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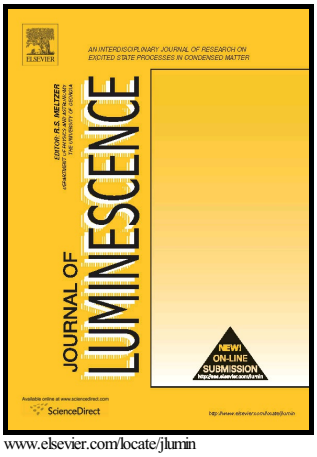

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Oxyfluorotellurite glasses doped with neodymium and ytterbium - thermal and spectroscopic properties as well as energy transfer phenomena

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ABSTRACT

Oxyfluorotellurite (65-x)TeO_2–20ZnF_2–12PbO–3Nb_2O_5–xLn_2O_3 (Ln = Nd^{3+} and Yb^{3+}, x = 0.5, 2 and 5) and (65-x-y)TeO_2–20ZnF_2–12PbO–3Nb_2O_5–xNd_2O_3–yYb_2O_3 (x = 0.5, y = 2 and x = 0.5, y = 5) glass systems were fabricated and their optical and thermal properties were investigated. Absorption and emission spectra of RE admixture ions in oxyfluorotellurite glasses were measured and examined at room temperature in the wide spectral region. Oscillator strengths, phenomenological Judd-Ofelt (J–O) intensity parameters, radiative transition probabilities, branching ratios and radiative lifetimes of luminescent levels were determined. Luminescence decay curves of the $^4F_{3/2}$ (Nd^{3+}) and $^2F_{5/2}$ (Yb^{3+}) excited states were recorded and comprehensively analyzed for the single-doped Nd^{3+} and Nd^{3+}–Yb^{3+} co-doped samples. Relaxation dynamics of luminescent levels were studied as a function of the Nd^{3+} and Yb^{3+} concentrations. An effective non-resonant phonon assisted energy transfer from neodymium to ytterbium was observed and studied. It was found that good thermal stability combined with proper spectroscopic parameters of examined Nd, Yb-doped oxyfluorotellurite glasses imply the suitability of these materials for the design of NIR-emitting efficient optical devices. Furthermore, the ability of the Nd^{3+} ions in oxyfluorotellurite glass host as luminescent temperature sensor was verified. Relative intensity ratios of neodymium transitions originated in $^4F_{7/2}$/$^4F_{3/2}$ and $^4F_{5/2}$/$^4F_{3/2}$ thermally coupled closely-located excited states have been adequately determined and studied.

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