Abstract

This study reports the synthesis and application of Ag_2S-rGO nanocomposite to enhance organic solar cells (OSCs). The nanocomposite was used to modify the photoactive and hole transport layers of the OSC. The synthesis was done using the chemical reduction method. Morphological analysis of the Ag_2S-rGO nanocomposite through scanning electron microscopy (SEM) demonstrated the intercalation of rGO sheets within the nanoparticles of Ag_2S during the chemical reduction process, and that Ag_2S had a nanowire shape. X-ray diffraction (XRD) analysis revealed that Ag_2S nanoparticles are of high crystallinity, having a 1.0 Å to 5.2 Å d-spacing range. The nanocomposite exhibited strong optical absorption in the UV region. The surface plasmon resonance effect associated with Ag_2S nanoparticles, crystallinity, and hydrophilicity of the nanocomposite made it suitable for OSC application. Incorporating Ag_2S-rGO into the OSCs' photoactive layer slightly increased the absorption band within the visible region. All the OSCs with modified active layers and HTL exhibited an improved photovoltaic performance. The nanocomposite improved J_{sc} by enhancing charge generation within the photoactive layer, resulting in a subsequent enhancement in PCE of up to 127%. On the other hand, the nanocomposite improved charge collection at the interface, leading to an enhanced PCE of up to 53%.