Elastic properties of TeO2–ZnO–Ag2O doped with Nd2O3

ABSTRACT

A series of Neodymium doped zinc-tellurite glasses incorporated with Ag2O with chemical composition {[(TeO2)0.70(ZnO) 0.30] (1-X)Nd2O3(X)}(0.99)Ag2O(0.01), x = 0.01, 0.02, 0.03, 0.04 and 0.05, were synthesized by applying the melt-quenching technique. The FTIR analysis confirmed the presence of only two (2) active functional group (TeO3 and TeO4) in the wavenumber range of 200–4000 cm−1. The spectra of the XRD confirmed the glassy and amorphous nature of the studied glasses. With the addition of more Nd2O3 in the glass composition, both the density and molar volume increased. The elastic moduli (longitudinal modulus, shear modulus, Young's modulus and Bulk modulus) were calculated from the measured density and ultrasonic velocities obtained from the non-destructive ultrasonic testing performed at 5 MHz frequency. The experimental results showed that the elastic moduli and density rely upon the composition of the glass system and the impact of Nd2O3 within the glass network. The increase in ultrasonic velocities and the elastic moduli is associated with the increase in rigidity and change in the structural network of the glass system. The effects of Nd2O3 on the Debye temperature, softening temperature, micro-hardness and Poisson's ratio of TeO2–ZnO–Ag2O glasses were also studied in this work. The acoustic impedance, as well as the coefficient of thermal expansion of the studied glasses, were also calculated. The elastic and the physical properties' parameters suggest that the glasses are strong enough for utilization in both fibre and laser technology.

Keyword: Tellurite glasses; Neodymium; Zinc oxide; Silver dioxide; Elastic moduli