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Thickness Effect of ZnO Electron Transport Layers in Inverted Organic Solar Cells

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Organic solar cells (OSCs) with low cost have been studied to apply on flexible substrate by solution process in low temperature [1]. In previous researches, conventional organic solar cell was composed of metal oxide anode, buffer layer such as PEDOT:PSS, photoactive layer, and metal cathode with low work function. In this structure, indium tin oxide (ITO) and Al was generally used as metal oxide anode and metal cathode, respectively. However, they showed poor reliability, because PEDOT:PSS was sensitive to moisture and air, and the low work function metal cathode was easily oxidized to air, resulting in decreased efficiency in half per day [2]. Inverted organic solar cells (IOSCs) using high work function metal and buffer layer replacing the PEDOT:PSS have focused as a solution in conventional organic solar cell. On the contrary to conventional OSCs, ZnO and TiO2 are required to be used as a buffer layer, since the ITO in IOSC is used as cathode to collect electrons and block holes. The ZnO is expected to be excellent electron transport layer (ETL), because the ZnO has the advantages of high electron mobility, stability in air, easy fabrication at room temperature, and UV absorption. In this study, the IOSCs based on poly [N-900-hepta-decanyl-2,7-carbazole-alt-5,5-(40,70-di-2-thienyl-20,10,30-benzothiadiazole)] (PCDTBT) : [6,6]-phenyl C71 butyric acid methyl ester (PC70BM) were fabricated with the ZnO electron-transport layer and MoO3 hole-transport layer. Thickness of the ZnO for electron-transport layer was controlled by rotation speed in spin-coating. The PCDTBT and PC70BM were mixed with a ratio of 1:2 as an active layer. As a result, the highest efficiency of 2.53% was achieved.

Keywords: Organic solar cells, ZnO, Thickness, Opv