

Physical, structural and optical properties of erbium doped rice husk silicate borotellurite (Er-doped RHSBT) glasses

ABSTRACT

A series of erbium doped rice husk silicate borotellurite glasses with chemical composition $\{[(\text{TeO}_2)_{0.7} (\text{B}_2\text{O}_3)_{0.3}]_{0.8} (\text{SiO}_2)_{0.2}\}_{1-x} (\text{Er}_2\text{O}_3)_x$ with $x = 0.01, 0.02, 0.03, 0.04$ and 0.05 mol was prepared using the melt-quenching technique. The density and the molar volume were determined and found to be increasing with Er^{3+} concentration. The glasses were subjected to FTIR and XRD to study the structural changes in the glass. UV-Vis spectroscopy was carried out to obtain the absorption spectrum that is used in the calculation of the optical energy band gap (Direct and Indirect), the Urbach energy and the refractive index. Using the refractive index, density and molar volume, the molar polarizability, metallization criterion, polaron radius, average boron-boron separation, inter-nuclear distance of Er^{3+} , surface reflection loss, transmission coefficient and oxygen packing density were determined. The density, molar volume, optical band gaps, molar refraction, transmission coefficient and metallization criterion were found to have increased with increasing concentration of Er^{3+} ions. While the values of the refractive index, Urbach energy and inter-nuclear distance of Er^{3+} ions decreased. As more Er^{3+} ions were introduced, the reflectivity of the glasses decreased. The polaron radius also decreased, with the values suggesting that the glass has small polaron.

Keyword: Rice husk silicate (RHS); Erbium; Refractive index; Reflectivity; Polaron radius