Performance Characteristics of P3HT:PCBM/pentacene-doped PEDOT:PSS polymer photovoltaic cells

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Polymer photovoltaic cells based on bulk-heterojunction have been fabricated with a structure of ITO/poly(3,4-ethylenedixythiophene)-poly(styrenesulfonate) PEDOT:PSS-pentacene/poly(3-hexylyhiophene) (P3HT):phenyl-C60-butyric acid methyl ester (PCBM)/Al. The effect of pentacene-doped PEDOT:PSS as a hole conducting layer material on the performance of photovoltaic cells have been investigated. Pentacene-doped PEDOT:PSS was prepared by blending pentacene with 1-methyl1-2-pyrrolidinone (NMP) and PEDOT:PSS in solution. Pentacene has formed aggregation with PEDOT:PSS during the film forming process. UV-visible transmission intensity also increased as the doping percent of pentacene increased. The work function of pentacene-doped PEDOT:PSS film decreased by 0.3eV and this may contribute to moving holes easily toward ITO substrate. The maximum power conversion efficiency of 3.47% has been achieved. The electrical properties and film morphology of pentacene-doped PEDOT:PSS were characterized by X-ray diffraction, atomic force microscopy, optical absorption, work function, surface resistance and photovoltaic responses analysis.