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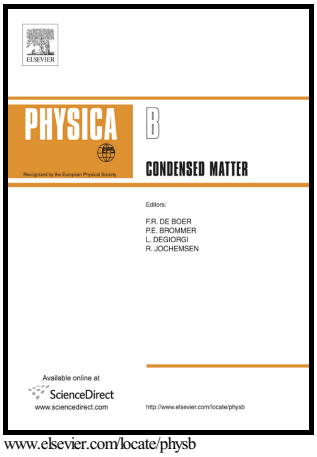

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Luminescence studies on Dy^{3+} doped Calcium boro-tellurite glasses for White light applications

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Abstract

A new series of Dy^{3+} doped calcium boro-tellurite glasses have been prepared by melt quenching technique and their spectroscopic properties were studied through FTIR, absorption luminescence and lifetime spectral measurements. FTIR studies have been made to explore the presence of various stretching and bending vibrations of different borate and tellurite groups in the prepared glasses. The bonding parameter values were estimated from the absorption band positions using Nephelauxetic ratios to examine the nature of the metal-ligand bond. The optical band gap and Urbach energy (ΔE) values were obtained from the absorption spectra to explore the electronic band structure of the studied glasses. Judd-Ofelt (JO) theory have been used to determine the JO intensity parameters (Ω_2, Ω_4, Ω_6) following the least square fitting procedure between the experimental and calculated oscillator strength values. The luminescence spectra of the Dy^{3+} doped calcium boro-tellurite glasses exhibit two intense emission bands corresponding to the $^4F_{9/2} \rightarrow {}^6H_{15/2}$ and $^4F_{9/2} \rightarrow {}^6H_{13/2}$ transitions. Further, they exhibit less intense emission band due to the $^4F_{9/2} \rightarrow {}^6H_{11/2}$ transition. Luminescence spectra were characterized through CIE 1931 chromaticity diagram to obtain the dominant emission color of the prepared glasses. The JO intensity parameters and refractive index values have been used to calculate the radiative parameters such as transition probabilities (A_R), branching ratios (β_R) and stimulated emission cross-section (σ_P^E) values for the observed transitions in the luminescence spectra. The decay curves of all the studied glasses found to exhibit non-exponential behavior and further to understand the energy transfer process takes place between the Dy^{3+} ions, the decay curves were fitted to the Inokuti-Hirayama (IH) model. The structural and optical properties of the Dy^{3+} doped calcium boro-tellurite glasses have been studied as a function of different metal cations (Zn, Cd, Pb and Bi) and the obtained results were discussed and compared with the similar reported glasses.

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