Dr. Nimet YILMAZ CANLI

Department of Physics

Yildiz Technical University Davutpasa Campus

Esenler/Istanbul/Turkey

Research Interests

Liquid crystals

Organic Solar cells

Dielectric spectroscopy

Education

September 2004- June 2012 Ph.D. in Physics, at Yildiz Technical University about liquid crystals's mesomorphic, morphologic and electro-optic properties.

Dissertation: The Study Of Mesomorphic, Morphologic and Electro- Optic Properties of Liquid Crystal Systems
Supervisors: Prof. Dr. Belkız Bilgin Eran, Prof. Dr. Arif Nesrullazade

September 2001-July 2004: Master Degree in Physics, Yildiz Technical University,
Arts and Science Faculty, Physics Department,
Istanbul/Turkey

Dissertation: The Effect of Cupper diffusion to CdTe films's Electrical and Optical properties
Supervisor: Prof. Dr. Tayyar Caferov

June 2001: Bachelor Degree in Physics, Karadeniz Technical University,
Arts and Science Faculty, Physics Department, Trabzon/Turkey
Supervisor: Prof. Dr. Belgin Kuçukomeroglu

Work Experience:

2001- Research assistant at Physics Department, Yildiz Technical University, Science and Art Faculty, Istanbul/Turkey

Teaching assistant in Physics 1 and Physics 2 and Modern Physics courses and laboratory experiments.
Developing and setting up undergraduate physics laboratory experiments.
Teaching assistant in mechanics and electricity laboratories (Turkish and English)

Skills:
Experience in
Polarization Microscopy (PM), vacum evoporation

Scientific visits
Mugla University Physics department, Mugla, 2007 and 2008.
Firat University Physics Department, Elazığ, 2007.
Linz Institute for Organic Solar Cells (LIOS), Physical Chemistry, Johannes Kepler University Linz, Austria, **01.04.2008–30.09.2008.**
Humboldt Kolleg 2014, 11-13 June Ankara,Turkey

Fellowships and Awards
Tübitak, Turkey, Scientific Publication awards.
European Science Foundation (**ESF**) for the exchange grant no 1843 in 2008.

Projects Attended:

P1- Researcher at BAP (Scientific Research Projects) (Yildiz Technical University) " **Organic Solar Cells's fabrication and characterization and improvement by using Liquid Crystals**" under supervision of Assoc. Prof. Dr. Serap GUNES (01.07.2007–01.07.2009).

P2- Researcher at BAP (Scientific Research Projects) (Yildiz Technical University) "**The study of Current- Voltage Characteristic of Organic Solar Cells**" under supervision of Assoc. Prof. Dr. Serap GUNES (01.05.2008–01.05.2009).

P3- Researcher at TUBİTAC (Scientific Research Projects) "**Liquid Crystal's design, synthesis and study of mesomorphic properties and application to Organic Solar Cells**" under supervision of Prof. Dr. Belkız BILGIN-ERAN (01.10.2007).

P4- Researcher at BAP (Scientific Research Projects) (Yildiz Technical University) "**The new Chiral Liquid Crystal Materials's Synthesis, Characterizations and Application to Organic Solar Cells**" under supervision of Prof. Dr. Belkız BİLGİN ERAN (01.05.2008–01.05.2009).

P5- Researcher at (113M950) TÜBİTAK "**Development of Polymer-based flexible organic photovoltaic fibers and improvement of their properties**" under supervision of Ass. Prof. Dr. Ayse Bedeloglu 01.05.2014-01.05.2016.

P6- Supervision at (2014-01-01-GEP02) (Yildiz Technical University) "**The Improvement of the Morphological Properties of Organic Solar Cells Adding Calamitic Liquid Crystal**"02.03.2014-02.03.2016

P7- Supervision at (2014-01-01-GEP05) (Yildiz Technical University) "**The Determination of Dielectric Parameters of Liquid Crystals**" 2014-2016.

Liquid Crystalline Compounds as Additive into Polymer Solar Cells

- We have studied the role of liquid crystal incorporation in P3HT:PCBM bulk-heterojunction solar cells. The effect of LC in P3HT:PCBM solar cells was the increase in short circuit current density from 4.1 mA/cm2 to 11.2 mA/cm2 and result in substantial improvement of power conversion efficiency from %1.1 to %2.9 from P3HT:PCBM BHJ solar cell with an optimized amount of liquid crystal 0.3mg. To elucidate the reason for high efficiency upon addition of liquid crystals we have performed a systematic study by means of PL, PIA, CELIV techniques. In case of PL measurements no significant changes can be seen, whereas in the PIA spectra we see a slight increase of the delocalized charge carrier absorption at 1.83 eV. CELIV measurements show that the significant improvement in charge carrier mobility/extraction in the P3HT: PCBM blends with liquid crystal shows that larger IPCE values and higher power conversion efficiency can be reached in these cells compared to the blends without LC.

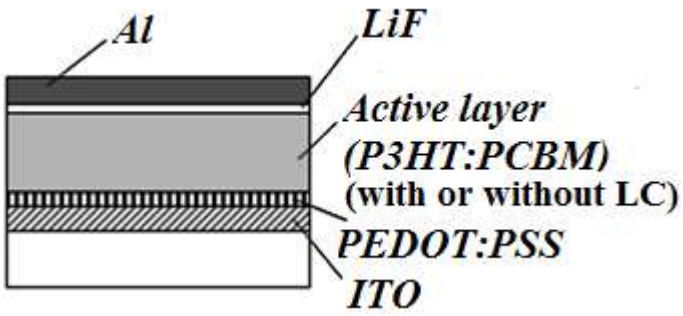

Fig. 1. *The device structure of cells.*

*N. Yilmaz Canli, S. Günes, A. Pivrikas, A. Fuchsbauer, D. Sinwel, N. S. Sariciftci, Ö. Yaşa, B. Bilgin-Eran "**Chiral (S)-5-octyloxy-2-[{4-(2-methylbuthoxy)-phenylimino}-methyl]-phenol Liquid Crystalline Compound as Additive into Polymer Solar Cells"** Solar Energy Materials and Solar Cells 94, 1089-1099, 2010.*

➢The following points can be responsible for the low photovoltaic performance of P3HT:C60 bilayer heterojunction solar cells before annealing: Excitons produced in pure P3HT and C60 layers travel to the interface and generate free electrons and holes. Electrons are then collected at the Al cathode, holes at the PEDOT anode; the exciton diffusion length of C60 is larger than that of P3HT. The unbalanced exciton diffusion lengths of P3HT and C60 may lead to the loss of charge carriers via recombination and therefore, appropriate determination of the thicknesses of both films become very important. On the other hand, the polymer layer is porous and C60 may diffuse into P3HT forming weakly interconnected islands; part of C60 penetrates through P3HT and accumulates at the PEDOT layer. Diffusion of Al during deposition into C60 film may let the Al electrode touch the P3HT layer. All these reasons may be seen as the issues to be solved within the layer stack itself. There can be two ways to approach to improve the low performance of bilayer P3HT and C60 bilayer heterojunction solar cells: either to focus within the layer stack itself, e.g try to optimize the P3HT and C60 layers and insertion of an additional layer between PEDOT:PSS and P3HT to prevent the penetration of C60 through the P3HT layer etc. or to find other alternative ways such as incorporation of materials which could improve the morphology, e.g. as in this study addition of a liquid crystal. We chose the second route and have studied the role of liquid crystal incorporation in P3HT:C60 bilayer solar cells. The effect of **LC** in P3HT:C60 solar cells was the increase in short circuit current density from 0.53 mA/cm2 to 3.68 mA/cm2 and result in substantial improvement of power conversion efficiency from % 0.008 to % 0.27 from P3HT: **LC**:C60 solar cell with an optimized amount of liquid crystal 1mg.

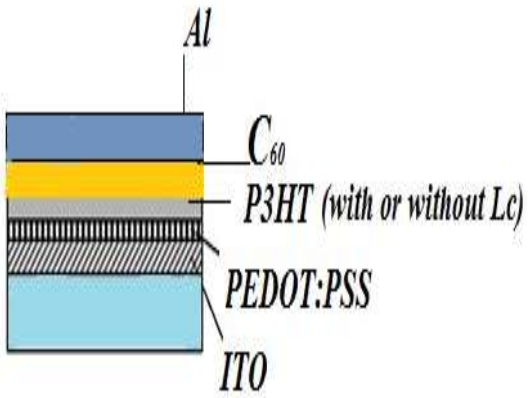

Fig. 2. *The device structure of cells.*

*N. Yilmaz Canli, M. Safak-Boroglu, B. Bilgin-Eran, S. Günes "**Bilayer Polymer/Fullerene Solar Cells with a Liquid Crystal**"*
Thin Solid Films 2013.