Optical absorption and emission properties of Pr\(^{3+}\) and Er\(^{3+}\) in mixed alkali borate glasses

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Abstract

This article presents the optical absorption and emission properties of Pr\(^{3+}\) and Er\(^{3+}\) in mixed alkali borate glasses of the type 68B\(_2\)O\(_3\).xLi\(_2\)O.(32-x)Cs\(_2\)O (where x= 8, 12, 16, 20 and 24). The variation of Judd-Ofelt intensity parameters (\(\Omega_\lambda\)), the peak wavelength of the hypersensitive transitions, radiative transition probabilities (\(A_{\text{rad}}\)) and peak emission cross-sections (\(\sigma_p\)) with x in the glass matrix has been discussed in detail. The changes in position of hypersensitive transition and intensity parameters with x are correlated to the structural changes in the host matrix. The estimated radiative lifetimes (\(\tau_R\)) of certain excited states of both Pr\(^{3+}\) and Er\(^{3+}\) in lithium cesium mixed alkali borate glasses are reported. Branching ratios (\(\beta\)) and integrated absorption cross sections (\(\Sigma\)) for certain important transitions are presented. Peak stimulated emission cross-sections (\(\sigma_p\)) are calculated for the observed emission peaks of Pr\(^{3+}\) and Er\(^{3+}\) ions in this glass matrix.

Keywords: Rare earths; absorption; emission; lifetime; cross section

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