XXXII Panhellenic Conference on Solid State Physics and Materials Science
Conference Center "Carolos Papoulias", 18-21 September 2016, Ioannina, Greece

Polymeric Semiconductors and their Carbon Nanostructure Hybrids for Organic Photovoltaics

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Organic Photovoltaics is an emerging topic due to their potential low cost high throughout device production using continuous manufacturing processes. One of the most successful device architecture is bulk heterojunction (BHJ) solar cells in which the donor and the acceptor are blended to form a bicontinuous interpenetrating network. Intensive research efforts resulted in a performance increased over 10% recently. For the efficiency optimization of these devices, design of either new electron donating semiconducting polymers with broaden absorption spectra and narrow bandgap or new fullerene derivatives as electron accepting materials, as well optimization of the architecture of the device have been made. However, device's performance and stability is strongly affected by the morphology of the active layer. The phase separation between the donor and the acceptor materials have to be controlled to provide an about 10nm phase separated mixture.

Working in the direction of electron donors, low bandgap polymers have been synthesized in our laboratory for the application of these materials in large areas OPVs. Besides that, we have developed a straightforward methodology to create tailor made hybrid materials, composed of the selected polymeric electron donor and any fullerene derivative chosen. These hybrid polymers could be used to control the morphology of the active layer as well as the stability performance of BHJ device. A large number of materials have been synthesized and after tedious purifications the final materials were characterized in terms of structural, electronic and morphological properties.

Acknowledgments:
This research has been co-financed by the project SMARTONICS – 310229 - FP7-NMP-2012.1.4-1 (2013-2017) "Development of Smart Machines, Tools and Processes for the Precision Synthesis of Nanomaterials with Tailored Properties for Organic Electronics".