Nanorod films of bisbenzimidazo[2,1-a:2′,1′-a′]anthra[2,1,9-def:6,5,10-def′,e′f′]diisoquinoline-10,21-dione7 (BI-diisoQ) for highly optoelectronic devices

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Abstract:

Nanostructure thin films of bisbenzimidazo[2,1-a:2′,1′-a′]anthra[2,1,9-def:6,5,10-def′,e′f′]diisoquinoline-10,21-dione7 (BI-diisoQ) were prepared by using vacuum thermal evaporating procedure under vacuum of 2.45 ×10⁻⁵ mbar with thickness of 150 nm. Structural and optical properties for the as-deposited and the annealed BI-diisoQ thin films were carried out in the temperature range of (373–623 K). The X-ray diffraction (XRD) examination of BI-diisoQ confirmed that the annealed films were a mixture of amorphous and crystalline structure, whilst the as-deposited films are utterly amorphous. Scanning Electron Microscopy (SEM) images showed a clear shape of nanorods of BI-diisoQ with diameter of 40 nm at 632 K. The optical characteristics of nanostructure thin films of BI-diisoQ were investigated by measuring transmittance and reflectance spectrum versus the incidence of visible light in the range of 190–2500 nm. Our conception dissected that the optical transition type of BI-diisoQ nanorod films is indirect allowed transition with optical and fundamental energy gaps equal to 1.54 eV and 3.54 eV respectively, which decreased to 1.36 eV and 3.45 eV at the annealed temperature of 623 K. The oscillation energy, E₀, and the dispersion energy, E_d, were investigated by using the ideation of single oscillator model (SOM). Moreover, the non-linear optical susceptibility, χ(3), and non-linear refractive index, n², were found to be temperature annealing dependence. The optical investigation of BI-diisoQ nanorod films indicated that these films have excellent optical characteristics, and thus can be recommended as a potential material for integrated highly optical applications.

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