Improving Power Conversion Efficiency of P3HT/PCBM based Organic Solar Cells by Optimizing Graphene Doping Concentration and Annealing Temperature

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Graphene (GN) doping concentration and annealing temperature in blended poly (3-hexylthiophene) and [6,6]-phenyl C61 butyric acid methyl ester (P3HT/PCBM) with GN (P3HT/PCBM /GN) based organic solar cells (OSC) were investigated. Results indicate the power conversion efficiency (PCE) of P3HT/PCBM /GN based OSC can be efficiently increased by 3 wt% GN doping and 120°C annealing. The OSC doped with 3 wt% GN exhibited the highest PCE among OSC doped with 0~10 wt% GN under the same annealed condition: unannealed status and 120°C annealing. The PCE of 120°C annealed OSC doped with 3 wt% GN is 2.81, which is almost two times higher than that doped with 10 wt% GN. Thermal desorption spectra of unannealed P3HT/PCBM /3 wt% GN show two desorption peaks at around 130 and 182°C resulting from water vapor. The two temperatures are close to the glass transition temperature of PCBM and melting temperature of P3HT, respectively. The 120°C annealing on P3HT/PCBM/3 wt% GN can make both P3HT and PCBM have relatively good crystallization compared with unannealed status and 170°C annealing. Good crystallization makes charge carriers transport easily in P3HT/PCBM/3 wt %GN based OSC.

Keywords: power conversion efficiency, P3HT/PCBM, grapheme

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