Photovoltaic and Photophysical Properties of a Novel Bis-3-Hexylthiophene Substituted Quinoxaline Derivative

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ABSTRACT

Conventionally, solar cells were built from inorganic materials such as silicon. Despite the high efficiencies of above 20 % achieved by monocrystalline silicon solar cells, their production cost and energy consumption during fabrication are quite high. The flexibility, low cost fabrication, easy integration in a wide variety of devices and tuneable physical/chemical properties are the advantages of organic “plastic” solar cells over that of conventional silicon solar cells.

In this project, we have studied a novel thiophene based conjugated polymer, namely poly-2,3-bis(4-tert-butylphenyl)-5,8-bis(4-hexylthiophen-2-yl)quinoxaline (PHTQ) as an electron donor in bulk heterojunction solar cells where it was blended with the acceptor PCBM. PHTQ is easy to synthesize in high yields and large amounts with good solubility in common organic solvents such as chloroform, chlorobenzene and toluene. A simple oxidizing agent like $FeCl_3$ was employed for the synthesis of the corresponding polymer. The components for the solar cell were spin cast from ortho-dichlorobenzene (ODCB) and characterized by measuring current-voltage characteristics under simulated AM 1.5 conditions. Efficiencies up to 0.3 % have been reached. Incident photon to current efficiency (IPCE) is reported and the nanoscale morphology was investigated with atomic force microscopy (AFM). Photoinduced absorption spectroscopy confirms the photoinduced charge transfer in such donor acceptor blends.