

Abstract No: PO-20

Stability of the performance of inverted P3HT/PCBM based organic solar cells

M. L. A. Weerasinghe*, W. T. M. A. P. K. Wanninayake, K. M. D. C. Jayathilaka and R. P. Wijesundera

Department of Physics and Electronics, University of Kelaniya, Sri Lanka
weerasingheanjilika@gmail.com*

The organic solar cell extracts and converts solar energy to electricity without environmental hazardous including global warming. Bulk heterojunction (BHJ) structure of the organic solar cells (OSCs) have higher performance than the layered structure. But the main disadvantage of the OSCs is the poor stability of the device. Therefore, this study was focused on the stability of fabricated P3HT/PCBM OSCs. A series of inverted organic solar cells were fabricated on titanium substrate using spin coated P3HT/PCBM, doctor bladed PEDOT: PSS and sputter coated Au. Device characterizations were carried out under AM 1.5 illumination during 20 days. Electrical parameters of open-circuit voltage (V_{OC}), short circuit current density (J_{SC}), fill factor (FF) and power conversion efficiency (PCE) were obtained during 20 days from dark and light I-V measurements. Best device produced V_{OC} of 282 mV, J_{SC} of 2.65 mA/cm², FF of 0.21 and PCE of 0.15%. The PCE decreased dramatically and became almost constant value of 0.04% within 20 days. FF was constant throughout the 20 days and V_{OC} decreased slightly within 20 days. However, J_{SC} of the device decay from 2.65 mA/cm² to 1.0 mA/cm² within the considered time duration. Hence, this PCE behavior of the device is due to the loss of J_{SC} . PCE of the organic solar cell is not higher than the silicon solar cell, but it can be improved by changing the geometry of the solar cell, annealing conditions, etc. This instability of the device upon irradiation is due to photochemical and photophysical degradation in the active layer, and the active layer/electrode interface. Further, low J_{SC} is mainly due to the low electron mobility and low exciton diffusion length. Performance of the device can be improved carefully controlling the device fabrication parameters in the inert gas surrounding.

Keywords: OSC, P3HT/PCBM, Bulk heterojunction, Stability