

Author's Accepted Manuscript

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PII: S0022-2313(16)31329-1
DOI: <http://dx.doi.org/10.1016/j.jlumin.2016.11.046>
Reference: LUMIN14384

To appear in: *Journal of Luminescence*

Received date: 25 September 2016
Accepted date: 18 November 2016

Cite this article as: P.A. Loiko, E.V. Vilejshikova, X. Mateos, J.M. Serres, E.B. Dunina, A.A. Kornienko, K.V. Yumashev, M. Aguiló and F. Díaz, Europium doping in monoclinic $\text{KYb}(\text{WO}_4)_2$ crystal, *Journal of Luminescence* <http://dx.doi.org/10.1016/j.jlumin.2016.11.046>

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Europium doping in monoclinic KYb(WO₄)₂ crystal

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Abstract

We report on a detailed spectroscopic study of Eu³⁺ ions in the monoclinic KYb(WO₄)₂ crystal. The polarized room and low-temperature absorption spectra are measured. The maximum σ_{abs} corresponding to the $^7F_1 \rightarrow ^5D_1$ transition is $1.32 \times 10^{-20} \text{ cm}^2$ at 534.2 nm with a bandwidth of 0.7 nm (for $E \parallel N_m$). The Stark sub-levels of the excited multiplets are determined. A Judd-Ofelt analysis is applied to the Eu³⁺:KYb(WO₄)₂ crystal to determine the probability of spontaneous transitions, radiative lifetimes and luminescence branching ratios. Within the strong configuration interaction (SCI) approximation, the intensity parameters are $\Omega_2 = 4.757$, $\Omega_4 = 2.295$, $\Omega_6 = 1.644$ [10^{-20} cm^2] and $\Delta_f = 50160 \text{ cm}^{-1}$. The radiative lifetime of the 5D_0 state is 351 μs . The maximum stimulated-emission cross-section corresponding to the $^7F_1 \rightarrow ^5D_1$ transition is $1.44 \times 10^{-20} \text{ cm}^2$ at 703.2 nm (for $E \parallel N_m$). Under UV excitation, the Eu³⁺: KYb(WO₄)₂ crystal provides intense red photoluminescence with CIE coordinates, $x = 0.675$, $y = 0.325$.

Keywords: double tungstates, europium, absorption, luminescence.

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