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Transport and device applications of organic photovoltaic materials

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Transport and Device Applications of Organic Photovoltaic Materials

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Abstract

Organic photovoltaic (OPV) cells have received much attention in the past decade. The low cost in fabrication and flexibility are the potentials for commercializing the device. Recently, the power conversion efficiency (PCE) of small molecule OPV cells has reached about 1 to 4%. In this thesis, we first focused on fabricating a standard small molecule device in order to reach the benchmark of PCE. Then, the influences of transition metal oxides (TMOs) treatment and thermal annealing on the standard cells were investigated. Additionally, in the standard cells, the insertion of the exciton blocking layer bathocuproine (BCP) improves the efficiency significantly. To provide a detailed description of its improvement on the cells, the electrical properties, such as electron mobility and traps density, of BCP were characterized. Three techniques were applied for the characterization, including transient electroluminescence (EL), time-of-flight (TOF) and organic thin film transistors (OTFTs) measurements. In particular, a recipe of studying the *n*-type OTFT was developed based on the BCP's devices. Also, various treatments on the contact between the active layer BCP and the source and drain electrodes (BCP/Al), and the interface between the gate dielectric and BCP (SiO_2/BCP) for optimizing the performance of the BCP-based OTFTs will be demonstrated.

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