T2-P025

Performance Characteristics of Polymer Photovoltaics using Dimethyl Sulphoxide incorporated PEDOT:PSS Buffer Layer

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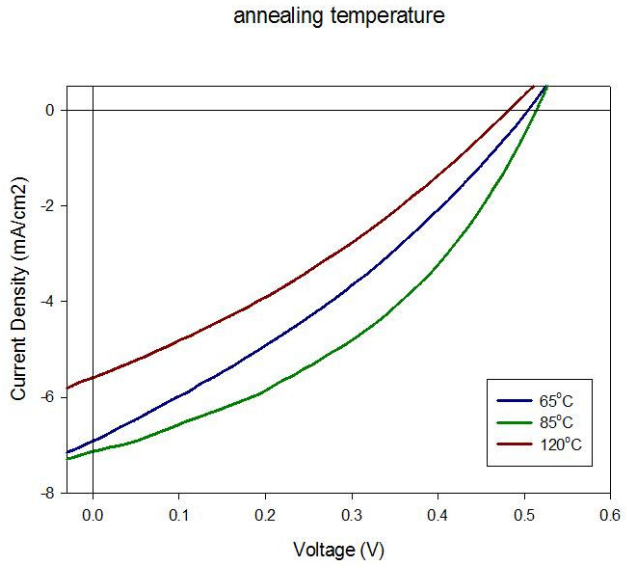
Dimethyl sulphoxide (DMSO) is one of the widely-used secondary dopants in order to enhance the conductivity of poly(3, 4-ethylenedioxy-thiophene):poly(styrene sulfonate) (PEDOT:PSS) film. In this work, we investigated the effect of DMSO doping in to PEDOT:PSS on the electrical performance of the bulk heterojunction photovoltaics consisting of poly(3-hexylthiophene-2, 5-diyl) and phenyl-C61-butyric acid methyl ester. Correlation between the power conversion efficiency and the mechanism of improving conductivity, surface morphology, and contact properties was examined. The PEDOT:PSS films, which contain different concentration of DMSO, have been prepared and annealed at different annealing temperatures. The mixture of DMSO and PEDOT:PSS was prepared with a ratio of 1%, 5%, 15%, 25%, 35%, 45%, 55% by volume of DMSO, respectively. The DMSO-contained PEDOT:PSS solutions were stirred for 1hr at 40°C, then spin-coated on the ultra-sonicated



glass. The spin-coated films were baked for 10min at 65^{o}C, 85^{o}C, and 120^{o}C in air. In order to investigate the electrical performance, P3HT:PCBM blended film was deposited with thickness of 150nm on DMSO-doped PEDOT:PSS layer. After depositing 100nm of Al, the device was post-annealed for 30min at 120^{o}C in vacuum. The fabricated cells, in this study, have been characterized by using several techniques such as UV-Visible spectrum, 4-point probe, J-V characteristics, and atomic force microscopy (AFM). The power conversion efficiency (AM 1.5G conditions) was increased from 0.91% to 2.35% by tuning DMSO doping ratio and annealing temperature. It is believed that the improved power conversion efficiency of the photovoltaics is attributed to the increased conductivity, leading to increasing short-circuit current in DMSO-doped PEDOT:PSS layer.