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Federico González, Rabindra Khadka, Rigoberto
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Emission of white-light in cubic $\text{Y}_4\text{Zr}_3\text{O}_{12}:\text{Yb}^{3+}$ induced by a continuous infrared laser.

Federico González^{a,b,*}, Rabindra Khadka^a, Rigoberto López-Juárez^c, John Collins^d,
Baldassare Di Bartolo^a

^a*Department of Physics, Boston College, 02467, Chestnut Hill, MA, USA*

^b*Departamento de Ingeniería de Procesos e Hidráulica, Universidad Autónoma Metropolitana-Iztapalapa, A.P. 55-534, 09340, Ciudad de México, México*

^c*Unidad Morelia del Instituto de Investigaciones en Materiales, Universidad Nacional Autónoma de México, Antigua Carretera a Pátzcuaro No. 8701, Col. Ex Hacienda de San José de la Huerta, C.P. 58190 Morelia, Michoacán, México*

^d*Department of Physics, Wheaton College, 02766, Norton, MA, USA*

Abstract

In this work nanostructured powders with nominal composition $\text{Y}_4\text{Zr}_3\text{O}_{12}$, undoped and doped at Yb^{3+} 1 mol%, were synthesized by the polymerizable complex method. The crystal structure, microstructure and performance to produce white-light continuous emission spectra of powders under 975 nm continuous laser irradiation were investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM), high resolution transmission electron microscopy (HRTEM), and optical spectroscopy. Continuous emission spectra of white-light were well-fitted by Planck's law of blackbody radiation. The threshold power values for generating white-light in sample annealed at 800 °C and 1100 °C were 1.36 W and 1.75 W, respectively. This difference was attributed to the crystallite size. The dependence of the absolute temperature, obtained from Planck's law fittings, as a function of the laser's power is explained as due to the microstructural changes, verified by XRD measurements. Finally, a stimulating mechanism of white-light generation involving non-radiative processes of Yb^{3+} is suggested.

* Corresponding author: Department of Physics, Boston College, 02467, ChestnutHill, MA, USA.
E-mail address: garciaqa@bc.edu, fgg@xanum.uam.mx (F. González)

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