Systematic optimization of diketopyrrolopyrrole-based organic photodiode for achieving low dark current and high detectivity

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Here we performed the optimizations of organic photodiodes (OPDs) by systematic approach in terms of hole blocking layer, electron blocking layer, thickness and morphology of active layer. We selected PBDTT-DPP which has a backbone consisting of repeating alkylthienylbenzodithiophene (BDTT) and diketopyrrolopyrrole (DPP) units as an electron-donor. It is known that PBDTT-DPP is a promising electron-donor material for organic solar cell (OSC) application. Considering its superior optoelectronic properties, we fabricated OPDs in conjunction with $PC_{70}BM$ as an electron-acceptor. We observed the effects of the thickness of active layer and the energy level of blocking layers on minimizing the dark currents of OPDs with the investigation of various interfacial layers systematically. We have also experimentally shown the effect of morphology of the active layer on photocurrent of OPDs by changing the deposition method of the active layer or by using post-treatment.