Realization of Narrowband Blue-Selective Polymer Photodiodes with High Detectivity by Fullerene Doping on Dialkoxynaphthalene-based Conjugated Polymer

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We here synthesized a dihexyloxynaphthalene-based conjugated polymer (PNa6-Th) to fabricate blue-selective polymer photodiode (PPD) with narrowband spectral response. The synthesized polymer was investigated in terms of optical, electrochemical, and thermal properties. PNa6-Th showed a blue-selective absorption with an absorption peak at ~430 nm and a wide optical band gap of ~2.5 eV. Planar heterojunction structure was used for PPD fabrication with PNa6-Th and ZnO as a blue-selective electron donor and non-absorbing acceptor, respectively. We introduced a minor amount of [6,6]-phenyl-C61-butyric acid methyl ester (PCBM) on the donor layer to boost the photodiode performance. The external quantum efficiency (EQE) was increased from 5.4% to 37.8% as a result of introduction of PCBM and the dark current values showed nearly constant. This increase of EQE resulted in high detectivity over 2.0 × 1012 cm·Hz1/2/W at −1 V.