Abstract

Samir Y Marzouk

Er3+/Yb3+ ions in a novel zinc borate glass: spectroscopic and physical properties

Novel zinc borate glass doped with mixed rare-earth ions such as erbium (Er3+) and ytterbium (Yb3+) ions were prepared by conventional melt annealing process. The structural glass network comprised units of ZnO4, triangle borate (BO3), tetraborate (BO4), and B–O–B and B–O–Zn bridges. The glass density (q) values increased from 3.490 to 3.573 g/cm3, when the Yb content increased from 0.2 to 1.0 mol%. The optical transition values decreased from 3.076 eV to 2.936 eV as the Yb3+ ions increased from 0.2 to 1.0%. Judd–Ofelt theory is used to analyze the spectroscopic properties of the glass. The intensity parameter X2 has higher values than X4 and X6 indicating to the covalent character of the glass. The calculated radiative lifetime $\tau_r$ for the glass containing 1.0% Yb2O3 sample has the lowest value around 25 ls. The absorption cross section $\sigma_a$ intensity increased from $1.632 \times 10^{20}$ to $1.9 \times 10^{20}$ cm$^{-2}$ where the Yb content increased from 0.2 to 1.0 mol%, whereas the emission cross section $\sigma_e$ of the 0.8 Yb sample has the highest value at $1 \times 10^{19}$ cm$^{-2}$. 