A benzo[c][1,2,5]selenadiazole core substituted D-A-D small organic chromophore for solution processed bulk heterojunction organic solar cells

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A new small organic chromophore (BSe-TPA2) with benzo[c][1,2,5]selenadiazole core acceptor end capped with strong electron donor triphenylamine (TPA) unit was synthesized and applied as a donor material for solution processed fabrication of bulk heterojuction (BHJ) organic solar cells (OSCs). The BSe-TPA2 thin film exhibited the absorption bands at ~342/496 nm and estimated an optical bandgap of ~1.98 eV. The good HOMO (-5.36 eV) and LUMO (-3.38 eV) energy levels of BSe-TPA2 were calculated from cyclic voltammetry. The presence of TPA units in BSe-TPA2 was helped to achieve the uniform and smooth surface morphology in thin film state which might be promoted the fast charge transfer in BHJ OSCs. The fabricated device with ITO/TiO2/BSe-TPA:PC61BM/Au (BSe-TPA2:PC61BM, 1:2, w/w) achieved highest power conversion efficiency (PCE) of ~4.12% with a high short circuit current-density (Jsc) of ~11.28 mA/cm2, open-circuit voltage (Voc) of 0.775 V and improved fill factor (FF) of 0.48.