Dielectric properties of B2O2 - TeO2 - Sm2O3 glass system

ABSTRACT

Glasses in the system containing [B2O3]0.3 [Te02]0.7-x [Sm2O3]x was prepared from melt-quenching technique over a wide range of composition (x = 0.3~1.2 mol%) denoted as BTS1, BTS2, BTS3, BTS4 and BTS5 respectively. The structural changes were studied by XRD spectra, FTIR spectroscopy and DTA spectra. Network units existed in Sm3+ doped glass and Sm3+ existed as network modifier. The higher concentration of Sm3+, the more units of TeO3 would transform to TeO4. The optimum Sm3+ concentration was about 1.0 mol% (BTS4) for this glasses system. The density (ρ) and molar volume (Vm) was obtained attributed to non-bridging oxygen (NBO). The addition of samarium oxide (4f5) indicates of strong bonding between the components and enhances the glass formation ability. The dielectric properties (dielectric constant, ε′, and dielectric loss factor, ε″), which were characterized in the frequency range 10-2ï 106 Hz over temperature range 100 ï 220°C, show a larger value at lower frequencies (below 100 Hz) and higher temperatures (above 140°C). The graphs were fitted using Cole-Cole and Quasi dc models. Activation energy obtained from the master plot graph was found to decrease as Sm2O3 content increased. The optical band gap was found to decrease with increasing Sm2O3 content attributed to increase in degree of disorder in the system, direct consequence of the increases of NBO in the system.

Keyword: Dielectric properties; B2O3 ï TeO2 ï Sm2O3 glasses; Rare earth; Polarization; Non-bridging oxygen