Accepted Manuscript

Highly efficient infrared to visible up-conversion emission tuning from red to white in Eu/Yb co-doped NaYF4 phosphor

Trilok K. Pathak, Ashwini Kumar, L.J.B. Erasmus, Anurag Pandey, E. Coetsee, H.C. Swart, R.E. Kroon

PII:	S1386-1425(18)30843-6
DOI:	doi:10.1016/j.saa.2018.08.064
Reference:	SAA 16439
To appear in:	*Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*
Received date:	5 June 2018
Revised date:	17 August 2018
Accepted date:	30 August 2018

Please cite this article as: Trilok K. Pathak, Ashwini Kumar, L.J.B. Erasmus, Anurag Pandey, E. Coetsee, H.C. Swart, R.E. Kroon , Highly efficient infrared to visible up-conversion emission tuning from red to white in Eu/Yb co-doped NaYF4 phosphor. Saa (2018), doi:10.1016/j.saa.2018.08.064

Highly efficient infrared to visible up-conversion emission tuning from red to white in Eu/Yb co-doped $NaYF_4$ phosphor

Trilok K. Pathak[a, b]*, Ashwini Kumar[a*], L.J.B. Erasmus[a], Anurag Pandey[a], E. Coetsee[a], H.C. Swart[a] and R.E. Kroon[a*]

[a]Department of Physics, University of the Free State, Bloemfontein, South Africa

[b]Department of Physics, TKCOE Teerthanker Mahaveer University, Moradabad, India

Abstract

Eu/Yb co-doped $NaYF_4$ phosphors have been synthesized by the combustion method. The Eu doping was fixed and the effect of Yb doping concentration on the structural, morphological and luminescence properties has been investigated. X-ray diffraction analysis revealed that the phosphors consisted of mixed α- and β-phases, but the β-phase was dominant. All elements of the host and dopants, as well as adventitious C, were detected using X-ray photoelectron spectroscopy. The surface morphology showed a microrod-like structure with sharp hexagonal edges. Energy dispersive X-ray spectroscopy spectra proved the formation of the desired materials. The photoluminescence spectra illustrated the optical emission properties of Eu^{3+} in the red region when excited at 394 nm, while, under the same excitation, Yb^{3+} ions gave emission at 980 nm. The up-conversion (UC) emission of Eu/Yb co-doped $NaYF_4$ produced a white color at the higher concentration of Yb excited by a 980 nm laser, which was made possible by green emission of Er contamination (from Yb source) and blue emission of Eu^{2+} ions. The lifetime of the Eu^{3+} UC luminescence at 615 nm was also affected by the Yb doping concentration. The temperature sensitivity associated with the Er^{3+} peaks at 520 and 542 nm was assessed as a function of temperature and the maximum of 0.0040 K^{-1} occurred at 463 K.

Keywords: $NaYF_4$; Phosphor; Up-conversion; White light emission; Temperature sensitivity.