

Effects of Composition and Chirality on the Performance of Chiral Perylene Diimides/Insulating Polymer Blend Based Phototransistors

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Introduction of the charge trapping effect is an effective method to enhance the optical performance of organic phototransistors by suppressing the dark current. Herein, organic phototransistors using enantiomeric or racemic n-type organic semiconductor PDI-derivatives PDI-CN2-C6 with insulating polymer polylactic acid were fabricated and investigated. In comparison with pure PDI-CN2-C6 based phototransistors, the blending system greatly enhanced optoelectronic performances and enabled the solution process on the hydrophobic surface. Phototransistors could endure over 1,000 h under ambient conditions, owing to the barrier effect against water and oxygen. In addition, the racemic system showed 3 times higher electron mobility and 12 times higher specific photo-detectivity (1.3×10^{13} Jones) compared with the enantiopure systems, indicating that chiral composition can be used as a tuning parameter in optoelectronic devices. Our systematic study provides a feasible and effective way to achieve high-performance n-type organic phototransistors.