

Luminescence and upconversion dynamics of praseodymium in LiLuF₄ laser crystals

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Abstract

We have investigated the spectroscopic properties of Pr³⁺ ions in LiLuF₄ laser host doped with 0.5% Pr³⁺ ions as a function of temperature. We obtained the luminescence spectra by exciting selectively the sample at 439nm into the 3P₂ level and at 593nm into the 1D₂ level. With excitation in the 3P₂ level we obtained emission only from the 3P₀ level but not from the 1D₂ level at all temperatures between 24 and 300K. With excitation into the 1D₂ level we observed the luminescence emitted by the same level and a strong blue up-conversion emission from the 3P₀ level. We used the decay pattern inspection to assign spectral lines to specific radiative transitions and to study the dynamics of the excited ions in the crystal. Under direct excitation, the 1D₂ decay curve is nonexponential at all temperatures, whereas the 3P₀ decay is exponential only at low temperatures. The experimental data indicate that the 3P₀ level is populated via upconversion due to mainly energy transfer. © 2005 Materials Research Society.
