Addition of graphene oxide doped Al_2O_3 to enhance performance of bulk hetero-junction PCPDTBT:PCBM solar cells

팜하우텐비엣, 트롱윈탐윈, 트린탄기에우, 김창득[1], 박진호†
영남대학교; [1]경북대학교
(chpark@ynu.ac.kr†)

Soluble graphene oxide doped Al_2O_3 was blended with poly[2,6-(4,4-bis-(2-ethylhexyl)-4H-cyclopenta [2,1-b;3,4-b′]dithiophene)-alt-4,7(2,1,3-benzothiadiazole)] (PCPDTBT) and [6,6]-phenyl C_{61} butyric acid methyl ester (PCBM), and used as the active layer in bulk heterojunction (BHJ) polymer photovoltaic cells. The device containing only 1.0 wt % of graphene shows the best performance with a power conversion efficiency of 3.4%, an open-circuit voltage of 0.62 V, a short-circuit current density of 14.0 mA/cm^2, and a fill factor of 0.42 under simulated AM1.5G conditions at 100 mW/ cm2 after an annealing treatment at 140 oC for 10 min. The annealing treatment at the appropriate temperature (140 oC, for example) greatly improves the device performance; however, an annealing at higher temperature such as at 210 oC results in a decrease in the device efficiency (0.62%). The morphology investigation shows that better performance can be obtained with a moderate content of graphene oxide, which keeps good dispersion and interconnection.