Self-Assembled MePc:perylene diimide supramolecular systems in solution for photovoltaic applications

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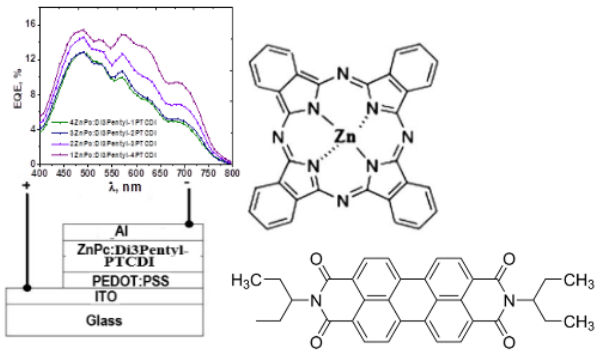
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I. Abstract

Metal phthalocyanines, and perylenes are compounds with great potential for serving as components of molecular materials that possess unique electronic and photophysical properties. The present study investigated the synthesis and characterization of the device based on ZnPc and N, N'-bis (3-pentyl) perylen-3,4,9,10-bis (dicarboximide) (Di3Pentyl-PTCDI). For the preparation of a donor-acceptor molecule from chemical solution, Di3Pentyl-PTCDI and ZnPc powders were separately dissolved. ZnPc 1.0 mg/L and Di3Pentyl-PTCDI 1.0 mg/L were each solubilized in formic acid. Both ZnPc and Di3Pentyl-PTCDI solutions were sonicated for 1 hour and then were mixed in the different weight ratios. Device structure of bulk ZnPc:Di3Pentyl-PTCDI photovoltaic device and molecular structures of components are shown in image. The structure and optical properties of the ZnPc:Di3Pentyl-PTCDI blend thin films obtained by spin coating were analysed by Jasco X-ray Ultima III advanced diffractometer, Raman spectroscopy and UV-VIS spectroscopy. The current density-voltage (J-V) characteristics were measured under an intensity of 100 mW/cm^2. External quantum efficiency (EQE) was measured at varying wavelengths (300- 1000) nm with an interval of 10 nm. XRD analysis show that the formic acid affects the crystalline structure of the ZnPc, but not of Di3Pentyl-PTCDI. Absorption spectra of the ZnPc:Di3Pentyl-PTCDI blend thin films show representative phthalocyanine B and Q bands with well-defined intensive peaks of the Di3Pentyl-PTCDI that demonstrate the formation of a supramolecular architecture by the self-assembly of ZnPc and Di3Pentyl-PTCDI.

II. Image:



The key device parameters such as ideality factor, barrier height, junction/interfacial resistance and forward current rectification of the device measured in the dark exhibit the formation of depletion region. Also, we investigated the heterojunction effects of the Di3Pentyl-PTCDI derivative on the ZnPc-based photovoltaic devices. The Di3Pentyl-PTCDI derivative enhanced the current density in the ZnPc photovoltaic device. The ZnPc:Di3Pentyl-PTCDI device have the highest efficiency of 1.3%.

III. Reference:

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IV. Biography:

POTLOG T. has completed her PhD at the age of 31 years from Khisinev State University, Republic of Moldova. She is the Head of Organic/Inorganic Materials for Optoelectronics Laboratory, Moldova State University. She has published more than 195 papers in reputed journals and conference proceedings.

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