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Enhanced Performance Characteristics of Polymer Photovoltaics by Adding an Additive-incorporated Active Layer

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Thin films spin-coated from solvent solutions are characterized by solution parameters and spin-coating process. In this study, performance characteristics of polymer solar cells were investigated with changing solution parameters such as solvent and additives. The phase-separation between polymer and fullerene is needed to make the percolation pathway for better transportation of hole and electron in polymer solar cells. For this reason, cooperative effects of solvent mixtures adding additives with distinct solubility have been studied recently.

In this study, chlorobezene, 1, 2-dichlorbenzene, and chloroform were used as solvent. 1, 8-diiodoctaned and 1, 8-octanedithiol were used as additives and were added into poly(3-hexylthiophene-2, 5-diyl)/[6, 6]-phenyl C61 butyric acid methyl ester (P3HT/PCBM) blends.

Pre-patterned ITO glass was cleaned using ultrasonication in mixed solvent with ethyl alcohol, isopropyl alcohol and acetone. PEDOT:PSS was spin-coated on to the ITO substrate at 3000rpm and was baked at 120^{o}C for 10min on the hotplate. The prepared solution was spin-coated at 1000rpm and the spin-coated thin film was dried in the Petri dishes. Al electrode was deposited on the thin film by thermal evaporation. The devices were annealed at 120^{o}C for 30min.

By adding 2.5 volume percent of additives into the chlorobenzene from that bulk heterojunction films consisting of P3HT/PCBM, the power efficiency (AM 1.5G conditions) was increased from 2.16% to 2.69% and 3.12% respectively. We have investigated the effect of additives in P3HT/PCBM blends and the film characteristics and the film characteristics including J-V characteristics, absorption, photoluminescence, X-ray diffraction, and atomic force microscopy to mainly depict the morphology control by doping additives.