

Energy transfer from trapped to untrapped Er^{3+} ions in Calcium Niobium Gallium Garnet Crystal doped with trivalent erbium ions investigated by time-resolved laser excitation spectroscopy

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Luminescence properties of Er^{3+} ions doped in Calcium Niobium Gallium Garnet

($\text{Ca}_3(\text{NbGa})_{2-x}\text{Ga}_3\text{O}_{12}$ CNGG) crystal are investigated by laser excitation spectroscopy. Time resolved emission spectra of Er^{3+} in CNGG are obtained together with the luminescence decays under the 355 and 532 nm pulsed laser excitations which excite the Er^{3+} ions from the $^4\text{I}_{15/2}$ state to the $^4\text{G}_{9/2}$ and $^2\text{H}_{11/2}$ states at room temperature. Emission bands are observed in the wavelength region 390-450, 510-580, 600-720, and 820-880 nm corresponding to the transitions from the $^2\text{G}_{9/2}$, $^2\text{H}_{11/2}$, $^4\text{S}_{3/2}$, $^4\text{F}_{9/2}$, and $^4\text{I}_{9/2}$ states to the $^4\text{I}_{15/2}$ state, respectively. Under excitation at 355 nm, unlike at 532 nm, the emission band shows two types of spectral features and temporal behaviours. We attribute Er^{3+} emission with the fast decay to the trapped Er^{3+} ions associated with oxygen-vacancy centre of other defect centres. We also observed the energy transfer occurs from the trapped Er^{3+} ions to the untrapped Er^{3+} ions under excitation at 355 nm.