Morphological, structural and electrical properties of pentacene thin films grown via thermal evaporation technique

ABSTRACT

The physical and structural characteristics of pentacene thin films on indium tin oxide (ITO)-coated glass were studied. The pentacene films were deposited using the thermal evaporation method with deposition times of 20, 30, and 60 minutes. Field-emission scanning electron microscopy (FESEM) images revealed that film thickness increased with deposition time, with a bulk phase layer appearing at 60 minutes. The presence of the thin-film phase corresponding to 15.5 Å lattice spacing was demonstrated by X-ray diffraction (XRD) patterns in pentacene films with deposition times of 20 and 30 minutes. Meanwhile, with a deposition time of 60 minutes and a lattice spacing of 14.5 Å, the existence of the bulk phase was verified in the pentacene film. Atomic force microscopy (AFM) images of the crystallinity of the pentacene films revealed that the pentacene films deposited on ITO-coated glass exhibited the formation of similar islands with modular grains, results in a fine crystalline structure. From the current-voltage (I-V) and current density-voltage (J-V) characteristics, the pentacene films were ohmic and that current increased as the pentacene's thickness decreased. Pentacene films deposited on an ITO-coated glass substrate showed potential in the development of broadband and narrowband optoelectronic devices on a transparent substrate.