Low Leakage Current by Solution Processed PTAA-ZnO Transparent Hybrid Hetero-Junction Device

ABSTRACT

In this work solution processed novel poly-triarylamine (PTAA) organic p-type active layer on inorganic n-ZnO device transparency and electrical properties are investigated under illumination. Low cost organic-inorganic transparent hybrid hetero-junction (HHJ) is a promising candidate for next-generation photovoltaic applications. Greater band gap organic material window layer while inorganic material's higher thermal stability as HHJ is suitable for detection and photovoltaic applications. However, hetero-interface defects associated leakage current is the key issue of undermining large-area device electrical performance. Hetero-interface defect associated carriers optical absorption limits transparency whereas leakage current density is reliant on physical property and band barrier effect. It is demanded to investigate hetero-device physical stuff and band barrier effect on electrical properties. Novel PTAA is deposited on RF-sputtered inorganic n-ZnO/ITO/glass substrate by spin-coating method. 100 and 60 nm PTAA thin films are deposited with 1,000 and 2,000 revolution per minute (rpm) growth sequence, respectively. PTAA as a transparent p-emitter is shown to absorb incident light beyond visible band, thereby it has promoted excitonic effect. Device I–V characterization carried out at different annealing temperatures and applied voltage. Suitable annealing condition leakage current is shown to reduce nearly 10-4A/cm2 and at higher applied field the greater rectifying I(+)/I(-) ratio is realized. Grain size is shown to increase with annealing effect however; leakage current is remained almost independent of grain size.