

Crystal-field analysis, upconversion, and excited-state dynamics for (U⁴⁺, U³⁺):Ba₂YCl₇ single crystals.

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Streszczenie

Single crystals of (U⁴⁺,U³⁺):Ba₂YCl₇ were grown by the Bridgman-Stockbarger technique. The U⁴⁺ and U³⁺ ions substitute for Y³⁺ and have C₁ site symmetry in Ba₂YCl₇. Sixty energy levels of U⁴⁺ were assigned to 40000cm⁻¹ from absorption, excitation, and luminescence spectra, which encompasses all but the 1S₀ multiplet. A crystal-field analysis was performed by fitting 8 atomic and 19 crystal-field parameters to the experimental Stark levels. The values obtained from the fit had a standard deviation of 36.6cm⁻¹ and agreed with those calculated from the angular overlap model. Efficient luminescence was observed at 7 K from the 4G_{7/2} and 4F_{9/2} levels of the U³⁺ ions and from the 1D₂ and 1I₆ of the U⁴⁺ ions with decay times of 0.5, 0.55, 9.2, and 4.3 μs, respectively. For the U⁴⁺ ions, a very strong anti-Stokes emission was observed due to energy-transfer processes. The emission of the U³⁺ ions is strongly quenched by temperature in contrast to that of the U⁴⁺ ions for which emission was observed even at room temperature. Energy transfer between the U³⁺ and U⁴⁺ ions has been shown to occur in the (U⁴⁺,U³⁺) doped Ba₂YCl₇.

Adres publiczny

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