Comparison of TeO_2 and Sb_2O_3 as Heavy Metal Oxide Glass Formers

Nuşik GEDİKOĞLU, Orhan KIBRISLI, Ali Erçin ERSUNDU, Miray ÇELİKBİLEK ERSUNDU

Yildiz Technical University, Department of Metallurgical and Materials Engineering, Faculty of Chemical and Metallurgical Engineering, Istanbul, 34220, Turkey

Heavy metal oxide (HMO) glasses are promising materials for new generation opto-electronic applications. Among HMO glasses, TeO_2 and Sb_2O_3-based glasses step forward with their unique properties, such as high refractive index, high dielectric constant, relatively low phonon energy, wide optical transparency window, thermal and chemical stability, high devitrification resistance, low glass transition and melting temperature. In this work, a series of HMO glasses from two different ternary systems (WO_3–MoO_3–TeO_2 and WO_3–MoO_3–Sb_2O_3) were prepared by conventional melt quenching technique and the effect of glass formers (TeO_2 and Sb_2O_3) on thermal, physical, structural and optical properties of glasses were investigated. Thermal properties were investigated by differential scanning calorimetry (DSC) analysis in terms of glass transition temperature (T_g) and crystallization temperature (T_c/T_p). Thermal stability against crystallization was evaluated by calculating temperature difference (ΔT) and thermal stability (S) values. Density (ρ), molar volume (V_M), oxygen molar volume (V_O), oxygen packing density (OPD), average cross-link density (n_c), and number of bonds per unit volume (n_b) values were calculated for the interpretation of physical and structural properties. FTIR spectra of the glasses were discussed in terms of structural transformations in the glass network. For the optical characterizations, transmittance in the visible region and short wavelength absorption edge values were determined by means of UV-Vis spectroscopy analysis.

The authors of this study gratefully acknowledge The Scientific & Technological Research Council of Turkey (TUBITAK) for the financial support under the project numbered 116M210.

Keywords: Tellurite glasses; antimonate glasses; thermal properties; physical properties; structural properties; optical properties