

Optical and structural properties of lithium sodium borate glasses doped Dy³⁺ ions

Abstract

Absorption and emission spectra of lithium sodium borate glass doped with different concentrations of Dy³⁺ have been reported. The concentration of Dy³⁺ was varied from 0.3 to 1.3 mol%. The amorphous nature of the prepared samples was confirmed by the X-ray Diffraction (XRD). Fourier transforms infrared (FTIR) spectra, and other significant physical properties (energy band gap, density, ion concentration, molar volume, Polaron radius and inter-nuclear distance) have been analyzed in the light of the different oxidation states of the co-dopant ions. The absorption spectrum showed nine peaks with hypersensitive transition corresponding to $6F_{11/2} + 6H_{9/2}$ at 1256 nm. As a result of 380 nm excitation wavelength, the luminescence spectra showed two characteristic bands at 479 nm and 587 nm. These absorption bands were attributed to $6P_{15/2} \rightarrow 6H_{15/2}$ and $6P_{15/2} \rightarrow 6H_{13/2}$ transitions of trivalent Dy³⁺ ions. The current study indicates that Dy doped lithium sodium borate glasses are attractive for solid-state laser applications.

Keyword: Lithium sodium borate; Dysprosium; Photoluminescence