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PII: S0022-2313(18)30856-1
DOI: <https://doi.org/10.1016/j.jlumin.2018.08.034>
Reference: LUMIN15832

To appear in: *Journal of Luminescence*

Received date: 14 May 2018
Revised date: 3 August 2018
Accepted date: 6 August 2018

Cite this article as: G. Cabello-Guzmán, Diego González, C. Caro-Díaz, L. Lillo-Arroyo, F. Valenzuela-Melgarejo, G. Cárdenas Triviño, G.E. Buono-Core, B. Chornik and Yosselin Huentupil, Preliminary evaluation of the up-conversion emission of $\text{Y}_2\text{O}_3:\text{Er-Yb}$ thin films prepared by a solid state photochemical deposition method, *Journal of Luminescence*, <https://doi.org/10.1016/j.jlumin.2018.08.034>

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Preliminary evaluation of the up-conversion emission of $\text{Y}_2\text{O}_3\text{:Er-Yb}$ thin films prepared by a solid state photochemical deposition method

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Abstract

Y_2O_3 thin films doped with different concentrations of erbium ions and co-doped with 10 mol % of ytterbium were synthesized by a solid state photochemical deposition method followed by a subsequent calcination process. The photo-reactivity of the thin films was monitored by Fourier transform infrared (FT-IR) spectroscopy. X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), UV-vis spectroscopy and photo-luminescence (PL) were employed to characterize the samples. The results reveal that $\text{Y}_2\text{O}_3\text{:Er}$ films under 980 nm irradiation exhibit characteristic up-conversion emissions that are focused in the green region of the spectrum; these emissions are assigned to the $(^2\text{H}_{11/2}, ^4\text{S}_{3/2}) \rightarrow ^4\text{I}_{15/2}$ transitions of the Er^{3+} ions. These emissions greatly increase in intensity with the addition of Yb^{3+} ions in the preparation of the co-doped films. This phenomenon is explained based on the efficient $\text{Yb}^{3+} \rightarrow \text{Er}^{3+}$ energy transfer processes.

Keywords: Thin films, photochemical deposition, up-conversion emission, energy transfer.

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