

## Influence of silver oxide on structural, physical, elastic and optical properties of zinc tellurite glass system for optical application

### ABSTRACT

The research on several properties of erbium-doped zinc tellurite glass system is thoroughly investigated recently. However, the introduction of silver oxide as a dopant plays a role on the fabrication of new optical materials specifically in optical application. By conducting the investigation, the use of melt-quenching technique is one of the techniques to fabricate a series of silver-doped zinc tellurite glass systems with the chemical composition of  $[(\text{TeO}_2)_{0.7}(\text{ZnO})_{0.3}]_{0.96}(\text{Er}_2\text{O}_3)_{0.04}]_{1-x}(\text{Ag}_2\text{O})_x$  at different molar fraction of  $x = 0.01, 0.02, 0.03, 0.04$  and  $0.05$ . The characterization of X-ray diffraction (XRD), Fourier Transform Infrared (FTIR) spectroscopy, density, elastic and optical measurements were investigated to analyse the prepared glass samples. The result of the XRD, FTIR, density, elastic and optical properties were all reported at the room temperature. The glass samples are proven as amorphous in nature which can be seen by the XRD spectra. Besides that, the presence of functional vibration of tellurite network can be clearly observed through the analysis of FTIR spectra. The density of the glass system is found to increase with the increase of silver oxide concentration. Anyhow, the value of molar volume is noticed to be inversely proportional to the density. Therefore, the inclination in the density value causes the decrement of the molar volume which can be associated with the inclusion of silver oxide in the glass system. Plus, this also follows the theoretical formula where the density is equivalent to molar mass per molar volume. In the meantime, the ultrasonic velocity was employed in order to specify the elastic moduli of the glass systems. The elastic moduli for instance longitudinal modulus, shear modulus, bulk modulus, Young's modulus as well as other parameters come out with a varying trend against the concentration of silver oxide. The increment of the elastic moduli can be attributed to the high connectivity and rigidity of the glass structure. Nonetheless, the decrement of the elastic moduli can be associated with the breakage of bonds within the zinc tellurite glass system which impair the structure of the glass sample. The UV-Vis analysis can determine the optical properties of the prepared glass samples. The optical absorption was reported at room temperature within the wavelength ranging from 200 to 2000 nm. The optical absorption spectra unveil the fundamental absorption edge shifts to longer wavelength as the content of silver oxide increases. The values of direct and indirect band gap and metallization criterion have been evaluated and noticed to have a decreasing trend with the increasing content of silver oxide whereas the Urbach energy, refractive index, molar refraction, molar polarizability, oxide ion polarizability and optical basicity are obviously increasing as the concentration is included into the glass system.

**Keyword:** XRD;  $\text{Er}_2\text{O}_3$ ;  $\text{Ag}_2\text{O}$ ; Ultrasonic velocity