Anomalous elastic and optical behaviours of mixed electronic-ionic of xAg2O-(35-x)[0.5MoO3-0.5V2O5] -65TeO2 conductor glasses

ABSTRACT

Ag2O addition to quaternary xAg2O-(35-x)[0.5MoO3-0.5V2O5]-65TeO2 (x = 0-25 mol%) glasses resulted in nonlinear behaviours with maxima at x = 10 mol% for ultrasonic velocities, independent elastic moduli and transition glass temperature (Tg). These results coincided with the electronic-to-ionic transition region as previously reported. A large decrease in elastic moduli beyond x ≤ 10 mol% indicated a decrease in stiffness, thereby enabling ionic conductivity. Although Ag2O addition weakened the glass network, the presence of MoO3 played an important role as an additional glass former at x = 10 mol% apart from V2O5. Analysis of bulk compression and ring deformation models showed a large decrease in the ratio of theoretical to experimental bulk moduli (Kbc/Ke) at x ≤ 10 mol% followed by near constancy with increased Ag2O content. These results showed that ring deformation was reduced in the electronic region, but limited ring deformation took place in the ionic region, and that the main compression mechanism was mainly isotropic ring compression. Meanwhile, the optical energy gap (Eopt) and refractive index (n) showed a slope change at x = 10 mol% which confirmed the effect of mixed electronicionic conductivity on optical properties.

Keyword: Elastic moduli; Tellurite glass; Ultrasonic velocity; Optical energy gap; Glass transition temperature