ABSTRACT

We have successfully synthesized and employed graphene oxide (GO) to boost photons harvesting and charge transport process in thin film organic solar cells (TFOSCs). The graphene oxide was inlayed in both the P3HT:PCBM-based photoactive medium of the device, as well as, a dopant in PEDOT:PSS hole transport buffer layer (HTL). The parameters of the solar cells produced with the inclusion of GO in the HTL and the active layer results in high short-circuit current densities (Jsc), which translated into high power conversion efficiencies (PCEs). GO in the HTL facilitates charge transport, selective electron blocking and hole injection at the interface for enhanced device performance. On the other hand, the use of GO in the active layer remarkably improves the optical absorption leading to high charge carriers photogeneration requisite to efficient OSCs. Similarly, effective exciton dissociation is energetically favoured in the GO modified active layer devices which corroborated with improved conductivity of the medium that assisted charge carriers transport processes. Enhanced photocurrent has been recorded, as high as 18 mA cm−2, from the TFOSCs by the inlay of GO in the active layer. Consequently, increased PCE of up to 40% and 120% is achieved by the inclusion of GO in the HTL and photoactive layers, respectively.