Abstract

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Judd-Ofelt analysis of spectroscopic measurements of Er3+ doped boro-zincate glasses

Glasses based on the base composition (ZnO 70 – B2O3 30 mol %) containing increasing Er2O3 as dopant (0.2 ? 2.2 mol%) were synthesized by traditional melting. Collective investigation was done through measuring their UV-visible and structural FTIR spectra. The density and derived physical properties were calculated in relation to the constitution and percent of rare-earth oxide. Optical absorption studies show specific and characteristic peaks which are correlated with the absorption of Er3+ originated from the ground state 4I15/2 to several possible energy transitions. Structural IR data indicate distinct and extended bands from 400-1600 cm⁻¹ which are assigned to the two known characteristic borate units with triangular and tetrahedral coordinations (BO3, BO4). The possible forming of ZnO4 is considered due to the abundance of ZnO (70 mol%) but the intensities of the vibrations of the two borate units are distinctively higher due to the known lightest boron element which is reflected on its oxide (B2O3) than other glass forming oxides. The IR spectra have been confirmed by the measurements of the IR spectrum of pure crystalline ZnO to elucidate its specific vibrational sites. The density and molar volume data are correlated with the trivalent erbium ions concentration and their housing in the glass structure. The various optical parameters of the Er2O3-doped glasses were derived and analyzed in relation to the concentration of Er3+ ions.