Synthesis and tuneable emission studies of new up-converting $Ba_2GdV_3O_{11}$ nanopowders doped with Yb^{3+}/Ln^{3+} (Ln^{3+} = Er^{3+}, Ho^{3+}, Tm^{3+})

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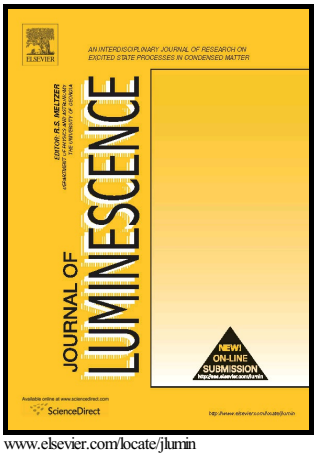

www.elsevier.com/locate/jlumin

PII: S0022-2313(18)30093-0
DOI: https://doi.org/10.1016/j.jlumin.2018.03.085
Reference: LUMIN15504

To appear in: *Journal of Luminescence*

Received date: 21 January 2018
Revised date: 24 March 2018
Accepted date: 27 March 2018

Cite this article as: Nina Kaczorowska, Agata Szczeszak and Stefan Lis, Synthesis and tuneable emission studies of new up-converting $Ba_2GdV_3O_{11}$ nanopowders doped with Yb^{3+}/Ln^{3+} (Ln^{3+} = Er^{3+}, Ho^{3+}, Tm^{3+}) , *Journal of Luminescence,* https://doi.org/10.1016/j.jlumin.2018.03.085

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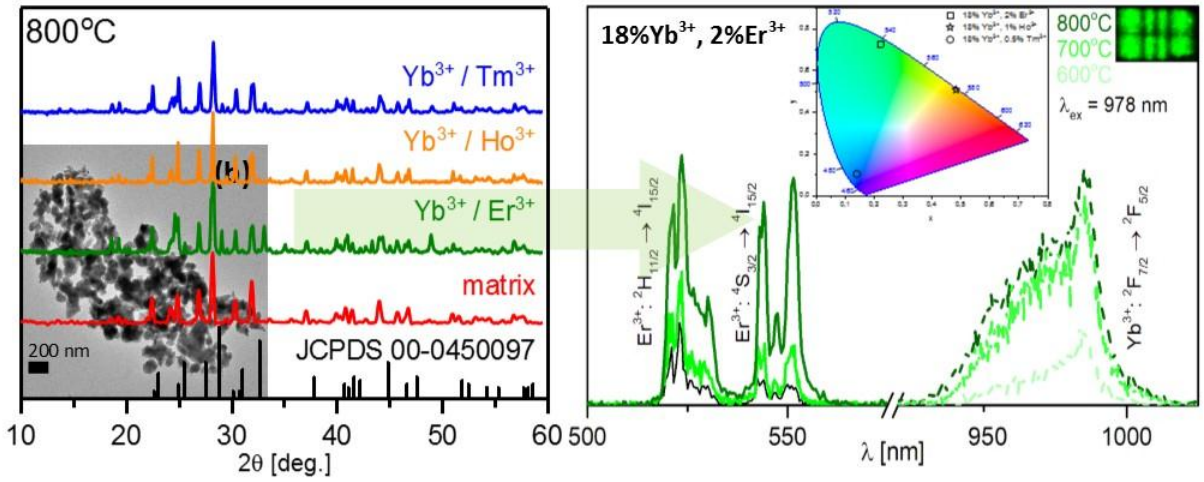
Abstract

Nanopowders of Ba2GdV3O11 were successfully synthesised using a sol-gel method. Luminescence upconversion properties in the obtained $Ba_2GdV_3O_{11}$ matrix doped with the Yb^{3+}/Er^{3+}, Yb^{3+}/Ho^{3+} and Yb^{3+}/Tm^{3+} ion pairs were investigated. Thermogravimetric analysis was necessary to set the optimal calcination temperature of the gel precursors and to form desired structure. Monoclinic structure and P21/a space group of products were defined based on X-ray diffraction analysis method and compared with an appropriate reference pattern. Morphology and the grain sizes of obtained nanophosphors were confirmed by transmission electron microscopy. The nanomaterials containing lanthanide ions in the structure show intense visible green, red and blue emission under infrared radiation, λ_{exc}=985 nm, depending on the emitting Ln^{3+} ions used (Ln^{3+} = Er^{3+}, Ho^{3+}, Tm^{3+}). Detailed spectroscopic analysis showed dependence of luminescence intensity and lifetime of the nanophosphor samples on calcination temperature.

Graphical Abstract:



Keywords

up-conversion, lanthanide ions, vanadates, sol-gel method, nanomaterials