coated on active layer and then the cell annealed in air at 120 °C for 3 min. Silver (Ag) was coated by thermal evaporation technique in vacuum as top contact electrode with thickness of 100 nm. Device structure for inverted solar cells is shown Figure-1b. Photovoltaic characteristics of cell was measured using a Kithely 2400 sourcemetre under dark and 100 mW/cm$^2$ AM1.5G illumination. The crystal structure of films were characterized by x-ray diffraction (XRD) and surface properties were investigated using AFM. The composition parameters (x) of samples were determined with energy dispersive x-ray fluorescence (EDAX) technique. The optical transmittance spectra were obtained within the range of 300-1100 nm using UV spectrometer.




(a) (b)

**Figure-1:** (a) Schematic representation of spray pyrolysis deposition system [1], (b) Schematic device structure for inverted solar cells.

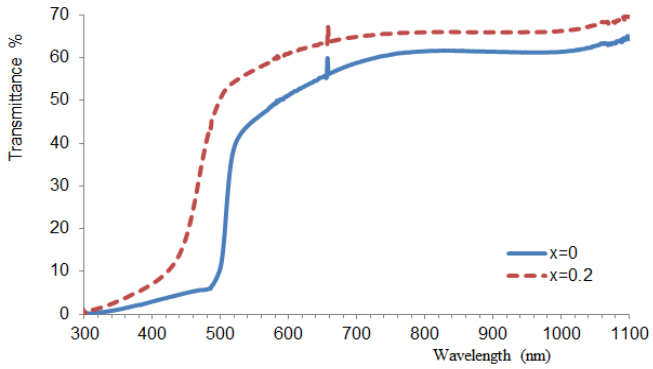



**Figure-2** Optical transmittance spectra for (a) $Cd_{1-x}Zn_xS$ (x=0), (b) $Cd_{1-x}Zn_xS$ (x=0.2), for inverted solar cells.

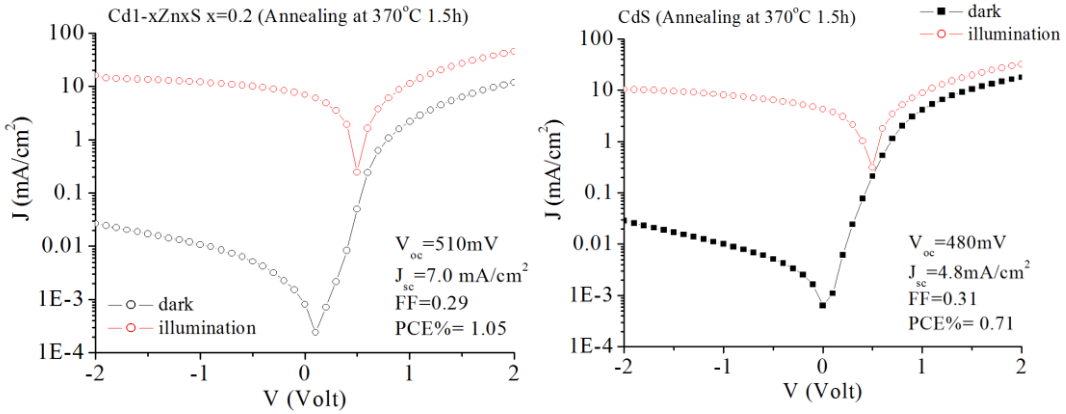



**Figure-2:** The Current density voltage characteristics (a) $Cd_{1-x}Zn_xS$ (x=0), (b) $Cd_{1-x}Zn_xS$ (x=0.2), for inverted solar cells.

When $Cd_{1-x}Zn_xS$ (x=0.2) has been used as electron selective layer in the cell, compared to reference cell (x=0) short-circuit current density increased from 4.8 mA/cm$^2$ to 7.0 mA/cm$^2$, open circuit voltage increased from 480 mV to 510 mV, and also power conversion efficiency increased from 0.71 to 1.05 %.

**Acknowledgement:**
We acknowledge the financial support of Turkish Scientific and Technological Research Council (Tubitak) with the project number 112-T-759.

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# Preparation and Characterization of ZnO Nanorod Films by Electrodeposition Method onto ITO Substrate

Pınar Bilgiç Özden[1*] , Yasemin Çağlar [2]

[1]Graduate School of Sciences, Anadolu University, Eskisehir, Turkey
[2]Department of Physics, Faculty of Science, Anadolu University, Eskisehir, Turkey

*Corresponding Author: pbilgic@anadolu.edu.tr

**Abstract—**In this study, Zinc Oxide (ZnO) nanorod films were deposited onto ITO substrates via chronoamperometry. The deposition time of the films was selected as 60, 75 and 90 min. Effect of the deposition time on the structure and morphology of the films were studied. The cystal structure and morphology of the films were investigated using X-ray diffractometer (XRD) and field emission scanning electron microscope (FESEM), respectively..

ZnO is a transparent, n-type semiconductor. It has a high exciton binding energy (60 meV) and a broad band gap (3.2-3.4 eV) [1,2]. It can be produced in various structures using different deposition techniques and is a useful material for most of the optic and electronic applications [1].

ZnO films were grown by electrochemical deposition method onto ITO substrates from an aqueous route, called chronoamperometry. Electrolyte solution was prepared in 10ml of deionized water using $10^{-2}$ M hexamethylenetetramine ($C_6H_{12}N_4$) and $10^{-2}$ M zinc nitrate hexahydrate ($Zn(NO_3)_2.6H_2O$). As working electrode, 100 nm tin doped indium oxide (ITO) coated glass substrate was used (1cm$^2$ surface area, ≤20 Ω/□). Experiments were carried out in a three electode electrochemical cell, a platinum (Pt) wire and a silver/silver chloride (Ag/AgCl) electrode were used as counter and referance electrode respectively. The electrodeposited films were grown under -1 V applied voltage, at 60, 75 and 90 min of deposition time (named as Z60, Z75 and Z90, respectively).

Effects of deposition time on the structural properties of the films were analyzed by an XRD and given in Fig. 1.

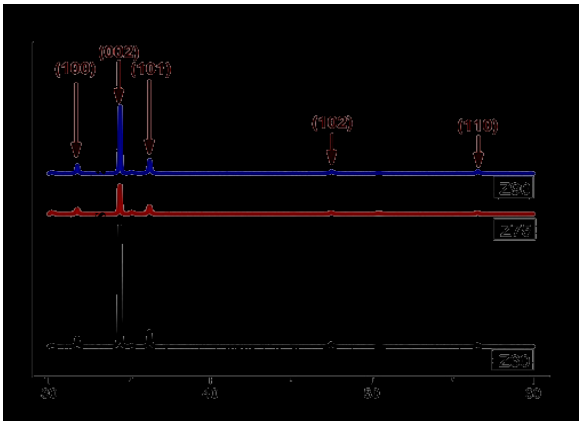


**Figure-1:** XRD spectra of the electrodeposited ZnO films

From XRD diffractograms all samples show diffraction peaks at same 2θ values: 2θ = 31.7, 34.4, 36.2, 47.5 ve 56.6$^0$. Those are correspond to (100), (002), (101), (102) ve (110) diffraction planes respectively. All of them are highly c-axis oriented.

The surface morphology of the ZnO films was investigated by FESEM. FESEM micrographs of the deposited films were given in Fig. 2. These results shows that all sample surfaces have coated uniformly. Obtained films consist of ZnO rods which grew perpendicular to the substrate surface as seen on Fig. 2. Beside this, it is observed that diameters of ZnO rods increases with increasing deposition time. In addition to this, flower like ZnO agglomerates deposited onto ZnO rods which shapes of these structures change from needle like shapes to more hexagonal structures.

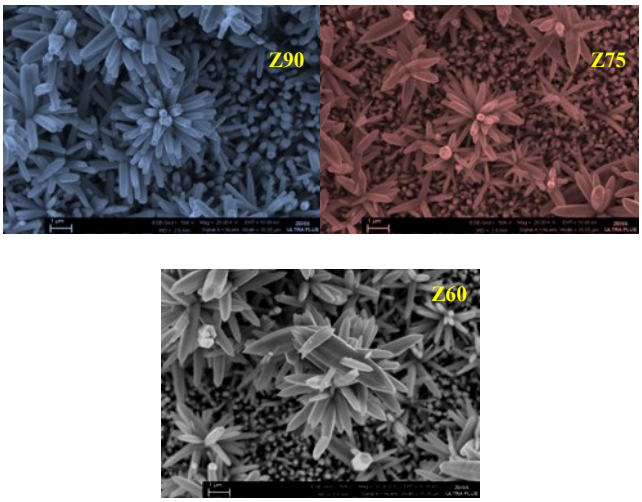


**Figure-2:** FESEM micrographs of the electrodeposited ZnO films

## References:

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# Effect of Lanthanum dopant on the Characterization of the Dip Coated ZnO Films

Gonca Ilgu[1]* and Saliha Ilican[2]

[1]Graduate School of Sciences, Anadolu University, Eskisehir, Turkey
[2]Department of Physics, Anadolu University, Eskisehir, Turkey

*Corresponding Author: goncailgu@anadolu.edu.tr

**Abstract—**Zinc oxide (ZnO) is a II–VI semiconductor with a hexagonal wurtzite structure. Further, it is an inexpensive n-type semiconductor with a wide band gap of 3.3 eV. This property makes it good candidate as host materials for the visible and infrared emission of various rare earth (RE) elements. RE elements doped ZnO films have been increasingly taking an important role in optoelectronics and photonics. On the other hand, RE elements are good luminescence centers due to their narrow and intense emission lines originating from 4f intrashell transition. Moreover, RE complexes have the ability to absorb light at shorter wavelength and emit at a longer wavelength.

2-Methoxyethanol and monoethanolamine (MEA) were used as a solvent and stabilizer, respectively. Lanthanum (III) acetate hydrate were used as a dopant source. The cleaned p-Si substrate was placed on the sample holder and was dipped at withdrawn speed of 8 mm/min. The dip coated films were preheated at 300$^{o}$C for 10 min in a tube furnace. This coating/drying procedure was repeated ten times, before the films were annealed at 600$^{o}$C in air for 60 min.

The present work is focused on investigating the effect of La doping concentration on the crystalline structure, microstructure and electrical properties of ZnO films prepared by the sol–gel method using the dip-coating technique. As a starting material, zinc acetate dihydrate (ZnAc) was used. Using XRD method, the crystallinity and the preferred crystal orientation of the ZnO films were analyzed. Using SEM, the surface morphology of the films is studied. SEM micrographs and XRD patterns of the undoped and 1% La films are shown in Fig 1. The images were performed at x100k magnifications. The electrical transport characteristics (hall mobility and electron concentration) were measured by a Hall measurement system using the Van der Pauw configuration under 0.55T magnetic field at room temperature.

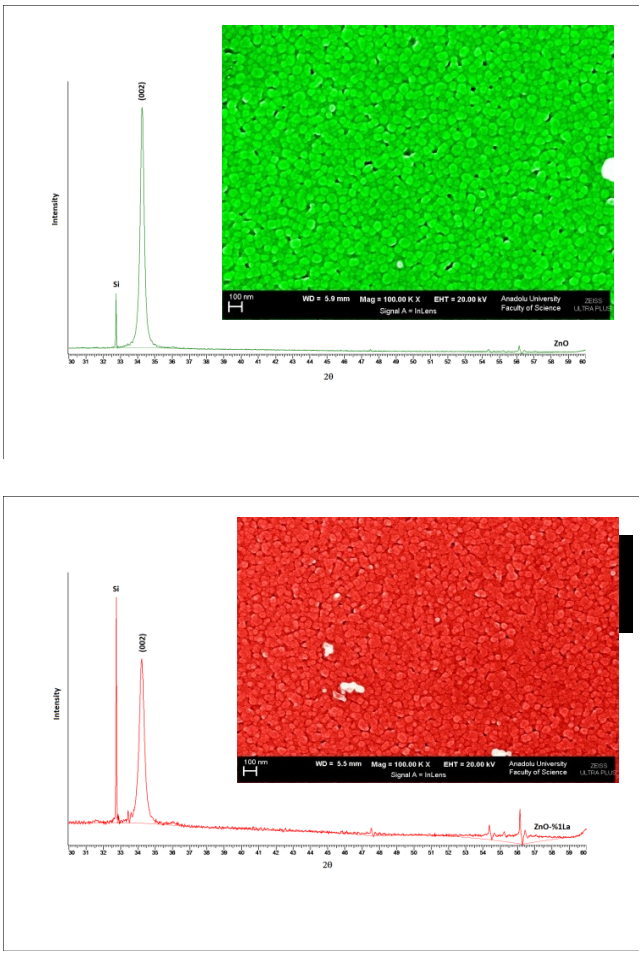


**Figure 1.** XRD patterns and SEM micrographs of undoped and 1%La doped ZnO films

# Effect of Annealing Temperature on Electrical Properties of n-$SnO_2$/p-Si heterojunction diode

Seval Aksoy* and Yasemin Caglar

*Physics Department, Anadolu University, Eskişehir, Turkey*

*Corresponding Author: sevala@anadolu.edu.tr

**Abstract—**In present study, the $SnO_2$ films were prepared using the sol gel spin coating method. Field emission scanning electron microscope (FESEM) was used to analyze the surface morphology of the $SnO_2$ films. After, n-$SnO_2$/p-Si diodes were fabricated. The electrical properties of the heterojunction diodes were characterized by *I-V* techniques. The ideality factor and barrier height of diodes were calculated.

Tin oxide ($SnO_2$) is an important and widely used wide band-gap semiconductor. It is of great interest in corrosive environment applications due to its high stability. $SnO_2$ occurs in nature as the mineral Cassiterite. $SnO_2$ is an n-type conductor, in which wide band gap and high conductivity coexist. As in the case of other binary metal oxides, oxygen vacancies are responsible for conduction electron-carrier generation in $SnO_2$. The interest in $SnO_2$ coatings is due to the coexistence of high conductivity and transparency in the visible range of the electromagnetic spectrum. For transparent conducting oxide (TCO) applications a band gap of at least 3.1 eV is required. Undoped conductive tin oxide films exhibit a larger band gap, typically greater than 3.6 eV [1].

Various deposition techniques have been used for $SnO_2$ films. Among these techniques, the sol gel process presents an easy way to integrate $SnO_2$ devices, since it offers the possibility of excellent compositional control, simplicity, homogeneity, lower crystallization temperature and low production costs [2].

In this study, $SnO_2$ films were deposited by sol gel method using spin coating technique on p-Si substrates. The films were inserted into a tube furnace and dried in air at 300°C for 1 hour and then the films have been annealed at 400, 500, 600 °C for 1 hour. Effects of different annealing temperature on the morphological properties of the $SnO_2$ films have been investigated. After than n-$SnO_2$/p-Si diodes were fabricated.

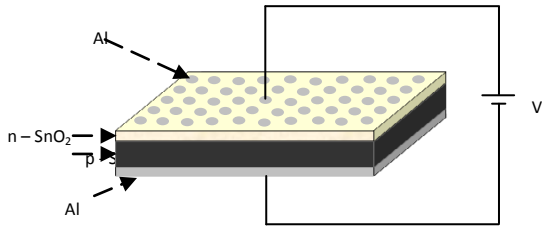


**Figure-1:** The schematic structure of the n-$SnO_2$/p-Si heterojunction diode.

Surface morphology of the films was studied using ZEISS Ultraplus model FESEM. The *I-V* measurements of the n-$SnO_2$/p-Si heterojunction diode were performed using a KEITHLEY 4200 SCS/CVU semiconductor characterization system with connected SIGNATONE Semi-Atomatic Probe Station at room temperature in air under dark conditions. The schematic structure of diode

is given in Fig. 1. The ideality factors of diodes were calculated as 7.84 (400°C), 6.17 (500°C) and 5.22 (600°C), respectively. The surface morphology of the films are shown in Fig. 2.

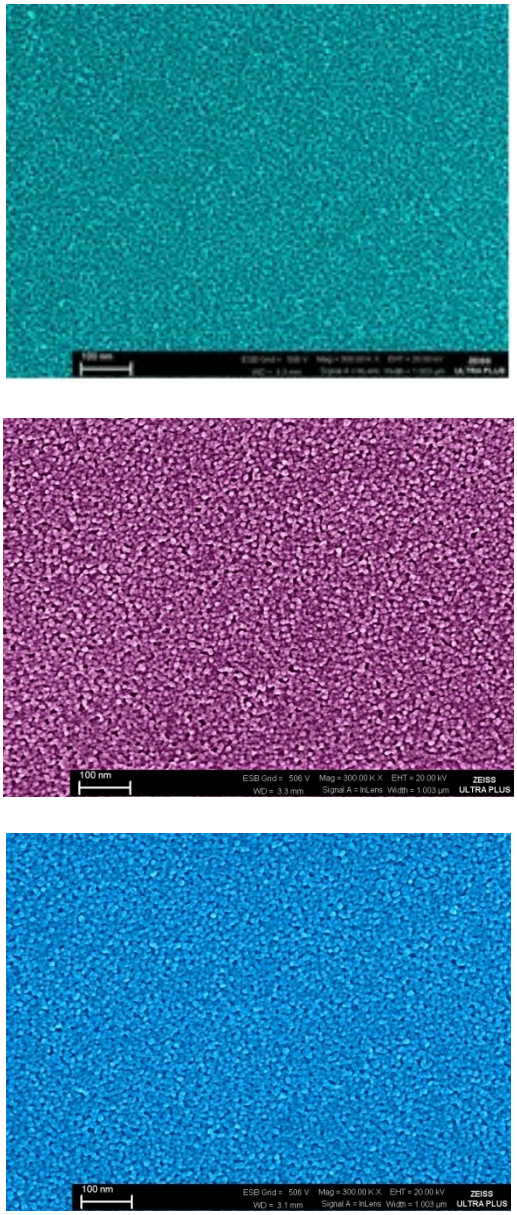


**Figure-2:** FESEM micrographs of the $SnO_2$ films.

**Acknowledgement** :
This work was supported by Anadolu University Commission of Scientific Research Project under Grant No: 1001F05

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# The Protective Effects of Vitamin E on Aflatoxin $B_1$-Induced Testicular Toxicity in Rat

E.Kaya[1*], S. Yılmaz[1], S. Gür[2], Ş. Özer Kaya[2]

[1]*Department of Biochemistry, Faculty of Veterinary Medicine, Elazığ, Fırat University, Turkey*
[2]*Department of Reproduction and Artificial Insemination, Faculty of Veterinary Medicine, Fırat University, Turkey*

*Corresponding Author: emrekaya@firat.edu.tr

**Abstract—**In study, 28 male Wistar Albino rats were used. The rats were divided into 4 groups as control, vitamin E, aflatoxin (AF), aflatoxin + vitamin E. Control group wasn't treated. The rats were administered $AFB_1$ daily at dose levels of 0.5 mg/kg body weight by oral gavage for 7 days. The rats were administered vitamin E daily at dose levels of 100 mg/kg body weight by oral gavage for 20 days. Malondialdehyde (MDA), glutathione (GSH) levels and catalase (CAT), glutathione peroxidase (GSH-Px) and glutathione-S-transferase (GST) activities in testes tissue samples were determined by the spectrophotometric methods.

In the group treated with AF, MDA level was detected to significant increases when compared with the control group. In the group treated with AF + vitamin E, MDA level was detected to decreases when compared with the AF group ($p<0.05$). GSH level, GSH-Px and GST activities were found to be higher the group treated with AF when compared with the control group ($p<0.05$). CAT activity wasn't changed in the group treated with AF. While GST activity reached to normal levels ($p<0.05$), GSH level, CAT and GSH-Px activities weren't changed in the group treated with AF + vitamin E. Statistically significant difference wasn't found in the group treated with vitamin E when compared with the control group.

While in the group treated with AF has observed reduction of sperm motility, increase in the rate of abnormal sperm, AF + vitamin E has provided significant improvement in spermatological characteristics. While in the groups treated with AF and AF + vitamin E hasn't observed change in sperm density and vesicula seminalis weight when compared with the control group, in the groups treated with vitamin E has observed increase of sperm density and vesicula seminalis weight.

AF-induced testicular toxicity may play a role in the pathogenesis of the deterioration in the oxidant-antioxidant balance, vitamin E may observe to reduce severe side effects of AF-induced and have alternative for clinical applications such as impairment of testicular function by mycotoxin.

Key Words: Aflatoxin, vitamin E, malondyaldehide, antioxidant, testes.

# Polymer doped 4-Cyano-4'-pentylbiphenyl Liquid crystals

Faten Al-Hazmi[1*], Ahmed A. Al-Ghamdi[1] and F. Yakuphanoglu[1,2]

[1]*Department of Physics, Faculty of Science, King Abdulaziz University, Jeddah, 21589, Saudi Arabia*
[3]*Faculty of Science, Department of Physics, Firat University, Elazig, Turkey*

*Corresponding Author : fialhazmi@kau.edu.sa

**Abstract—**The dielectric anisotropy and molecular reorientation properties of poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] doped 4-Cyano-4'-pentylbiphenyl (5CB) liquid crystals were investigated. The polymer doped 5CB liquid crystals indicate a p-type dielectric anisotropy behaviour at room temperature. The poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] polymer changes the dielectric anisotropy and molecular reorientation properties of the 5CB liquid crystal. Molecular reorientation properties of polymer doped 5CB liquid crystals were analysed by Cole-Cole relaxation curves. It is evaluated that the dielectric anisotropy and molecular reorientation properties of the 5CB liquid crystal can be improved by poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] polymer.

# Non-linear optics of Aluminum doped ZnO (AZO) for optoelectronic technology

Attieh A. Al-Ghamdi[1*], Haya Alhummiany[1,2], M.Sh. Abdel-wahab[1], I.S. Yahia[3]

[1]*Centre of Nanotechnology, King AbdulAziz University, Jeddah, Saudi Arabia.*
[2]*Department of Physics, Sciences Facluty for Girles, King Abdulaziz University, Jeddah, Saudi Arabia*
[3]*Department of Physics, Faculty of Science, King Khalid University, P.O. Box 9004, Abha, Saudi Arabia.*

*Corresponding Author : aaaalghamdi4@kau.edu.sa

**Abstract—**Al-doped ZnO (AZO) thin films (thickness ≅ 60 nm) as transparent conductive metal oxide were prepared by RF reactive magnetron sputtering at room temperature (RT). The RF power source were changed from 20-60 watt whereas other conditions kept constants throughout deposition process. The hexagonal structure emerged from the as grown samples with space group P63mc has been shown from XRD analysis. The pure ZnO and Al-doped ZnO structures presented by SEM measurements has shown a uniform and/or non-uniform spherical shape and grain size ranged from 18-35nm. The linear refractive (*n*) indices are calculated on the basis of Fresnel's equations. It is clear that the refractive showed a pounced peaks changed with changing the Al-dopnats. The linear optical susceptibility $\chi^{(1)}$, non-linear refractive index ($n_2$) or non-linear optical susceptibility $\chi^{(3)}$ were calculated and analyzed on the basis of the non-linear theory. The values of the $n_2$ in the range from 2.4 x$10^{-10}$ to 5.585 x$10^{-12}$ while the values of $\chi^{(3)}$ are in the range from 1.8 x$10^{-11}$ to 1.364 x$10^{-13}$ esu. The as-deposited Al-doepd ZnO thin films showed a non-linearity in comparison to the other reported data of metal oxide. Al-doped ZnO is a good candidate for new generation of electronic and optoelectronic devices

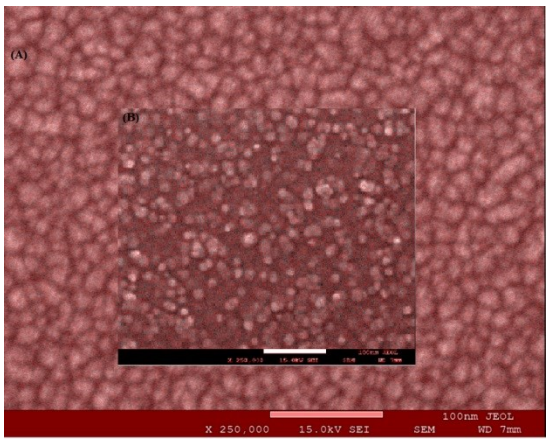


**Figure 1 :** The SEM micrographs of (A) pure ZnO, (B) 5.3 wt % Al doped ZnO.

# Photocatalytic Degradation of Astrazon Golden Yellow 7GL by UV/$TiO_2$ Process

Veyis Selen [1*], Tuğba Dipi [1], And Gülbeyi Dursun [1]

[1] *Department of Chemical Engineering, Faculty of Engineering, Fırat University, Elazığ, 23279, Turkey.*

*Corresponding Author : vselen@firat.edu.tr

**Abstract—**Dyeing and finishing of textile goods is a major environmental concern, because of the introduction of large quantities of color, chemical oxygen demand, non-biodegradable organics and other hazardous chemicals into the process effluents [1]. Therefore, treatment of these effluents has been receiving increasing attention. The traditional techniques for dye removal from wastewater are the use of adsorption, filtration, coagulation and treatment with ozone [2]. These techniques are transferring the organic pollutants from one phase to another phase leading to the need of further treatment. To triumph over these difficulties, highly effective and environmentally benign advanced oxidation process namely heterogeneous photocatalysis using semiconductor materials are promising alternative technology to the traditional remediation processes for the purification of wide variety of organic pollutant present in water and air [3]. So, photocatalytic oxidation is one of the advanced oxidation process using for complete degradation of organic pollutants. $TiO_2$ is a well-known effective semiconductor photocatalyst for the purification of water and air due to its high photocatalytic activity, chemical as well as biological stability, relatively low-cost and especially non-toxicity [4]. The principal objective of this study was to investigate the application of UV/$TiO_2$ for degradation of Astrazon Golden Yellow 7GL (AGY-7GL). In experiment, UV-C lamb (200-280 nm) was used as a light source and $TiO_2$ was used as a catalyst. The effects of key operating parameter, such as initial solution pH (3.0, 5.0, 7.0 and 9.0), initial dye concentration (10-50 mg/L), photocatalyst ($TiO_2$) concentration (0-1.5 g/L) and air flow rate (0-6 L/min) were investigated for photo degradation process in photocatalytic column reactor. Primary objective was to determine the optimal conditions for each of the process parameters. For degradation and mineralization of 10 mg/L of AGY-7GL (as representative concentration in wastewaters), the most suitable operation conditions are; photocatalyst concentration 1.5 g/L, initial solution pH value 6.0 (natural pH of dye solution) and air flow rate 6 L/min. This study showed that can effectively remove AGY-7GL from aqueous solutions by UV/$TiO_2$ photocatalytic degradation process. This process may be applicable for treatment of a large volume of textile wastewaters.

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# The Investigation for Photoactivity Properties of $TiO_2$ (anatase)-Carbon Nanotube Composites

Ömer Güler[1*], Fatih Sarihan [1], S. Hale Güler [2], Veyis Selen [3], And Ertan Evin [1]

[1] *Department of Metalurgical and Material Engineering, Faculty of Engineering, Fırat University, Elazığ, 23279, Turkey.*

[2] *Department of Metalurgical and Material Engineering, Faculty of Engineering, Mersin University, Mersin, 33343, Turkey.*

[3] *Department of Chemical Engineering, Faculty of Engineering, Fırat University, Elazığ, 23279, Turkey.*

*Corresponding Author : oguler@firat.edu.tr

**Abstract—**Photocatalysis has been widely applied as a technique of destruction of organic pollutants due to its high performance, low cost, nontoxicity, stability, and availability [1, 2]. Titanium dioxide ($TiO_2$), a semiconductor with direct bandgap of 3.2 eV, has excellent photocatalytic properties and chemical stability, and it is an environmentally friendly and abundant substance [3, 4]. However, a major limitation to achieve high photocatalytic efficiency is the quick recombination of photo- generated charge carries [5]. Recombination has faster kinetics than surface redox reactions and greatly reduces the quantum efficiency of photocatalysis. Recently, carbon-based nanomaterials, such as carbon nanotubes (CNTs) and graphene, have been reported as the hybrid component to be incorporated into $TiO_2$ due to their unique electrical properties, superior chemical stability, and good conductivity. In the present study, we have prepared Titanium dioxide-carbon nanotube nano-composites to improve electrical and optical properties of $TiO_2$ semiconductor.

The commerical $TiO_2$ powders (anatase phase) (Sigma Aldrich 248576) were used for preparation of the composites. In this study, used carbon nanotubes were synthesized by chemical vapour deposition (CVD) method. p-doped Si (100) substrates were used to growth the carbon nanotube. The $TiO_2$-CNT composites were prepared for the ratios of the carbon nanotubes: $TiO_2$ are 0.1, 0.2 and 1 %. It was dispersed the carbon nanotubes homogeneously in the matrix. Powder mixes were compacted in a 20 mm diameter compaction die at 600 MPa. The compacts were sintered at 1200 $^oC$ for 1 h under Ar atmosphere. The composites were analyzed by FESEM (Jeol Jsm-7001F). Electrical conductivity of the compsoites was measured using two-probe method with the help of Keithley 6517A Electrometer/High-Resistance Meter.

**Table 1** : shows Electronic Properties of CNT/$TiO_2$ composites.

Table 1. Electronic Properties of CNT/$TiO_2$ composites.

| Samples | $E_g$ (eV) |
|---|---|
| Pure $TiO_2$ | 2,97 |
| 0.1% MWCNT+ $TiO_2$ | 2,99 |
| 0.2% MWCNT+ $TiO_2$ | 3.02 |
| 1% MWCNT+ $TiO_2$ | 3.06 |

It show that $E_g$ values increase with increasing CNT amount Fig.1 shows the plots of the diffused reflectance for pure $TiO_2$ and CNT-reinforced $TiO_2$ composites.

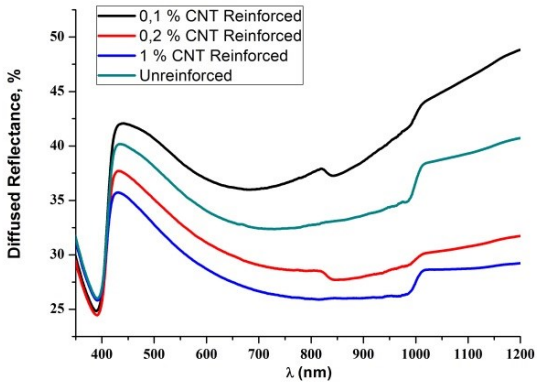


**Fig. 1.** Diffussed Reflectance of the CNT/$TiO_2$ composites.

The optical band gap of the composites was determined from the plots of $(F(R)hv)^2$ versus $hv$, as shown in Fig.2.

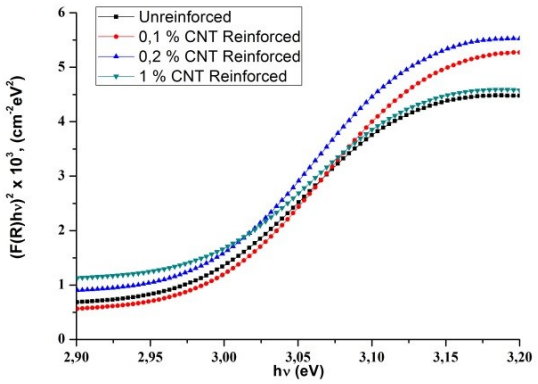


**Fig. 2.** Plots of $(F(R)hv)^2$ versus the photon energy (hv) of the CNT/$TiO_2$ composites.

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# The Effect to Properties of ZnO-Carbon Nanotube Composites Sintering Temperature

Ömer Güler[1 *] ,Handan Aydin [2], S.Hale Güler[3], Cihat Aydin [4]

[1] *Department of Metallurgy and Materials Engineering, Engineering Faculty, Firat University, Elazığ, Turkey*
[2] *Department of Metallurgy and Materials Engineering, Engineering Faculty., Tunceli University, Tunceli, Turkey*
[3] *Department of Metallurgy and Materials Engineering, Engineering Faculty., Mersin University, Mersin, Turkey*
[4] *Department of Metallurgy and Materials Engineering, Technology Faculty., Firat University, Elazığ, Turkey*

*Corresponding Author : oguler@firat.edu.tr

**Abstract—**In semiconductor photocatalysts, ZnO is usually considered as an alternative photocatalyst to $TiO_2$ [1–4] for use in solar cells, pollutant degradation, photolysis of water, gas sensor and biological application due to its unique physico-chemical properties. However, ZnO cannot be utilized for direct solar irradiation because of its quick recombination of charge carriers, poor response to visible light and critical drawback of photocorrosion [5,6]. To solve these problems, several methods, including developing ZnO-based heterostructures or composites with electron scavenging agents such as nano-materials [7–9]

The commerical ZnO powders (purity:99.5%) with particle size of 10 µm were used for preparation of the composites. p-doped Si (100) substrates were used to growth the carbon nanotube. The ZnO-CNT composites were prepared for the ratios of the carbon nanotubes:ZnO are 0.1, 0.5 and 1 %. It was dispersed the carbon nano-tubes homogeneously in the matrix. Powder mixes were compacted in a 20 mm diameter compaction die at 600 MPa. The compacts were sintered at 600, 800, 1000 °C for 1h under Ar atmosphere. The carbon nanotubes obtained were characterized via XRD (Bruker Advance D8, CuKα) diffraction and HR-TEM (Jeol Jem 2100F) techniques. The composites were analyzed by FESEM (Jeol Jsm-7001F). Electrical conductivity of the compsoites was measured using two-probe method with the help of Keithley 6517A Electrometer/High-Resistance Meter. Fig.1 shows SEM image of 0.5 wt % CNT reinforced specimen which sintered at 1000 °C.

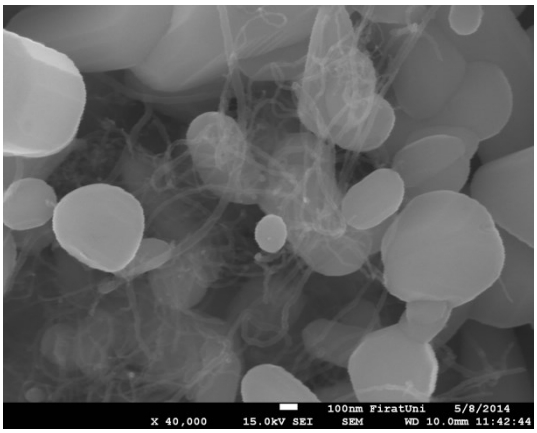


**Figure 1:** SEM image of of 0.5 wt % CNT reinforced specimen which sintered at 1000 °C

The electrical transport mechanisms of CNT-ZnO composites were studied by the temperature dependent conductivity dependent on sintering temperature, as seen in Fig.3. As seen in Fig.3, the electrical conductivity of the samples which sintered at 600 °C are higher than other samples which sintered at 800, 1000 °C.

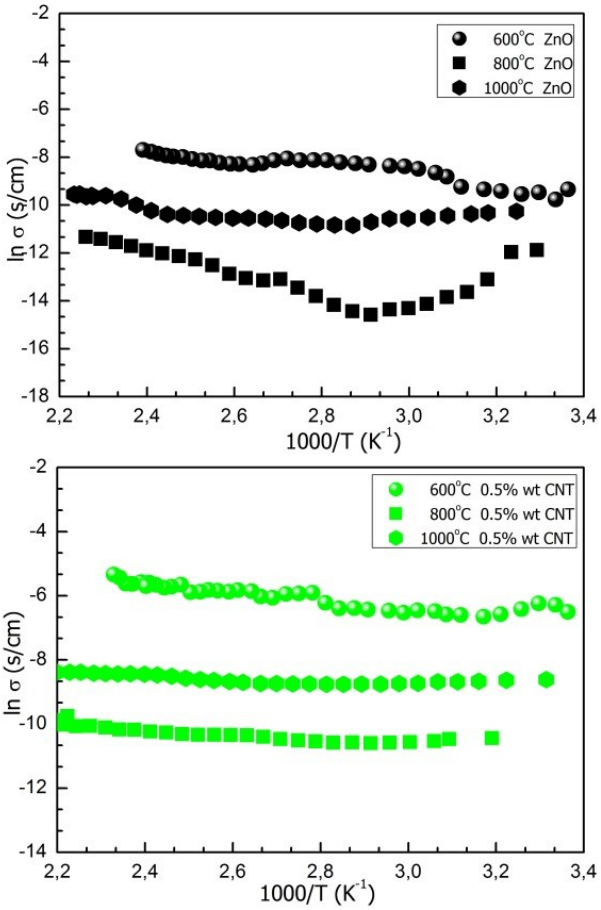


**Figure 2 :** Plots of the electrical conductivity versus temperature of the studied nano-composites.

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# Production Of Carbon-Boron Nitride Hybrid Nanotube By Mechano-Thermal Process

Ömer Güler,[1 *] Ertan Evin [1], Sinan Yardımcı[1], Ali Keleş [1], S.Hale Güler[2]

[1] *Metalurgical and Material Eng. Dept., Firat University, Elazığ, Turkey*
[2] *Metalurgical and Material Eng. Dept., Mersin University, Mersin, Turkey*

*Corresponding Author: oguler@firat.edu.tr

**Abstract—**BNNTs are electrical insulator and transparent to visible light due to a wide band gap (around 5.2–5.8 eV) that is almost independent of tube chirality [1,2]. But, CNTs are electrical conductor as dependent on tube chirality and optical applications are limited because of optical properties. We think that next-generations tubular structures were synthesized by having predominant properties of both nanotubes. In this study, hybrid nanotubes and hybrid structures were synthesized by mechano-thermal process.Hexagonal Boron Nitride (h-BN) powder (Merck KGAA 99 %, 1-2 μm) and hexagonal graphite powders (Merck kGAA, 99.5%, <50 μm) are were used as the starting material. Milling experiments were performed in a planetary ball mill (Restch PM 200) running at room temperature. The vials used were made of hardened steel material. The mixture of graphite and boron nitride powders was dry milled for 20h. And then, the milled samples were isothermally annealed separately in an alumina-tube furnace under the Ar gas in 1300 °C for 2 h. Milled and annealed samples were examined using high-resolution transmission electron microscopy (JEOL JEM 2100F HR-TEM) and by means of CuKα radiation in the Bruker D9 branded X-ray diffraction analysis.Fig.1 shows TEM image of milled (20h) sample. In Fig. 1, turbostratic and amorphous structures were seen after ball milling for 20 h. In addition, There also are porous- nanopororus structures similar to crumpling of a piece a papaer. These structures are precursor for nanotubes formation [3-4].

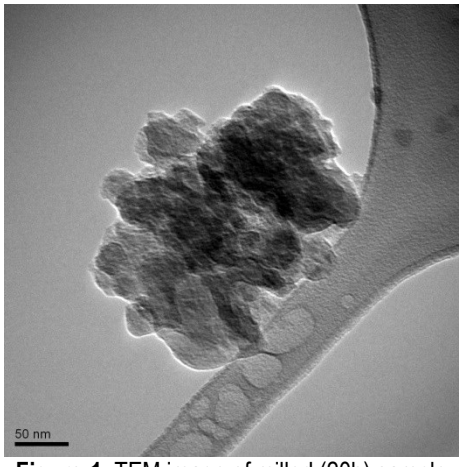


**Figure-1**: TEM image of milled (20h) sample

Fig.2 shows TEM and EDX images of milled (20h) and then annealed (1300 °C for 2 h) sample. It was seen that nanotubes were formed in structure. EDX analysis of nanotubes show that boron, nitrogen and carbon atoms exist in structure of nanotubes

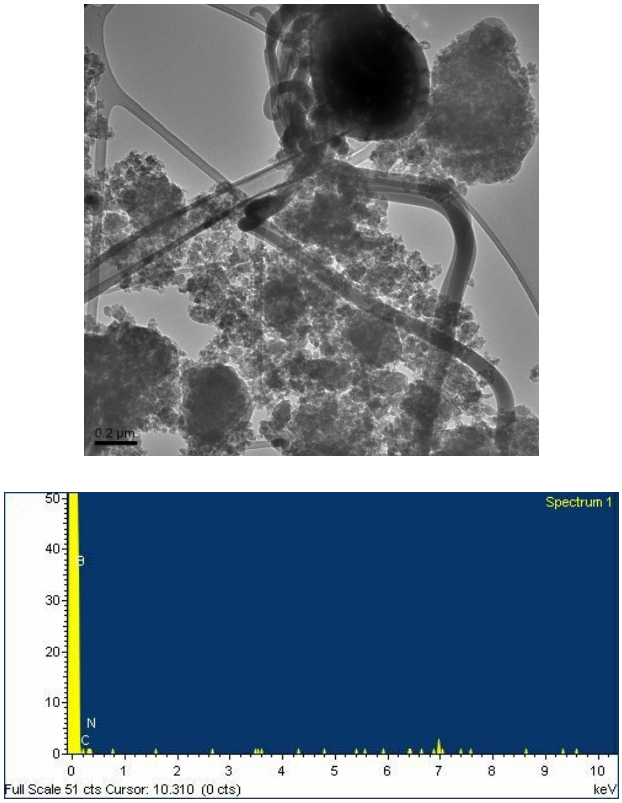


**Figure-2:** TEM and EDX images of milled (20h) and then annealed (1300 ◦C for 2 h) sample

## References :

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# Electrical Characteristic Parameters of QY/p-Si Organic Schottky Diodes

Ali Ugur,[1] Arife Gencer Imer [1,*] and Yusuf Selim Ocak [2,3]

[1]Department of Phyics, Yuzuncu Yil University, 65080, Van, Turkey
[2]Department of Science, Dicle University, 21280, Diyarbakir, Turkey
[3]Scie. & Technol. Appl. and Res. Cen., Dicle University, 21280, Diyarbakir, Turkey

*Corresponding Author: gencerimerarife@gmail.com, aliugur_176@hotmail.com

**Abstract—**A thin film of $C_{18}H_{11}NO_2$ (QY) has been coated by using this solution on the glass and p-Si substrate for optical and electrical measuremets, respectively. Optical energy band gap of QY have been defined as 2.69 eV by using an $\alpha(hv)^2$-hv graph. Aluminum has been thermally evoparated on the QY thin film under high vacuum condition. Finally, the Al/QY/p-Si structure has been obtained. The current-voltage (*I-V*) and capasitance-voltage (*C-V*) measurements of fabricated Al/QY/p-Si structure were taken under dark at room temperature. It is understood from the *I-V* measurements that the fabricated heterostructure showed rectification property.

Organic molecules have been widely used in the fabrication of organic/inorganic Schottky diodes owing to their low cost, easy of synthesis, structural flexibility and environmental friendly [1-3]. Furthermore, organic materials have been used as interfacial layer for metal-inorganic semiconductor (MS) contacts to modify electrical parameters such as an ideality factor (*n*) and a barrier height ($\phi_b$) of them [2-7]. Many studies have reported that the organic thin layer on the inorganic semiconductor substrate could influence the interface states, modifies the $\phi_b$ of the MS contact, and converts into metal-insulator-semiconductor (MIS) contact [7,9].

In this study, optical transmission measurements of the QY thin films were performed by using a UV-Visible spectrophotometer. From the optical measurements it was revealed that the QY compound may have a semiconductor characteristic with a band gap value of 2.69 eV (Fig. 1).

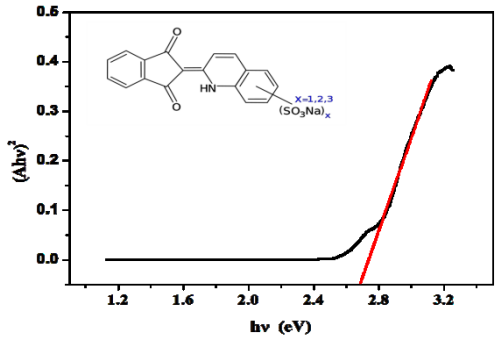


**Figure-1:** The dependence of $(Ahv)^2$ on photon energy for the QY film on glass

After standart cleaning procedure, p type Si wafer with (100) orientation and 5-10 Ω-cm resistivity was used to fabricate QY/p-Si contacts. The ohmic contact was formed by evaporating of Al on the back side of cleaned p-Si substrate, followed by annealing at 580 $^0$C for 3 min in $N_2$ atmosphere. The thin QY layer was formed by spin coating QY solution in methanol having a concentration of $2x10^{-2}$ M on the front surface of the p-Si substrate and left for the evaporation of the solvent at room temperature. After formation of QY/p-Si contact, Al top metal was evaporated by using a shadow mask in vacuum coating at about $10^{-5}$ Torr. The contacts were labeled as D1, D2, D3, D4, D5.

The forward and reverse bias current- voltage plots of the Al/QY/p-Si structure at room temperature in the dark are shown in Fig.2 for different dots. The forward bias current-voltage (*I-V*) measurements revealed a satisfactory rectifying behavior of QY/p-Si contacts with a mean ideality factor of 1. 23 and a mean barrier height of 0.65 eV (Fig. 2). In addition, Cheung's functions and Norde's functions were used to obtain and verify the some electrical characteristic parameters of the contacts. The mean value of series resistance of contacts has been calculated as 1.002 kΩ and 1.498 kΩ by Cheungs' and Norde functions, respectively. The results obtained from both methods were compared and interpreted.

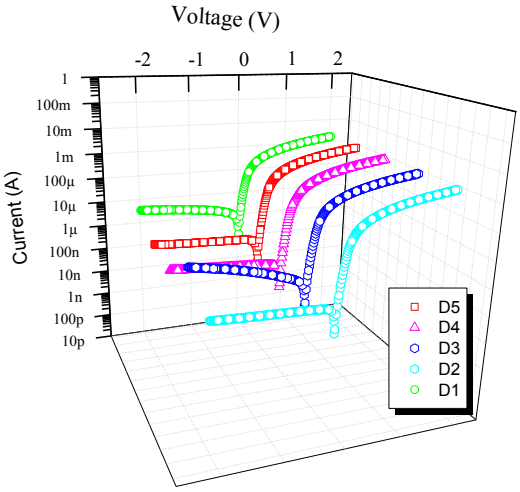


**Figure-2:** Semilogarithmic I-V plots of the Al/QY/p-Si structure for different dots

In conclusion, the Al/QY/p-Si/Al structure was fabricated by coating a QY thin organic film as an interlayer between the metal and semiconductor. The device shows a good rectifying characteristic.

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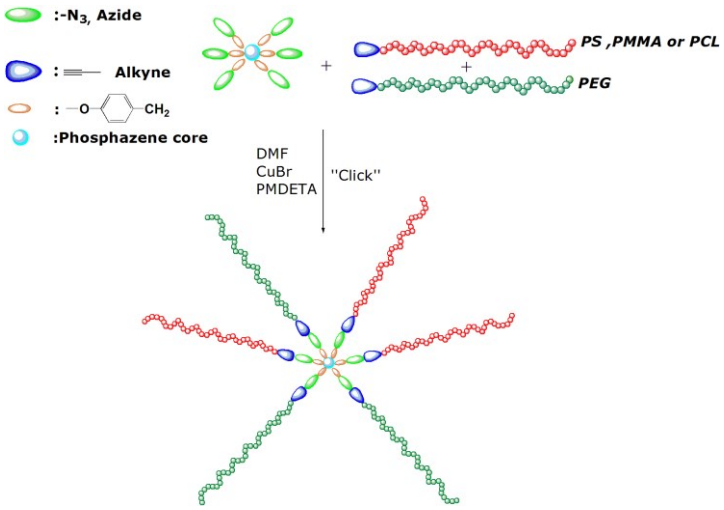
# Preparation of Homo/Hetero-armed Star Polymers with Phosphazene Core via "Click" chemistry

E.Doganci[1,2*], O.Gunaydin[1], M. Gorur[3], and F. Yilmaz[1]

[1]*Department of Chemistry, Gebze Technical University, Kocaeli,Turkey*
[2]*Department of Science Education, Kocaeli University, Kocaeli,Turkey*
[3]*Department of Chemistry, İstanbul Medeniyet University, Istanbul, Turkey*

*Corresponding Author: edoganci@gyte.edu.tr

**Abstract—**Polyphosphazenes offer remarkable properties as material for many applications especially in drug delivery for their hydrolytic degradability and non-toxic degradation products [1]. Star-shaped polymers which have any number of different types of polymer chains emanate from a core. And these polymer arms can be varied by chemical characteristics and/or molecular weight [2]. In this study, well-defined homo/hetero-armed star polymers containing poly(ethylene glycol) (mPEG), poly(ε-caprolactone) (PCL), polystyrene (PS), poly(methyl methacrylate) (PMMA) with phosphazene core were successfully synthesized by "click" chemistry (Scheme 1). The chemical structures of the obtained intermediates and polymers were characterized by gel permeation chromatography (GPC), FT-IR, and $^1$H NMR spectroscopy.




**Scheme 1.** General synthesis procedure of homo/hetero-arm star polymers.

**Acknowledgement :**
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# Cholesterol containing metharylate-based liquid crystal polymers: Investigation of electrical conductivity mechanism

Erdinc Doganci[1,2*], Cigdem Cakirlar[3], Sumeyra Bayir[1], Faruk Yilmaz[1], Sait Eren San[3], Muhammad Yasin[4], Mustafa Okutan[5], Cavit Uyanik[6]

[1]*Department of Chemistry, Gebze Technical University, Kocaeli, Turkey*
[2]*Department of Science Education, Kocaeli University, Kocaeli, Turkey*
[3]*Department of Physics, Gebze Technical University, Kocaeli, Turkey*
[4]*National University of Sciences and Technology, Islamabad, Pakistan*
[5]*Department of Physics, Yildiz Technical University, Istanbul, Turkey*
[6]*Department of Chemistry, Kocaeli University, Kocaeli, Turkey*

*Corresponding Author : edoganci@gyte.edu.tr

**Abstract—**In semiconductor industry, liquid crystals are one of the most promising materials especially for microelectronic devices.[1] They can be implemented in wide range of applications such as flat-panel displays, electronic paper, and chemical sensors.[2] Potentially, side chain liquid crystal polymers (SCLC) could be used as a key component in the field of organic microelectronics.[3] In this study, methyl methacrylate-based SCLC homopolymers and copolymers containing cholesterol (Chol) pendant groups with different lengths of flexible aliphatic spacer (n= 3, 7, and 10 methylene units) were synthesized. To exploit fully their possible applications for flexible organic field effect transistor (OFET) and organic photo voltaic (OPV) assemblies, dielectric properties and conductivity mechanisms of the polymers were then studied in details. Mesomorphic properties were investigated by using differential scanning calorimetry (DSC), polarized optical microscopy (POM), and X-ray diffraction (XRD). Dielectric properties and conductivity mechanisms of the polymer films were estimated using parallel plate impedance spectroscopic technique (Figure 1).

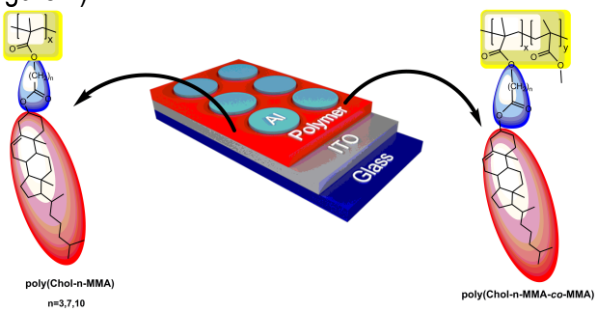


**Figure 1.** Design schematic of parallel plate structure and metharylate-based polymers used for impedance spectroscopic analysis

**Acknowledgement** :
This work was financially supported by the Scientific and Technical Research Council of Turkey (TUBITAK, Project No. 112T846)

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# The Effect of Laser Light on VCNR Behavior of NiPc and PCBM Doped Nematic Liquid Crystals

[1]Z. Güven Özdemir*, [1]N. Yilmaz Canli, [1]Omer Yılmaz, [2]Ahmet Kırsoy, [1]Mustafa Okutan, [3]Oğuz Koysal

[1]*Yildiz Technical University, Department of Physics, 34210 Istanbul, Turkey*
[2] *Turkish Air Force Academie, İstanbul, 34149, Yeşilyurt, Turkey*
[3]*Duzce University, Department of Physics, 81620, Duzce, Turkey*

*Corresponding author: zguven@yildiz.edu.tr

**Abstract—**Due to increasing attention of technological device applications of liquid crystals, determination of their electrical properties becomes important. Especially, negative differential resistance (NDR) phenomenon and electrical conductivity mechanism have a crucial importance on both theoretical and experimental point of view. In this work, experimental optimization for *concentration* and laser power *effects* on nematic liquid crystal' VCNR (Voltage Control Negative Resistance) behavior was studied co-usage of NiPc and PCBM in nematic liquid crystal (E63). NiPc concentration are arranged to be between percentages changing from 1 wt % to 5 wt % where as a 1 wt % of PCBM was used in E63 liquid crystal. The LC cells have been exposed to 632 nm laser lights with the power of 0-100 mW and the influence of laser light on current-voltage characteristics of E63 also have been studied. In investigated LC composites' I-V measurements revealed an increase in current conductivity due to dispersal agents of NiPc and PCBM. The possible reason behind this result can be the increase of the impurity ion in E63 under laser illumination. Ionic charge carriers can move freely in the volume of the LC structure and hence conductivity increases. The value of the current increases for NiPc doped E63 in dark, and it increases further to a higher value under photoirradiation due to the ionic charges caused by photo-excited electrons from NiPc to LC medium. The higher increase in conductivity was observed to more efficient free-charge carrier collection provided by 5 wt % NiPc and 1 wt % PCBM doped in LC hybrid medium under laser irradiation.

**Keywords:** Nematic Liquid crystal, Negative differential resistance , VCNR

# Preparation and Characterization of Poly ( Thiophene)-modified nanoclay composites

E. Ahlatcıoglu[1,3], B. Filiz Senkal[1*], M. Okutan[2] , A. Celik Bozdogan[2]

[1]*Istanbul Technical University, Department of Chemistry, Maslak, İstanbul, Turkey*
[2]*Yıldız Technical University, Department of Physics, Davutpaşa, Istanbul, Turkey*
[3]*Yıldız Technical University, Department of Technical Programs, Maslak, Istanbul, Turkey*

*Corresponding Author : bsenkal@itu.edu.tr

**Abstract—**Polythiophene in both undoped and doped states have been studied for various applications, including organic field effect transistor, solar cells, sensors, electrochromic devices, and light emitting diodes [1-3]. Composites of clay and Poly (thiophene) are interesting for their application as electrochromic and photovoltaic materials. The addition of a very small amount of organically-modified clay, these nanocomposites show a significant increase in many properties, including mechanical properties, thermal stability, flame retardancy and barrier properties [4].
In this study, the new synthesized cationic surfactant was synthesized starting from oleic acid and tetramethylethylenediamine (TEMED). Preparation of of octadecylamine modified nanoclay with different weight percentage (1%, 2% , 5% and 10%) and thiophene composites were investigated in water in the presence of cationic surfactant by using copper (II) sulfate and hydrogen peroxide as oxidants at room temperature for 48 h.

FE-SEM (field emission scanning microscopy) and FT-IR (Fourier transform infrared) spectroscopy were used to characterize the morphology and structure of the samples. Also, electrical characterizations of the composites have been investigated by impedance spectroscopy.

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# Self-cleaning Polymeric Electrochromic Surfaces by LBL Deposition

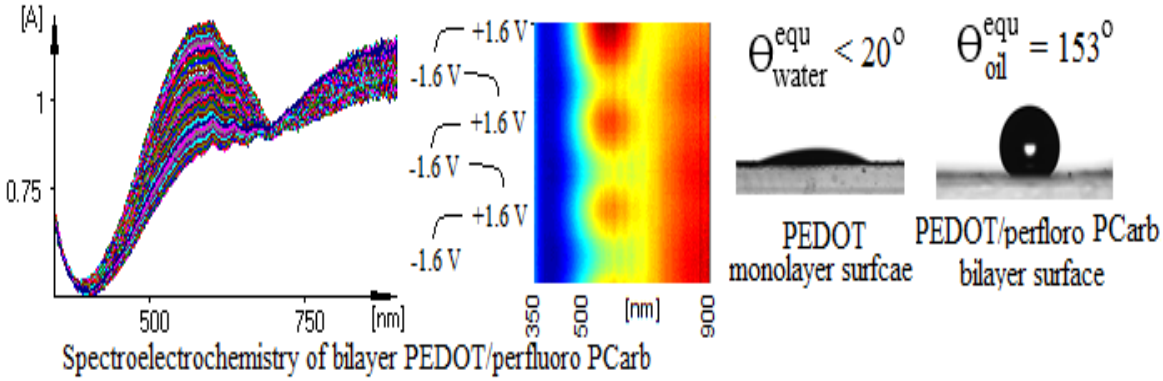
M. Yıldırım[1,2*], A. Çağlar[2,3], G. E. Özel[2,3], U. Cengiz[4] and İ. Kaya[2]

[1]*Department of Materials Science & Engineering, Faculty of Engineering, Canakkale Onsekiz Mart University (COMU), Turkey*
[2]*Polymer Synthesis and Analysis Laboratory, Department of Chemistry, Faculty of Science and Arts, COMU, Turkey*
[3]*Department of Bioengineering & Materials Science Engineering, COMU, Turkey*
[4]*Department of Chemical Engineering, Faculty of Engineering, COMU, Turkey*

*Corresponding Author : mehmetyildirim@comu.edu.tr

**Abstract—**Polymeric electrochromics have been designed as future candidates for electrochromic displays (ECDs) and smart windows. They have been studied with their several optical and spectroelectrochemical properties including color change between the redox states, response time, electrochromic switching stabilities etc. They have several advantages to compare with inorganic electrochromic surfaces such as inexpensive and easy production. However, their water or oil based contamination and abrasion could be a signaficiant problem for practical use in the future. Accordingly, their hydrophobic/oleophobic characterstics have to be improved. Recently, some studies have been focused on this problem of polymeric electrochromics [1]. Bilayer poly(ethylenedioxythiophene) (PEDOT)/poly(alkylthiophene) surfaces have been designed by layer-by-layer deposition (LBL) technique and tunable superhydrophobic/superhydrophylic properties have been obtained. PEDOT increases the porosity of the surface and thus, could be selected as the first layer in LBL. On the other hand, superoleophobic conducting polymer surfaces have been generally obtained using perfluoroalkyl substituted staring materials as extensively investigated by Darmanin et al [2].

We describe here a well-defined bilayer electrochromic surface produced by LBL deposition technique. PEDOT is used as the first layer of the material and a pre-synthesized perfluoro substituted carbazole based soluble copolymer (newly synthesized and characterized by spectral methods) is used for the second (above) layer deposition. Traditional electropolymerization conditions are used in synthesis. The results clearly indicate that the obtained bilayer surface has superhydrophobic and oleophobic characteristics as well as fine electrochromic properties identified by spectroelectrochemical measurements. However, the monolayer PEDOT surface is superhydrophilic and easily polluted. Surface properties of the bilayer material are characterized by atomic force microscopy (AFM) and scanning electron microscopy (SEM) techniques. Water and oil contact angles are determined by static contact angle measurements. Resultantly, the obtained electrochromic bilayer surface could be a good candidate for production of durable ECDs.



Spectroelectrochemistry of bilayer PEDOT/perfluoro PCarb

**Acknowledgment:**
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# Temperature and frequency effects on the electrical and dielectric properties of the Ag/9,10-$H_2$BaP/n-Si/Au-Sb (MIS) Schottky structure

Enise Ozerden[1*], Tahsin Kilicoglu[2], Abdulmecit Turut[3], Huseyin Tecimer[4], Semsettin Altindal[4], Yusuf Selim Ocak[5,6], Ahmet Tombak[1]

[1] *Department of Physics, Faculty of Science and Art, Batman University, Batman, Turkey*
[2] *Department of Physics, Faculty of Science, Dicle University, Diyarbakır, Turkey*
[3] *Department of Physics Engineering, Faculty of Science, İstanbul Medeniyet University, İstanbul, Turkey*
[4] *Department of Physics, Faculty of Science, Gazi University, Ankara, Turkey*
[5] *Department of Science, Faculty of Education, Dicle University, Diyarbakır, Turkey*
[6] *Science and Technology Application and Research Center, Dicle University, Diyarbakır, Turkey*

*Corresponding Author : enise.ozerden@batman.edu.tr

**Abstract—**The capacitance-voltage (*C-V*) and conductance-voltage (*G/ω-V*) measurements of the Ag/9,10-Dihydrobenzo[a]pyrene-7(8H)-one/n-Si/Au-Sb Schottky device were carried out to investigate the electrical and dielectric properties of the device in the temperature range 80-360 K and in the frequency range 1 kHz-2 MHz. It was seen that both electrical and dielectric parameters of the structure were strongly depended on the temperature and the frequency. The *C* and *G* values of the Ag/9,10-$H_2$BaP/n-Si/Au-Sb diode increase with both increasing temperature and increasing voltage. These values decrease with increasing frequency. This situation was explained that interface states ($N_{ss}$) cannot follow the ac signal at high frequencies. The dielectric and electrical characteristics such as dielectric constant ( $\varepsilon'$ ), dielectric loss ( $\varepsilon''$ ), loss tangent (tan $\delta$), electric modulus ( $M'$ and $M''$ ) and ac electrical conductivity ( $\sigma_{ac}$ ) were obtained by using *C-V* and *G/ω-V* measurements of the Ag/9,10-$H_2$BaP/n-Si/Au-Sb structure. The changes in these parameters were investigated against temperature and frequency and plotted as both a function of temperature and the function of frequency. Experimental results showed that the dielectric parameters were quite strongly temperature and frequency dependent.

**Keywords:** Metal/Organic/Inorganic Semiconductor Contacts, Schottky Diodes, Temperature Effect, Frequency, Dielectric Properties, ac Electrical Conductivity, Interface States.

# Electrical Properties and Determination of Activation Energy Based on Ionic Conductivity of Comb-Type Copolymer

G. Pihtili[1*], K. Demirelli[2]

[1]*Department of Food Technology, Tunceli Pertek Sakine Genç Vocational School, Tunceli, Turkey*
[2]*Department of Chemistry, Science Faculty, Elazig, Turkey*

*Corresponding Author : gpihtili@tunceli.edu.tr

**Abstract—**In this study, firstly methylmethacrylate macromonomer was synthesized from acylation reaction of methacryloyl chloride with 7-hydroxy coumarin ended PMMA. The comb type copolymers containing macromonomer synthesized by free radical polymerization of benzylmethacrylate (BMA). Series of P(MMA-comb-BMA) polymers were synthesized. The FT-IR, $^{1}H$ and $^{13}C$-NMR techniques for structural characterization were used. The AC-electronic conductivity of comb-type copolymers were measured with impedance analyzer. Conductivity values (σ) measured which was calculated conductance (Gp) value. Also, susceptance and impedance values were determined. The conductivity, susceptance (Bp) and impedance (Z) values of comb-type copolymers were investigated as a function of temperature and frequency. The temperature dependence of the ionic conductivity has been investigated for P(MMA-comb-BMA) bulk electrolyte prepared by sintering method the traditional Arrhenius equation; "$\sigma = \sigma o/ T \exp (-E_a/ kT)$" is usually adopted to analyze the measured conductivity data, where $E_a$ is the activation energy for ionic conduction [1] It was found that activation energy deduced from the modified Arrhenius equation is a constant independent of temperature. According to transition-state theory in physical chemistry, Ea in the modified Arrhenius equation is considered to be a potential energy barrier for a given chemical reaction at standart state. Similarly we can define, $E_a$ as a potential energy barrier for ionic conduction at $0^{o}K$ [2].

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# Characterization and Dielectric Properties of the Comb-Type Block Copolymer Doped with $EuCl_3$

G. Pihtili[1*], G.Torgut[2] and K.Demırelli[3]

[1]*Department of Food Technology, Tunceli Pertek Sakine Genç Vocational School, Tunceli, Turkey*
[2]*Department of Chemistry and Chemical Processes, Tunceli Vocational School, Tunceli, Turkey*
[3]*Department of Chemistry, Science Faculty, Elazig, Turkey*

*Corresponding Author : gpihtili@tunceli.edu.tr

**Abstract—**In this study, dielectric properties of Poly[Ɛ-CL-b(MMA-comb-EMA)] was studied. First, methylmethacrylate macromonomer and macroinitiator based Ɛ-caprolacton (Ɛ-CL) were synthesized. Methylmethacrylate macromonomer was synthesized from acylation reaction of methacryloyl chloride with 7-hydroxy coumarin ended PMMA. The macroinitiator was prepared from reaction of chlorine acetylchloride P(Ɛ-CL) synthesized by ring opening polymerization of Ɛ-caprolactone. This macromonomer with a macroinitiator and Ethyl methacrylate monomer in different rates was synthesized by ATRP method for series of comb-type block copolymers. The FT-IR, $^{1}H$, $^{13}C$-NMR and gel permeation chromatography (GPC) techniques for structural characterization were used mainly. The thermal properties of ($T_g$ and $T_m$) the copolymers investigated TGA and DSC. The dielectric behaviors of comb-type copolymers were measured with impedance analyzer. It is possible to derive the value of the capacitance from geometric parameters and the properties of the dielectric material. The dielectric permittivity (ε') was calculated by capacitance (Cp) value. The dielectric constant and dielectric loss (ε'') have been calculated using $Cp = \varepsilon' \varepsilon_0 A / d$ and $\varepsilon'' = \varepsilon' DF$ [1,2]. The (ε'), and (ε''), values of comb-type copolymers were investigated as a function of temperature and frequency. Measurements for this comb-type polymer both real part of permittivity and dielectric loss are practically constant in frequency range of 100 Hz-2 kHz at room temperature and temperature range 305-410 K. The frequency dependence of dielectric constant measurement shows that as the frequency increases, the dielectric constant drops sharply and drives to stability. Beside, their effects on the electrical properties by doping with $EuCl_3$ (w/w: %5, %10 ve %20 ) for Poly[Ɛ-CL-b(MMA-comb-EMA)] copolymers were, and were investigated. Results showed that, dielectric constant of doped all comb polymer, increased frequency, as well as with temperature.

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# Spectroscopic and Electrical Properties of Amphiphilic ABC Triblock Copolymers Synthesized by ROP and ATRP

G. Torgut[1*] ,G.Pihtili[2], K. Demirelli[3]

[1]*Department of Chemistry and Chemical processes,Tunceli Vocation School, Tunceli,Turkey*
[2]*Department of Food Technology, Tunceli Pertek Sakine Genç Vocational School, Tunceli, Turkey*
[3]*Department of Chemistry, Faculty of Science, Elazığ, Turkey*

*Corresponding Author : gtorgut@tunceli.edu.tr

**Abstract—**In this study, monomer containing epoxide ring [(1,2-epoxy-3-phenoxy)propane] and ε-caprolactone were suffered ring opening polymerization by using and $BF_3O(C_2H_5)_2$ as catalyst. Acylated hydroxyl ended group synthesized block copolymers, were converted ATRP macro initiator for used in polymerization of different monomers and ABC type block copolymers were synthesized. The homopolymers and block copolymers were characterized by FT-IR, $^1$H-NMR. The electrical properties of ABC type polymers depending on frequency and temperature were investigated. Conductivity, susceptance and impedance values were showed by graphics and compared with each other. From the temperature dependence of electrical conductivity, the activation energy was calculated using the Arrhenius relation [1]. İmpedance rapidly decrease by increasing frequency until 0.5 kHz, above which it remains nearly constant (1.0 kHz) for all samples. At higher frequencies ion migration is effectively clamped and the material behaves as a resistor with no mechanical deformation [2].

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# Illumination Effects on Current-Voltage Characteristics of Au/ZnO/n-GaAs Schottky Barrier Diodes (SBDs)

O. Çiçek[1*], H. Uslu Tecimer[2], İ. Orak[3], H. Tecimer[4] and Ş. Altındal[5]

[1]*Department of Electric and Energy, Arac Rafet Vergili Vocational School of Higher Education, Kastamonu University, Kastamonu, Turkey*
[2]*Department of Electrical and Electronic Engineering, Faculty of Engineering, Karabük University, Karabük, Turkey*
[3] *Vocational School of Health Services, Bingöl University, Bingöl, Turkey*
[4] *Department of Mechatronics Engineering, Faculty of Technology, Karabük University, Karabük, Turkey*
[5] *Department of Physics, Faculty of Science, Gazi University, Ankara, Turkey*

*Corresponding Author : ocicek@kastamonu.edu.tr

**Abstract—**The electrical characteristics of Au/ZnO/n-GaAs Schottky Barrier Diodes (SBDs) have been investigated using current-voltage (I-V) measurements in dark and under various illumination levels at room temperature. Experimental results confirmed that the value of current increases with increasing illumination level especially in the negative bias region due to the illumination induced interface states. The illumination effect on main electrical parameters such as ideality factor (n), reverse bias saturation current ($I_o$) and zero-bias barrier height ($\Phi_{Bo}$) were found to be strong function of illumination and applied bias voltage. The energy distribution profile of $N_{ss}$ was obtained from the forward bias I-V characteristics by taking into account voltage dependent effective barrier height ($\Phi_{ef}$), series resistance ($R_s$) and ideality factor ($n_v$) for dark, 100 W and 200 W conditions. Voltage dependent series and shunt resistances ($R_s$ and $R_{sh}$) profiles were also obtained from Ohm's law. In addition, reverse bias leakage current-voltage of the sample has been investigated in dark and under illumination. These results show that the $I_r$-$V_r$ characteristics can be well described by the electric field dependence so the dominant conduction mechanisms are either Frenkel-Poole emission (FPE) or Schottky emission (SE) in this structure.

**Keywords:** I-V measurements; illumination effect; series resistance; interface states.

# The Frequency-Dependent Admittance Measurements of Au/ZnO/n-GaAs Schottky Barrier Diodes (SBDs)

İ. Orak[1], B. Akın[2*], H. Tecimer[3], H. Uslu Tecimer[4] and Ş Altındal[2]

[1] *Vocational School of Health Services, Bingöl University, Bingöl, Turkey*
[2]*Department of Physics, Faculty of Sciences, Gazi University, Ankara-Turkey*
[3]*Department of Mechatronics Engineering, Faculty of Technology, Karabük University, Karabük, Turkey*
[4]*Department of Electrical and Electronic Engineering, Faculty of Engineering, Karabük University, Karabük, Turkey*

*Corresponding Author : bktakn90@gmail.com

**Abstract—**The frequency dependence of admittance measurement which is including capacitance-voltage (C-V) and conductance-voltage (G/ω-V) plots for various frequencies of the Au/ZnO/n-GaAs Schottky Barrier Diodes (SBDs) have been investigated in the frequency range of 3 kHz-3 MHz at room temperature by considering series resistance ($R_s$), interface states ($N_{ss}$) and interfacial ZnO layer effects in the whole measurement range. The C-V and G/ω-V characteristics confirm that the $R_s$ and $N_{ss}$ are important parameters that strongly influence the electrical parameters of SBDs. In order to good interpret the origin of negative capacitance (NC) and anomalous peak in the forward bias C-V plot admittance measurements were carried out in the wide applied bias voltage range of ±5V. The main electrical parameters such as the barrier height ($\Phi_{Bo}$), doping concentration ($N_D$) and depletion layer width ($W_D$) were obtained from linear relationship with $1/C^2$ vs. V plot. In addition, the values of $N_{ss}$ and $R_s$ are found to decrease with the increasing frequency.

**Keywords:** C-V measurements; frequency effect; interface states; series resistance.

# Negative Capacitance Behaviour in The Forward Bias of Au/ZnO/n-GaAs Schottky Barrier Diodes (SBDs) in Dark and Under Various Illumination Levels

S.O. Tan[1*], H. Uslu Tecimer[2], İ. Orak[3], H. Tecimer[4] and Ş. Altındal[5]

[1]*Department of Electric and Energy, Karabuk Vocational School, Karabuk University, Karabük, Turkey*
[2]*Department of Electrical and Electronic Engineering, Faculty of Engineering, Karabük University, Karabük, Turkey*
[3] Vocational School of Health Services, Bingöl University, Bingöl, Turkey
[4] *Department of Mechatronics Engineering, Faculty of Technology, Karabük University, Karabük, Turkey*
[5] *Department of Mechatronics Engineering, Faculty of Technology, Karabük University, Karabük, Turkey*

*Corresponding Author : serhatorkuntan@karabuk.edu.tr

**Abstract—**In order to explain the source of negative capacitance (NC) in the forward bias region, both the capacitance-voltage (C-V) and conductance-voltage (G/-V) measurements of the Au/ZnO/n-GaAs Schottky Barrier Diodes (SBDs) have been investigated both in dark and various illumination levels at room temperature. Experimental results show that the C-V and G/-V characteristics show fairly large illumination dispersion especially in the reverse bias region due to illumination induced interface states and electron-hole pair. NC phenomenon has been observed in the C-V curves both in dark and under illumination. The C-V and G/-V curves were drawn for enough high frequency (500 kHz) and low frequency (10 kHz) to compere the inductive behavior. It is clear that, the decrease in the capacitance corresponds to an increase in conductance. Such behavior of C in the forward bias was attributed to the loss of charges located at surface states/interface traps and series resistance. Voltage dependent $R_s$ profile was obtained from C-V and G/-V data using Nicollian and Brews methods. In addition, the high frequency C and G/ values measured under reverse and forward bias were corrected by eliminating the effect of $R_s$ to obtain the real SBD capacitance and conductance.

**Keywords:** C-V measurements; illumination effect; negative capacitance; series resistance.

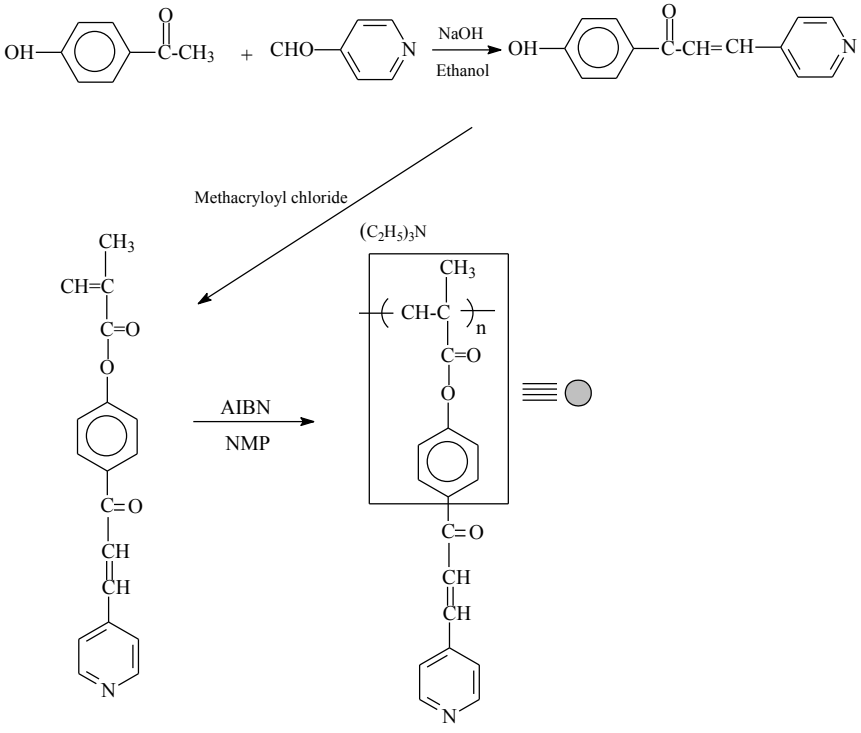
# Synthesis of chalcone Based Hydrogen Bonded Side Chain Liquid Crystalline Polymer

Burak Korkmaz[1], Yesim Gursel[1], B.Filiz Senkal[1*], Mustafa Okutan[2]

[1]*Istanbul Technical University, Department of Chemistry, Maslak, İstanbul, Turkey*
[2]*Yıldız Technical University, Department of Physics, Davutpaşa, Istanbul, Turkey*

*Corresponding Author : bsenkal@itu.edu.tr

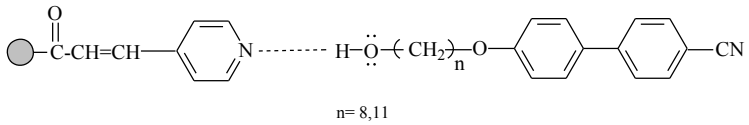
**Abstract—**α,β unsaturated carbonyl group is a chalcone group and it has excellent photoreactivity. The technological applications of photosensitive polymers are applied in the fields of microlithography, photoconductors, nonlinear optical materials, energy exchange materials, liquid crystalline display etc. [1].The hydrogen-bonding interaction is one of the most important and widely used non-covalent interactions in the design and construction of functional materials because biopolymers such as nucleic acids, polypeptide, and cellulose have hydrogen bonding groups. The formation and dissociation of hydrogen bonds for these polymers play key roles in biological processes [2].A new chalcone based polymer was prepared starting from synthesis of chalcone based monomer reaction with 3-aminoacetophenone and 4-carboxypyridine. This compound was reacted with methacryloyl chloride to obtain chalcone based monomer (scheme 1).




**Scheme 1**.Preaparation of the chalcone based polymer

The monomer was polymerized free radical polymerization method Chalcone based side chain liquid crystalline polymer (HB-PLC) was prepared from pyridine group in the polymer as a hydrogen bond acceptor and 11-(4-cyanobiphenyl-4'-oxy) undekan-1-ol (LC11) by molecular self-

assembly processes via hydrogen bond formation between nitrogen of PVP and hydroxyl group of the LC11(scheme 2).




**Scheme2.** Preparation of side chain liquid crystal polymer

The formation of H-bond was confirmed by using FTIR spectroscopy. The liquid crystalline behavior of the HB-PLC was investigated by differential scanning calorimeter (DSC) and polarized optical microscopy (POM).

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# The source of negative capacitance and anomalous peak in the forward bias capacitance-voltage of Cr/p-Si/Au Schottky barrier diodes (SBDs)

Ç. Bilkan[1,2*], A. Gümüş[3], Ş. Altindal[1], M.T. Bilkan[1,2]

[1]*Department of Physics, Faculty Sciences, Gazi University, 06500, Ankara, Turkey,*
[2]*Department of Physics, Faculty Sciences, Karatekin University, 18000, Çankırı, Turkey,*
[3]*Department of Physics, Faculty Sciences, Niğde University, 51000, Niğde, Turkey,*

*Corresponding Author : cigdembilkan@gazi.edu.tr

**Abstract—**The frequency and voltage dependence of capacitance-voltage (C-V) and conductance–voltage (G/ω-V) characteristics of the Cr/p-Si/Au Schottky barrier diodes (SBDs) have been investigated in the frequency and applied bias voltage ranges of 10 kHz-5 MHz and (-4 V)-(+4V), respectively, at room temperature. Both the effect of series resistance ($R_s$) and interface states ($N_{ss}$) on C-V and G/w-V characteristics have been examined, in detail. Both the C-V and G/w-V characteristics are found a strong function of frequency and applied bias voltage. In addition, both a strong negative capacitance (NC) and anomalous peak behavior have been observed in the forward bias C-V plots for each frequency. The negative value of C increases with decreasing frequency and this decrement in the NC corresponds to the increment in the conductance. The main electrical parameters such as doping concentration of acceptor atoms ($N_A$), Fermi energy level ($E_F$), and barrier height ($\Phi_B$) were obtained from the linear part of $C^{-2}$-V plot for each frequency. The value of $N_{ss}$ was obtained using Hill-Coleman method for each frequency and it show a peak behavior at about 30 kHz. In addition the voltage dependent profile of $R_s$ was obtained using Nicollian and Brews methods. The experimental results confirm that the magnitude of $N_{ss}$, $R_s$ and $N_A$ are more effective on C-V and G/ω-V characteristics and so they taking in the calculations.

# The Mesoporous Cobalt Oxide microtubes synthesis for Supercapacitor Electrodes

A. Bingol[1*], F.E. Atalay, D. Asma[2], H. Kaya, S. Kama[2]

[1]*Inonu University, Science and Art Faculty, Department of Physics, Malatya 44280, Turkey*
[2]*Inonu University, Science and Art Faculty, Department of Biology, Malatya 44280, Turkey*

*Corresponding Author :funda.atalay@inonu.edu.tr

**Abstract—**In the present study, we made a rapid, low cost, and ecofriendly $Co_3O_4$ materials synthesis using *Clodosporium clodosporoides* fungi as biotemplate. Fungal hyphae are particularly attractive biotemplates due to their tubular structures. $Co_3O_4$ nanostructured porous microtubes were prepared by chemical precipitation method onto *C. clodosporoides* fungal hyphae. The synthesized materials were used as a supercapacitor active material. The morphological properties of the synthesized material were studied by scanning electron microscope (SEM). $Co_3O_4$ microtubes diameter varies from 1-7 µm and up to several millimeters in length. X-ray energy dispersive spectroscopy (EDS) spectrum confirmed the presence of elemental Co signal in high percentage. The surface area of that was also studied by Brunauer–Emmett–Teller (BET) analysis method. BET results indicated that the material had mesoporous structure and the surface area of the material was 109 $m^2/g$. Supercapacitor characteristics such as long term charging/discharging, and impedance characteristics were also examined.

**Acknowledgements:**
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# Influence of deposition pressure ($O_2$) on single crystal YIG ($Y_3Fe_5O_{12}$) thin films prepared by pulsed laser deposition

U.Soykan[1], M.T.Yurtcan[1], A.O.Kaya[2] and S. Atalay[2*]

*[1]Department of Nanoscience & Nanoengineering, Atatürk University, Erzurum, Turkey*
*[1]Department of Physics, Inonu University, Malatya, Turkey*

*Corresponding Author : selcuk.atalay@inonu.edu.tr

**Abstract—**There are a lot of parameters in the production process of single crystal YIG ($Y_3Fe_5O_{12}$) film [1-2]. In this paper, the influence of deposition pressure on film quality of single crystal YIG thin films prepared by Pulsed Laser Deposition (PLD) was investigated. For this purpose, YIG target was prepared by yttrium iron oxide nanopowder ( <100 nm BET) and sintered. YIG thin films were deposited on one side polished single crystal $Gd_3Ga_5O_{12}$ (GGG) substrates at five different oxygen pressures with 25 mTorr step (50-150 mTorr). X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) techniques were used to make comparative studies of film microstructure. All variables except deposition oxygen pressure, such as number of pulses, repetition rate, deposition temperature, heating and cooling rate, target-substrate distance, laser excitation energy, annealing temperature and annealing pressure was fixed. For this set of fixed parameters, the SEM and XRD analysis of these films revealed that crystal structure quality of YIG thin films are better at the oxygen deposition pressure of 125 and 150 mTorr and deposition rate of YIG/GGG found to be very low.

**Acknowledgments:**
This work was supported by TUBİTAK with the Project number MFAG-112T820

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# The Energy Density Distribution Profile of Interface Traps and Their Relaxation times and Capture Cross Sections of MS structure with GO-doped PBCoO nanoceramic Structure in Forward and Reverse Bias Regions

S. Altındal[1*], A. Kaya [2], S. Demirezen[1], İ Uslu[3]

[1] *Department of Opticianry, Vocational school of Medical sciences, Turgut Özal University, Ankara, TURKEY*
[2]*Department of Physics, Faculty of Sciences, Gazi University, Ankara, TURKEY*
[3]*Department of Chemistry, Faculty of Science and Arts, Gazi University, Ankara, Turkey*

*Corresponding Author :altundal@gazi.edu.tr

**Abstract—**MS structure with GO-doped PBCoO nanoceramic structures have fabricated and their admittance measurements were carried out in the frequency range of 1 kHz-1 MHz at room temperature. Experimental results show that capacitance (C) and conductance (G/w) values were found a strong function of frequency and applied bias voltage. While the C-V plot has two distinct peaks which are located at about 0 and 2 V, respectively, at low frequencies, the first peak becomes disappear at high frequency. The energy density distribution profile of the interface states ($D_{it}$) and their relaxation time ($\tau$) and capture cross section ($\sigma_p$) of the sample were obtained by using admittance method. In addition, voltage dependent profile of $D_{it}$ and resistance were obtained by using low-high frequency capacitance and Nicollaian and Brews methods [1] and they show also two distinctive peaks, respectively. Two peaks behavior in the C-V, Dit-V and Ri-V plots confirmed that the existence two different localized regions of interface trap between Si and interfacial layer at band gape. The value of Rs decreases with increasing frequency and it was found as 175 Ω at 1 kHz and 72 Ω at 1 MHz, respectively. As a result, the mean value of $D_{it}$ was found $5x10^{13}$ $eV^{-1}cm^{-2}$ order and they are suitable for an electronic device.

**Keywords:**
MS structure with GO-doped PBCoO nanoceramic, frequency and voltage dependence, interface states

**References:**

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# Preparation and properties of boron nitride-modified polyimide fims for the development of biomedical dopamine sensor

Aziz Paşahan[1*], Öznur Güngör[1], Büşra Aksoy[1], Süleyman Köytepe[1], Turgay Seçkin[1]

[1]*İnönü University, Faculty of Arts and Science, Chemistry Department, 44280, Malatya, Turkey*

*Corresponding Author: apasahan1@gmail.com

**Abstract—**A series of a series of boron nitride based polyimides used to construct a novel dopamine electrode for the detection of dopamine by differential pulse voltammetry (DPV).The boron nitride based polyimides were characterized by FT-IR, differential scanning calorimetry and thermogravimetric analysis.

Dopamine (DA) is one of the naturally occurring catecholamines that are an important class of neurotransmitters. For example, useful information for diagnoses of Alzheimer's and Parkinson's diseases and schizophrenia may be obtained from the concentration values of this compound in biological fluids.The most adopted methods are based on chromatography, capillary electrophoresis, chemiluminescence, fluorescence, mass spectrometry and electrochemistry. Electrochemical methods have always been a powerful tool for determination of DA at a low level in solution. The design of electrochemical sensors for DA determination has been given an intensive research effort to search for low detection limit, very fast responsetime and ease of fabrication [1-3]. However, electrochemical determinations of DA are usually disrupted by the coexistance ascorbic acid (AA) and uric acid (UA), whose oxidation potentials are close to that of DA. Thus, to circumvent this selectivity problem, it is necessary to develop an electrochemical method with high selectivity and rapid measurement of DA without interference from UA and AA [4-8].

In the present study, a series of boron nitride based polyimides were synthesized and characterized by means of FT-IR, $^1$H NMR, DSC, TGA and elemental analysis methods. Boron nitride based polyimide films with different boron concentrations were used for determination of dopamine. The boron nitride based polyimides were formed by casting the film on the electrode surface. Selectivity behaviour of films prepared from polyimide solutions containing 1%, 3% and 5%, nitride to electroactive and nonelectroactive substances was examined by differential pulse voltammetry (DPV).

Moreover, boron nitride based polyimides were used to preparation of the dopamine sensor as a selective membrane in the presence of ascorbic acid. Electrochemically dopamine responses of the polyimide covered electrodes were examined by DPV. It was found that boron nitride dopants play an important role in the structural quality and electrochemical properties of polyimide-coated electrode containing boron nitride. The results demonstrated that polymer electrode containing 5% boron nitride was allowed penetration of dopamine while blocking the permeation of ascorbic acid and uric acid through film. A simple, quick and sensitive electrochemical sensor has been developed for the dopamine detection in the presence of electroactive (uric acid and large quantities of ascorbic acid), and nonelectroactive species(lactose, sucrose and urea).

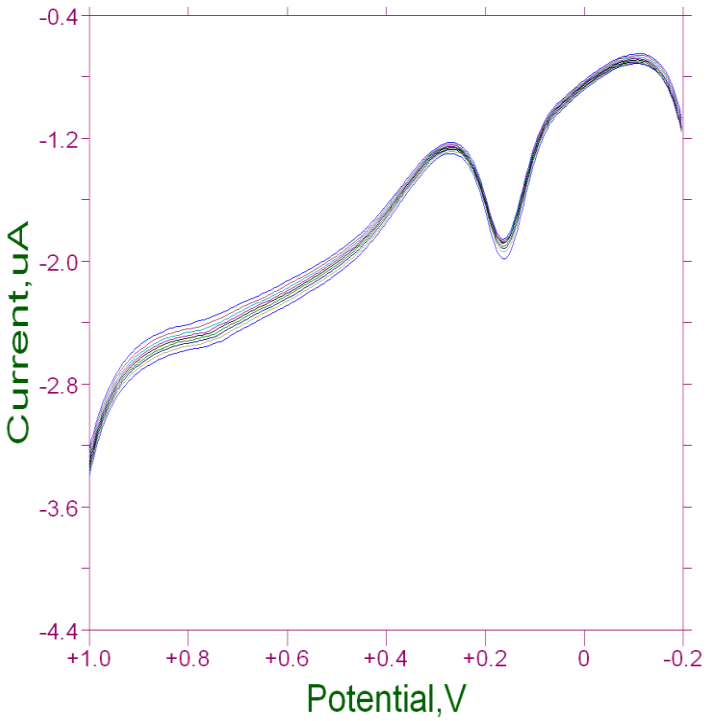


**Figure-1:** DPVs of the polyimide-coated electrode containing boron nitride (5%) in increasing concentration of dopamine in the presence of interferences.

Electrochemical measurement results illustrated that the boron nitride-modified polyimide possessed wide linear ranges, excellent sensitivity, selectivity, reusability and low response time. Based on these excellent characteristics, the polyimide-coated electrode containing 5% boron nitride provides a new strategy for the development of biomedical dopamine sensor.

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# Structural and dielectric properties of HAP/Graphene Composites

Bilal Arif*, Fahrettin Yakuphanoglu

*Department of Physics, Firat University, Elazig 23119, Turkey*

*Corresponding Author : bilalarif@ymail.com

**Abstract—**Graphene doped hydroxyapatite (HAP) nanocomposites with various concentrations (x= 0, 0.2, 0.3, 0.4 and 0.5 at %) were synthesized by sol gel method. The structural and morphological properties of the composites were studied using X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy and field electron scanning electron microscopy (FESEM) along with energy dispersive X-ray (EDX). The FTIR results show the formation of hydroxyapatite samples. EDX confirmed the graphene substitution into the hydroxyapatite structure. The dielectric properties were investigated by the impedance spectroscopy. The average crystallite size for the composites was found to change between 42 -50nm. The relative permittivity, dielectric loss, structural and morphological properties were effected by the graphene content.

# Effects of Caffeic Acid Phenethyl Ester (CAPE) on Renal Damage by Consumption of High Fructose Corn Syrup in Rats

Mehmet Kaya Özer[1], Gonca Ozan[2], Nevin Kocaman[3], Abdurrahman Gün[4*]

[1] *Adiyaman University, Medical School, Department of Pharmacology, Adiyaman/TURKEY*
[2] *Firat University, Faculty of Veterinary Medicine, Department of Biochemistry, Elazığ/TURKEY*
[3] *Firat University, Medical School, Department of Histology and Embriyology, Elazığ/TURKEY*
[4] *Inonu University, Faculty of Pharmacy, Department of Pharmacology, Malatya/TURKEY*

*Corresponding Author : abdurrahmangun23@hotmail.com

**Abstract—**Fructose consumption in the form of high fructose corn syrup (HFCS) or sucrose, particularly as sweeteners of carbonated beverages, has increased dramatically in the last 30 years. The consumption of fructose plays an important role in the chronic disorders in the modern world. Caffeic Acid Phenethyl Ester (CAPE), an active component of propolis, has important physiological activities, including antioxidant, anti-inflammatory, antiproliferative, antiviral, antifungal and antineoplastic properties. We aimed to investigate whether CAPE has any effect on kidney damage that occurs due to consumption of HFCS.

Eighteen male 8 week aged Spraque-Dawley rats were randomly divided in to three groups (n=6): Control, HFCS and HFCS+CAPE. Metabolic syndrome was induced by HFCS 30% in tap water for six weeks. CAPE applications at the dose of 50 micromol/kg/day/i.p for two weeks, were initiated after four weeks of fructose consumption. After the experimental period of six weeks, rats were decapitated and kidneys were taken for the evaluation of biochemical and histopathology. Kidney tissues malondialdehyde (MDA) levels and catalase (CAT) activities were quantified by spectrofotometry. Also kidney tissues were fixed in 10% neutralized formalin and embedded in paraffin blocks. Sections obtained from paraffin blocks were used for immune detection of eNOS.

Liver MDA level was significantly higher and CAT activity was lower in HFSC group than control group. CAPE administration led to a significant decrease in MDA level and an increase in CAT activity in HFCS+CAPE group when compared to HFCS group. Immunohistochemical analysis of eNOS in kidney tissue revealed their presence in the epithelium cells of the glomeruli. In light microscopic observations of tissues from rats, decreased eNOS immunoreactivity were determined in HFCS group and CAPE treatment increased all these adverse effects.

These results indicate that HFCS consumption leads to an oxidative damage in kidney. On the other hand CAPE supplementation to HFCS-fed rats had beneficial effects and normalized the renal abnormalities.

**Keywords:** High fructose corn syrup, CAPE, Kidney, Rat

# Electrical Properties inorganic-on-organic hybrid GaAs/Graphene Oxide Schottky Barrier Diode

A. Kırsoy [1,*], M. Ahmetoglu[2], M. Okutan[3], F. Yakuphanoglu[4]

[1] *Turkish Air Force Academie, İstanbul, 34149, Yeşilyurt, Turkey*
[2] *Department of Physics, Uludag University, 16059, Bursa, Turkey*
[3] *Department of Physics, Yıldız Technical University, 34212, Istanbul, Turkey*
[4] *Department of Physics, Fırat University, 23169, Elazığ, Turkey*

*Corresponding Author: admkirsoy@yahoo.com

**Abstract—**The $Au_{88}Ge_{12}$ alloy/n-type GaAs(100)/Graphene Oxide (GO)/Au Schottky barrier diode has been fabricated by Hummers method. Schottky diode was investigated under dark and light intensity by the current–voltage characteristics of the hetero junction. Thermionic current mechanism above the barrier has detected by current-voltage measurements. It is found that the barrier height increases and the ideality factor decreases with light intensity. The obtained results indicate that GaAs/GO diode can be used as a photo-sensor in optoelectronic applications.

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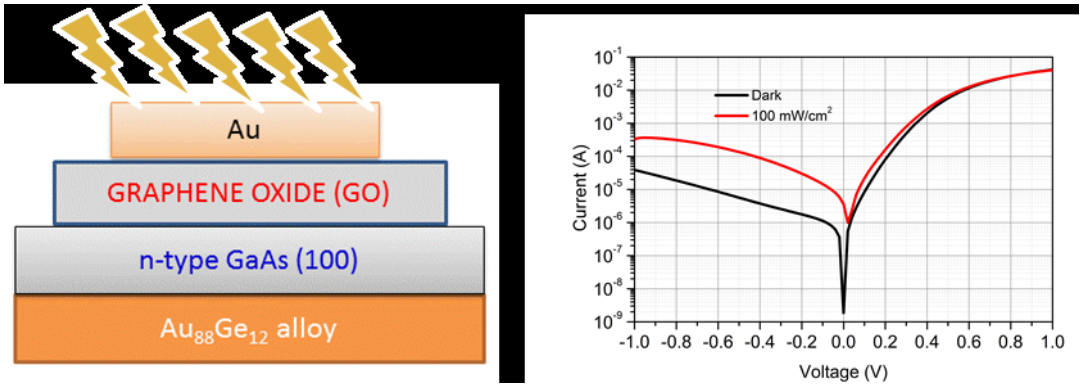



**Figure1.** Layer sequence and I–V characteristics of the AuGe/n-type GaAs/Graphene Oxide/Au hetero junction under dark and 100 mW/cm².

**Keywords:** Graphene Oxide, GaAs, Schottky Contacts, Current-Voltage

# For Conversion of $CO_2$ and Epoxides to Cyclic Organic Carbonates: Synthesis and Characterization of Mono/Multinuclear Cobaloxime and Organocobaloxime

Ahmet Kilic*[1], Emine Aytar[1], Mahmut Ulusoy[1], Mustafa Durgun[1], and Seyithan Akdağ[1]

[1]*Chemistry Department, Harran University, Osmanbey Campus, Sanliurfa, 63190, Turkey*

*Corresponding Author: kilica63@harran.edu.tr

**Abstract—**The catalytic chemical fixation of carbon dioxide ($CO_2$) to fine chemicals has long attracted considerable attention because of its abundant, inexpensive, almost nontoxic, and bio renewable properties. The chemical fixation of $CO_2$ into useful organic compounds has attracted intense attention in view of resource utilization and pollution prevention. One of the most promising methodologies in this area has been the synthesis of cyclic organic carbonates [1].

For the reactions of $CO_2$ and epoxides to produce cyclic organic carbonates, many effective metal and organometallic catalysts has been intensively studied since a long time. Recent literature on the chemistry of cobaloximes and organocobaloximes indicates that not much attention has been paid to the possibility of studying different groups containing cobaloximes and organocobaloximes.

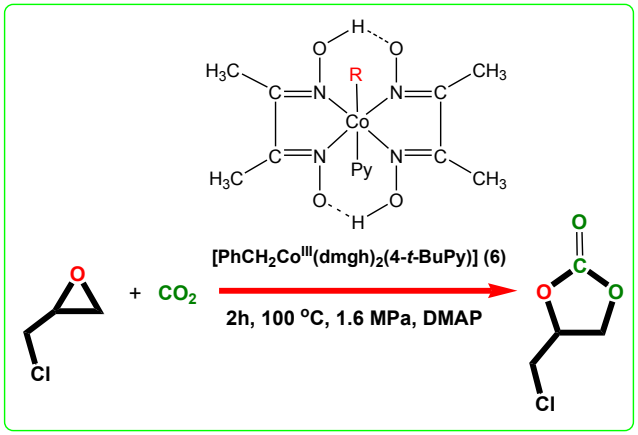
When the investigated literature, cobaloximes and organocobaloximes with one or both of the intramolecular O–H···O bridges replaced by organoboryl groups are well known and have recently been reviewed. Whereas, the intramolecular O–H···O bridges replaced by different metal ions are not well known in the literature.

Thus, in this study, at first the mono- and multinuclear cobaloxime and organocobaloxime complexes bearing bidentate dimethyl glyoxime ligands have been synthesized and characterized. At secondly, the catalytic efficiency of these complexes for the conversion of carbon dioxide and different epoxides into organic products (five-membered cyclic organic carbonates) under optimally conditions and without using any solvent will be investigated (Scheme 1).

In the catalytic experiments 4-dimethylamino pyridine (DMAP) was prefered as co-catalyst, since DMAP is more active base with higher yield compared to other Lewis bases. In addition, various influencing factors on the cycloaddition reaction, such as co-catalyst, temperature, $CO_2$ pressure and reaction time, were investigated.

Complexes (1) and (3), which have two dimethyl glyoxime per cobalt center (mononuclear complexes), are better catalytic systems than the corresponding multinuclear cobaloxime and organocobaloxime complexes (2-5) and (7-10) with two dimethyl glyoxime per cobalt center and one linked ligands per copper center.

The used as catalysts mono- and multinuclear cobaloxime/organocobaloxime complexes were characterized by $^1H$ and $^{13}C$ NMR spectra, FT-IR spectra, UV-Vis spectra, LC-MS spectra, molar conductivity measurements, melting point measurements and magnetic susceptibility measurements [2-4].




**Scheme-1.** Synthesis of cyclic carbonates from various epoxides and $CO_2$.

**Acknowledgement:**
This work has been supported by TÜBİTAK (Project no: 111T944).

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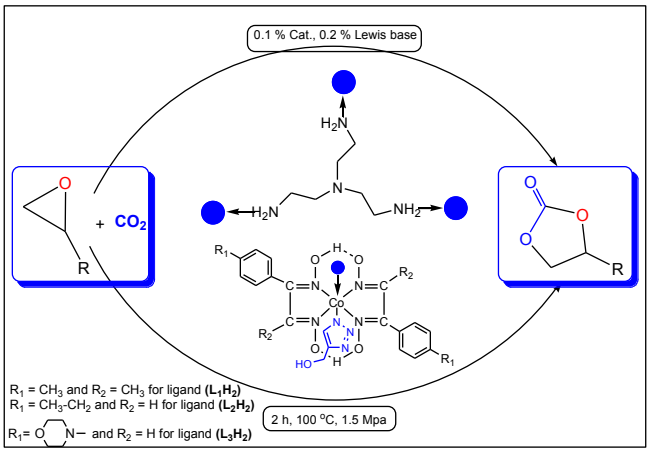
# Evaluation of Multinuclear Cobaloxime Complexes Obtained by Click Chemistry for $CO_2$ Activation and Conversion to Form Cyclic Organic Carbonate

Ahmet Kilic*[1], Armağan Keles[1], Emine Aytar[1], Mustafa Durgun[1], and Mahmut Ulusoy[1]

[1]*Chemistry Department, Harran University, Osmanbey Campus, Sanliurfa, 63190, Turkey*

*Corresponding Author: kilica63@harran.edu.tr

**Abstract—**Over the past several decades, one of the major problems in the world is that the average atmospheric concentration of $CO_2$ has increased from 280 ppm to 400 ppm during the summer of 2013 and as a result, the average temperature has increased between 0.6 $^oC$ and 1 $^oC$ in the same period.As a solution to such a serious problem, one of the most common ways in chemical industry has been the synthesis of five-membered cyclic carbonates via coupling carbon dioxide and epoxides for effective utilization of $CO_2$.The synthesized five-membered cyclic organic carbonates are used both in industrial chemistry and in academic chemistry studies as monomers, excellent aprotic polar solvents, pharmaceutical/fine chemical intermediates, in many biomedical applications, electrolytes for secondary batteries, starting materials for polycarbonates, enantiopure aminoalcohols, and thermosetting coatings. For the synthesis of five-membered cyclic organic carbonates from carbon dioxide and epoxides, many efficient and cost effective homogeneous catalytic systems have been developed from the academia and industry. At the same time, the synthesized five-membered cyclic organic carbonates are simple separation from the reaction mixture arrives to operational flexibility, selectivity, efficiency, stability and ease of handling and economy in various industrial processes. Although many efficient and cost effective homogeneous catalytic systems have been proposed for the synthesis of five-membered cyclic organic carbonates, the search of new homogeneous or heterogeneous catalytic systems still remains an exciting topic.We reported structurally similar multinuclear cobaloxime complexes obtained by click chemistry base on dissymmetrical dioxime ligands were synthesized and characterized as trinuclear complexes with respect to varied axial groups. These various multinuclear cobaloxime complexes obtained by click chemistry have been successfully applied to the synthesis of a five-membered cyclic organic carbonates from CO2 and epoxides under optimally conditions and without using any solvent [1-3]. Additionally, in this study the effects of reaction temperature, pressure, and time on the yield of a five-membered cyclic organic carbonate were discussed in detail. These various multinuclear cobaloxime complexes obtained by click chemistry were characterized by 1H and 13C-NMR spectra, FT-IR spectra, UV-Vis spectra, LC-MS spectra, melting point measurements and magnetic susceptibility measurements.




**Scheme-1.** Synthesis of cyclic carbonates from various epoxides and $CO_2$.

**Acknowledgement:**
This work has been supported by TÜBİTAK (Project no: 111T944).

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# Dynamic mechanical properties and swelling behavior of Filled Liquid Silicon Rubber

Betül Çiçek Özkan[1*] Joachim Kaschta [2]

[1] *Metallurgy and Materials Engineering Department, Firat University, Elazığ, Turkey*
[2] *Institute of Polymer Materials, Friedrich Alexander Uni., Erlangen 91058, Germany*

*Corresponding Author: bcozkan@firat.edu.tr

**Abstract—**Materials having the properties which are changed with the effect of magnetic fields belong to the group of smart materials and these are known as magnetorheological materials. Liquid Silicon Rubber (LSR) having the applications as liquid or elastomer is present in this group. Magnetorheological property is obtained by filling of liquid Silicon with iron particles. In this study, the influence of concentrations of spherical carbonyl iron particles on both viscoelastic properties and cross-linking behavior of liquid silicon was figured out. Polymer networks were synthesized by reacting of a commercially available chemical namely divinyl Polydimethylsiloxan $[(CH3)_2SiO]_n$ containing platinum catalyst with a cross-linker namely methyl hydrogen siloxan ($CH_3(H)Si-O$). In the structures of both chemicals, there are nano-silica ($SiO_2$) particles. Rheological characterization of liquid silicon was carried out in a rotational Rheometer by dynamic mechanic test. Enhancement in the cross linking density and acceleration in the polymer network formation rate were observed with increasing temperature. $SiO_2$-Particles/PDMS-Matrix and particle/particle interactions were found to occur with the increasing amount of filler material. In addition, it was observed that relaxation time and hence the frequent dependence of elasticity modulus (G') was changed. Cross-linking behavior of the elastomer was examined by swelling test, and it was figured out that crosslinking density (interaction at the particle/matrix interface) was increased with the increasing amount of filler material.

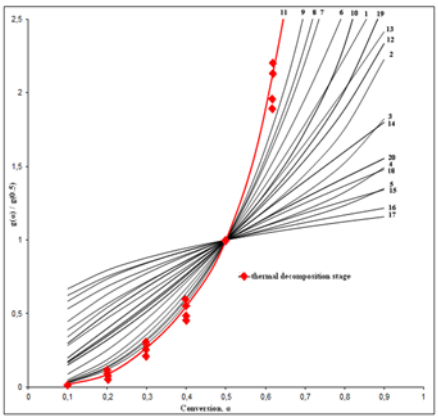
# A kinetic study on the thermal decomposition of Poly(6-aminoquinoline)/copper composite

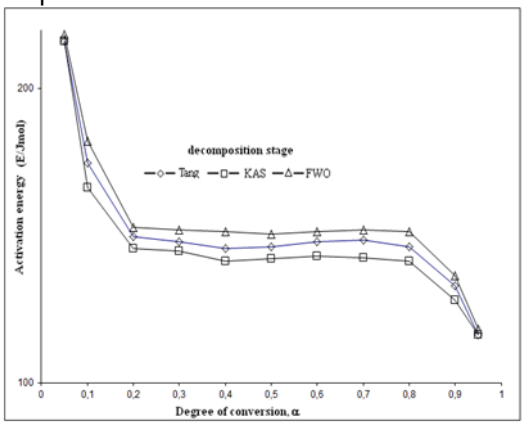
Ali Bilici[a]*, Fatih Doğan[b], İsmet Kaya[a]

[a]*Çanakkale Onsekiz Mart University, Faculty of Sciences and Arts, Department of Chemistry, Polymer Synthesis and Analysis Lab. 17020 Çanakkale, Turkey*
[b]*Department of Secondary Science and Mathematics Education, Faculty of Education, Canakkale Onsekiz Mart University, 17100 Canakkale, Turkey*

*Corresponding Author:alibilici66@hotmail.com

**Abstract—**In the previous work, we reported the synthesis and characterization of a novel hybrid material consisting of poly(6-aminoquinoline) and copper particles (PAQ/Cu) [1]. This study deals with the thermal decomposition kinetics of PAQ/Cu. For this purpose, thermal analysis of PAQ/Cu was performed by a thermal gravimetry instrument (TG) at four different heating values: 5,10,15 and 20 ºC.Thermograms showed that the product was decomposed mainly one decomposition steps. The activation energy of thermal decomposition for all heating rates was calculated by Flynn-Wall-Ozawa (FWO), Kissinger-Akahira-Sunnose (KAS), Tang, Friedman, Kissinger and Kim-Park methods. The calculated activation energy values from all methods are very close to each other. In order to evaluate the mechanism function related to the thermal decomposition of the resulting polymer, Coast-Redfern method (CR) and master plots were also used. TG thermograms present deceleration-shaped curves based on diffusion mechanism.




**Acknowledgement:**
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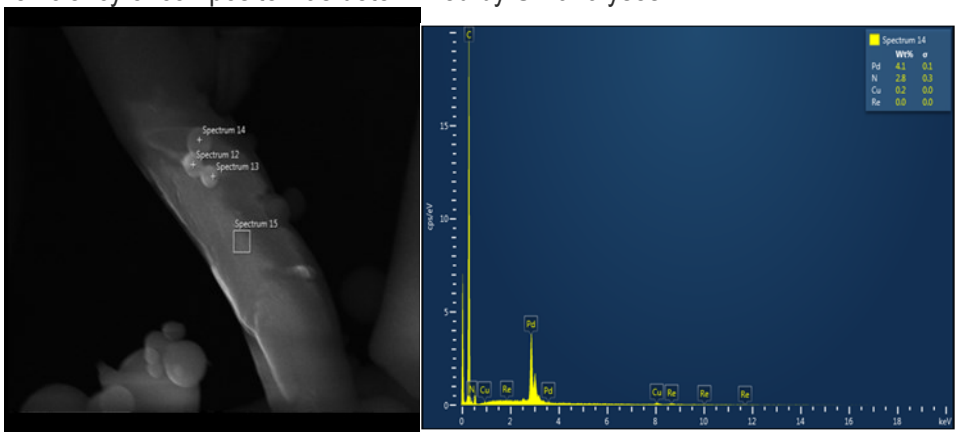
# One step synthesis of blue light emitter palladium/polyquinoline hybride and its potential usage in the 4-nitrophenol removal

Ali Bilici*, Nilay Tezel, İsmet Kaya

*Çanakkale Onsekiz Mart University, Faculty of Sciences and Arts, Department of Chemistry, Polymer Synthesis and Analysis Lab. 17020 Çanakkale, Turkey*

Corresponding Author : alibilici66@hotmail.com

**Abstract—**Nitrophenols(NP) are one kind of pollutants and they are widely found in industrial wastewater. As known, 4-nitrophenol and its derivatives result from the production processes of pesticides, herbicides [1] and synthetic dyes [2]. They have high toxicity and carcinogenic character. Therefore, they have caused considerably damage to the ecosystem and human health. In this study, palladium particles have been successfully synthesized on the polyquinoline matrix and used as a solid-phase catalyst for the reduction of 4-nitrophenol in presence of sodium borohydride. For synthesis of composite material, 5-aminoizoquinoline (monomer) and palladium acetate (oxidant) were used as monomer and oxidant, respectively. The characterization of resulting composite was performed by UV-vis, FTIR, SEM and fluorescence analysis. The NP removal efficiency of composite was determined by UV analyses.

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# Theoretical Investigation of the Thione-Thiol Tautomerism in 5-Pyridin-4-yl-4H-1,2,4-Triazole-3-Thion

C.Orek[1*], M. Koparir[1], A. Cansiz[1], K. Sarac[2]

[1]*Firat University, Faculty of Science, Department of Chemistry, 23119 Elazığ, Turkey*
[2]*Bitlis Eren University, Faculty of Architecture-Engineering, Department of Metallurgy and Material Engineering, 43400, Bitlis, Turkey*

Corresponding Author : cahitorek@firat.edu.tr

**Abstract—**The 1,2,4-triazole moiety is an important system that is present in a large number of compounds with a wide variety of uses in many fields, such as medicinal chemistry, materials science, and organocatalysis. Tautomerization and single or multiple proton transfer processes (intra- or intermolecular) draw considerable scientific attention due to their fundamental importance in a wide range of chemical and biological processes and their role in different reaction mechanisms [1]. In this work all calculations were performed by means of the Gauss View molecular visualization program [2] and GAUSSIAN 09W program package [3] using the spin-restricted hybrid density functional theory (B3LYP) method with the 6-311++G(d,p)basis set. The energies of 1,2,4-triazol-3-thione and thiol forms and energy differences of these forms calculated at DFT/B3LYP levels and have been compared. The solvent effect on the proton transfer reactions was investigated in two solvents (ethanol and DMSO) using the polarizable continuum model (PCM) [4].It is determined that the thione form is the predominant tautomer among the tautomeric forms both in the gas phase and in solution phase. The predicted energy differences between thione and thiol tautomers was within the range of 50–70 kJ $mol^{-1}$ while the activation energy of thione-thiol tautomerization process was within the range of 190–230 kJ $mol^{-1}$. Thus, tautomerization in parent molecule is not occurred from both thermodynamics and kinetics point of views. Although the participation of a single molecule of the same solvents in the proton-transfer reaction significantly reduces the barrier height, the obtained values still make the tautomerization unfavorable. However, it can be deduced that the inclusion of more molecules of solvent as well as the effect of the bulk will reduce more these barriers.

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# The Use of Explicitly Correlated Methods on the Ar–$NO^+$ van der Waals Complex

Cahit Orek* And Niyazi Bulut

*Firat University, Faculty of Science Department of Physics, 23119 Elazig*

Corresponding Author : cahitorek@firat.edu.tr

**Abstract—**The interaction between a rare gas atom and a closed shell diatom represents one of the simplest atom–diatomic molecule interactions. The Ar-NO+ cation has received considerable interest recently, stimulated by the report of the high-resolution zero-kinetic-energy (ZEKE) spectrum by Takahashi [1]. For the explicitly correlated calculations, the CCSD(T)-F12x (x=a, b) method [2] was used with cc-pVnZ-F12 (n = D, T, Q) orbital basis sets [3] on the N, O and Ar atoms. All the electronic structure calculations were performed using the MOLPRO suite of programs [4]. The basis set superposition error (BSSE) was corrected using Boys and Bernardi's counterpoise procedure in the RCCSD(T) calculations. Calculations of the adiabatic energies were carried out for 47 intermolecular distances in the range between 2 $a_0$ and 100 $a_0$, while the angular grid for the $\theta$ variable consisted of 19 values (every 10◦). The harmonic vibrational frequencies were calculated for the intermolecular bend, Ar-$NO^+$ stretch and $NO^+$ stretch. In addition, Mulliken population analysis and electric dipole moment were performed with the MRCI method.As a result of this study we present comparison of the equilibrium geometries, vibrational harmonic frequencies, and dissociation energies corrected for the BSSE, calculated with CCSD(T), CCSDT, and CCSD(T)-F12x methods and with several basis sets.

**Acknowledgement:**
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# Thermal Analysis of Cu-Based Shape Memory Alloy and Shape Memory Thin Film

Ayşe Tekataş[a], Canan Aksu Canbay[a*], Zuhal Karagoz Genc[b]

[a]*Department of Physics, Faculty of Science, Firat University, 23119, Elazig, Turkey*
[a]*Department of Metallurgy and Materials Engineering, Faculty of Engineering, 02040, Adiyaman, Turkey.*

*Corresponding Author : caksu@firat.edu.tr

**Abstract—**Among the functional materials, shape memory alloys are important because of their unique properties. So, these materials have attracted more attention to be used in micro/nano electronic and electromechanic systems. In this work, thermal evoporation method has been used to produce CuAlNi shape memory alloy thin film. The produced CuAlNi thin film has been characterized and the presence of the martensite phase was investigated and compared with the CuAlNi alloy sample. The characteristic transformation temperatures of austenite and martensite phase are determined by Differential scanning calorimetry (DSC) and phase transition temperatures of the studied alloy were determined by Differential thermal analysis (TG/DTA) measurements. In addition to this, we compare the thermal observation results of the SMA with thin film.

**Acknowledgements:**
This work is financially supported by FÜBAP, Project No: FF.12.35.

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# The Observation of the Differences Between Cu-Based Shape Memory Alloy and Shape Memory Thin Film by Structural Analysis

Ayşe Tekataş[a], Canan Aksu Canbay[a*], Fahrettin Yakuphanoglu[a], Zuhal Karagoz Genc[b]

[a]*Department of Physics, Faculty of Science, Firat University, 23119, Elazig, Turkey*
[b]*Department of Metallurgy and Materials Engineering, Faculty of Engineering, 02040, Adiyaman, Turkey.*

Corresponding Author : caksu@firat.edu.tr

**Abstract—**SMAs have a diffusionless and first order transformation characterized by an atomic shearing of the crystal lattice from at high temperature to low temperature, which present characteristic strucrural domains, called martensite variants. Cu-based SMAs show order-disorder phase transitions from high-symmetry crystal structure (at high temperature) to low symmetry crystal structure (at low temperature) Due to the high working capability of SMAs, they have attracted much attention to be used in micro/nano electromechanical systems. So these materials acquired more attention in technological developments. According to this factor, there has been a significant researh focused on SMA thin films that could be used in Microsystems. In this work, thermal evoporation method has been used to produce CuAlNi shape memory alloy thin film. The produced CuAlNi thin film has been characterized and the presence of the martensite phase was investigated and compared with the CuAlNi alloy sample. X-Ray diffraction patterns of the samples were taken at room temperature. The surfaces of the alloy sample and thin film were characterized by optical metallographic microscope. And the thickness of the thin film was observed by scanning electron microscope SEM.

**Acknowledgements:**
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# Preparation and characterization of camphene/decanoic acid composites as shape-stabilized phase change materials for thermal energy storage

Zuhal Karagoz Genc[a*], Murat Genc[b], Canan Aksu Canbay[c]

[a]*Department of Metallurgy and Materials Engineering, Faculty of Engineering, 02040, Adiyaman, Turkey.*
[b]*Department of Chemistry, Faculty of Science and Arts, Adiyaman University, 02040, Adiyaman, Turkey.*
[c]*Department of Physics, Faculty of Science, Firat University, 23119, Elazig, Turkey*

Corresponding Author : zgenc@adiyaman.edu.tr

**Abstract—**PCMs melt and solidify at a broad range of temperatures, which are evaluated in many applications such as building energy conversation, solar energy storage and thermal energy recycle. PCMs can be categorized into organic inorganic and their mixture.This study focuses on preparing PCM (phase change materials) which contain camphene and decanoic acid with fly ash, pyroclastic, barite, marble powder as supporting material. For these reasons, a series of shape-stabilized phase change materials of camphene/ decanoic acid (CD) were prepared and their thermal properties were measured by differential scanning calorimetry. The results indicated that the mixture consisting of 60 wt% camphene and 40 wt% decanoic acid is the optimum as the PCM in terms of the phase change temperature.The DSC results show that the melting point of the camphene/decanoic acid is 14,39°C with a latent heat of 629.25 J/g and solidifies at -3,94°C with a latent heat of 620.82 J/g. The TGA, FT-IR and SEM measurements will employ to determine the thermal properties, thermal stability, chemical structure and morphology of the composite based PCMs.

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# Thermal Observations of Aged Cu-Based Shape Memory Alloys at High Temperatures

Samet Gudeloglu, Canan Aksu Canbay*

*Fırat University, Faculty of Science, Department of Physics*

Corresponding Author : caksu@firat.edu.tr

**Abstract—**The martensitic transformation is a diffusionless phase transition in the solid state. In this transformation, the atoms keep on moving comparatively their neighbourness. The thermoelastic martensitic transformations are responsible for the shape change from martensite to the austenite phase or from austenite to martensite phase (M↔A) in the shape memory alloys (SMAs). In this work, the effect of thermal ageing on transformation temperatures and structure of Cu-26.56 Al-3.06 Mn (% at.) shape memory alloy processed by arc melting, have been studied by differential scanning calorimetry (DSC) measurements and differential thermal analysis (TG/DTA) measurements. The produced sample was solution treated at β-phase region and then the sample was thermally aged above austenite transformation temperatures. Characteristic transformation temperatures ($A_s$, $A_f$, $M_s$ and $M_f$) of the aged sample is characterized by thermal analysis and phase transition analysis to determine the effect of ageing on transformation temperatures and phase transition steps. After the determination of austenite and martensite transformation temperatures, $T_0$ equilibrium temperature and hysteresis values were calculated for each ageing temperature of the sample.

**Acknowledgements:**
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# Graphene Based Solar Light Sensitive Photodiode

A. Hendi*

*Physics Department, Sciences Faculty for Girls, King Abdulaziz University, Jeddah, 21589, Saudi Arabia*

*Corresponding Author : dr.asmahendi@hotmail.com

**Abstract—**Graphene Based Solar Light Sensitive Photodiode was fabricated. The photoresponse properties of the diode were investigated by I-V and C-V measurements. The reverse current of the diode increases with solar light intensity. This suggests that the prepared device exhibits a photodiode behavior. The photoresponse mechanism of the diode was analyzed by transient photocapacitance measurements. The obtained electrical and photocurrent measurements suggest that graphene based solar light sensitive photodiode can be used as a sensor in optoelectronic applications.

# Photoresponse Properties of Organic Semiconductor Based Photodiode Sensitive to Solar Light

R. H. Alo Rainy*

*Physics Department, Sciences Faculty for Girls, King Abdulaziz University, Jeddah, 21589, Saudi Arabia*

*Corresponding Author : r-aloraini@hotmail.com

**Abstract—**An organic Semiconductor based photodiode diode was fabricated to obtain a photodiode sensitive to solar light. The electrical and photoresponse properties of organic semiconductor based photodiode have been investigated. The current-voltages characteristics of the photodiode were analyzed under solar light. The electronic parameters such as photosensitivity and photoresponsivitiy of the diode were determined. It is seen that the photocurrent in the reverse bias of the diode is higher than the dark current. This suggests that the prepared diode exhibited a photodiode behavior and it can be used in solar light sensor applications.

# The importance of the "$O^+ + H_2$" reactıon in astrophysics

D.Cimenoglu[1*], O. Roncero[2], N.Bulut[3]

[1]*Department of Physics, Faculty of Science, Firat University, Elazig, TURKEY*
[2] *Instituto de Fisica Fundamental (IFF-CSIC), C.S.I.C., Serrano 123, 28006 Madrid, SPAIN*
[3]*Department of Physics, Faculty of Science, Firat University, Elazig, TURKEY*

Corresponding Author :duygucimenoglu@gmail.com

**Abstract—**The reactions of oxygen atoms with hydrogen are interest of in astrophysics mainly because of their participating in the ozone cycle. The most important of these reactions is $O^+ + H_2$. Because, its interest in combustion. The aim of this work is to investigate stereodynamics of this reaction. A great amount of information about reaction stereodynamics is obtained by studying how the reaction cross section and reaction probabilities depend on initial/final excitation of reactants/products. Obtaining reaction cross-sections and reaction probabilities allow us to understand how chemical reaction rates change with initial/final states. In this work, total and state-to-state integral cross sectisons for the title reaction using a time-dependent quantum wave-packet method presented.

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# State-to-state dynamics of the fhcl reaction

F. Arslan* and N. Bulut

*Firat University, Department of Physics, Faculty of Science, Elazig, TURKEY*

Corresponding Author : faruk.arslan5@gmail.com

**Abstract—**In this work the dynamics of the FHCl reaction have been investigated in state-to-state level. Reaction probabilities and cross sections have been calculated. For all the calculations a time independent quantum method implemented in combined with simple J-shifting approximation. The total reaction probability as a function collision energy calculated in a broad range of collision energy to interpret the reactive collision between atom and diatomic molecule. It is found that the total cross sections expand with expanding collision energy as expected for an endothermic reaction.

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# Poly(*p*-azidomethylstyrene-co-styrene) : Synthesis, Characterization and Dielectric measurements

İnci Armağan*, Fatih Biryan, Ersin Pekdemir, Kadir Demirelli

[1]*Firat University, Faculty of Science, Department of Chemistry, 23119, Elazig, Turkey*

Corresponding Author : İnci Armağan

**Abstract—**Since last more than three decades various research groups [1-2] have been involved actively to synthesize polymer electrolytes with high conductivities but up to now the desired conductivities.In this study, *p*-azidomethyl styrene was synthesized from the reaction of *p*-chloromethyl styrene with sodium azide. The copolymerization of styrene and *p*-azidomethyl styrene was carried out by the free radical polymerization method.The structures of monomer and copolymers were defined by Fourier-Transform Infrared (FT-IR) and NMR techniques. The glass transition temperature (Tg) of copolymers was measured by differential scanning calorimeter (DSC). The thermal behavior of both homopolymer and copolymers were investigated by thermogravimetric analysis (TGA). The results obtained were compared with each other. Then, the dielectric measurements (dielectric constant, dielectric loss factor and conductivity) of polymers were carried out by means of an impedance analyzer as a function of frequency from 100 Hz to 2000 Hz. The results were compared with each other.

**Keywords:** Dielectric properties, Conductivity

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# A graft copolymer system by combination of atrp and click chemistry : Synthesis, Characterization and Dielectric behaviors

Inci Armağan, Fatih Biryan*, Gamze Çelik And Kadir Demirelli

[1]*Firat University, Faculty of Science, Department of Chemistry, 23119, Elazig/Turkey*

Corresponding Author : fatihbiryan@gmail.com

**Abstract—**In recent studies, it has been shown that the heterocyclic 1H-1,2,4-triazol is a promising three nitrogen atoms in the ring [1]. The immobilization of triazol ring, which can be copolymerization with an acid monomer was reported [2].

In this study, 4-azido methyl styrene was synthesized from the reaction of 4-chloromethyl styrene with sodium azide. The copolymerization of styrene and 4-azido methyl styrene was performed by the free radical polymerization method. The copolymer containing 1H-1,2,4-triazol ring was obtained by the reaction of copolymer compound with propargyl bromide according to click reaction procedure [3]. The graft copolymer synthesis from copolymer with 1H-1,2,4-triazol ring containing bromine methyl polymer used as ATRP initiator was prepared by benzyl methacrylate at 110 $^{o}$C in presence 2,2'-bipiridine and CuBr. The structure characterization of these polymers were defined by FT-IR, $^{1}$H and $^{13}$C- NMR techniques. The thermal behaviors of graft copolymers were investigated by DSC and TGA measurements The results were compared with each other. The dielectric measurements (dielectric constant, dielectric loss factor and conductivity) of the graft copolymers were carried out by means of an impedance analyzer as a function of the frequency from 100 Hz to 2000 Hz .

**Keywords:** Click chemistry, Dielectric Properties, Conductivity

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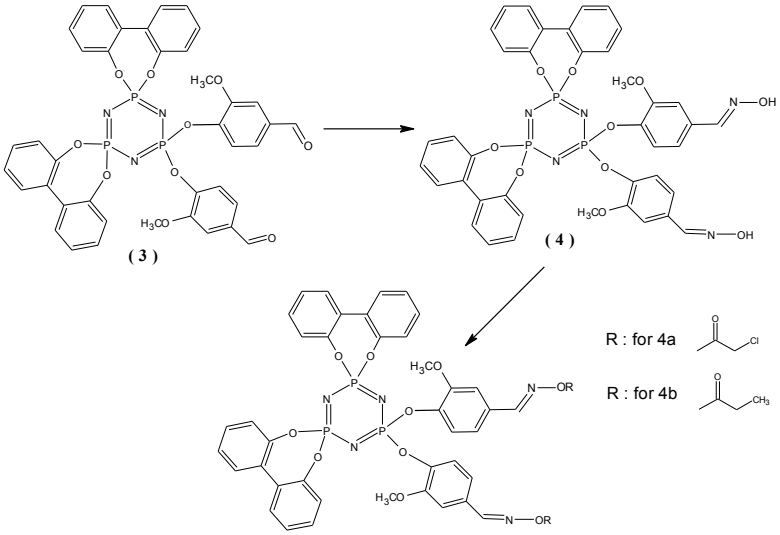
# Synthesis, characterization and dielectric properties of 2,2-dichloro-4,4,6,6,-bis[spiro(2',2"-dioxy-1',1"-bifenilyl)] cyclotriphosphazene bearing oxime ester

Fatih Biryan[1*], Furkan Özen[1], Kenan Koran[1], Ahmet Orhan Görgülü[1]

[1]*Firat University, Faculty of Science, Department of Chemistry, 23119, Elazig, Turkey*

Corresponding Author : fatihbiryan@gmail.com

**Abstract—** In this study, 2,2-Bis(4-formil-3-methoxyphenoxy)-4,4,6,6,-bis[spiro(2',2"-dioxy-1',1"-phenylyl)]cyclotriphosphazene **(2)** was synthesized from the interaction of 2,2-dichloro-4,4,6,6,-bis[spiro(2',2"-dioxy-1',1"-phenylyl)]cyclotriphosphazene (**1**) with 4-hydroxy-3-methoxybenzaldehyde. 2,2-Bis(4-[hydroxyimino]-2-methoxyphenoxy)-4,4,6,6-bis[spiro(2',2"-dioxy-1',1"-biphenylyl)]cyclotriphosphazene (**3)** were obtained from the reactions of **2** with hydroxylamine hydrochloride in the presence of pyridine[1-2]. Compound **4** was reacted with chloroacetyl chloride and propanoyl chloride. From these reactions, disubstituted compounds **(4a, and 4b)** were obtained from all of the oxime protons replacement with acyl groups. The structures of compounds were characterized by FT-IR, $^{1}H$, $^{13}C$, and $^{31}P$-NMR spectroscopy.




Dielectric measurements for phosphazenes containing oxime ester compounds **(4a and 4b)** were carried out by means of an impedance analyzer as a function of frequency. Dielectric properties of samples prepared in a plate form were measured at room temperature over the frequency range 50 Hz to 4 kHz and given as compared with each other.

**Keywords:** Dielectric Properties, Phosphazene, Oxime ester phosphazene

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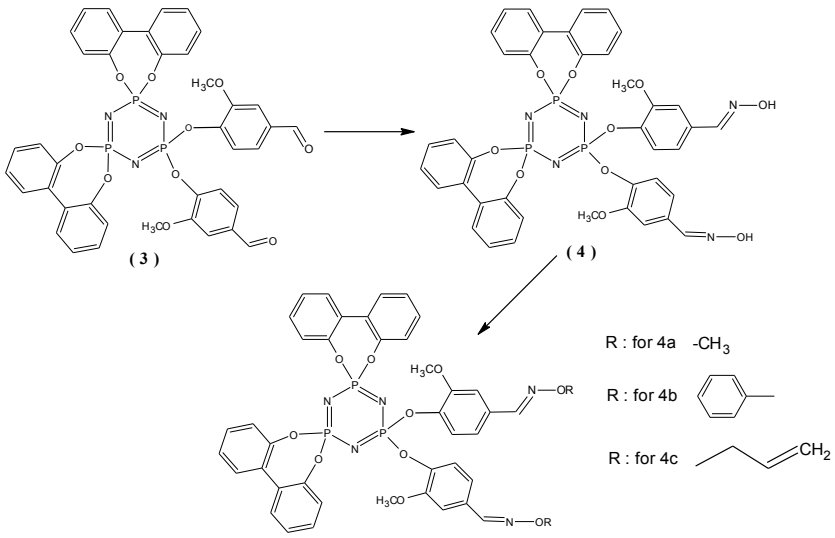
# Synthesis, characterization and investigation of dielectric properties of new cyclotriphosphazene compounds containing oxime ether

Fatih Biryan[1*], Kenan Koran[1], Furkan Özen[1], Ahmet Orhan Görgülü[1]

[1]*Firat University, Faculty of Science, Department of Chemistry, 23119, Elazig, Turkey*

Corresponding Author : fatihbiryan@gmail.com

**Abstract—** Hexachlorocylotriphosphazene (**1**) was reacted with biphenyl-2,2'-diol. From this reaction, 2,2-dichloro-4,4,6,6,-bis[spiro(2',2"-dioxy-1',1"-biphenylyl)]cyclotriphosphazene (**2**) was obtained[…]. 2,2-Bis(4-formil-3-methoxyphenoxy)-4,4,6,6,-bis[spiro(2',2"-dioxy-1',1"-biphenylyl)]cyclotriphosphazene **(3)** was synthesized from the interaction of **2** with 4-hydroxy-3-methoxybenzaldehyde. 2,2-Bis(4-[hydroxyimino]-2-methoxyphenoxy)-4,4,6,6-bis[spiro(2',2"-dioxy-1',1"-biphenylyl)]cyclotriphosphazene (**4)** were obtained from the reactions of **3** with hydroxylamine hydrochloride in the presence of pyridine[2]. Compound **4** was reacted with benzyl chloride, allyl bromide and methyl iodide. From these reactions, disubstituted compounds **(4a, 4b and 4c)** were obtained from all of the oxime protons replacement with alkyl groups. The structure of these compounds were defined by FT-IR, $^{1}H$, $^{13}C$, and $^{31}P$-NMR spectroscopy.




Dielectric measurements for phosphazenes containing oxime ether compounds (5–8) were carried out by means of an impedance analyzer as a function of frequency. Dielectric properties of samples prepared in a plate form were measured at room temperature over the frequency range 50 Hz to 4 kHz and given as compared with each other.

**Keywords:** Dielectric Properties, Phosphazene, Oxime-phosphazene

**Acknowledgements:**
The authors are grateful to the Fırat University Research Fund for financial support of this work (project no: FF.11.26)

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# Metal complexes of a homopolymer system containıng dıethenolamıne sıde group : synthesıs and dıelectrıcal behavıors

Aslışah Açıkses[1], Necmittin Çömez[1*], Fatih Biryan[1], Ersin Pekdemir[1]

[1]*Fırat University, Faculty of Science, Department of Chemistry, 23119, Elaziğ/Turkey*

Corresponding Author : Necmittin Çömez

**Abstract—**In this work, the first modification of 4-clormethylstyrene with diethanolamine was prepared according to adapted method from the litareture [1]. The homopolimerization of modificated styrene was carried out by free radical polimerization method at 60 $^0$C in presence of 1,4-dioxane and AIBN. The metal complexes were prepared by reaction of the homopolymer used as ligand and Ni(II),Cu(II), Co(II), Zn(II) metal ions in presence of ethanol and NaOH at 65$^o$C for 48h in pH=6.5.

The structures of monomer modificated, homopolymer used as ligand and polymer metal complexes were characterized by Fourrier -Transform Infrared (FT-IR) spectroscopy. The glass transition tempareture (Tg) of homopolymer was determined by differantial scanning calorimeter (DSC). The thermal behavior of both homopolymer and polymer methal complex were investigated by thermogravimetric analysis (TGA). The results obtained were compared with each other. Then, the dielectrical measurements (dielectric constant, dielectric loss and conductivity) of polymer-metal complexes were investigated as a function of temprature and frequency [2, 3].

**Keywords:** Dielectrical behavior, Ligand, Metal Complexes

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# Synthesis, Characterization and Dielectric Properties of Polymers Bearing Chalcone As Initiator

Serkan Çete*, M. Fatih Coşkun, Demet Coşkun, Fatih Biryan

*Firat University, Faculty of Science, Department of Chemistry, 23119, Elaziğ/Turkey*

Corresponding Author : ceteserkan@hotmail.com

**Abstract—** In this study, the first stage, 4-[(1E)-3-(1-benzofuran-2-yl)-3-oxoprop-1-en-1-yl]phenylchloro acetate **(3)** was synthesized from the reaction of (2E)-1-(1-benzofuran-2-yl)-3-(4-hydroxyphenyl-prop-2-en-1-on **(2)** with chloroacetyl chloride **(1)**. The compound **3** was used as a atom transfer radical polymerization initiator. The methyl methacrylate and n-butyl methacrylate were used in the polymerization reaction.The structure characterizations of these polymers were defined by GPC, FT-IR, $^{1}H$ and $^{13}C$- NMR spectra techniques. Thermal behaviour of these homo polymers were investigated by DSC and TGA analysis. The results were compared with each other. In the last step, Dielectric measurements (dielectric constant, dielectric loss and conductivity) of the obtained polymers were carried out by means of an impedance analyzer as a function of frequency from 50 Hz to 2000 Hz.

**Keywords:** Polymers, Dielectric Properties, Conductivity

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# Synthesis and characterization of a novel tetra functional polyaren system

Fatih Doğan [a]*, Kevser Temzikan[a], Ali Bilici[a], İsmet Kaya[a]

[a]*Çanakkale Onsekiz Mart University, Faculty of Sciences and Arts, Department of Chemistry, Polymer Synthesis and Analysis Lab. 17020 Çanakkale, Turkey*

Corresponding Author : fatihdogan@comu.edu.tr

**Abstract—**In the present work, we reported the synthesis and characterization of a novel tetra functional polyaren system consisting of multi active centers. We performed the facile and template-free oxidative synthesis of poly (4-amino-5-naphthol-2,7-disulfonic acid) nanoparticles (PAND) by NaOCl as oxidant in aqueous basic medium [1]. The chemical and physical properties of PAND were determined by NMR, FT-IR, UV-Vis, size exclusion chromatography (SEC), thermogravimetry (TG), differential scanning calorimetry (DSC), cyclic voltammetry (CV), photoluminescence (PL), dynamic light scattering (DLS), scanning electron microscope (SEM) and transmission electron microscope (TEM). The reversible redox behavior of the polymer was attributed to its electroactive nature [2]. In addition, the kinetic parameters related to the solid state decomposition of the polymer were calculated by several methods based on multiple heating rates [3].

**Acknowledgement:**
This research has been supported by The Scientific and Technical Research Council of Turkey (TUBİTAK) (Project No: 113Z587).

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# Synthesis of Ferrocene-Based Metal Complexes; Investigation of Photoluminescence and Electrochemical Properties

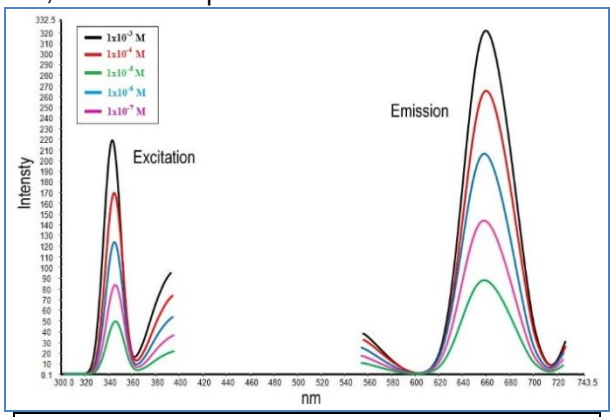
Gökhan Ceyhan*, Muhammet KÖSE, Savaş Purtaş, Mehmet Tümer

*Chemistry Department, Kahrammaras Sutcuimam University, Kahramanmaras, 46100, Turkey*

*Corresponding Author : gceyhan@ksu.edu.tr

**Abstract—**Ferrocene (dicyclopentadienyliron) has been called the benzene of modern organometallic chemistry. They are of considerable interest in various areas [1], like asymmetric catalysis, non-linear optics [2] and electrochemistry [3] due to the quasi-reversible oxidation of iron II. Ferrocene was used extensively luminescent suppression which takes place in solution in the intermolecular process. Ferrocene photochemistry has been the topic of abundant literature and excellent reviews [3].

In this study, ferrocene based ligands having different properties and their Cu(II), Pd(II) and Ru(III) metal complexes were synthesised. In the first step, acetylferrocene and ferrocenecarbaxaldehyde were reacted with substitue aniline to give nitro group containing ferrocene Schiff bases. Nitro group, in the next step, was then reduced to primary amines using Pd/C catalysis. In the following step, the Schiff base ligands were obtained by the reaction of the ferrocene containing free amines with 2,4-dihydroxy benzaldehyde. In the fourth step, transition metal complexes of these ferrocene based ligands were prepared. In the final step, transition metal complexes of the ligands were reacted with long chain bromo alkanes to result in molecules having liquid crystal properties. These properties of the molecules were examined by POM, DSC and XRD. Electrochemical, thermal and photoluminescence features were studied.



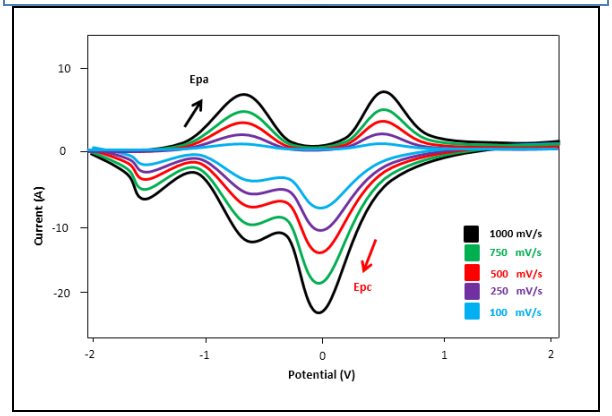



**Fig 1.** Photoluminescence spectra and CV voltammograms of one of the ferrocene complex.

**Keywords:** Ferrocene, Electrochemistry, Photoluminesence

**References :**

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## Ferrocene Based Schiff Bases Metal Complexes: Synthesis and Investigation of ~~of~~ the liquid crystal properties

Gökhan Ceyhan*, Mehmet Tümer

*Chemistry Department, Kahrammaras Sutcuimam University, Kahramanmaras, 46100, Turkey*

*Corresponding Author : gceyhan@ksu.edu.tr

**Abstract—**The Schiff bases are important ligands in the coordination chemistry [1, 2]. These ligands are readily obtainable, versatile and, depending on the nature of the starting materials. The number, the nature, and the relative position of the donor atoms of the Schiff base ligands play a part in the determining of the stereochemistry of the metallic centers as active during the formation of the homo and heteropolynuclear complexes [3]. Schiff bases and their metal complexes are the important compounds using in the areas such as in bioinorganic chemistry, catalysis, encapsulation, transport and separation processes, magnetochemistry, agrochemistry [3]. In recent years, researches on the liquid crystal materials based on the Schiff base have been increased [4]. Liquid crystal property has been determined due to the structure of the free ligands and their metal complexes [5]. These compounds have potential applications in optical switching, high-density optical data storage and optical computing . In this study, ferrocene based ligands having different properties and their Cu(II), Pd(II) and Ru(III) metal complexes were synthesised. These properties of the molecules were examined by POM, DSC and XRD. POM (polarized optic

microscope) data indicated that some of the complexes have potential applications as liquid crystals in material science.

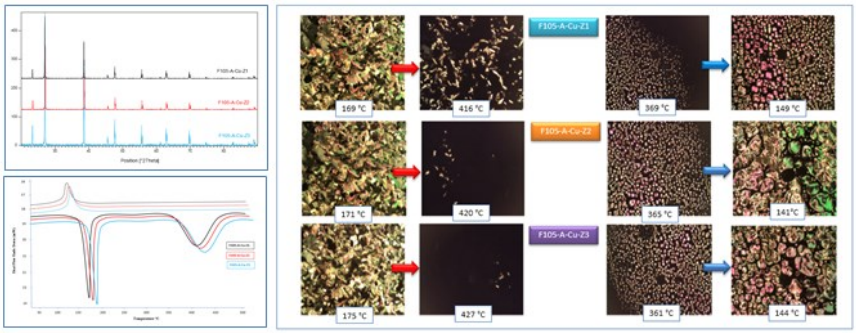

**Fig 1.** POM, DSC and XRD of the ferrocene based complexes.

**Keywords:** Ferrocene, Liquid Crystal, XRD, DSC.

**References :**

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## Synthesis, Characterization, Antibacterial and Antifungal Activities Studies of Metal Complexes of the Schiff Base Ligand Derived from 4,4-Diaminodiphenylmethane

[1]Hakan Şahal*, [2]Erdal Canpolat [1]Mehmet Kaya

*[1]Faculty of Sciences, Department of Chemistry, Firat University, 23119, Elazig, Turkey*
*[2]Faculty of Education, Department of Elementary Science Education, Firat University, 23119, Elazig, Turkey*

*Corresponding Author : hakan.shl@gmail.com

**Abstract—**The complexes of Co(II), Zn(II) and Cu(II) with the Schiff base ligand derived from 4,4-diaminodiphenylmethane were prepared and characterized by physical, spectral and analytical data. The synthesized compounds were tested for antimicrobial activity against in vitro antibacterial and antifungal activities. Several metal complexes of Schiff bases containing nitrogen, oxygen and sulfur donor atoms have been synthesized and studied [1-3]. The presence of nitrogen and oxygen donor atoms in the complexes makes these compounds effective and stereospecific catalysts for oxidation, reduction hydrolysis and they also show biological activity and other transformations of organic and inorganic chemistry [4]. It is well known that some drugs have higher activity when administered as metal complexes than as free ligands [2]. The structure of the ligand and the complexes were established from their IR, $^{1}H$ and $^{13}C$-NMR spectra, UV-

VIS, elemental analyses, magnetic susceptibility measurements and thermogravimetric analyses. The synthesized compounds were tested in vitro for their antimicrobial activity. The satisfactory analytical data and all of the physico-chemical studies presented above suggest that these complexes may be formulated as $[Zn(L)(AcO)(H_2O)_2]$ and $[Co(L)(AcO)(H_2O)_2]$. Suitable mononuclear and dinuclear structures have been proposed for these complexed and are shown in Fig. 1. All the metal complexes were found to have showed weak antimicrobial activity against some bacterial strains (Fig-2).

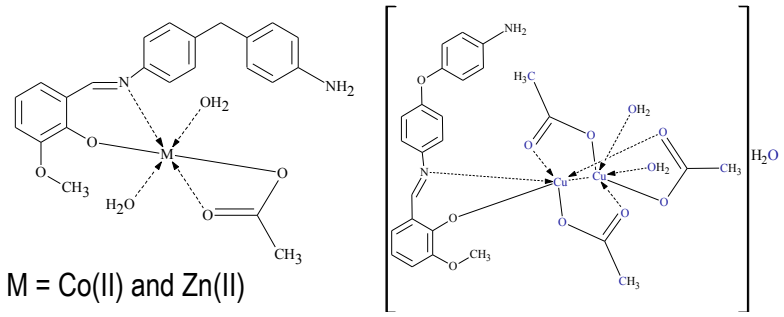


**Fig. 1:** Suggested structure of the Co(II), Zn(II) and complexes. dinuclear Cu(II) complex.

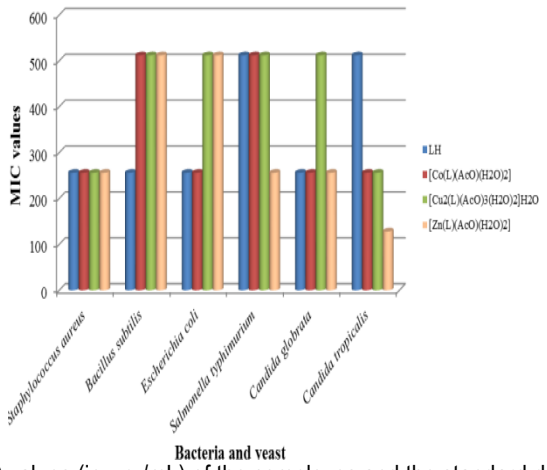


**Fig-2**: Comparison of the MIC values (in µg /mL) of the complexes and the standard drugs against different bacteria.

## References:

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# The dynamics of the H + $F_2$ (v=0, j=0) →HF + F reaction

H. Kebiroğlu*, D. Çimenoğlu, and N. Bulut

*Firat University, Department of Physics, Faculty of Science, Elazig, TURKEY*

*Corresponding Author : hanifi007@hotmail.com

**Abstract—**In this study the dynamics of the title reaction have been investigated. Reaction probabilities, state-to-state cross sections and the kinetic properties of the reaction investigated. For all the calculations a time dependent wave packet method implemented in reactant jacobi coordinate. The total reaction probability as a function collision energy calculated in a broad range of energy. It is found that the total cross sections expand with expanding collision energy as expected an endothermic reaction.

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This work has received financial support from Scientific and Technological Research Council of TURKEY (TUBITAK) through project no.TBAG-112T827.

# Zinc phthalocyanines substituted with naphthyl chalcones: Graphene/Silicon Photosensors

H. Tuncer[1*], D. Cemek Sarı[1], A. Dere[2] and F. Yakuphanoglu[2]

[1]*Department of Chemistry, Faculty of Science, Firat University, 23169 Elazig, Turkey*
[2]*Department of Physics, Faculty of Science, Firat University, 23169 Elazig, Turkey*

*Corresponding Author : htuncer@firat.edu.tr

**Abstract—**There are many studies of light-sensitive diodes in the literature. Heterojunction and Schottky diodes have been fabricated using various semiconducting organic and inorganic compounds [1]. Organic semiconductors based on phthalocyanines (Pcs) have been extensively investigated due to their potential use in a variety of organic electronic and optoelectronic devices, such as field effect transistors, organic light-emitting diodes (OLEDs), photovoltaic (PV) cells and photodetectors [2]. In present study, zinc phthalocyanines substituted with naphthyl chalcones:graphene photodiodes were prepared with various graphene oxide contents. The photoresponse properties of the diodes were investigated under various solar light illuminations. The diodes exhibited a photoconducting behavior, in which the reverse current increases with the increasing illumination intensity. It is seen that the current of the diode having 0.1 GO content under illumination is higher than dark current with a photoresponsivity of $8.702 \times 10^3$. This indicates that the prepared diode can be used as a photosensor in solar cell applications.

**Keywords:** Photodiodes; Cobalt phthalocyanine; Graphene

**References :**

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# Graphene-2,9,16,23-tetrakis[7-oxo-3-chloro-4-methylcoumarin] phthalocyaninatocobalt (II) Nanocomposites Photodiodes

H. Tuncer[1*], A. Tataroğlu[2], Ahmed A. Al-Ghamdi[3], A. Dere[4], S.Yol[1], F. Yakuphanoglu[3,4]

[1]*Department of Chemistry, Faculty of Science, Firat University, Elazig 23169, Turkey*
[2]*Department of Physics, Faculty of Science, Gazi University, Ankara, Turkey*
[3]*Department of Physics, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia*
[4]*Department of Physics, Faculty of Science, Firat University, Elazig 23169, Turkey*

*Corresponding Author : htuncer@firat.edu.tr

**Abstract—**Phthalocyanines are aromatic organic compounds having semiconducting properties due to their spatially extended pi-electron system[1]. On the other hand, graphene films are also one of the most favorable materials for next generation transparent conductive electrodes. The high interest in graphene based materials is due to its unique electronic and optical properties [2]. In present study, the photoconducting properties of graphene-2,9,16,23-tetrakis[7-oxo-3-chloro-4-methylcoumarin] phthalocyaninatocobalt (II) organic semiconductor photodiodes were investigated. GO doped cobalt phthalocyanine (CoPc) thin films were prepared with various graphene oxide (GO) contents. The electrical properties of the diodes were analyzed by using current-voltage and capacitance/conductance-voltage measurements. The reverse current of the diodes increases with the increasing illumination intensity. The transient photocurrent, photocapacitance, and photoconductance measurements of the diodes were also investigated. The photocurrent, capacitance and conductance increase after illuminating and returns to original value after turning off the illumination. The electrical and photoconducting properties of the fabricated diodes are strongly dependent on the solar light.

**Keywords:** Photodiodes; Cobalt phthalocyanine; Graphene oxide

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# Synthesis and characterization of novel 4-cynanophenyl-functionalized N,N,N',N'- teraphenylbenzidine (TPB) as Hole Transporting molecular materials

Kamuran Görgün[1*]

[1] *Chemistry Department, Eskişehir Osmangazi University, Eskişehir 26480, Turkey*

*Corresponding Author: kgorgun@ogu.edu.tr

**Abstract—**A novel cyanophenyl-functionalized N,N,N',N'-tetraphenylbenzidine (TPB) derivative were synthesized and characterized and employable as hole-transporting molecular material. The field of organic electronics has been significantly developed in the last two decades, aiming at practical applications to ultrathin, large-area, and/or flexible devices of future generation, consisting of organic field-effect transistors (OFETs), organic light-emitting diodes (OLEDs), and organic photovoltaics (OPVs). Since these devices can be fabricated by low-cost and low-energy consumption processes, organic electronics has been expected as a powerful and fascinating technology that offers great differentiation from the conventional electronics technology based on inorganic materials. [1-3]. Hole transporting materials (HTMs) are widely used in organic electronic devices such as organic light emitting diode (OLED) [4], organic field-effect transistor (OFET) [5] and dye-sensitized solar cells (DSSC) [6]. N,N,N',N'-tetraphenylbenzidine (TPB) is the essential HTMs, which have been widely used in diverse organic electronic devices. They can also serve as building blocks for construction of largely conjugated HTM molecules [7–9].

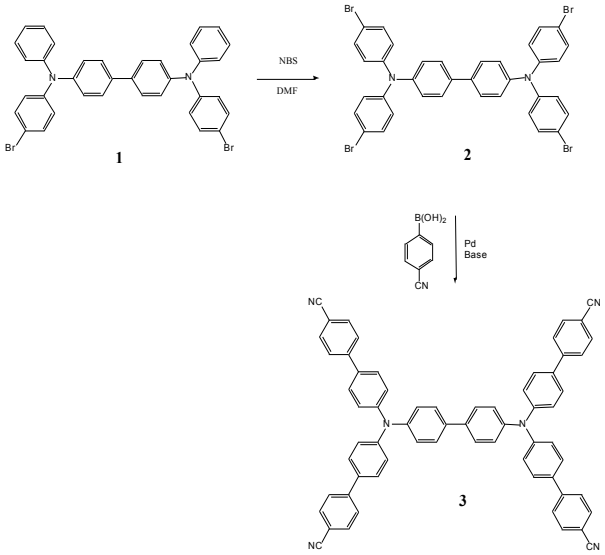


**Figure-1:** Synthetic route to the compound 3

The palladium-catalyzed Suzuki-Miyaura (SM) coupling reaction is one of the most important and efficient strategies for the construction of biaryls. This reaction involves the coupling of organic halides, typically a bromide with organoboron compounds, in the presence of a base and a catalytic amount of palladium complex[10-13]. Arylboronic acids are often synthesized by a low-temperature transmetalation reaction and can be difficult to modify or isolate. They are often purchased (many are expensive) for use in SM couplings, which limits the scope of the parallel synthetic process [10-13]. On the other hand, arylboronic acids are advantageous in that they avoid the use of a strong base and the necessity for preformation of air- and temperature-sensitive reagents [14]. Considering the information given in the literature the palladium-catalyzed Suzuki-Miyaura (SM) coupling reaction were carried out using N,N,N',N'-tetraphenylbenzidine (TPB) and aryl boronic acid (Figure 1). Synthesized novel cyanophenyl-functionalized N,N,N',N'-tetraphenylbenzidine (TPB) derivative (3) employable as hole-transporting molecular material.

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# Structural and potentiometric characterization of urea biosensor by using nanobiocomposite of chitosan-iron oxide magnetic nanoparticles

M Atif [1,2*], A Ali [3,4], M. Tufail[3], O Nur[4] and M Willander[4]

[1]*Physics and Astronomy Department, College of Science, King Saud University, Riyadh, Saudi Arabia*
[2]*National Institute of Laser and Optronics, Nilore, Islamabad, Pakistan*
[3]*Department of Basic Sciences, Riphah International University, I-14, Islamabad, Pakistan*
[4]*Department of Science and Technology, Campus Norrköping, Linköping University, SE-60174 Norrköping, Sweden*

*Corresponding Author: atifhull@gmail.com

**Abstract—**In this study we have fabricated iron oxide ($Fe_3O_4$) magnetic nanoparticles through a simple, reproducible and cheap approach. To look the morphology, compositional purity, crystallinity and emission characteristics of the fabricated nanoparticles the techniques like scanning electron microscope and x-rays powder diffraction characterization tools have been utilized. Furthermore, in this experiment, the potentiometric urea biosensor was fabricated by drop casting the initially produced isopropanol and chitosan solution, consisting $Fe_3O_4$ nanoparticles, on the glass fiber filter (2 cm diameter). A copper wire (thickness ~500 µm) was used to extract the voltage signal from the functionalized nanoparticles. In order to perform the functionalization of surface of the $Fe_3O_4$ nanoparticles the electrostatically immobilization of urease onto the nanobiocomposite of the $Fe_3O_4$-chitosan (CH) is utilised. Urea biosensor with enhanced sensitivity, specificity, stability and reusability was fabricated. To measure the potentiometric response over the wide logarithmic concentration range of the 0.1 to 80 mM electrochemical detection procedure has been used. Urea biosensor based on $Fe_3O_4$

nanoparticles depicts good sensitivity with 42 mV per decade at room temperature. In order to enhance the durability of the biosensor could be enhanced using a thin layer of the nafion. The output response of the biosensor observed to be approximately 12 sec.

**Keywords:** iron oxide (Fe3O4) magnetic nanoparticles, x-rays powder diffraction, potentiometric response, urea biosensor, chitosan solution

## Synthesis of cellulose-based metallo-supramolecular polymers and their use a smart materials

İmren Özcan[1], Büşra Aksoy[1], Maruf H. Demirel[2*], Süleyman Köytepe[1], Turgay Seçkin[1]

[1] *İnönü University, Faculty of Arts and Science, Chemistry Department, 44280, Malatya, Turkey*
[2] *Chemistry Department, Firat University, Elazığ, Turkey*

*Corresponding Author: mhdemirel@firat.edu.tr

**Abstract—**Cellulose based stimuli responsive polymers have been synthesized from terpyridine based cellulose and some transition metal ions. Obtained metallo-supramolecular polymers were investigated in terms of FTIR, GPC, amperometric techniques and thermal analysis methods. Prepared polymers were used for the investigation of situmuli-responsive propetries of polymers.

A supramolecular polymer is a polymer whose monomer repeat units are held together by reversible interaction of the secondary. In macromolecules (known in the conventional polymer), structure of the polymer is covalently located. This situation is replaced by non-covalent interactions in supramolecular structures. Non-covalent forces that hold supramolecular polymers together include coordination, π-π interactions, and hydrogen bonding [1-2]. One of the most important advances in the field of supramolecular chemistry, the morphology of polymer is rearrangement by the use of functional side groups. For the rearrangement of polymer, the most suitable method is the use of transition metals ligand interaction. Metallo-supramolecular

chemistry involves "the use of transition metal centres to control the assembly of novel supramolecular architectures [3].

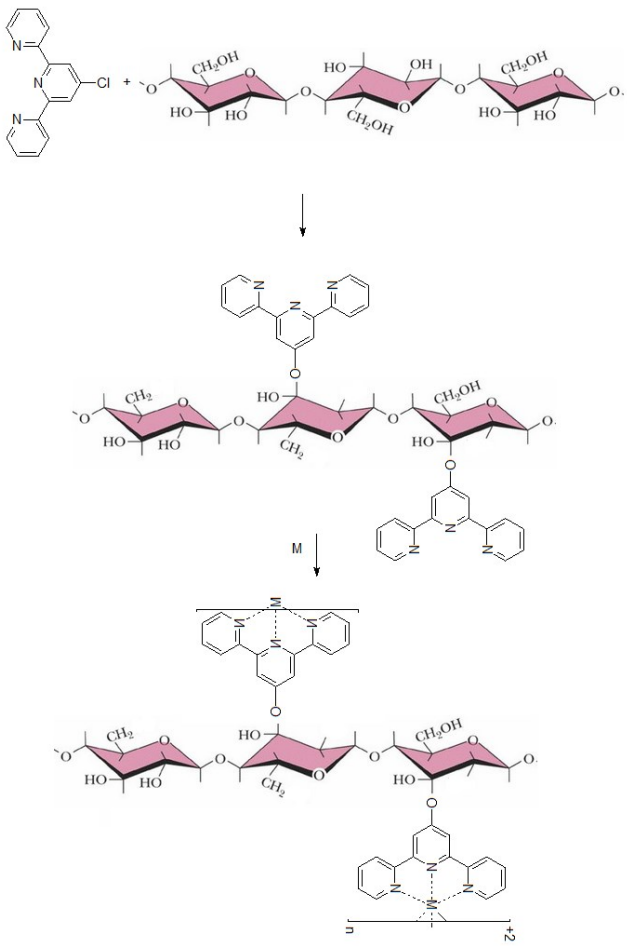


**Figure-1:** Synthesis of cellulose based metallo-supramolecular polymers.

In this study, terpyridine side group containing cellulose used for the design of metallo-supramolecular polymeric system. Cellulose contains a large number of hydroxyl groups [3]. These hydroxyl groups (-OH) of cellulose can be partially or fully reacted with 4'-chloro-2,2':6',2"-terpyridine for terpyridine side group containing polymer. Synthesized this terpyridine based cellulose was coordinated with different metal ions (Co, Cu and Ni) by the metal-ligand interactions. The obtained supramolecular polymeric system was characterized by elemental analysis, NMR and FTIR. The structures and thermal properties of all the products also determined by of thermal analysis techniques [DTA, TGA and DSC].

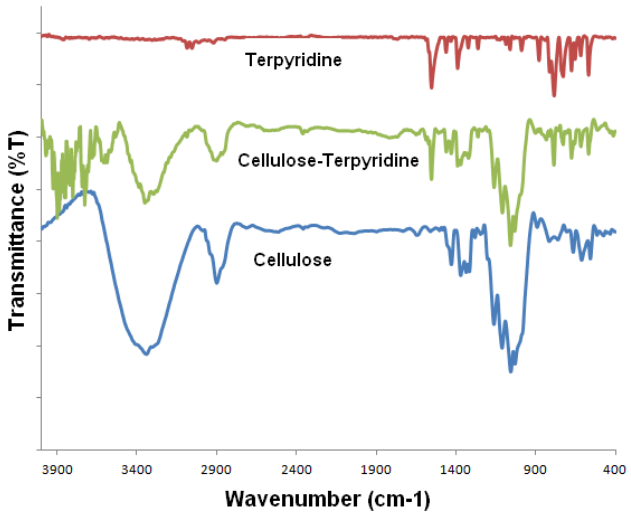


**Figure-2:** FTIR spectrum of terpyridine ligant, cellulose and cellulose based metallosupramolecular polymer.

The stimuli-responsive properties of supramolecular structures were determined by UV and GPC measurements. As a result, prepared terpyridine-functionalized cellulose are good candidates for electronic, opto-electronic, and photovoltaic applications as a smart stimuli-responsive material.

## References:

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# Synthesis, characterization and stimuli-responsive properties of bisphenol-A based metallosupramolecular polymers

Maruf H. Demirel[2*], Süleyman Köytepe[1], Turgay Seçkin[1]

[1] *İnönü University, Faculty of Arts and Science, Chemistry Department, 44280, Malatya, Turkey*
[2] *Chemistry Department, Firat University, Elazığ, Turkey*

*Corresponding Author: marufdemirel@firat.edu.tr

**Abstract—**Bisphenol-A based metallo-supramolecular polymers have been synthesized from these difunctional ligand and some transition metal ions (Co, Cu, Zn and Ni ions). Obtained Bisphenol-A based metallo-supramolecular polymers were investigated in terms of FTIR, NMR, TGA, DTA and DSC. GPC and amperometric techniques were used for the investigation of stimuli-responsive propetries of polymers.Stimuli responsive materials have gained great interest in recent years since these materials are able to exhibit a dramatic change in their properties in response to the application of an environmental stimulus. In the stimuli-response materials, metallo-supramolecular polymers exhibit quite important. Metallo-supramolecular chemistry involves "the use of transition metal centres to control the assembly of novel supramolecular architectures [1]. There is a wide variety of transition metals, and each of these has a preferred coordination geometry as well as a preference for certain types of donor ligand [2]. The choice of a specific metal for coordination in supramolecular assembly therefore allows the design of building blocks based around these coordination geometries. 4'-Substituted 2,2':6',2"-terpyridine ligands as a ligand are well known in the literature as building blocks for supramolecular self assembly.

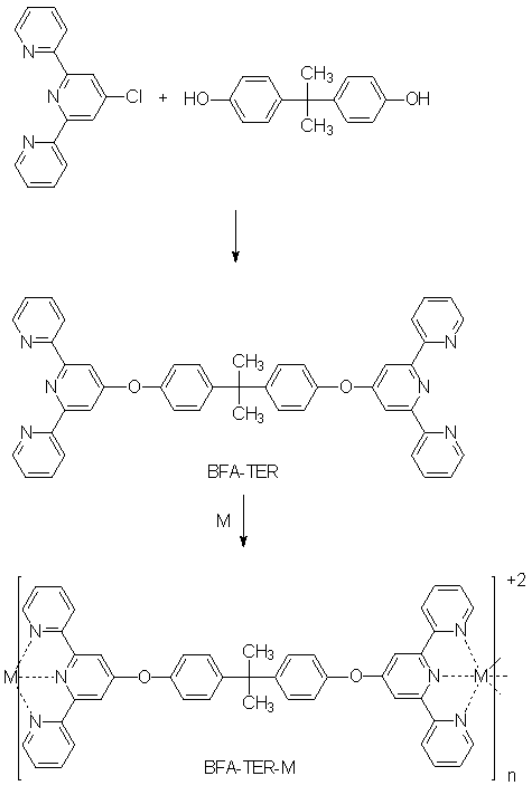


**Figure-1:** Synthesis of bisphenol-A based metallo-supramolecular polymers.

In this study, firstly, bisligand as a monomer were prepared from bisphenol A and 4'-chloro-2,2':6',2"-terpyridine with substitution technique. Bisphenol-A based metallosupramolecular polymers have been synthesized from these bisligand and Some transition metal ions (Co, Cu, Zn and Ni ions).


**Figure-2:** Changes of stimuli-responsive properties of synthesised polymers.

Obtained Bisphenol-A based metallo-supramolecular polymers were investigated in terms of FTIR, NMR, TGA, DTA and DSC. GPC and amperometric techniques were used for the investigation of situmuli-responsive propetries of polymers. The stimuli-responsive properties of supramolecular structures were determined by UV and GPC measurements. As a result, prepared terpyridine-functionalized cellulose are good candidates for electronic, opto-electronic, and photovoltaic applications as a smart stimuli-responsive material.

**References**:

*[1] E. C. Constable, Pure Appl. Chem., 1996, 68, 253.*
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# Structure of Perylene/Graphene Oxide organic nanocomposite

C. Aydin[1]*, B.Cicek Ozkan[1], H.Aydin[2], F. Yakuphanoglu[3]

[1]Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey
[2] Department of Metallurgy and Materials Engineering, Engineering Faculty., Tunceli University, Tunceli, Turkey
[3]Physics Department, Faculty of Science, Firat University, Elazig, Turkey

*Corresponding Author: cihataydin_26@hotmail.com

**Abstract—**Perylene and their related derivatives have attracted considerable attention due to their potential applications in molecular electronic and optical devices, such as dye lasers [1], optical power limiters [2], light-emitting diodes [3,4], organic fieldeffect transistors (OFETs) [5–10], light-harvesting arrays, photovoltaic cells, LCD color filters, electrophotographic devices, photochromic materials, logic gates and molecular wires [11].

In present study, graphene doped perylene-3,4,9,10-tetracarboxylic dianhydride nanocomposites were prepared for various concentrations ($m_{GO}/m_{perylene}$= 0.0005, 0.001, 0.003 and 0.01) with various chemical routes. Perylene-3,4,9,10-tetracarboxylic dianhydride was used as obtained from Sigma Aldrich Company. The graphene oxide was synthesized by Hummers method. The chemical compositions of the materials were confirmed by energy disperse X-Ray (EDX), Fourier transform infrared spectroscopy (FTIR) techniques. Typical scanning electron microscopy (SEM) images were carried out to investigate the structural properties of the nanocomposites.

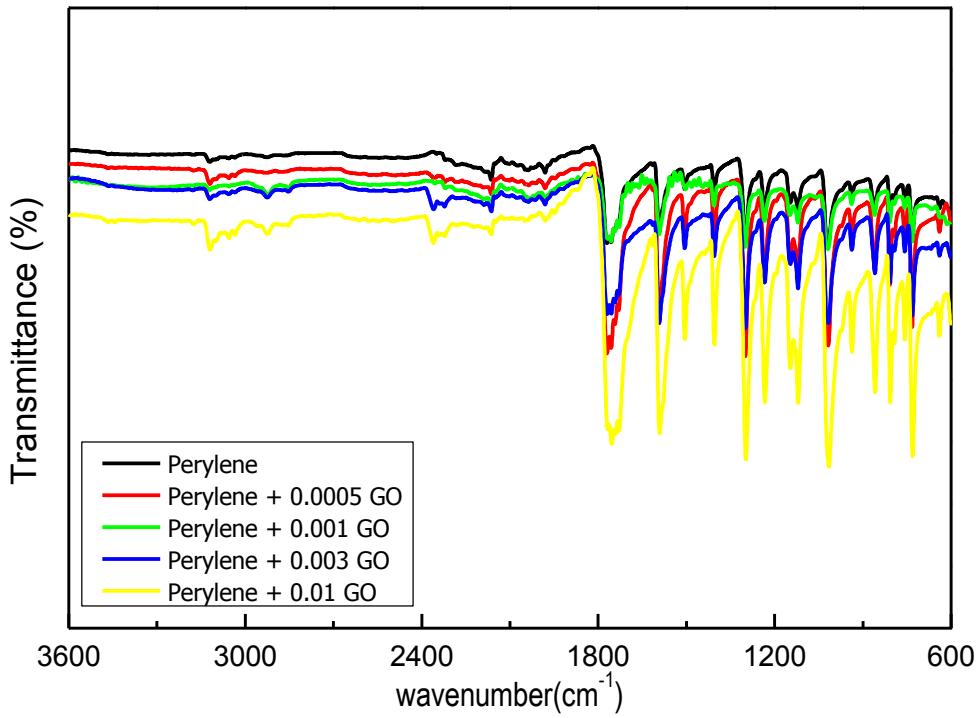


**Figure 1.** FTIR spectrums of all nanocomposites

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# Phononic Band Gap and Wave Propagation on Polyvinylidene Fluoride Based Acoustic Metamaterials

O.Oltulu[1*], A. Gunes[1],S. Simsek[2], A.M. Mamedov[3,4], E. Ozbay[3]

[1] *Department of Physics, Harran University, Sanliurfa, Turkey*
[2]*Material Science and Engineering Department, Hakkari University, Turkey*
[3]*Nanotechnology Research Center (NANOTAM), Bilkent University, Ankara, Turkey*
[4]*International Scientific Center, Baku State University, Baku, Azerbaijan*

*Corresponding Author: oltulu@harran.edu.tr

**Abstract—**Phononic crystals (PC) are periodic arrangements of inclusions inside a viscoelastic organic material or fluid, for example polymer in water, narrow band semiconductor in air, etc. With such a structure, band gaps may appear and are independent of the direction of propagation of the incident elastic wave. In this case, the phononic crystal behaves like a perfect non absorbing acoustic mirror for the rejected frequencies[1]. In present work the acoustic band structure of a two-dimensional phononic crystal containing a organic ferroelectric (PVDF-polyvinylidene fluoride) and topological insulator (GeTe) were investigated by the plane-wave-expansion (PWE) method [2]. Two-dimensional PC with square lattices composed of GeTe cylindrical rods embedded in the PVDF matrix are studied to find allowed and stop bands for the waves of certain energy. This phononic bandgap - forbidden frequency range- allows sound to be controlled in many useful ways in structures that can act as sonic filters, waveguides or resonant cavities. Phononic band diagram ω=ω(k) for a 2D PC, in which non dimensional frequencies ωa/2πc (c-velocity of wave) were plotted versus the wavevector k along the Γ-X-M-Γ path in the square Brillouin zone show six stop bands in the frequency range from (15.9-30.7), (37.4-43.8), (48.8-49.6), (60.9-62.7), (72.4-73.6), and to (96-105)kHz, respectively. Ferroelectric properties of PVDF and unusual properties of topological insulator give us ability to control the wave propagation through the PC in over a wide frequency range of $10^3$-$10^6$Hz.

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# Specific Heat Capacity of Polymethylmethacrylate-ZnO Composites Investigated by DSC

Selda Sezer,[1*] İmren Özcan,[1] Ahmet Gültek, [1] Süleyman Köytepe[1] and Turgay Seçkin [1]

[1] *Chemistry Department, Inonu University, Malatya 44280, Turkey*

*Corresponding Author: seldasezer.44@gmail.com

**Abstract—**In this study, The ZnO nanostructures withdifferent morphology, have been blended with polymethylmethacrylate (PMMA) by solution mixing to prepare PMMA-ZnO composite films. The structure of PMMA-ZnO composite films was characterized using FTIR, UV and X-ray diffractometry. The prepared nanocomposite films are highly transparent and a clear excitonic peak is observed in their absorption spectra. We also determined their heat capacity properties of PMMA-ZnO. Investigation of specific heat capacity of composites achieved by using DSC analysis. This study is unique about exploration of morphological effect on specific heat capacity of polymeric composites.

Specific heat capacity as a basic thermal property is one of the main parameters for evaluation, calculation and design of thermal system. It is defined as the required heat per unit mass of material when raising 1 °C. Composite has an extremely broad usage range, and there are different requirements on specific heat capacity according to different cases. For example, for high-temperature heat shielding composites used in a short term, high specific heat is required in order to absorb more heat in use; however, for thermal sensitive function composites, small specific heat is required in order to have a higher thermal sensitivity. By the addition of fillers to plastics the thermal behavior of polymers can be increased significantlyZnO is a typical II-VI semiconductor material with a wide bandgap of 3.37 eV at room temperature. Although its bandgap value is closer to 3.44 eV, its exciton bounding energy is as higher as 60 meV, which is much larger than that of GaN (21 meV) and even room temperature thermal excitated energy (25 meV). Therefore, theoretically, we can harvest high efficient UV exciton emission and laser at roomtemperature, which will strongly prompt the applications of UV laser in the fields of benthal detection, communication and optical memory with magnitude enhancement in the performance. Moreover, the melting point of ZnO is 1975 °C, which determines its high thermal and chemical stability. Plus, ZnO has owned a huge potentially commercial value due to its cheaper price, abundant resources in the nature, environmentfriendly, simply fabrication process and so on. Therefore, ZnO has turned into a new hot focus in the various field. Especially, ZnO is very important material in optoelectronin and polymeric composite areas.

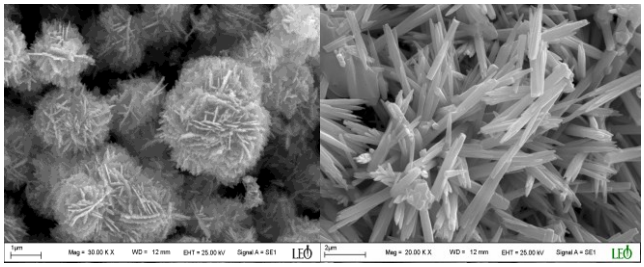

**Figure-1:** Morphologies of synthesized ZnO particles.

In this study firstly we prepared ZnO nanoparticles with different morphologies. Powder X-ray diffraction was used to investigate the phase, purity, and homogeneity of the nanoparticles. Scanning electron microscopy was used to imaging and determination of nanoparticle morphologies. Figure-1 showes these morphologies. Then polymeric composites prepared as shown at figure-2. Characterization of these composites achieved by using XRD and SEM techniques.

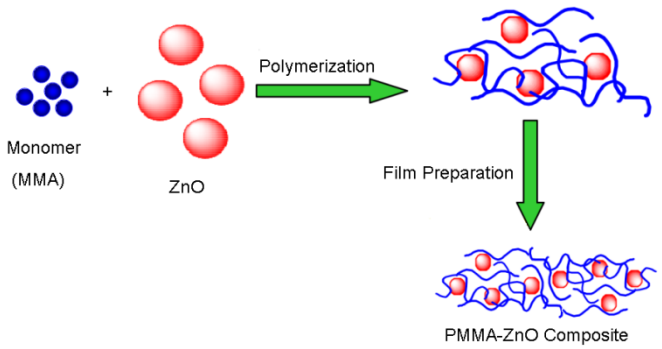


**Figure-2:** Synthesis of the PMMA-ZnO composite composites.

This study is unique about investigation of morphological effect on specific heat capacity of polymeric nanocomposites. Determination of specific heat capacity of nanocomposites achieved by using differential thermal analysis..

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# Preparation, Characterization and Optic Properties of Polymethylmethacrylate-$SiO_2$ Composites

Selda Sezer,[1*] Ahmet Gültek [1] and Turgay Seçkin [1]

[1] *Chemistry Department, Inonu University, Malatya 44280, Turkey*

*Corresponding Author: seldasezer@gmail.com

**Abstract—**Polymethylmethacrylate-$SiO_2$ composites were prepared from solution of polymethylmethacrylate and the $SiO_2$ particles using toluene as a solvent. The prepared polyimide-$SiO_2$ hybrid materials were characterized by fourier transform infrared spectroscopy (FTIR), scanning electron microscope (SEM) and X-ray diffraction spectroscopy (XRD) techniques. Thermal stabilities and glass temperatures of materials have been checked by thermogravimetric analysis (TGA) and differential scanning calorimeter (DSC). These composites appears very good the thermally stability properties. The SEM results confirmed the highly porous structure and the formation of $SiO_2$ particles in the polyimide matrix. The effect of $SiO_2$ groups on the porous structure and dielectric properties were investigated. The silica content significantly influences optic transparency behavior of the polymeric films. The glass transition temperatures of the composites were higher than that of the original polymer. The optic properties of them were demonstrated by UV spectrometer. Recently, polymer nanocomposites with both electrical and ferromagnetic properties have generated tremendous attraction, and they have become one of the most active and promising research areas [1–2]. These materials are largely being used in nonlinear optics, electrochemical display devices, molecular electronics, electrical and magnetic shields and microwave absorbing materials. The large surface to volume ratio of the nanoparticles results in the formation of composites with unusual physical and chemical properties [3]. $SiO_2$ is a very important material in modern technology due to its properties. In the majority of silicates, the Si atom shows tetrahedral coordination, with 4 oxygen atoms surrounding a central Si atom. (Figure 1)

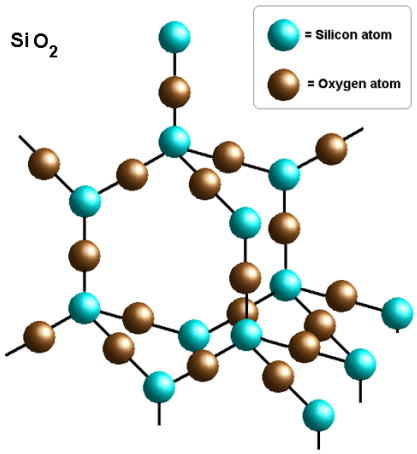


**Figure-1:** Structure of synthesized $SiO_2$ particles.

In this study, Polymethylmethacrylate-$SiO_2$ composites were prepared by mimidization and blending the different ratios of silica nanoparticles and unsaturated aliphatic polyester resin. The prepared Polymethylmethacrylate-$SiO_2$ nanocomposite films were characterized for their structure, morphology, and thermal behavior employing fourier transform infrared spectroscopy (FTIR), scanning electron micrograph (SEM), X-ray diffraction (XRD), and thermal analysis (DTA/TGA/DSC) techniques. These studies showed the homogenous dispersion of $SiO_2$ particles in the polymer matrix.Structural changes due to $SiO_2$ particle was identified by comparing the functional groups of Polymethylmethacrylate and composites. The FTIR spectra of pure PMMA and Polymethylmethacrylate-$SiO_2$ composite with different amount of $SiO_2$. The FTIR of polymer shows vibration band at wave number of 2931.27 $cm^{-1}$ as aliphatic hydrocarbon (CH stretching), carbonyl group (C=O) at 1735.62 $cm^{-1}$. Meanwhile the FTIR of composites shows additional peak at 1268-1132 $cm^{-1}$ assigned as vibration of asymmetric stretching of Si-O-Si bonds. Si-OH groups also exist at 966 $cm^{-1}$. The broad strong bands around 3457 $cm^{-1}$ are assigned to the O-H stretching vibration of silanol hydroxyls, while the absorption at 1630 $cm^{-1}$ is assigned to the O-H bending. This proves that the existency of $SiO_2$ particle in the polymer matrix structural change of composite. Morphological surface of composite reveals that well-dispersed $SiO_2$ in the matrix occurred in low concentration. However, increasing of $SiO_2$ concentration causes aggregation of particles. The presence of $SiO_2$ particles in PMMA improves the thermal stability of the system as evidenced by thermogravimetric analysis.

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# Physical and Electrical Characteristics of Low-Temperature Annealed Zinc Oxide Thin Films for Flexible Polymer-Based Organic Solar Cells

Z. Islek Cin[1], N. Yilmaz Canli [2*], I Borazan[3], A.Demir[3], A. Celik Bedeloglu[1*]

[1] *Fiber and Polymer Engineering, Bursa Technical University, Bursa, TURKEY*
[2] *Department of Physics, Yildiz Technical University, Istanbul, TURKEY*
[3] *Department of Textile Engineering, Istanbul Technical University, Istanbul, TURKEY*

*Corresponding Author: niyilmaz@yildiz.edu.tr

**Abstract—**Organic solar cells having possibility of high volume and low cost processing, attracted more attention since their performance have been improved dramatically in the past 10 years (for single cell 11% and for minimodule 9.5% [1]). In inverted polymer-based organic solar cells, the buffer layers such as ZnO, $TiO_2$ make ITO more effective as an electron collecting electrode. Among these, ZnO is more appealing for its environmentally friendly nature, low-cost processing, good optical transmittance, high electron mobility, excellent thermal and chemical stability. Several thin film deposition techniques have been used to produce ZnO thin films, including molecular beam epitaxy, chemical vapour deposition, spray pyrolysis, sol-gel method and etc. The sol-gel method is the most widely applied solution-based method used for the development of efficient thin films for inverted polymer-based solar cells as well as its easy applicability and low-cost. The low temperature is always preferred for the studies related to flexible solar cells fabricated on the polymer-based substrates such as fibers, plastic foils or textile fabrics. In this study, the physical and electrical features of low-temperature annealed zinc oxide thin films formed by using sol-gel technique and flexible polymer-based organic solar cells were developed. The optimum parameters for sol-gel and spin-coating process were also determined.

**Acknowledgement:**
This study was supported by Turkish Scientific and Technical Research Council, TUBITAK, Project No: 113M950

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# Anamolous capacitance behavior of sol-gel deposited $V_2O_5$ film on crystalline silicon

Ayşe Evrim Saatci,* F. Pınar Gökdemir, Orhan Özdemir and Kubilay Kutlu

*Physics Department, Yildiz Technical University, İstanbul, Turkey*

*Corresponding Author: bulgurcu@yildiz.edu.tr

**Abstract—**$V_2O_5$ thin film was produced with organic sol by sol-gel method on c-Si substrates and investigated through I-V and admittance analysis at room temperature and under dark/illuminated ambient. Structural and optical properties were investigated via TG-DTA, FTIR and UV-Vis spectrophotometry. As to the experiments, a thin insulating layer was existed between $V_2O_5$ and c-Si semiconductors and so, structure turned into semiconductor-insulator-semiconductor [SIS] where one of the semiconductors was a wide band gap semiconductor. Additionally, negative capacitance was observed in the present device at large reverse bias under low frequency. As expected, mobility of injected carriers followed the Poole-Frenkel type conduction mechanism and distinguished in the frequency range due to the difference of transit times in admittance measurement. The proposed analytical model for admittance, derived for the frequency dependent space charge limited behavior leading negative capacitance issues, was applied on the measured data for the present device. The analytical model is well-matched with the experiment results.

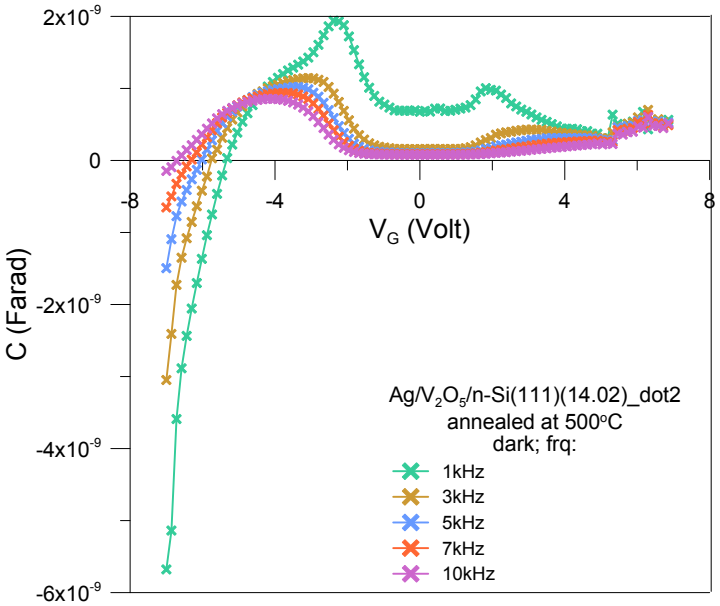



**Figure-1:** Capacitance-Voltage plot of Ag/$V_2O_5$/n-Si(111) structure at room temperature,within the 1-10 kHz frequence interval under dark ambient.

# Investigation of optical properties of chitosan biopolymer thin films

Suat Cihangir Karayılanlı[1], Çağlar Özer[2,3] , Ömer Mermer[1,2*] and Erdal Çelik[4]

*[1]Ege University, Department of Electrical and Electronics Engineering,35100, Izmir, Turkey*
*[2]Dokuz Eylul University, Center for Fabrication and Application of Electronic Materials,35160, Izmir, Turkey*
*[3]Dokuz Eylul University, Department of Nanoscience and Nanoengineering,35160, İzmir,Turkey*
*[4]Dokuz Eylul University, Department of Metallurgical and Materials Engineering,35160, İzmir,Turkey*

*Corresponding Author : omermermer@gmail.com

**Abstract—**Chitin is the second most abundant polysaccharide in nature. It is commonly found on the shell of crustacean, the cuticles of insects and the cell walls of the fungi. Deacetylation treatment of chitin produces chitosan which is the most important derivative of chitin. Recently, chitosan has become widely used in many kind of technological areas such as food industry, textile industry, water treatment, agriculture and biomedical devices due to its high biocompatibility, biodegrability and bioadhesive properties. In addition to these properties electrical, humidity and optical properties have important roles for the applications of chitosan.

In this work, acetic acid were used as a solvent for chitosan with deacetylation 82%. The solution was dropped into both glass and silisium substrate. Gold electrodes were evaporated on the film for electrical characterization. Optical properties chitosan thin films were determined by using UV-VIS spectrofotometer and its attachment of difuse reflectance. Transmittance and reflectance values of the films were measured in the wavelength range of 350-700 nm. The optical parameters (band gap, refractive index, etc.) of the films were then calculated based on these data. Our results open a approach to create a new semiconductor material for the engineering applications especially for gas sensing.

# Improvement of photovoltaic performance of dye sensitized solar cell via $TiO_2$ surface modification using different SAM molecules

Mevlut Boz[1], Ömer Mermer[1*], Ahmet Nuri Özcivan[2], M. Zeliha Yigit[3], Cem Tozlu[4] and Mustafa Can[3*]

[1]*Ege University, Department of Electrical and Electronics Engineering,35100, Izmir, Turkey*
[2]*İzmir Katip Çelebi University, Department of Electrical and Electronics Engineering,35620, Izmir, Turkey*
[3]*İzmir Katip Çelebi University, Department of Engineering Science,35620, Izmir, Turkey*
[4]*Karamanoglu Mehmet Bey University, Department of Energy System Engineering,35160, Karaman,Turkey*

*Corresponding Author : omermermer@gmail.com

**Abstract—**Dye-sensitized solar cells (DSSCs) are promising next–generation alternatives to conventional silicon based photovoltaics devices owing to their low manufacturing cost and potentially high conversion efficiency. DSSCs mainly composed of dye sensitizer, wide band gap semiconductor oxide, redox electrolyte and counter electrode. DSSCs employing sensitizers have shown the highest efficiency value of over 11%. Several kinds of additives have been introduced as co-adsorbents onto the TiO2 surface to improve the photovoltaic performance of DSSCs. Utilizing co-adsorbents to avoid the competitive adsorption and aggregation among dyes that may induce unfavorable charge or energy transfer and quenching of photo- excited states. Also utilizing co-adsorbents reduce the recombination of electrons in the TiO2 film with I3 or other acceptor species. The ideal candidate for a co-adsorbent should have three characteristic; (i) It should have a large molar extinction coefficient (ii) The structure of molecule should be suitable for avoiding competitive among dyes while effectively suppressing the aggregation of dyes on the TiO2 surface (iii) It should be able to reduce the recombination of electrons in the TiO2 film with I3 and other acceptor species by the formation of a compacted molecule monolayer covering the bare TiO2 surface.

In this study we report different SAM materials based for co-adsorbents and study the performances of the corresponding devices. The effect of these SAM based co-adsorbents on device parameters (Isc, Voc, FF, efficiency) were analyzed by measuring current-voltage of the DSSCs.

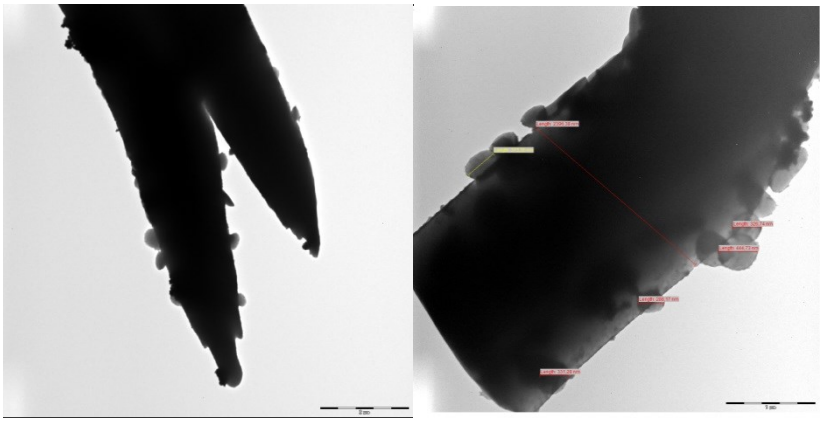
# Fabrication of ruthenium material stabilized with pyridine-2,6-dicarboxamide: determination of the performance in the Dye-Sensitized Solar Cell (DSSC) and catalytic activity in the reduction of ketones and nitroarenes

Osman Dayan[1*], Serkan Dayan[2], Nilgün Kayaci[2], Nilgün Kalaycioğlu Özpozan[2]

[1]*Çanakkale Onsekizmart University, Faculty of Science, Chemistry Department, Çanakkale/ Turkey*
[2]*Erciyes University, Faculty of Science, Chemistry Department, Kayseri/ Turkey*

*Corresponding Author : osmandayan@hotmail.com

**Abstract—**Since the first report on dye-sensitized solar cells (DSSCs) introduced by M. Grätzel at 1990 [1], too much attention has been attracted to the development of new and ever more performing materials as this technology fulfils many requirements concerning the cost of the materials and cells, low energy expenditure and ease of preparation [2, 3]. Their maximum conversion efficiency of over 12 % [4] suggests that they are a promising type of next generation solar cells. For their commercial application, it is important to develop low-cost materials and to achieve maximum efficiency for the cells.Herein, ruthenium nanoparticle stabilized by $N^2$,$N^6$-dimesitylpyridine-2,6-dicarboxamide were successfully synthesized with an easy method. The structural elucidations of the ruthenium material were characterized by different methods such as FT-IR, elemental analysis, TG/DTA, nitrogen adsorption-desorption (BET), TEM, SEM and EDX. The ruthenium(0) nanoparticle were used as photoactive layer in the dye-sensitized solar cell. In addition, the material was applied for the hydrogenation of ketones and nitroarenes at ambient temperature.



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# The Effects of dietary antioxidants added to the ration of freshwater crayfish (Astacus leptodactylus, Esch. 1823) in moulting period

Özden Barım-Öz[1*] , Mustafa Karatepe[2]

[1]*Fisheries Faculty, Firat University, 23119, Elazig, TURKEY*
[2]*Department of chemistry, Fırat University, 23119, Elazığ, TURKEY*

*Corresponding Author: obarimoz@hotmail.com

**Abstract—**The effects of dietary antioxidant (vitamin A (VA), β-carotene (βC), astaxanthin (AX)) supplementation on oxidative stress and vitamins A, E, C, β-carotene and astaxanthin in the hepatopancreas, muscle and gills tissues of the freshwater crayfish, *Astacus leptodactylus* during moulting were investigated. The VA, βC and AX were added the control diet for preparation of experimental diet. *A. leptodactylus* with these diet were fed with 2% of their total weight daily, in a day during 66 days. The results of the study showed that the supplemental of VA, βC and AX in diet of *A. leptodactylus* decreased malondialdhyde levels in the hepatopancreas, muscle and gills tissues. However, vitamins A, E, C, β-carotene and astaxanthin levels changed according to tissue specific.

Keywords: *A. leptodactylus*, Vitamin A, β-carotene, Astaxanthin, MDA

# The Effects of Trout Diet on the Oxidative Stress in the Moulting Male of Freshwater Crayfish (*Astacus leptodactylus*, Esch. 1823)

Özden Barım-Öz[1*], Mine Erişir[2], Hülya Şahin[1]

[1]*Fisheries Faculty, Firat University, 23119, Elazig, TURKEY*
[2]*Department of Biochemistry, Veterinary Faculty of Firat University, 23119, Elazig, TURKEY*

*Corresponding Author: obarimoz@hotmail.com

**Abstract—**An experiment was performed on the freshwater crayfish, *Astacus leptodactylus* to investigate the effects of trout diet on oxidative stress (malondialdehyde (MDA)) and superoxide dismutase (SOD), glutathione peroxidese (GSH-Px), glutathione (GSH) in hepatopancreas, muscle and gills tissues during moulting period. The trout diet used in this study contained 52 % crude protein and 17 % crude lipid. *A. leptodactylus* with this diet were fed with 2% of their total weight daily. The study was carried out in triplicate for 50 days. The end of this study, SOD, GSH-Px, GSH and MDA levels changed according to tissue specific. However, the results showed that the feeding with this diet affected negatively the life cycle of *A. leptodactylus* during moulting period.

**Keywords:** *A. leptodactylus*, Trout diet, SOD, GSH-Px, GSH, MDA

# Effects of Varıous Storage Temperature and Tıme on Astaxhantın and Lıpıd Peroxıdatıon Levels of Freshwater Crayfish (*Astacus leptodactylus*, Esch., 1823) Muscle

Özden Barım-Öz[1*] , Mustafa Karatepe[2]

[1]*Fisheries Faculty, Firat University, 23119, Elazig, TURKEY*
[2]*Department of chemistry, Fırat University, 23119, Elazığ, TURKEY*

*Corresponding Author: obarimoz@hotmail.com

**Abstract—**The study was aimed to determine the effects of various storage temperatures and storage periods on astaxhantin and lipid peroxidation (Malondialdehyde (MDA)) levels of muscle of *A. leptodactylus*. For this purpose, freshwater crayfish samples (*A. leptodactylus*) were stored at +4, -12 and -18 °C. Astaxhantin levels were analysed at the beginning of 0, 1, 3, 6, 9, 12 days at +4 °C and 0, 2, 4, 6, 8, 10, 12 and 17 weeks at -12 and -18 °C. The results of the study showed that astaxhantin loss and increase of MDA levels were higher at +4 °C according to at -12 and -18°C.

**Key words:** *Astacus leptodactylus*, muscle, storage, MDA

# A novel porphyrin derivative and its metal complexes: Electrochemical, photoluminescence, thermal, DNA-binding and superoxide dismutase activity studies

Savaş Purtaş[1]*, Gökhan Ceyhan[1], Muhammet Köse[1], Ferhan Tümer[1], Ayşegül Gölcü[1], Mehmet Tümer[1]

[1]*Chemistry Department, Kahrammaras Sutcuimam University, Kahramanmaras, 46100, Turkey*

*Corresponding Author: savaspurtas@msn.com

**Abstract—**Porphyrin compounds are the heterocyclic macrocycle organic molecules and composed of four modified pyrrole subunits inter-connected at their α-carbon atoms via methine bridges (=CH−). Porphyrins are probably the most significant and common categorize of natural pigments [1]. There are a wide variety of tetrapyrrolic pigments with a resembling ligand core in the nature, but differing in the metal center and the auxiliary groups attached to the porphyrin rings. For example, in the heme molecule, the metal center is an iron ion, in the case of chlorophyll it is magnesium ion and in the vitamin B12, it is the cobalt ion [2,3]. In this study, a novel porphyrin-Schiff base ligand 4-ethyl-2,6-bis[5-(4-iminophenyl)-10,15,20-triphenylporphyrin]phenol (L) was prepared from the reaction of the 5-(4-aminophenyl)-10,15,20-triphenylporphyrin and 4-ethyl-2,6-diformylphenol in the toluene solution. The porphyrin-Schiff base compound was succesfully obtained by the separated from the reaction media. The porphyrin-Schiff base metal complexes (Cu(II), Fe(III), Mn(III), Pt(II) and Zn(II)) were synthesised. The compounds were characterized by the analytical and spectroscopic methods. The photoluminescence, Uv-vis, electrochemical, thermal, DNA-binding properties and superoxide dismutase activities of the porphyrin Schiff base and its metal complexes were investigated.

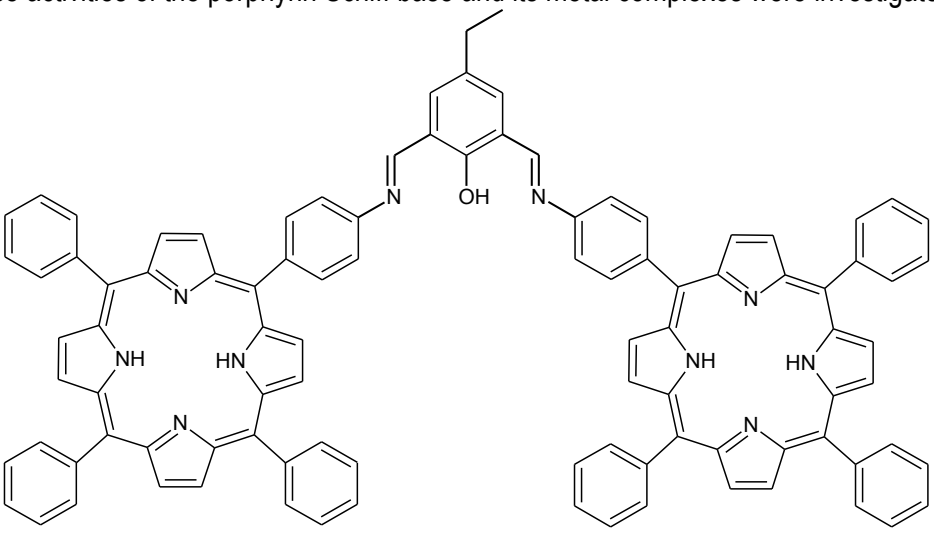


**Fig 1.** Proposed structure of the new porphyrin compound (L).

**Keywords:** Porphyrins, DNA binding, Superoxide dismutase, Photoluminesence

**Acknowledgements:** We are grateful to The Scientific &Technological Research Council of Turkey TUBITAK) and COST (European Cooperation in Science and Technology) (Project number:113Z907) for the financial support.

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# 4-{2-[(4-methoxybenzyl)amino]ethyl}benzenesulfonamide: Synthesis, characterization, spectroscopic properties, molecular structure, and theoretical calculation

Mustafa Durgun[1], Serife Pınar Yalçın[2*], Ümit Ceylan[3], Hasan Türkmen[4], Ahmet Kilic[1], Namık Özdemir[3]

[1]*Chemistry Department, Harran University, 63190 Şanlıurfa, Turkey*
[2]*Central Laboratory, Harran University, 63190 Şanlıurfa, Turkey*
[3]*Physics Department, Ondokuz Mayıs University, 55139 Samsun, Turkey*
[4]*Medical Pharmacology Department, Harran University, 63190 Şanlurfa, Turkey*

*Corresponding Author: serifeyalcin@harran.edu.tr

**Abstract—**Sulfonamides are still widely used pharmacological agents for the treatment or prevention of a variety of diseases, such as antimicrobial drugs, antithyroid agents, antitumor, antibiotics and inhibitors of carbonic anhydrase as antiglaucoma agents. Due to the wide variety of the biological and biochemical importance of the sulfonamides, the studies of sulfonamides crystal structure and other physical, chemical and biochemical studies have become interesting field in research for a long time [1-4].

Additionally, these compounds have been extensively investigated due to having biological activities and playing and developing a central role as chelating ligands in the main group and transition metal coordination chemistry. Thus, some these compounds and their metal complexes have been still prepared because of the widespread use area of these compounds such as transition metal-based molecular catalysts for transfer hydrogenation of ketones under different experimental conditions, cyclic voltammetric studies, spectroscopic and electro-spectrochemical properties [5].

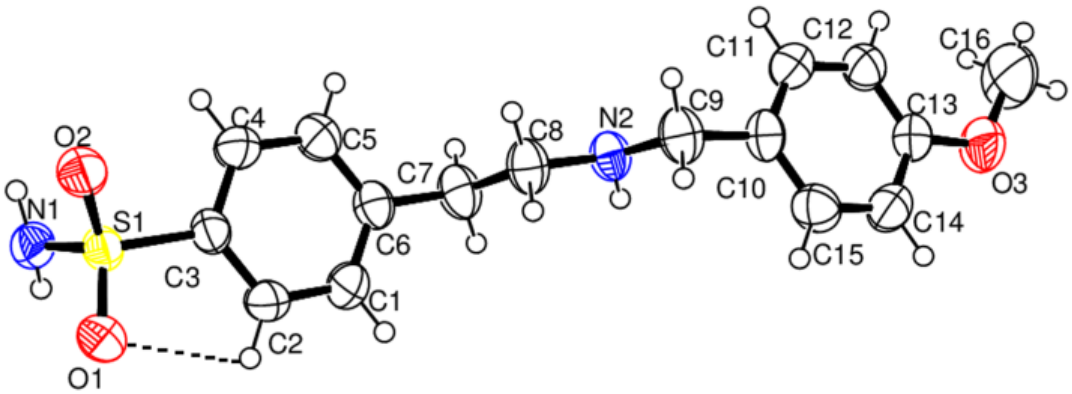


**Figure-1:** The molecular structure of the title compound

To the best of our knowledge, neither crystal structure nor DFT calculation of the title compound has been reported. Therefore, in this study, The sulfonamide compound, 4-{2-[(4-methoxybenzyl)amino]ethyl}benzenesulfonamide was synthesized and grown as a high quality single crystal by the slow evaporation solution growth technique. The structure of the compound was characterized by FT-IR, $^{1}H$ and $^{13}C$-NMR, UV-Vis and X-Ray single crystal techniques.

Density functional theory (DFT) calculations were carried out for the title compound by utilizing DFT level of theory using B3LYP/6-311++G(d,p) as basis set. The theoretical vibrational frequencies, $^{1}H$ and $^{13}C$-NMR chemical shifts, absorption wavelengths and optimized geometric parameters such as bond lengths and bond angles were calculated by using quantum chemical methods. In addition, DFT calculations of the title compound, Molecular Electrostatic Potential (MEP), Natural Bond Orbital (NBO), Frontier Molecular Orbital (FMO) analysis, thermodynamic properties, dipole moments, and HOMO-LUMO energy were also computed. The calculated results show that the optimized geometry can well reproduce the crystal structure parameters, and the theoretical vibrational frequencies, $^{1}H$ and $^{13}C$-NMR chemical shifts and absorption wavelengths show good agreement with experimental values of the molecule.

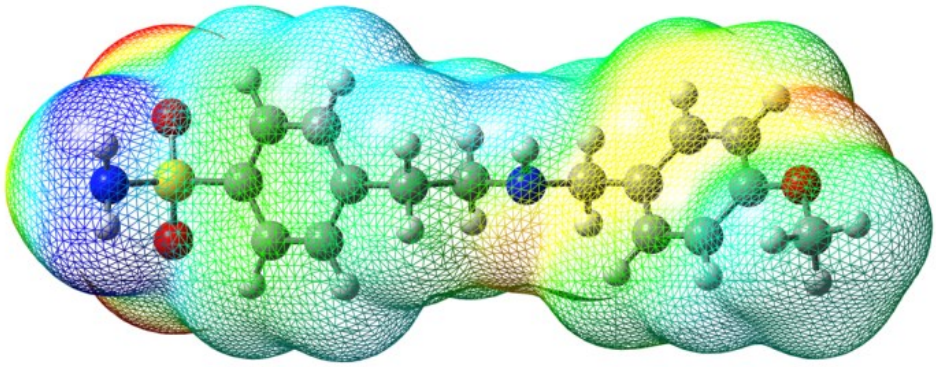

**Figure-2:** Molecular electrostatic potential map calculated as the B3LYP/6-311++G(d,p) level.

**Acknowledgement**:
This study supported by Harran University Scientific Research Project Coordinator (HUBAK) Project nos 1136, 12040 and 12059.

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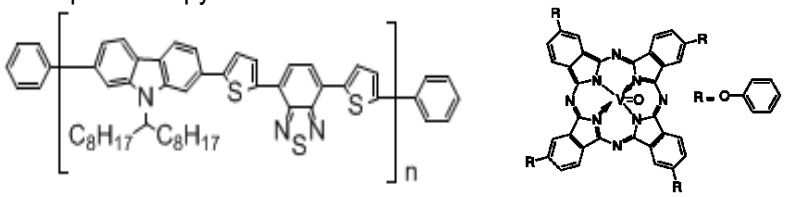
# Nano-flowers and nanotubes of organic semiconductors for application in organic solar cells

Azzuliani Supangat, Muhamad Saipul Fakir, Norasmaliza Abu Bakar* and Khaulah Sulaiman

*Low Dimensional Materials Research Centre (LDMRC), Department of Physics, Faculty of Science, University Malaya, 50603 Kuala Lumpur, Malaysia.*

*Corresponding Author: asma1643@gmail.com

**Abstract—**Conjugated polymers of p-type materials are beneficial to the electronic devices due to their favourable properties. These favourable properties are highly dependent on the preparation methods and the resultant morphologies. Conjugated polymers nanostructures such as nanorods, nanowires, nanotubes and nano-flowers are widely studied for their promising properties. Different nanostructures are reported to exhibit the different promising properties. The simplest, cost effective and convenient technique used for the fabrication of novel nanostructured polymers is template-assisted method. We report the fabrication of novel polymer/dye composite nanorods or nanotubes or nanoflowers with enhanced structural and optical properties, which are fully assisted by a porous alumina template. By utilizing this templating method, the highly facile fabrication of novel nanostructured composite can be realised. The semiconducting organic materials including poly(3 hexyl-thiophene (P3HT), poly[N- 90- hepta - decanyl – 2 , 7 -carbazole – alt- 5, 5- (40 , 70 – di – 2 – thienyl – 20 , 10 , 30-benzothiadiazole)] (PCDTBT) from Sigma Aldrich were used without further purification. The materials were dissolved in chloroform. The porous alumina templates used in this study were commercially available filter membrane (Whatman Anodisc) with nominal pore diameters of 200 nm and a thickness of 60 µm. The material solution was first dropped onto the cleaned porous alumina template, spin coated at certain spin rate (eg. 1000 rpm). After annealing process, the alumina template was dissolved in 3M sodium hydroxide and the remaining material nanorods were rinsed in deionized water prior to its characterisation. The P3HT:VOPcPhO composite nanorods were characterised by nano-structured materials were characterized by Field Emission Scanning Electron Microscopy (FESEM-EDX) Transmission Electron Microscopy (TEM), UV-Vis spectroscopy, Raman and photoluminescence spectroscopy.




(a) PCDTBT (b) VOPcPhO

**Figure-1:** Molecular structures of PCDTBT, (b) VOPcPhO.

For PCDTBT materials, there are several types of nanostructured materials being formed via template assisted method including nano-flowers, nanorods and nanotubes [1,2] as shown in Figure2. Small molecular weight semiconducting materials of VOPcPhO, also may form nano-flowers and nanotubes as shown in Figure 3 [3]. The formation of different types of nanostructured materials depends on the infiltration rate of the material solution into the porous alumina template. In some cases, longer spinning time was required to produce nanotubes or

nanorods, otherwise such organic material would rather exist in the form of nanoflowers. The selection of nanostructured types depends on the performance in electrical properties towards fabrication of opto-electronic devices. In general, our main objective is to examine the optical and morphological properties of these nano-flowers and nano-tubes. Then, we intent to introduce this nanostructured material in organic light sensor or organic solar cell.

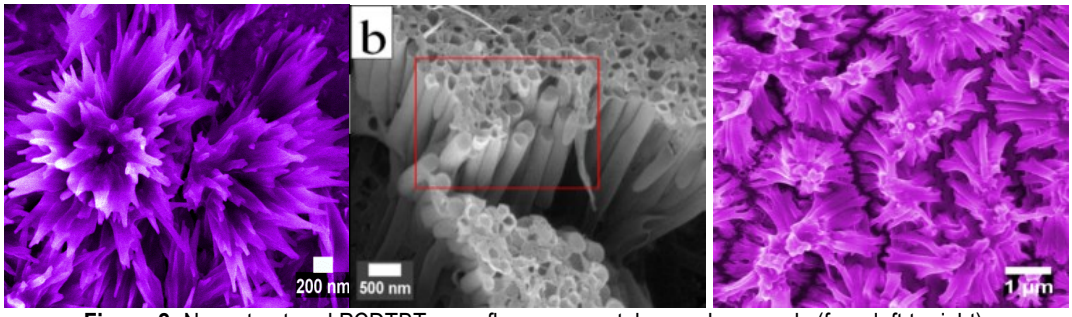



**Figure-2:** Nanostructured PCDTBT: nanoflowers, nanotubes and nanorods (from left to right).

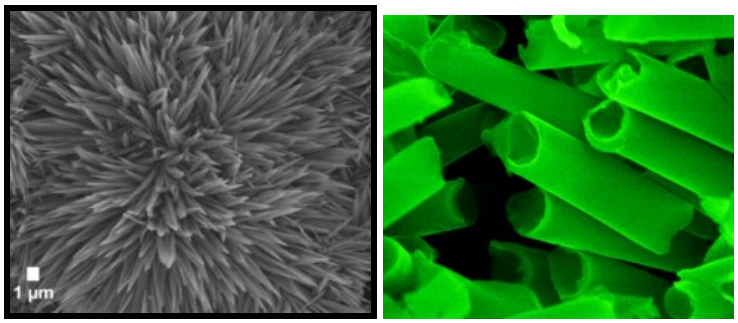



**Figure-3:** Nanostructured VOPcPhO: nanoflowers and nanotubes (from left to right).

**Acknowledgement :**
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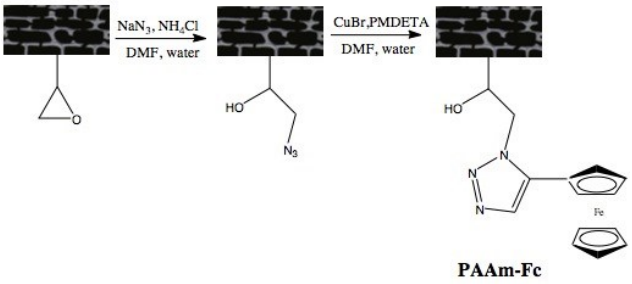
# Electrochemical Recognition of Halogen Ions Using Ferrocene Functionalized Polyacrylamide Cryogel

ZM.Şahin*, G.Basmaz, N.Ozturk, F.Yilmaz

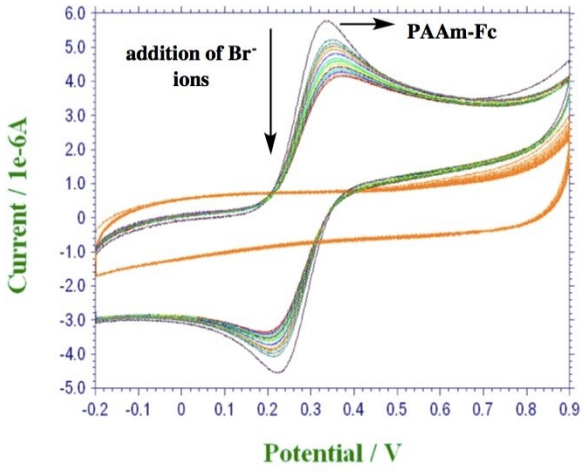
*Department of Chemistry, Gebze Technical University, Faculty of Science, Kocaeli, Turkey*

*Corresponding Author: zsahin@gtu.edu.tr

**Abstract—**Radical copolymerization of an aqueous solution of monomers and a cross-linker in a partially frozen system gives rise to macroporous hydrogel which is called as "cryogel". Ice crystals in the partially frozen state act as a porogen while the dissolved solid materials are concentrated in different portions of non-frozen phase. After completion of the reaction, a network characterized by large interconnected pores and surface area is formed that is ideally suited for further modification towards a wide range of applications such as bioseparation, biocatalysis, enzymatic conversion, affinity chromatography, adsorbents and cell scaffolds [1].Ferrocene (Fc) and its derivatives demonstrate well-established redox behaviors. Upon addition of target ions, negative or positive change in the redox potential of the ferrocene/ferrocenium redox couple can take place [2]. In this work, polyacrylamide cryogel (PAAm) was functionalized with Fc via click chemistry and then, the obtained redox active cryogel (PAAm-Fc) was employed for the sensing of halogen ions ($F^-$,$Cl^-$,$Br^-$, and $I^-$).




PAAm-Fc



Addition of $Br^-$ ions in the form of KBr salt to the PAAm-Fc with final molarities of $1x10^{-5}$, $3x10^{-5}$, $6x10^{-5}$, $1x10^{-4}$, $1.5x10^{-4}$, $2x10^{-4}$, $4x10^{-4}$, $6x10^{-4}$, $8x10^{-4}$, $1.4x10^{-3}$, $1.8x10^{-3}$, $2.3x10^{-3}$, $3.3x10^{-3}$, $6.5x10^{-3}$ from top to bottom sequentially in the presence of KCl (0.1M) at a scan rate of $100mVs^{-1}$ using glassy carbon as the working electrode, platinium wire as the counter electrode, and calomel ($Hg_2Cl_2$) as the reference electrode.

**Acknowledgement:**
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# Electrical and photoconductivity properties of GaZnO/p-Si/Al Photodiode

Mehmet Çavaş[1*], Niyazi Özdemir[2] , Fahrettin Yakuphanoglu[3], Savaş Kaya[4],

[1]*Department of Mechatronics Engineering, Faculty of Technology, Firat University, Elazig, Turkey*
[2]*Department of Metallurgy and Materials Engineering, Firat University, Elazig, Turkey*
[3]*Department of Physics, Faculty of Science, Firat University, Elazig 23169, Turkey*
[4]*Sch. of Electr. Eng. & Comput. Sci., Ohio Univ., Athens, OH, USA*

**Abstract—**In present study, the photoresponse characteristics of GaZnO/p-Si photodiode were investigated. The GaZnO film was prepared by sol-gel spin coating method. The current-voltage (I-V) characteristics of the photodiode were measured under dark and various illumination conditions. The reverse current of the diode is increased with increasing illumination intensity. The photocurrent of the photodiode is increased from $1.35x10^{-7}$ to $1.26x10^{-3}$ A under 100mW/cm$^2$. The surface morphology properties of the GaZnO film were analyzed by atomic force Microscopy (AFM). It is seen that the GaZnO film is formed from the nanoparticles. The electrical parameters of the photodiode such as ideality factor and barrier height were determined using thermionic emission model. The ideality factor and barrier height values of the photodiode was found to be and 0.81 eV, respectively. The capacitance –voltage (C-V) characteristics of the photodiode exhibited a dispersive behavior. The interface state density, $D_{it}$ value of photodiode is decreased with increasing frequency. The obtained results indicate that GaZnO/p-Si photodiode can be used as a photodiode in optoelectronic applications.

**Keywords:** CuZnO film, Photodiode

# Relationship Between Blood Antioxidant Enzyme Levels and Genotype in Rats Exposure to Aroclor 1254

U. Ozbey[1*], M. Erişir[2], A. Seyran[3], Y. Deger[4] and Z. Çambay[5]

[1]*Departmants of Genetic, Health High School, Tunceli University, Tunceli, Turkey,*
[2]*Departmants of Biochemistry, Faculty of Veterinary Medicine, Firat University, Elazig, Turkey*
[3]*Departmants of Biochemistry, Health High School, Bitlis Eren Üniversity, Bitlis Turkey*
[4]*Departmants of Biochemistry, Faculty of Veterinary Medicine, Yuzuncu Yil Üniversity, Van Turkey*
[5]*Departmants of Genetic, Health Service Vocation High School, Firat University, Elazig, Turkey*

*Corresponding Author: ulkuozbey@yahoo.com

**Abstract—**It is known that polychlorinated biphenyls (PCBs) may cause environmental contamination and threaten on people health because of lipophilic features. PCBs can enter the organism via especially gastrointestinal tract, and cutaneous tissue. It is determined that PCBs transferred to the foetus via placenta and to the newborn via maternal milk. The aim of this study is to research effect of Aroclor 1254 upon of antioxidant enzymes such as Superoxide Dismutase (SOD), Glutathione Peroxidase (GSH-Px), Catalase (CAT), and Malondialdehyte (MDA) of a lipid peroxidation product in rats exposure to Aroclor 1254. Moreover, the allele and genotype incidence of this polymorphism is being researched by looking at the gene polymorphism of the enzymes of Manganese Superoxide Dismutase (Mn-SOD), GSH-Px3 and CAT. In this study, 30 normally control and 30 Spraq-Dawley rats to exposure A1254 were used. The rats were given Aroclor1254 2 mg / kg / day (n = 30) and injection time was 20 days. After injections 30 normal and 30 rats to administered A1254 were decapitated. For biochemical analysis, Blood samples were obtained from rats to analyzed the parameters of MDA, SOD, CAT and GSH-Px. For molecular analysis, The genotype characteristics were determined by PCR-based RFLP method using DNA extracted from peripheral blood. We compared antioxidant enzymes (GSH-Px, CAT and SOD) and plasma MDA levels between Aroclor1254 administration in normal rat and control group, MDA levels both Rats exposed to Aroclor 1254 and control groups were observed decreased in plasma. Whereas, we haven't found any statistical difference in SOD, CAT and GSH-Px activity between Aroclor1254 administration in normal rat and control group. In the molecular part of our study, we haven't found any statistical difference between Aroclor1254 administration in normal rat and control group for Mn-SOD, CAT and GSH-Px1 allele, genotype. In conclusion, it was determined that Aroclor1254 has different and harmful effect on oxidant and anti-oxidant systems in all groups. The determining of an increase on MDA levels in rats and exposed to PCB is an obvious evidence of oxidant damage especially in these rats.

**Key words:** Aroclor1254, Oksidatif stres, Manganese Superoxide Dismutase, Glutathione Peroxidase-1, Catalase, Polymorphism.

# Investigation of Polimorphism of Glutathione Peroxidase, Catalase, Superoxide Dismutase Gene and Genotype Distribution in Sheep with Fluorosis.

U. Ozbey[1*], Y.Deger[2], F. Yur[3], and Z. Çambay[4]

[1]*Departmants of Genetic, Health High School, Tunceli University, Tunceli, Turkey,* [2]*Departmants of Biochemistry, Faculty of Veterinary Medicine, Yuzuncu Yil Üniversity, Van Turkey*
[3]*Departmants of Biochemistry, Faculty of Veterinary Medicine, Yuzuncu Yil Üniversity, Van Turkey*
[4]*Departmants of Genetic, Health Service Vocation High School, Firat University, Elazig, Turkey*

*Corresponding Author: ulkuozbey@yahoo.com

**Abstract—**Fluorosis is a serious public health problem in many parts of the world. As in the case of many chronic degenerative diseases, increased production of reactive oxygen species has been considered to play an important role, even in the pathogenesis of chronic fluoride toxicity. The aim of this study is to research effect of fluorosis upon of antioxidant enzymes such as Superoxide Dismutase (SOD), Glutathione Peroxidase (GSH-Px), Catalase (CAT), and Malondialdehyte (MDA) of a lipid peroxidation product in sheeps with fluorosis and control groups. Moreover, the allele and genotype incidence of this polymorphism is being researched by looking at the gene polymorphism of the enzymes of Manganese Superoxide Dismutase (Mn-SOD), Glutathione Peroxidase-1 (GSH-Px1) and CAT in sheep with nonfluorosis and fluorosis. In this study, 24 Akkaraman sheep with fluorosis that live in Doğubeyazit province of Ağrı and 20 Akkaraman sheep with nonfluorosis that live in Van were used. For biochemical analysis, blood samples were obtained from sheeps to analyzed the parameters of MDA, SOD, CAT and GSH-Px. For molecular analysis, The genotype characteristics were determined by PCR-based RFLP method using DNA extracted from peripheral blood. In our study, plasma MDA and GSH-Px, CAT, SOD activities were measured in sheep with fluorosis and nonfluorosis. The levels of fluorine in urines of the sheep with fluorosis were measured as 6.74 ± 0.49 ppm and 1.50 ± 0.30 ppm in the sheep with nonfluorosis. In group with fluorosis, MDA levels and GSH-Px activity were increased as compare to the control group ($p< 0.01$). Although, we detected a statistically remarkable decrease in CAT and SOD levels between sheeps with fluorosis from the region where endemic fluorosis and control group ($p<0.05$). In the molecular part of our study, For the Mn-SOD, CAT and GSH-Px1 polymorphism, there were found significant differences in the genotype and allele frequencies between between sheeps with fluorosis and control group ($p<0.01$). Consequently, oxidative stress and antioxidant enzymes play an important role in fluorosis pathogenesis, and according to our data Mn-SOD, CAT and GSH-Px1 gene polymorphisms cause an inclination to fluorosis for our regional community.

**Key words:** Fluorosis, sheep, Manganese Superoxide Dismutase, Glutathione Peroxidase -1, Catalase, Polymorphism.

# Synthesis, Characterization, and Fluorescence Anion Sensor Application of Pyrene Side-Functional Styrene Copolymer

O. Karagollu[1], Mesut Gorur[2*], Fethiye Gode[1], Busra Sennik[2,3], Faruk Yilmaz[3]

[1]*Department of Chemistry, Suleyman Demirel University, 32260, Isparta, Turkey*
[2]*Department of Chemistry, Istanbul Medeniyet University, 34700, Istanbul, Turkey*
[3]*Department of Chemistry, Gebze Technical University, 41400, Kocaeli, Turkey*

*Corresponding Author: mesut.gorur@medeniyet.edu.tr

**Abstract—**Great deals of scientific efforts have been focused on the design and development of new receptor molecules towards ionic species due to their crucial roles in a wide range of chemical and physiological processes [1]. Although some ionic species are essential to sustain growth, they may act as harmful pollutants when their concentrations in the environment exceed threshold levels [2]. Phosphates are fundamental ions in information processing, energy storage, and signal transduction. Therefore, they are among the main nutrients of plants and animals and widely used in fertilizers [3]. On the other hand, redundant use of phosphates resulted in eutrophication of rivers and lakes. Thus, determination of ion concentrations in water and soil samples has prominent importance from various points of views.In this work, pyrene side-functional styrene copolymer (PS-Pyr) was prepared via nitroxy-mediated radical polymerization (NMP) and click chemistry methods and then used as fluorescent chemical probe towards some anions (Figure 1).

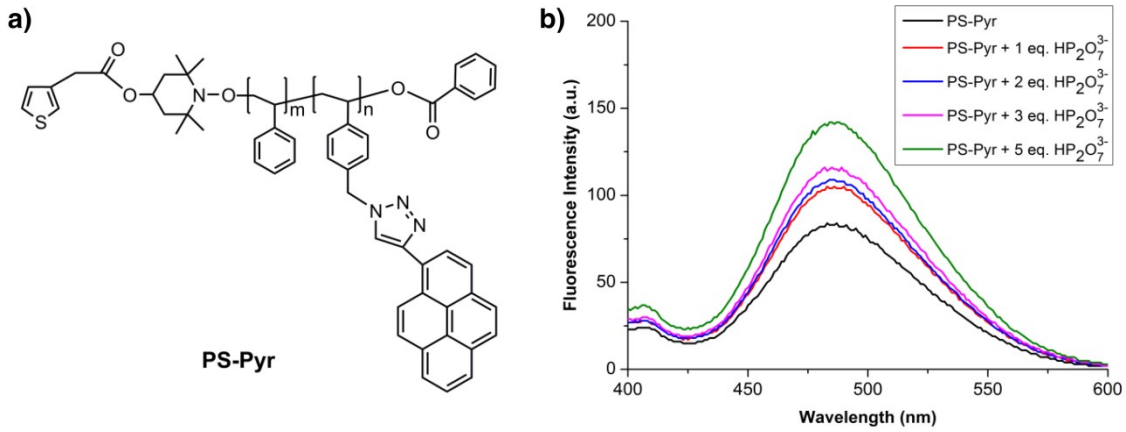


**Figure 1.** Molecular drawing of PS-Pyr (a) and its fluorescence responses against $HP_2O_7^{3-}$ anion at different equivalent ratios (b).

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# Shape Memory Properties of Poly(vinyl alcohol)/hydroxyapatite composites

Muruvet Kalay*, FahretinYakuphanoglu

*Physics Department, Faculty of Science, FiratUniversity, Elazig, Turkey*

*Corresponding Author : muruvet_kalay@hotmail.com

**Abstract—**Shape-memory polymers (SMPs) are a type of smart material possessing the capability of recovering their original shape upon the application of an external stimuli. In present study, the polyvinylalcohol based shape memory composites were synthesized for various contents of hydroxyapatite particles. Scanning electron microscopy (SEM), differential scanning calorimetry (DSC) were carried out to examine surface morphology, glass transition temperature (Tg) and shape memory effect of PVA/HAP composites, respectively. The HAP nanoparticles improve the recovery properties of the PVA polymer. The obtained results indicate that HAP particles improve the shape memory effects of PVA polymers and PVA/HAP composites can be used in biomedical applications.

# Graphene-Methylene Blue Based Organic Photocapacitor

Aysegul Dere*, F. Yakuphanoglu

*Department of Physics, Faculty of Science, Firat University, Elazig 23169, Turkey*

*Corresponding Author : ayse_fizik23@hotmail.com

**Abstract—**The graphene oxide was synthesized by Hummers' method. The graphene oxide:methylene blue composites were prepared for various graphene oxide contents. The films of the graphene oxide:methylene blue composites having various molar ratios were coated on p-Si/Al having ohmic contact. The transient photocapacitance measurements were performed under 100 mW/cm$^2$ illumination. The capacitance of the diodes is sensitive to illumination intensity and frequency of applied electric field. The photocapacitance gain, $C_{ph}/C_d$ for the diode having 0.1 GO content at 100 kHz was found to be 2.95. The obtained capacitance results suggests that the graphene oxide:methylene blue composites can be used in optoelectronic devices applications.

**Key words:** Photocapacitance, Graphene, Sensor

# Synthesis, Characterization and Dielectric Properties of Methyl methacrylate Using P(PCBO-co-ε-CL) a macroinitiator in ATRP

G.Torgut[1*], K. Demirelli[2]

[1]Department of Chemistry and Chemical Processes,Tunceli Vocational School, Tunceli,Turkey
[2]Department of Chemistry, Faculty of Science, Elazığ, Turkey

*Corresponding Author: gtorgut@tunceli.edu.tr

**Abstract—**Copolymer of 2-(3-methyl-3-phenylcyclobutyl) oxirane and ε-caprolactone were synthesized by ring opening polymerization using phenol as the initiator and $Sn(Oc)_2$ as the catalyst. To compose macroinitiator –OH groups in the copolymer acylatied with choloro acetyl chloride. A kinetic series of MMA carried out in the presence of this macroinitiator and catalyst CuBr/2,2'-bipyridn (bpy) at 110 $^0$C. The molecular structure of the copolymers were confirmed by Fourier transform infrared ( FT-IR), $^1$H-NMR spectroscopy and gel permeation chromatography (GPC). Kinetic study of ATRP showed that the polymerization proceeded in a controlled way up to high conversions and the number-average molecular weight ($M_n$) increased in a time. The thermal properties of (Tg and Tm) the copolymers investigated TGA and DSC. Dielectric properties of block copolymers against the frequency and the temperature were determined. Capacitance and dissipation factor values of P(PCBO-co-ε-CL-b-PMMA) were measured in the frequency range 0,01-2 kHz and temperature range 305-410 K. Polymer doped with $EuCl_3$ and the relative permittivity (ε') and dielectric loss (ε") were significantly affected by $EuCl_3$ content [1]. It was seen that the ε'and ε"decreased with increasing frequency and increased with increasing temperature [2].

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# Characterization of undoped and Graphene Oxide doped Poly (9-vinylcarbazole) (PVK) Organic Films

C. Aydin[1*], F. Yakuphanoglu[2]

[1]*Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey*
[2]*Physics Department, Faculty of Science, Firat University, Elazig, Turkey*

*Corresponding Author: cihataydin_26@hotmail.com

**Abstract—**Polyvinylcarbazole (PVK) appeared to be much more efficient emitting polymer because of its optically active carbazole groups.

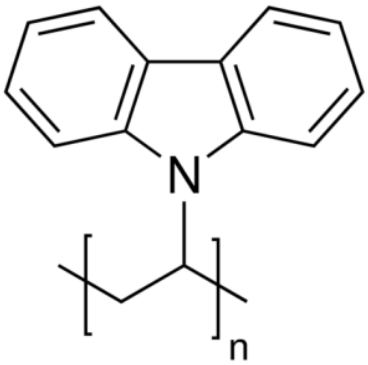


**Figure 1 :** The molecular structure of Poly (9-vinylcarbazole)

Poly (N-vinylcarbazole) (PVK) is well known for its photoconducting and electroluminescence properties. PVK has been widely used for electronic display, many electrical-electronic devices and home appliances [1-7] and its films have been prepared by solution method[3]. The graphene oxide was synthesized by Hummers method .The PVK is doped with graphene oxide for various ratios (1%wt, 5%wt, 10%wt, 15%wt). Firstly, poly(9-vinylcarbazole) is dissolved in cloroform by heating up to 50°C. The various molar concentrations of GO were added to the PVK. The prepared solution of PVK was spread on petry dish and air-dried at 40°C for 3 h. The structural properties of the films were investigated by means of Scanning Electron Microscopy (SEM) and UV-VIS-NIR spectrophotometer.

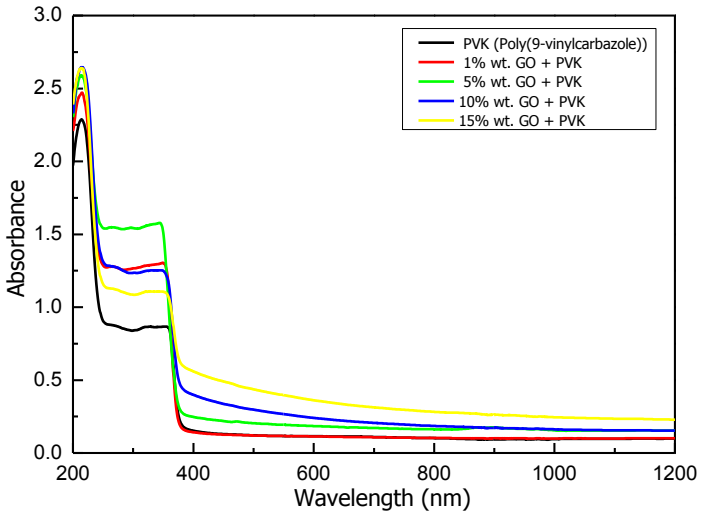


**Figure 2 :** Spectral Absorbance curves of Organic Films

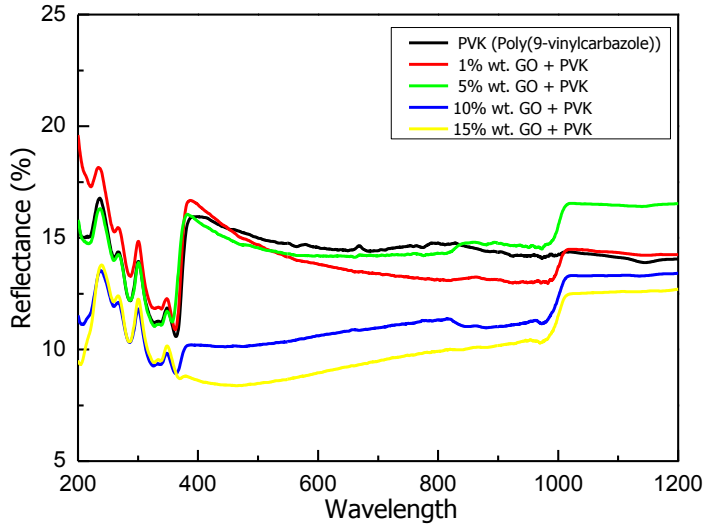


**Figure 3 :** Spectral Reflectance curves of Organic Films

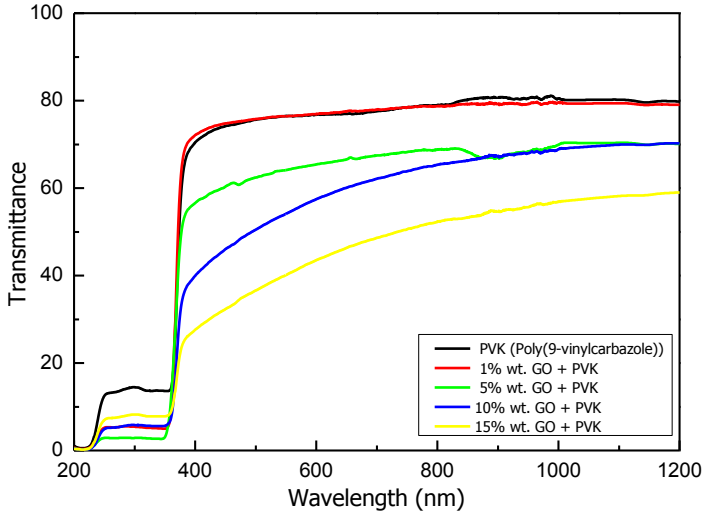


**Figure 4 :** Plots of Transmittance versus Wavelength for organic Films

SEM results indicate that the particle size of the organic films is changed with the graphene oxide doping. The optical energy band gap of the nanocomposites is changed with the increase in concentration of graphene oxide.

**Keywords:**
Organic, electronic materials, Organic thin films, microstructure, optical properties

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# Synthesis and Electrical properties of Graphene Oxide/$SnO_2$ nanocomposites by microwave hydrothermal technique

C. Aydin[1*], F. Yakuphanoglu[2]

[1]*Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey*
[2]*Physics Department, Faculty of Science, Firat University, Elazig, Turkey*

*Corresponding Author : cihataydin_26@hotmail.com

**Abstract—**The high interest in graphene based materials is due to its unique electronic and optical properties. In present study, the electrical and optical properties of Graphene Oxide/$SnO_2$ nanocomposites have been investigated by electrical conductivity and optical spectroscopy methods. The graphene oxide was synthesized by Hummers method. The Graphene Oxide/$SnO_2$ composites were prepared for various graphene oxide and Tin(II) oxide contents via a route which includes ultra-sonication, evaporation with microwave. Energy disperse X-Ray (EDX) results confirmed the chemical compositions of the composites. Typical scanning electron microscopy (SEM) images were carried out to investigate the microstructure of the nanocomposites. The electrical transport mechanism of GO/$SnO_2$ composites was studied by the conductivity-temperature measurements. The optical band gaps of the composites were determined by optical reflectance method which is based on Kubelka-Munk theory for the analysis of diffuse reflectance spectra obtained from weakly absorbing samples.

**Keywords:** Nanocomposites, Hummers method, Microwave, Graphene oxide

# $LiXO_2$ Lithium Ion Battery Materials for Portable Electronic Devices

M. Sasmaz* and F.Yakuphanoglu

*Department of Physics, Faculty of Science, Firat University, Elazig, Turkey

*Corresponding Author : merivansasmaz@gmail.com

**Abstract—**Li ion batteries (LIB) have become predominant sources for portable electronic devices and hybrid electric vehicles. Nowadays, the development of electrode materials for LIB has become quite necessary to require the existence of a higher power electrical appliances, high capacity, long life and good rate [1,2]. In present study, we prepared $LiXO_2$ (X=Ni, Mn, Co, Cu) nanocomposites with various chemical routes. The XRD patterns indicate that the $LiXO_2$ materials have polycrystalline structure (Figure 1). The chemical compositions of the materials were confirmed by energy disperse X-Ray (EDX) and XRD, Fourier transform infrared spectroscopy (FTIR) techniques. Typical scanning electron microscopy (SEM) images were carried out to investigate the structural properties of nanocomposites.

**Keywords:** Li ion batteries, nanocomposites, XRD

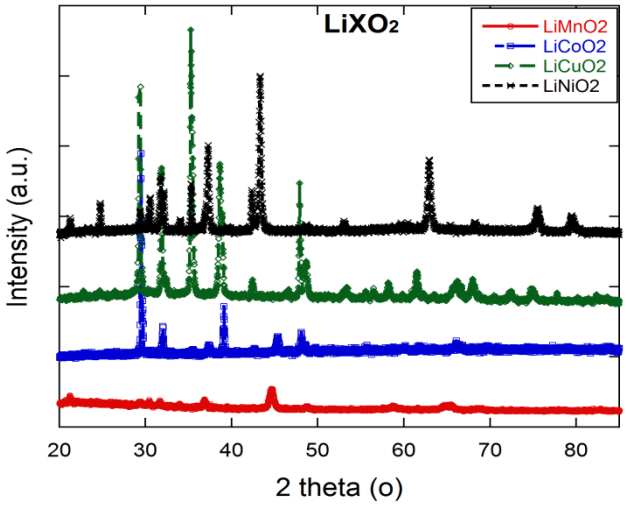


**Figure 1.** XRD pattern of $LiXO_2$ (X= Ni, Mn, Co, Cu) nanocomposites

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# Copper(II) phthalocyanine(CuPc)/Graphene Oxide(GO) Nanocomposites

C. Aydin[1*], H.Aydin[2], B.Cicek Ozkan[1], F. Yakuphanoglu[3]

[1]*Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey*
[2] *Department of Metallurgy and Materials Engineering, Engineering Faculty., Tunceli University, Tunceli, Turkey*
[3]*Physics Department, Faculty of Science, Firat University, Elazig, Turkey*

*Corresponding Author : cihataydin_26@hotmail.com

**Abstract—**Phthalocyanines are interesting class of materials. They have been researched with great interest by chemists, physicists, and industrial scientists due to their unique high stability, architectural flexibility, diverse coordination properties, good spectroscopic characteristics, and rich and reversible redox chemistry [1–4]. The unique properties of the Phthalocyanines lead to their use in different applications such as medicine, optical communication, gas sensors, photoconducting agents, chemical sensors, molecular metals, liquid crystals, non-linear optics, catalysis, and most importantly they are utilized as stand-alone or composite semiconductor materials [1-8].Copper phthalocyanine (CuPc) is one of the best known organic semiconducting materials and it exhibits interesting electrical, optical, photoconductive and photovoltaic properties [9-12]. In present study, graphene doped copper(II) phthalocyanine nanocomposites prepared for various concentrations ($m_{GO}/m_{CuPc}$= 0.0005, 0.001, 0.003 and 0.01) with various chemical routes. Copper(II) phthalocyanine (CuPc) was used as received from Sigma Aldrich. The graphene oxide was synthesized by Hummers method. The composites were analyzed by FESEM (Jeol Jsm-7001F). Scanning electron microscopy (SEM) images were carried out to investigate the structural properties of nanocomposites. The measurements of transmittance, reflectance and absorbance are carried out using a double beam spectrophotometer model, a Shimadzu UV–VIS–NIR 3600 spectrophotometer with an integrating sphere in the wavelength range 200–1200 nm.

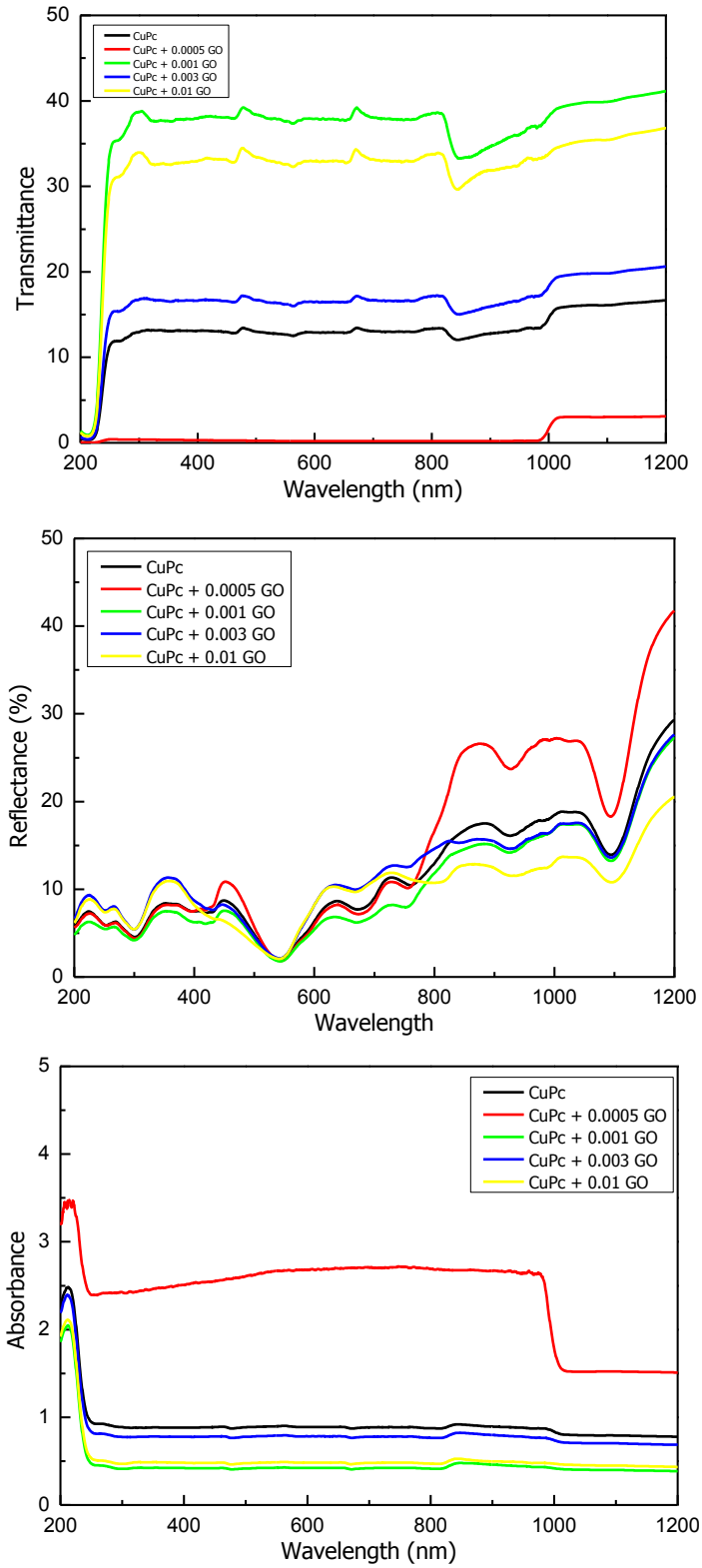


**Figure 1:** Optical spectra of CuPc/GO composites

All the measurements are carried out at the room temperature. The chemical compositions of the materials were confirmed by energy disperse X-Ray (EDX), Fourier transform infrared spectroscopy (FTIR) techniques.

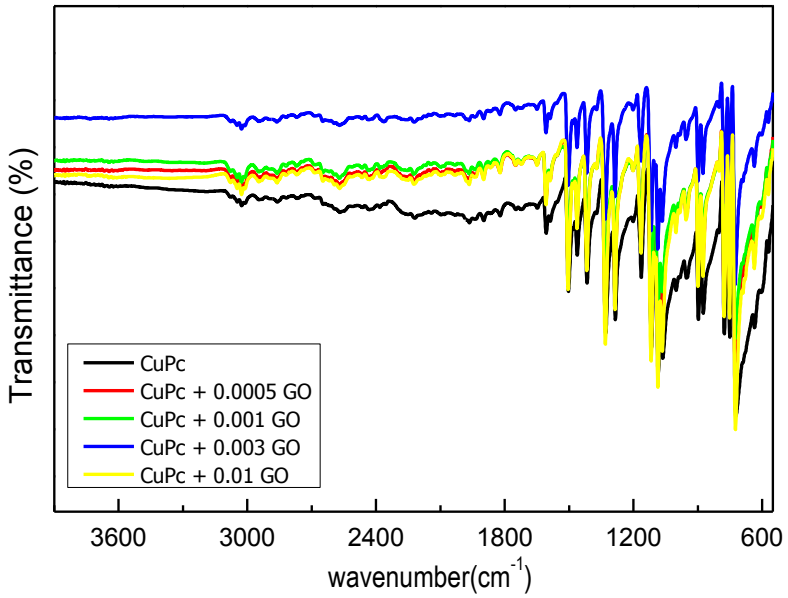


**Figure 2.** FTIR spectrums of all nanocomposites

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# Electrical Characterization of Ag/Polyaniline (Pedot:PSS)/ITO Structure

B. Sungu Misirlioglu[1*], M. Serin[1], F. Kuruoglu[2], and D. Sakar[3]

[1]*Department of Physics, Yildiz Technical University, Istanbul, Turkey*
[2] *Department of Physics, Istanbul University, Istanbul, Turkey*
[3] *Department of Chemistry, Yildiz Technical University, Istanbul, Turkey*

*Corresponding Author : banu@yildiz.edu.tr

**Abstract—**Conducting polymers (polyaniline, polypyrrole etc. ) attract much attention in microelectronic and optoelectronic devices. Among them, polyaniline (PANI) has lots of potential applications such as Schottky diodes, sensors [1-4] due to their high conductivity and easy fabrication. In this work, we present electrical characterization of Ag/Polyaniline (Pedot:PSS)/ITO diode structure by current-voltage (I-V) measurements at room temperature and in the dark. PANI was synthesized by the oxidative polymerization technique. The film form was deposited onto ITO substrates by casting the PANI solution with subsequent drying. Then (Pedot:PSS) was coated over PANI by drop-casting method. The structural analysis was performed by SEM images (Figure 1.a). I-V characteristics are used to investigate the electronic parameters of the structure (Figure 1.b). The diode indicated a rectification behavior with the ideality factor of 2. Cheung functions and Norde method were also used. The series resistance, ideality factor and the effective barrier height of the structure were calculated and discussed. According to the results, diode like behavior of the structure was shown.

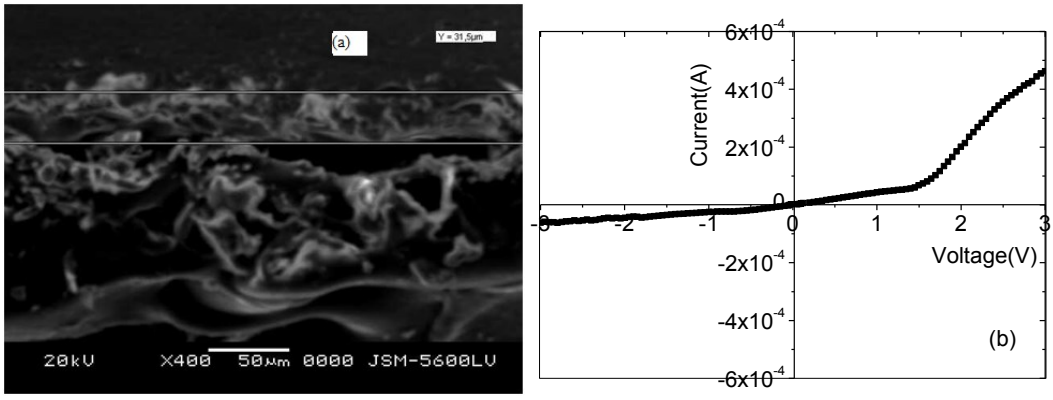


**Figure 1 :**(a) SEM images, (b) Current voltage characteristics of the Ag/PANI(Pedot:PSS)/ITO structure.

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# Fabrication and temperature dependent electrical characterization of poly(EDOT–co–TAA)/*p*–Si device in wide temperature range

Seçkin Akın* And Savaş Sönmezoğlu

*Department of Materials Science and Engineering, Karamanoğlu Mehmetbey University, Karaman, Turkey*

*Corresponding Author : seckinakin@kmu.edu.tr

**Abstract—**In the present work, poly(3,4–ethylenedioxythiophene) and poly(3–thiopheneacetic acid) copolymer [poly(EDOT–co–TAA)] has been used to improve the barrier height of *p*–Si-based devices due to their promising advantages over inorganic. The variation in electrical characteristics of this structure has been analyzed as a function of temperature using current–voltage (I–V) and capacitance–voltage (C–V) measurements over a wide temperature range of 50–380 K. The barrier heights $(\phi_b)$ and ideality factors $(n)$ of the device are found in the range 0.15 eV, 16.43 at 50 K and 0.96 eV, 1.22 at 380 K, respectively. These results observed that the $\phi_b$ decreases and $n$ increases with a decrease in temperature. This behaviour is attributed to barrier inhomogeneities by assuming Gaussian Distribution (GD) at the interface. Furthermore, from the C–V–T characteristics measured at 1 MHz, the capacitance was determined to increase with increasing temperature. The further temperature dependent electrical parameters such as series resistance, reverse saturation current, built–in potential, depletion width and energy distribution of interface state density $(N_{ss})$ profile are also reported. As a result, it can be concluded that the temperature dependent characteristic parameters for poly(EDOT–co–TAA) copolymer/*p*–Si structure can be successfully explained on the basis of thermionic emission mechanism with GD of the barrier heights.

**Keywords**: Poly(EDOT–co–TAA), Temperature dependent electrical properties, Barrier inhomogeneities, Ideality factor.

# Enhanced performance of Si-based devices using conducting poly (1,8-diaminocarbazole) polymer

Mahir Gülen* And Savaş Sönmezoğlu

*Department of Materials Science and Engineering, Karamanoğlu Mehmetbey University, Karaman, Turkey*

*Corresponding Author : mahirglen@gmail.com

**Abstract—**Recently, there has been a great interest for the usage of conducting polymers as active materials in microelectronic applications due to very promising properties. In this study, the conductive polymer, known as poly(1,8-diaminocarbazole) (PDACz), has been successfully deposited on the surface of p-type Silicon wafer to fabricate Al/poly(1,8-diaminocarbazole)/p-Si structure. The temperature dependent current–voltage (I–V–T) and capacitance–voltage (C–V–T) characteristics of the device are subsequently used for extracting electronic parameters of the device such as the ideality factor $(n)$, barrier height $(\phi_b)$, reverse saturation current, built-in potential, depletion width and doping concentration etc in the interval of 40 to 580 K. The estimated barrier height from the I–V measurement has varied from 0.12 eV to 1.24 eV, and the ideality factor from 5.50 to 1.40 in the temperature range 40 to 580 K. It has been observed that the $n$ decreases while the $\phi_b$ increases with increase of temperature. It was found that the PDACz-based diodes exhibited a better device performance than those with an free- PDACz..

**Keywords**: PDACz conducting polymer, I–V–T and C–V–T measurements, Barrier height, Ideality factor.

# A Novel Methacrylamide Monomer: Synthesis, Characterization And Its Copolymerization With Styrene

E. Barim[1], C. Kirilmis[2*], M. Degirmenci[1], N. Genli[3]

[1]*Department of Chemistry, Harran University, Sanlıurfa, TURKEY*
[2]*Department of Chemistry, Adiyaman University, Adiyaman, TURKEY*
[3]*Department of Chemistry, Dicle University, Diyarbakır, TURKEY*

*Corresponding Author : ckirilmis@gmail.com

**Abstract—**Benzofurans are the heterocyclic compounds which contains benzene and furan rings. Benzofurans and their derivates have been used in many research fields such as physic, chemistry, biology, pharmacology, and polymer chemistry [1]. They have physiological, pharmacological and toxic properties and find application as sedatives, hypnotics, agrochemicals, pharmaceuticals, cosmetics and as the building blocks of optical brighteners. Hence, there is continuing interest in their chemical synthesis [2]. In addition, they also exhibit important optical properties because of having π-conjugated system. In recent years, there has been an increased interest in the synthesis and use of new benzofurans in polymer chemistry [3].

In this study, a novel methacrylamide monomer was synthesized, characterized and copolymerized with styrene. The methacrylamide monomer namely, *N*-(2-acetyl-benzofuran-3-yl)methacrylamide (NABM), was prepared by the reaction of 1-(3-amino-1-benzofurane-2-yl) ethanone (which was synthesized by the reaction of 1-chloroacetone with 2-hydroxy-benzonitrile under basic conditions) with methacryloyl chloride at 0-5 $^{o}$C temperature. The free-radical copolymerization of NABM with styrene (St) was carried out in 1,4-dioxane at 70°C using AIBN as the initiator. The structures of synthesized compounds have been characterized by spectroscopic studies. The molar fractions of NABM and St in the copolymers were determined from $^{1}$H-NMR analyses. The monomer reactivity ratios were calculated according to the general copolymerization equation using Kelen-Tüdõs and Finemann–Ross linearization methods.

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# Synthesis And Characterization Of A New Conducting Polymer

E. Barim[1], D. Canakci[2], C. Kirilmis[3], G. Barim[3*]

[1]*Department of Chemistry, Harran University, Sanlıurfa, TURKEY*
[2]*Adıyaman Üniversity Vocational School of Technical Sciences, Adiyaman, TURKEY*
[3]*Department of Chemistry, Adiyaman University, Adiyaman, TURKEY*

*Corresponding Author : gbarim@gmail.com

**Abstract—**Polyazomethines, also called poly(Schiff base)s are known for more than five decades. The classical synthetic methods reported for these polymers are especially based on polycondensation reactions. Recently a new method for synthesizing polyazomethines was reported, i.e., oxidative polycondensation of monomers containing azomethine bonds. Oxidative polycondensation is simply the reaction of compounds including aromatic –OH groups in their structure with oxidant like NaOCl, $H_2O_2$ and air oxygen [1].

These polymers are interesting for a large number of applications in electrical conductivity and optoelectronics. Wholly conjugated polyazomethines are highly thermostable materials in the absence of moisture and following a suitable doping they may also show an attractive level of electrical conductivity [2]. In addition schiff base polymers have been synthesized because of their complex-forming stability and find use as catalysts, controlled-release agents for drugs, biocides and in recovery of trace metals ions [1].

In this study Schiff base was synthesized in general procedure by the condensation of 4-hydroxybenzaldehyde with 1-(3-aminobenzofuran-2-yl )ethanone in ethanol. Schiff base polymer was prepared through the oxidative polycondensation of 1-(3-((4-Hydroxy-benzylidene)-amino)benzofuran-2-yl)ethanone with an aqueous solution of NaOCl was dissolved in an aqueous solution of KOH. Metal complexes of the schiff base polymer were synthesized by the reaction of polymers and metal salts. The structures of synthesized compounds were characterized by spectroscopic studies and thermogravimetric analyses.

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# A comparative study on the main electrical parameters of Au/n-Si (MS), Au/biphenyl-CuPc/n-Si and Au/biphenylSubs-CoPc/n-Si (MPS) type Schottky barrier diodes (SBDs)

A. Demir[1,6*], İ. Yücedağ[2], G. Ersöz[2], Ş. Altındal[3], N. Baraz[4] and Mehmet Kandaz[5]

*1Department of Physics, Faculty of your Sciences, Düzce University, 81620, Düzce, Turkey*
*2Department of Computer Engineering, Technology Faculty, Düzce University,81620, Düzce, Turkey*
*3Department of Physics, Faculty of Sciences, Gazi University, 06500, Ankara, Turkey*
*4Department of electric and energy, Düzce University, 81620, Düzce, Turkey*
*5Department of Chemistry, Faculty of Sciences, Sakarya University, 54140, Sakarya, Turkey*
*6Department of Physics, Faculty of Sciences, Sakarya University, 54140, Sakarya, Turkey*

*Corresponding Author : ahmetdemir@duzce.edu.tr

**Abstract—**We have fabricated Au/n-Si (MS), Au/biphenyl-CuPc/n-Si, and Au/biphenylSubs-CoPc/n-Si (MPS) type Schottky barrier diodes (SBDs) to investigate the effect of interfacial layer on the main electrical parameters. Au /biphenyl-CuPc/n-Si Au/biphenylSubs-CoPc/n-Si interfacial layer were successfully coated on n-Si substrate by using the spin coating system and their surface morphology were offered by SEM images. The current-voltage (*I-V*) characteristics of these SBDs have been investigated at room temperature and they are considerably influenced by interfacial layer. The main electronic parameters of these three type diodes such as reverse saturation current (□), series resistance ($R_s$), ideality factor ($n$), and zero-bias barrier height (□) were determined from the forward bias *I-V* characteristic. The energy density distribution profiles of Nss was also obtained from the forward *I-V* data by taking into account voltage dependent effective barrier height (□) and ideality factor *n(V)* and they increases from the mid-gap energy of Si toward the bottom of conductance band almost an exponentially [1]. In addition, the voltage dependent profile of resistance was high frequency (500 kHz) capacitance-voltage (*C-V*) and conductance-voltage (*G/□-V*) data at room temperature for each diode. Experimental results show that the Rs, Nss and interfacial layer are important effect on the electrical characteristics.

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# Investigation of Electrical properties of nanostructured Al doped $SnO_2$ powders

C. Aydin[1*], F. Yakuphanoglu[2]

[1]Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey
[2]Physics Department, Faculty of Science, Firat University, Elazig, Turkey

*Corresponding Author : cihataydin_26@hotmail.com

**Abstract—** Metal oxide based on nanomaterials have been extensively investigated for the last few decades because of their wide range of applications .The nanomaterials are of considerable technological interest and have different industrial applications. $SnO_2$ is used in many devices where transparent semiconductors are needed, such as thin heat-reflecting foils, transparent electrodes, gas sensors, and solar panels, among others. Applications of $SnO_2$ have been less frequent because this oxide becomes unstable with temperature and undergoes a disproportionation reaction. Al-doped $SnO_2$ nanocrystalline powders were prepared by sol gel route. The sol was synthesized from tin (II) chloride ($SnCl_2.2H_2O$) and $Al(NO_3)_3.9H_2O$ dissolved in N-N-dimethyl formamide at room temperature. The $SnO_2$ samples were characterized by atomic force microscopy (AFM) and electrical conductivity analyses. The three dimensional 3D-AFM images taken at a scan area of 5.0 × 5.0 $\mu m^2$ indicate that Al doped $SnO_2$ samples were formed by nanoparticles. The average grain size images was measured from the difference between visible grain boundaries at the surface by AFM. The electrical conductivity of the samples were measured as a function of temperature. It increases with increasing temperature, confirming that the Al doped $SnO_2$ samples are the semiconductors. The results showed that calcination sol gel technique can be effectively used to produce doped nanocrystalline semiconductor materials.

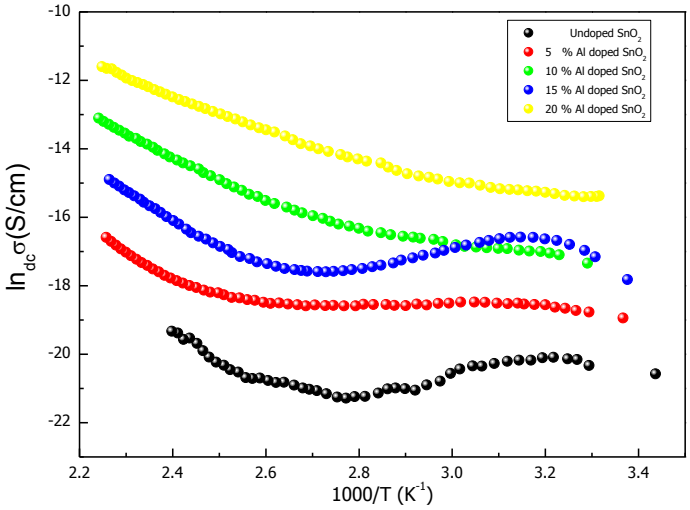


**Fig.1.** Plots of the electrical conductivity versus temperature of the samples

**Keywords :** $SnO_2$, Nanomaterials, Sol-Gel technique, Semiconductors

# Structural properties of Fe-doped Tin(II) oxide nanocrystalline powders prepared by sol-gel calcination route

H. Aydin[1*], C. Aydin[2], F. Yakuphanoglu[3]

[1]*Department of Metallurgy and Materials Engineering, Engineering Faculty., Tunceli University, Tunceli, Turkey*
[2]*Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey*
[3]*Physics Department, Faculty of Science, Firat University, Elazig, Turkey*

*Corresponding Author : haydin@tunceli.edu.tr

**Abstract—**Fe doped $SnO_2$ nanocrystalline powders were prepared for various ratios (0, 5%, 10%, 15%, 20% Fe) by sol gel method. The sol was synthesized from tin (II) chloride ($SnCl_2.2H_2O$) and $FeCl_3.6H_2O$ dissolved in N-N-dimethyl formamide. The samples were analyzed by Scanning Electron Microscopy (Jeol Jsm-7001F), X-ray diffractometer (Bruker Advance D8 model XRD) and Fourier transform infrared spectroscopy (Thermo Scientific Nicolet IS5 model FTIR). XRD patterns of Fe doped $SnO_2$ samples were identified by a tetragonal structure (Figure 1).The crystallite size of all the samples was calculated by the Scherrer equation. SEM images and XRD pattern indicate that Fe doped $SnO_2$ samples were formed by nanoparticles.

**Keywords :** Nanopowders, Tin(II) oxide, Sol-Gel technique, Scanning Electron Microscopy, FT-IR

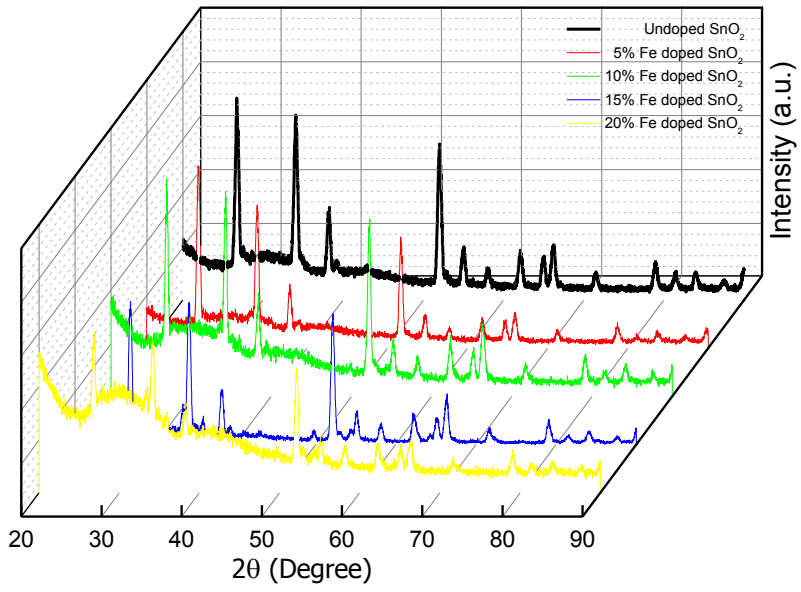


**Fig.1.** XRD pattern for undoped and Fe doped $SnO_2$

# Prevalence of *Helicobacter pylori* virulence genotypes among children in Eastern Turkey

Gokben Ozbey [1*], Yasar Dogan [2] and Kaan Demiroren [3]

[1] *Vocational School of Health Services, Firat University, Elazig, Turkey*
[2] *Department of Pediatric Gastroenterology, Faculty of Medicine, Firat University, Elazig, Turkey*
[3] *Department of Pediatric Gastroenterology, Dursun Odabaş Medical Center, Yüzüncü Yıl University, Van, Turkey*

*Corresponding author: gokben.ozbey@yahoo.com

**Abstract—**The present study aimed to detect the prevalence of virulence genotypes of *Helicobacter pylori* in Turkish children and to assess the association among these genotypes with antral nodularity and peptic ulcer. A total of 49 *H. pylori* isolates obtained from children in eastern Turkey were identified for the *cagA*, *vacA*, *cagE*, *iceA* and *babA2* genotypes by polymerase chain reaction. The most predominant *vacA* subtype was s1a, whereas the lowest percentage prevalence was determined in s2 gene. The most frequently identified types in children with antral nodularity were the genotypes *iceA2* and *vacA s1m2*. However, the genotypes *iceA1*, *babA2* and *vacA s1m1* were observed in similar ratios in all of *H. pylori* isolates from children with peptic ulcer. No genotypes *vacA s2m1* and s1c were found in any of *H. pylori* isolates.

This study indicated that *vacA s1m2*, *cagA* and *iceA2* were the most predominant genotypes and there was no correlattion between antral nodularity and genotypes.

**Key words:** children, genotype, *Helicobacter pylori*, polymerase chain reaction.

# Optical properties of Graphene oxide doped Methylene blue thin films

Aysegul Dere*, F. Yakuphanoglu

*Department of Physics, Faculty of Science, Firat University, Elazig 23169, Turkey*

*Corresponding Author : ayse_fizik23@hotmail.com

**Abstract—** The graphene oxide doped methylene blue thin films were prepared for various graphene oxide contetns. The optical properties of the films were analyzed by reflectance, transmittance and absorption measurements. Absorption properties of the films are increased with increasing graphene oxide. The optical absorption edge of the films are changed with GO content. This indicates that the optical band gap of methylene blue is controlled by GO content. The obtained optical results suggests that the graphene oxide:methylene blue films can be used in optic communication applications

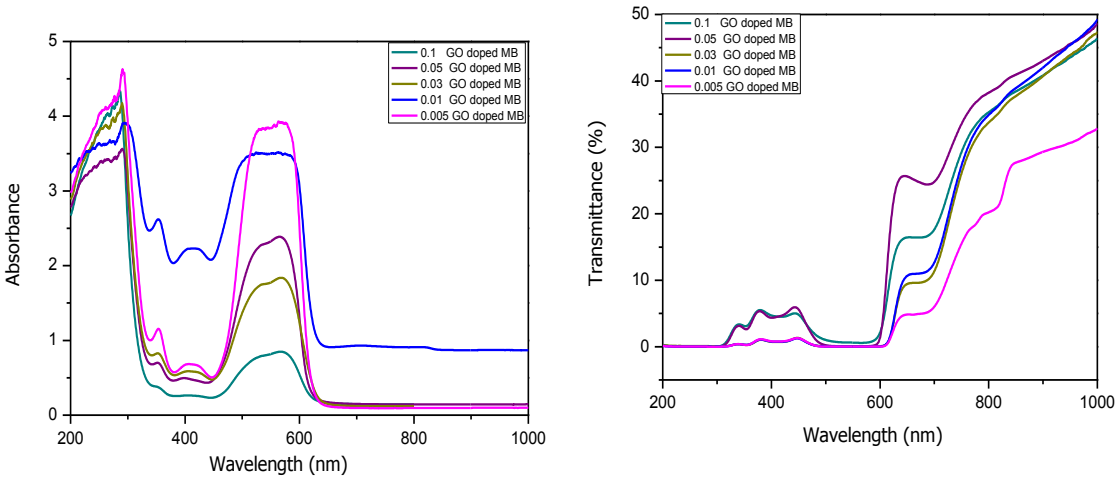


**Figure-1:** Absorbance and transmittance spectra of GO doped Methylene blue organic thin films.

# Influence of frequency on the dielectric properties of graphene oxide thin film

İbrahim Karteri, [1*] Şükrü Karataş, [1,2] Mehmet Çavaş,[3] Bilal Arif [4] and Fahrettin Yakuphanoğlu [4]

[1]*Materials Science And Engineering Department, Kahramanmaras Sutcu Imam University, Kahramanmaraş,Turkey*
[2]*Physics Department, Kahramanmaras Sutcu Imam University, Kahramanmaraş,Turkey*
[3]*Maden Higher Vocational School, Firat University, Elaziğ, Turkey*
[4]*Physics Department, Firat University, Elazığ, Turkey*

*Corresponding Author: ibrahimkarteri@gmail.com.tr

**Abstract—** The frequency dependence capacitance-voltage and conductance-voltage characteristics of the graphene oxide thin film are investigated in the frequency range of 25 kHz-100 kHz at room temperature. Graphene, a true two-dimensional material with many uniqueproperties, has aroused tremendous scientific and industrial interest since it was found by Geim's group in 2004 [1]. The properties, including high Young's modulus (1 TPa) and fracture strength (130 GPa), high thermal conductivity (5000 W/(m K)), high electrical conductivity (6000 S/cm), and high surface area (2600 $m^2/g$), make it very attractive for various applications [2]. By incorporating within a polymer matrix, these atomically thin carbon nanosheets can significantly improve the physical properties of the host polymer at very low filler loading. Therefore, numerous reports have focused on the preparation and structure propertyinvestigation of graphene/polymer composites in the past few years [3e9]. Furthermore, the most suitable grapheme samples for the fabrication of graphene/polymer composites must be the derivatives originated from graphite oxide (GO), due to their scalable production and low-cost [10]. GO, which is composed of stacks of graphene oxide sheets containing epoxide and hydroxyl groups on their basal planes, can be exfoliated and reduced to produce chemically modified graphene (CMG) nanosheets [11].

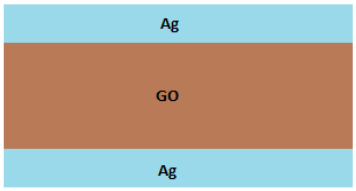


**Fig. 1.** Illustration for the device fabrication.

In this study, graphene oxide based thin film was made by using Hummers method produced grapheme oxide. The graphene oxide film are sandwiched by two Ag films to make devices, where GO is the dielectric layer. Graphene oxide thin film is about 400-nm-thick. The results are shown that the capatance of devices with grapheme oxide film spacer decreases with increasing the voltage scan rate or the AC frequency.

**Acknowledgement :**
We would like to thank Kahramanmaras Sutcu Imam University for financial support of the research program. (Project No:2013/4-24M).

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# Effect of temperature and gamma irradiation on the electrical characteristics of Sn/*p*-type Si Schottky diodes

İbrahim Karteri, [1*] Şükrü Karataş,[1,2] and Mehmet Çavaş[3]

[1]*Materials Science And Engineering Department, Kahramanmaras Sutcu Imam University, Kahramanmaraş,Turkey*
[2]*Physics Department, Kahramanmaras Sutcu Imam University, Kahramanmaraş,Turkey*
[3]*Maden Higher Vocational School, Firat University, Elaziğ, Turkey*

*Corresponding author: ibrahim karteri@gmail.com

**Abstract—** In this article, we have investigated effects of temperature and gamma irradiation on the electrical characteristics of the Sn/p-type Si Schottky diodes by using the current–voltage (*I–V*) and capacitance–voltage (*C–V*) measurements.
Sn/p-type Si Schottky diodes have been prepared by evaporating Sn on oxidised bulk (1 0 0) *p*-type Si wafers with a carrier concentration of $10^{14}$ $cm^{-3}$. The electrical characteristics of the Schottky diode have been investigated at room temperature, 400 K temperature and after under 500 kGy gamma irradiation with fluency $^{60}Co$ gamma-rays, respectively. The main parameters such as barrier height, ideality factor, and series resistance were calculated from the *I–V* measurements. The values of ideality factor and series resistance determined from the current–voltage data decreases with increasing temperature, whereas the same values increases with increasing irradiation. It has been seen that the device is sensitive to temperature and to gamma irradiation. Furthermore, it has also seen that the reverse bias current and capacitance of the device have decreased after temperature. This has been attributed to decrease in net ionized dopant concentration with temperature [1-4].

**Acknowledgement:**
We would like to thank Kahramanmaras Sutcu Imam University for financial support of the research program. (Project No:2013/4-24M).

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# Electrical properties of Sn/*p*-type Si Schottky structure under $^{60}$Co γ-ray source

İ. Karteri[1],H.Özerli[1],M. Gül, S. Karataş[1,2*]

[a]*Kahramanmaras Sutcu Imam University, Department of Materials Science And Engineering, Kahramanmaraş 4610, Turkey*
[b]*Kahramanmaras Sutcu Imam University, Department of Physics, Kahramanmaraş 4610, Turkey*

*Corresponding author: skaratas@ksu.edu.tr

**Abstract—** In this article, we have investigated effects of temperature and gamma irradiation on the electrical characteristics of the Sn/p-type Si Schottky diodes by using the current–voltage (*I–V*) and capacitance–voltage (*C–V*) measurements. Sn/p-type Si Schottky diodes have been prepared by evaporating Sn on oxidised bulk (1 0 0) *p*-type Si wafers with a carrier concentration of $10^{14}$ $cm^{-3}$. The electrical characteristics of the Schottky diode have been investigated at room temperature, 400 K temperature and after under 500 kGy gamma irradiation with fluency $^{60}$Co gamma (γ)-rays, respectively. The main parameters such as barrier height, ideality factor, and series resistance were calculated from the *I–V* measurements.

**Acknowledgements**
We would like to thank Kahramanmaras Sutcu Imam University for financial support of the research program. (Project N:o 2013/4-24M).

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# The electrical and dielectric properties of Au/Ti/$HfO_2$/*n*-GaAs Schottky Structures

A. Karabulut[1],İ.Karteri[2], Ş. Karataş[2,*], A. Turut[3], N. Bıyıklı[4,5]

[1]*Sinop University, Faculty of Engineering, Department of Electrical and Electronics Engineering, Sinop, Turkey, akerimkara@gmail.com*
[2]*Kahramanmaraş Sütçü Imam University, Faculty of Sciences and Arts, Department of Physics, 46100 Kahramanmaras, Turkey, skaratas@ksu.edu.tr (Ş. Karataş)*
[3]*Istanbul Medeniyet University, Faculty of Sciences, Engineering Physics Department, TR-34730 Istanbul, Turkey, abdulmecit.turut@medeniyet.edu.tr*
[4]*Institute of Materials Science and Nanotechnology, Bilkent University, Bilkent, Ankara 06800 Turkey, biyikli@unam.bilkent.edu.tr*
[5]*National Nanotechnology Research Center (UNAM), Bilkent University, Bilkent, Ankara 06800*

*Corresponding author: skaratas@ksu.edu.tr

**Abstract—**We formed Au/Ti/$HfO_2$/*n*-GaAs Schottky structures using the magnetron dc sputter technique, and investigated temperature dependent electrical and dielectric properties of the structure from capacitance–voltage and conductance–voltage characteristics in a wide temperature range (60-320 K by steps of 20 K) and at 1000 kHz. The dielectric constant ($\varepsilon'$), dielectric loss ($\varepsilon''$), dielectric loss tangent ($\tan\delta$) and ac electrical conductivity ($\sigma_{ac}$) were calculated from the capacitance–voltage and conductance–voltage measurements and plotted as a function of temperature at 1000 kHz. The values of the $\varepsilon'$, $\varepsilon''$, $\tan\delta$ and $\sigma_{ac}$ at 80 K, were found to be 2.272, 5.981, 2.631 and 3.32x10-6, whereas the values of the $\varepsilon'$, $\varepsilon''$, $\tan\delta$ and $\sigma_{ac}$ at 320 K were found to be 1.779, 2.315, 1.301 and 1.28x$10^{-6}$, respectively.

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# Effect of laser exposure on structural and optical properties of CdO and Li doped Cdo nano structured thin film synthesized by sol get method

W. A. Farooq[1*], L. E. AL-Otaibi[1], A. S. Al-Dwayyan[1], F. Yakuphanoglu[2], M, Atif[1]

[1] *Department of Physics and Astronomy, College of Science, King Saud University, Riyadh, 11451, Saudi Arabia*
[2] *Physics Department, Faculty of Science, Firat University, Elazig, 23169, Turkey*

E-mail : wafarooq@hotmail.com

Nano structured thin film of CdO and Li doped CdO have been synthesized by sol–gel spin coating method on amorphous glass substrates. The samples were irradiated with laser beam from pulsed Q-switched Nd:YAG laser of pulse width of 7ns and repetition rate of 10Hz at wavelength of 1064nm and 532nm. Effect of laser irradiation on structural and optical properties of these samples was investigated. The laser irradiation effects on morphology and microstructure were carried out with scanning microscope (SEM) and XRD respectively. Grain sizes were calculated with Scherrer formula. Optical studies were performed via absorption, fluorescence, calculation of bad gap and refractive indices.

The absorption of the samples were carried out in the range of 200-800 nm using UV-Vis Spectrophotometer and fluorescence spectra were studied in the range of 360 to 675 nm by exciting the samples at 350 nm using Fluorspectrometer. The band gaps were calculated using Tauc plot while the refraction indices were calculated using band gaps values.

SEM micrographs proved that the samples have nano structures and with laser irradiation the particles are agglomerated. XRD pattern of the samples revealed that the samples have polycrystalline cubic structure with preferred orientation of (111). Change in the grain sizes of the samples were observed with laser irradiation. Variation in absorption, fluorescence and band gaps were also observed with laser irradiation of the samples.

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# Effect of Deposition Time on the Properties of ZnO Films Prepared by MW-CBD

Sibel Yurtsever[1*] and Mujdat Caglar [2]

[1] *Graduate School of Sciences, Anadolu University, Eskişehir, Turkey*
[2]*Physics Department, Anadolu University, Eskişehir, Turkey*

*Corresponding author: syurtsever@anadolu.edu.tr

**Abstract—**In this work, the nanostructure ZnO films were prepared by using microwave-assisted chemical bath deposition (MW-CBD) method. The effect of deposition time on the structural and morphological properties of nanostructure ZnO films was investigated. Using XRD method, the crystallinity and the preferred crystal orientation of the films were analyzed. FESEM was used to study the surface morphology of the films.

Zinc oxide (ZnO) is a technically important semiconducting oxide possessing diverse and remarkable properties, such as, broad direct energy band gap (3.3eV) at room temperature, piezoelectricity, optical absorption and emission, chemical stability and biocompatibility. This material has been used in solar cell, transparent conducting films, ultraviolet-protection films, etc. [1-3].Chemical-bath deposition (CBD) method has become an attractive method for the preparation of thin films due to several advantages compared to other techniques, including industrial-scaled manufacturing, low cost, suitability for large scale deposition areas, ability to deposit the films on different substrates, and flexibility of tuning the film properties simply by controlling and adjusting the deposition experimental parameters. Microwave assisted chemical bath deposition (MW-CBD) is generally quite-fast, simple and energy-efficient. In this study, MW-CBD method will be used to prepare nanostructure ZnO films. The effect of deposition time (5, 8, 10, 12, 15 min) on the structural and morphological properties of ZnO films investigated. Constant microwave power was used for each experiment as 600 W. Fig.1 shows a flow chart of the complete steps for preparation of ZnO films and Fig. 2 shows the photograph of CEM Mars 6 MW-CBD device. To investigate the crystalline structure and the orientation of the films XRD patterns will be used. The lattice parameters of the films were calculated. The surface morphology of the films was analysed by using a field emission scanning electron microscopy (FESEM).

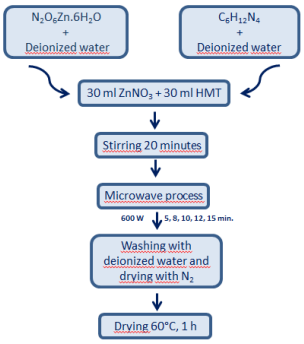


**Figure1 :** The flow chart of the ZnO films.

# Observation of nano sized particles in post alpha irradiated Polyallyl diglycol carbonate Polymer With Scanning electron Microscopy

M. R. Baig*, W. A. Farooq*, Syed Mansoor Ali ,S.S. Al-Ghamdi, , M. S. Al Garawi, M. Atif

*Physics and Astronomy Department, College of Science, P.O BOX 2455 King Saud university Riyadh 11451 Saudi Arabia*

*Corresponding Authors : mrehbaig@ksu.edu.sa, wafarooq@hotmail.com

**Abstract—**Polyallyl diglycol carbonate (PADC) is a well-known Solid State Nuclear Track Detector (SSNTD). We have investigated structural modifications of alpha irradiated PADC at different intervals of times from 5min to 360min. Structural modifications are investigated by Scanning Electron microscopic (SEM) technique**.** SEM micrograms reveal that at shorter irradiation time there is no structural change on the surface of the samples but at 120 min exposure some nano particles started appearing with continued exposure number of particles on the surface increased. Absorption spectra show abrupt increase in absorption in UV range and slight variations are observed with further increase of exposure time. Increase in intensities of emission peaks are observed with alpha irradiation. Optical band gaps at different exposure are estimated using Tauc's plot.

**Keywords-** Nanoparticles, alpha irradiation, band gap, photo Luminescence

# Impedance spectroscopy analysis of CdS quantum dots onto hierarchical $TiO_2$ structure for quantum dots sensitized solar cell applications

Syed Mansoor Ali*, M. Aslam, W. A. Farooq, Amanullah Fatehmulla, M. Atif

*Department of Physics and Astronomy, College of Sciences, P.O. Box 2455, King Saud University, Riyadh-11451, Saudi Arabia*

*Corresponding Author : mansoor_phys@yahoo.com

**Abstract—**Quantum dot sensitized solar cell composed on Hierarchical $TiO_2$ structure on transparent conductive fluorine doped tin oxide glass substrate is fabricated. The impedance spectroscopy properties of the solar cell were investigated. The capacitance–voltage, the conductance–voltage, the series resistances–voltage characteristics of the solar cell were measured at different frequency for QDSSC applications. The capacitance–voltage measurement shows a trend from the positive to negative capacitance due to injection of electrons from the FTO electrode into $TiO_2$ nanostructure. It is evaluated that the photovoltaic performance of the sensitized solar cell can be improved by the deposition of CdS quantum dots.

# Photoconducting and photocapacitance properties of Al/p-$CuNiO_2$-on-p-Si photodiode

I. A. Elsayed[1,2*], Mehmet Çavaş[3], T. Fahmy[1,4], F. Yakuphanoglu[5]

[1]*Physics Department, College of Science and Humanitarian Studies, Salman bin Abdulaziz University, Saudi Arabia*
[2]*Physics Department, Faculty of Science, Damietta University, Egypt*
[3]*E.O.S.B. Maden Higher Vocational School, Firat University, Elazig, Turkey*
[4]*Polymer Research Group, Physics Department, Faculty of Science, Mansoura University, Egypt*
[5]*Physics Department, Faculty of Science, Firat University, Elazig, Turkey*

*Corresponding Author :iaelsayed@gmail.com

**Abstract—**The $CuNiO_2$ thin film was prepared by sol gel method to prepare a photodiode. The surface morphology properties of the $CuNiO_2$ thin film were investigated by atomic force microscopy (AFM). AFM results indicate that $CuNiO_2$ thin film is formed from the nanoparticles and the nanoparticle size was found to be about 115 nm. The optical band gap of $CuNiO_2$ film was calculated using optical data and was found to be about 2.4 eV. Al/p-Si/$CuNiO_2$/Al photo diode was prepared. The electronic parameters such as ideality factor and barrier height of the Al/p-Si/$CuNiO_2$/Al diode were determined and were obtained to be 8.23 and 0.82 eV, respectively. The interface states properties of the Al/p-Si/$CuNiO_2$/Al diode was performed using capacitance-voltage and conductance-voltage characteristics. The series resistance of the Al/p-Si/CuNiO2/Al photo diode is decreased with increasing frequency. The diode exhibited a photoconducting behavior with a high photosensitivity value of $1.02x10^3$ under 100 $mW/cm^2$. The obtained results indicate that Al/p-Si/$CuNiO_2$/Al can used in optoelectronic device applications.

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