Elastic moduli of TeO$_2$–PbO glass system

ABSTRACT

Binary glasses $(1-x)(\text{TeO}_2)-x(\text{PbO})$ with $x = 0$, 0.10, 0.15, 0.20, 0.25, 0.30 mol% prepared using the melt quenching have been studied in this work. The amorphous nature of the glasses is confirmed by XRD analyses. Density, ρ and molar volume, V_m were measured for more information on structural changes. The ultrasonic velocities (longitudinal and shear) were obtained using the method of pulse-echo at 5 MHz resonating frequency. The elastic moduli, namely longitudinal (L), shear (G), Young (E) and the bulk (K) moduli were obtained from the density and ultrasonic velocities measurement. The softening temperature (T_S), Debye temperature (θ_D), Poisson's ratio (σ), fractal bond connectivity (d), microhardness (H) and acoustic impedance (Z) were obtained from the elastic moduli. The transition temperature (TgTg) and thermal expansion coefficient (α_P) were also calculated. The experimental elastic moduli data and the values calculated theoretically from the bond compression, Makishima–Mackenzie, and Rocherulle models were compared in this work.