

Effect of PTAA and PCBM concentrations on the electrical response of bilayer heterojunction PTAA/PCBM Diode

ABSTRACT

Poly[bis(4-phenyl) (2,4,6-trimethylphenylamine)] (PTAA) is a new promising hole transport material, and [6,6]-Phenyl C61 butyric acid methyl ester (PCBM) is a suitable electron acceptor material. This study deposited thin-film PTAA and PCBM at different spin coatings ranging from 1000 rpm to 5000 rpm. Ultraviolet–visible (UV–vis) spectrometer, X-ray diffraction (XRD) machine, and scanning electron microscope (SEM) techniques were used to determine the optical properties and structural properties, respectively. Thermal annealing with temperatures of 80 °C, 100 °C, 120 °C, and 150 °C was introduced to improve the properties of the PTAA and PCBM thin film. The results of SEM images for PTAA annealed at 150 °C appeared to darken and melt, whereas PCBM annealed at 120 °C and 150 °C had granule properties. The ideality factors for bilayer heterojunction diodes and bulk heterojunction PTAA/PCBM diodes with increased layers were 5.8–60.2 and 30.8–77.2, respectively. The optimum spin rate for the bilayer heterojunction PTAA/PCBM was 5000 rpm. The most appropriate diode behavior of the bilayer was at 5.0/1.0 wt%, 1.0/5.0 wt%, and 3.0/3.0 wt% of PTAA/PCBM, with the calculated ideality factors of 5.8, 6.2, and 15.45 with turn-on voltage of 1.57 V, 1.70 V, and 1.82 V, respectively.