ET-P025

Improved Efficiency by Insertion of TiO2 Interfacial Layer in the Bilayer Solar Cells

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We demonstrated that the power conversion efficiency (PCE) of bilayer solar cell was significantly enhanced by inserting interfacial layer between the organic bilayer film and the Al electrode. Moreover, the water contact angle shows that the bilayer solar cells suffer from the undesirable surface component which limits the charge transport to the Al electrode. The AFM measurement has revealed that the pre- and post-thermal annealing treatments results in different morphologies of the interfacial layer which is critical for the higher PCE of the bilayer solar cells. Furthermore we have investigated the electrical properties of the bilayer solar cells and obtained insights into the detailed device mechanisms. The transient photovoltage measurements suggests that the significantly enhanced Voc is caused by reducing the recombination at the interface between the organic films and the Al electrode. By inserting the TiO2 layer between the bilayer film and Al electrode, the open circuit voltage (Voc) was increased from 0.37 to 0.66V. Consequently, the power conversion efficiency (PCE) of bilayer solar cells was significantly enhanced from 1.23% to 3.71%. As the results, the TiO2 interfacial layer can be used to form an ohmic contact layer, serveing as a blocking layer to prevent the penetration of the Al, and to reduce the recombination at the interface.

Keywords: TiO2, bilayer, OPV

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New Design and Synthesis of Donor-Acceptor units by Introducing Boron Based to Non-Boron based Semiconductor for high Voc OPV

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A new A-D-A type (Acceptor-Donor-Acceptor) conjugated based on pyridine-borane complex (Donor), non-boron fluorine (Donor) and 2,5-bis(alkyl)-3,6-di(thiophen-2-yl)pyrrolo[3,4-c]pyrrole-1,4(2H,5H)-dione (DPP) (Acceptor) were designed and synthesized via Pd-catalyzed Suzuki cross-coupling reaction. The synthesized boron based complex exhibited high electron affinity, which indicates deep HOMO energy levels and good visible absorption led to their use as donors in BHJ (bulk heterojunction) solar cells. Inverted devices were fabricated, reaching open-circuit voltage as high as 0.91eV. To probe structure-property relationship and search for design principle, we have synthesized pyridine-boron based electron donating small molecules. In this study, we report a new synthetic approach, molecular structure, charge carrier mobility and morphology of blended film and their correlation with the photovoltaic J-V characteristics in details.

Keywords: OPV, BHJ , Boron based , small molecule