Synthesis and optical properties of ZnO-TeO2 glass system

ABSTRACT

Problem statement: Systematic series of ZnO-TeO2 glasses with mole fraction of 0.10-0.40 ZnO content with an interval of 0.05 were studied to obtain their physical and optical properties. Approach: All the glass samples were synthesized by rapid melting quenching method under controlled conditions, while their refractive indices (n) were measured by the EL X-02C high precision ellipsometer. The room temperature absorption of all glass samples were determined using Camspec M350 double beam UV-visible spectrophotometer. The infrared (IR) spectra of each glass samples were recorded with Thermo Nicolet Fourier Transform-Infrared (FT-IR) spectrophotometer. Their physical properties were measured and the amorphous nature was confirmed by the x-ray diffraction technique. Results: The increase of refractive index of the TeO2-ZnO glasses with the addition of ZnO was best explained in terms of either electron density or polarizability of the ions. The absorption edge shift to higher energy (shorter wavelength) with increasing ZnO content was observed in this glass. The optical band gap (Eopt) of zinc tellurite glass decreases with increasing of ZnO content probably due to the increment of Non-Bridging Oxygen (NBO) ion contents which eventually shifted the band edge to lower energies. Conclusion/Recommendation: The physical and optical properties of zinc tellurite glasses were found generally affected by the changes in the glass composition. FTIR spectra of zinc tellurite glass revealed broad, weak and strong absorption bands in the investigated range of wave numbers from 4000-400 cm-1 which associated with their corresponding bond modes of vibration and the glass structure. The addition of ZnO into TeO2 glass network shifted the major band from 626 cm-1 (for pure TeO2 glass) to the band at around 669 cm-1.

Keyword: Glass synthesis; Tellurite glass; Optical materials; Optical properties