

## Structural and optical properties of zinc borotellurite glass co-doped with lanthanum and silver oxide

### ABSTRACT

A series of zinc borotellurite glass co-doped with lanthanum and silver oxide with the chemical formula of  $[(\text{TeO}_2)_{0.7}(\text{B}_2\text{O}_3)_{0.3}]_{0.7}(\text{ZnO})_{0.3}]_{0.96}(\text{La}_2\text{O}_3)_{0.04}]_{1-x}(\text{Ag}_2\text{O})_x$  where the molar fraction of silver oxide,  $x = 0.02, 0.04, 0.06, 0.08$  and  $0.10$  had been successfully prepared via the conventional melt-quenching technique. The structural properties of the glasses were unveiled through X-ray Diffraction (XRD) and Fourier Transform Infra-Red (FTIR) spectroscopy while optical properties of the glasses were investigated with Ultra Violet Visible (UV-Vis) spectroscopy. The short range periodic atomic arrangement in the glass matrix that implies the amorphous nature of the glass was confirmed with the presence of a broad hump in the XRD pattern. On the other hand, the three absorption bands observable in the FTIR spectra had proven the existence of  $\text{BO}_4$ ,  $\text{BO}_3$  as well as  $\text{TeO}_4$  units in the glass network. The absorbance values retrieved from UV-Vis spectroscopy were utilized to calculate the indirect energy band gap and Urbach energy values of the fabricated glass. By employing the equations proposed by Mott and Davis, the obtained indirect energy band gap have values ranging from 2.16 to 4.16 eV. The decreasing trend in indirect energy band gap and increasing Urbach energy values were related to the increasing number of nonbridging oxygen (NBO) in the glass that is created from the breaking of Te-O-Te or B-O-B bonds after lanthanum as well as silver oxide are incorporated into the zinc borotellurite glass network.

**Keyword:** Zinc borotellurite glass; Lanthanum oxide; Silver oxide; Optical band gap; Urbach energy