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Investigations on the Spectroscopic properties of Dy³⁺ ions doped Zinc calcium tellurofluoroborate glasses

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Abstract

A new series of Dy³⁺ doped (30-x)B₂O₃+30TeO₂+20CaCO₃+10ZnO+10ZnF₂+xDy₂O₃ (x=0.01, 0.1, 0.5, 1, 2 and 3 in wt%) Zinc calcium tellurofluoroborate glasses were prepared and their structural, luminescence and excited state dynamics have been studied and reported. The structural properties have been characterized through XRD and FTIR studies to confirm the amorphous nature and to explore the presence of fundamental stretching vibrations. The bonding parameters (δ and β), optical band gap, Urbach's energy, oscillator strengths and Judd-Ofelt (JO) intensity parameters were calculated from the absorption spectra. The JO intensity parameters and the Y/B intensity ratio values have been used to explore the nature of the bonding and asymmetry around the Dy-ligand field environment. The luminescence properties of the present Dy³⁺ doped glasses have been analyzed through luminescence excited state dynamics and radiative properties such as transition probability (A), stimulated emission cross-section (σ_p^E) branching ratio (β) and radiative lifetime (τ_R) values. The combination of dominant blue (⁴F_{9/2}→⁶H_{15/2}) and yellow (⁴F_{9/2}→⁶H_{13/2}) emissions generate white light emission in the CIE chromaticity diagram thus suggest that the present Dy³⁺ doped glasses are suitable for white light applications. The lifetime of the ⁴F_{9/2} excited state is found to decrease with the increase in Dy³⁺ ion content and the concentration quenching of the Dy³⁺ ions emission could be ascribed due to the resonant energy transfer and cross-relaxation processes. The non-exponential behavior of the decay curves have

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