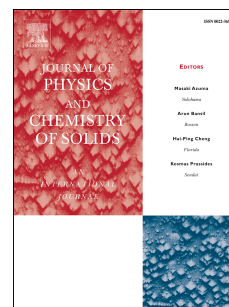


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Structural, optical, dielectric and electrical properties of (PEO–PVP)–ZnO nanocomposites

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Abstract

Polymer nanocomposite (PNC) films of poly(ethylene oxide) (PEO) and poly(vinyl pyrrolidone) (PVP) blend matrix (50/50 wt%) incorporated with zinc oxide (ZnO) nanoparticles (i.e., (PEO–PVP)– x wt% ZnO; $x = 0, 1, 3$ and 5) were prepared and characterized as potential candidates for applications in the next generation optoelectronic and microelectronic devices. The structural properties of these PNCs were investigated by using scanning electron microscopy (SEM), Fourier transform infrared (FTIR) spectroscopy and the X-ray diffraction (XRD) measurement techniques. The porous spherulites morphology, polymer-polymer and polymer-nanoparticle interactions, and the semicrystalline structures of these materials have been significantly influenced by the incorporated amount of ZnO nanoparticles in the polymer blend matrix. The optical behaviour of the PNC films was studied from ultraviolet-visible (UV-vis) spectroscopy, and the optical parameters viz. optical energy band gap (indirect and direct), Urbach tail energy, refractive index and the ZnO surface plasmon resonance energy were determined. Complex permittivity, electric modulus, electrical conductivity and the impedance spectra of these PNC materials as flexible nanodielectrics have been measured in the frequency range from 20 Hz to 1 MHz by employing the dielectric relaxation spectroscopy (DRS). The DRS results reveal that the ambient temperature values of complex permittivity increase with the increase of ZnO contents up to 3 wt% in the PEO–PVP blend matrix and then it slightly decreases at 5 wt%. The dielectric relaxation

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