ABSTRACT

In the quest to improve the optical absorption and electrical transport of poly-3-hexylthiophene (P3HT) and (6-6) phenyl-C61-butyric acid methyl ester (PCBM) blend film, reduced graphene oxide-germanium dioxide nanocomposite (rGO-GeO_2) was employed in the photoactive layer of thin film organic solar cells. Bulk heterojunction solar cells (BHJ SCs) with rGO-GeO_2 composite in the active layer exhibited an increase in power conversion efficiency (PCE) of up to 53%. Significant improvement in the measured photocurrent is achieved by the incorporation of rGO-GeO_2 in the active layer. High short-circuit current density (J_{sc}) of up to 17 mA/cm^2 is attained in the BHJ SCs. The high J_{sc} shows that the inlay of rGO-GeO_2 in the active layer facilitates exciton separation and creates percolation pathways for charge transport to the electrodes. Charge separation is energetically favoured by a built-in potential difference between the donor and acceptor phases of the active layer. Hence, the incorporation of rGO-GeO_2 composite in the active layer improves its charge photogeneration, separation and transport to yield high J_{sc} and enhanced PCE.