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Ambipolar transport and photoresponsive characteristics in soluble organic thin film transistors using 4(HP3T)-benzene and PCBM composites

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Wereport on the ambipolar transport and photoresponse characteristics in solubleorganic thin film transistors (OTFTs) using composite of p-type star-shaped 4(HP3T)-benzene molecules and n-type PCBM. Heavily doped Si wafer and SiO₂ layer were used as a gate electrode and insulator, respectively. Source and drain Au electrodes, which length and width were 10 μm and 1.9 mm, respectively, were deposited through photolithography method. On the SiO₂ layer, OTS (octadecyltrichlorosilane) was treated for increasing adhesion and crystallinity of organic active layer. Composites of 4(HP3T)-benzene and PCBM with various concentrations weredeposited as the active layer by spin coating. We measured the ambipolar transport for OTFTs in p-type and n-type operation with varying PCBM concentrations. We observed that p-type mobility decreased from 1.65×10^{-3} to 4.20×10^{-5} cm²/Vs and n-type mobility increased from 4.32×10^{-7} to 1.27×10^{-5} cm²/Vs, as the PCBM concentration increased. Mercury-Xenon Lamp was used as a light source and we measured the ambipolar transport characteristics in light condition. We observed that p-type and n-type mobility showed similar tendency in dark condition, and the photocurrent increased about 10 times compare with that in dark condition.

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