SYNTHESIS AND OPTICAL PROPERTIES OF Er^{3+}, Yb^{3+} AND Nd^{3+} DOPED Y_2BaZnO_5

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Upconverting phosphor materials are attracting considerable attention for their possible applications in solar cells with improved efficiency or as safety ink, nanomaterials for bio-imaging, lasers and novel display technologies [3]. Upconversion materials consists of inorganic host lattice doped with lanthanide ions, can convert low-energy incident radiation into higher energy emitted radiation. Upconversion refers to non-linear optical processes characterized by the successive absorption of two or more excitation photons via intermediate long-lived energy states followed by the emission of a shorter wavelength photon than the excitation [1]. Up to now, reported upconversion efficiencies have been relatively low, excitation thresholds quite high, and the investigated phosphors (generally fluorides) often presented poor chemical stability (hygroscopy), limiting their industrial applicability [2]. Y_2BaZnO_5 can be an excellent host material for doping with lanthanide ions. It has good chemical, physical properties and is stable at high temperature [3,4].

In this work, Er^{3+}, Yb^{3+} and Nd^{3+} co-doped orthorombic Y_2BaZnO_5 phosfors were synthesized via high temperature solid-state method. Pure phase Y_2BaZnO_5 synthesized by 4 stages of heating. A variety of dopants, including Er^{3+}, Yb^{3+} and Nd^{3+}, were embedded in the host lattice, resulting in bright red and green light emissions under 980 nm excitation and at relatively low excitation powers. Thermal stability of synthesised Y_2BaZnO_5 were measured by X-ray diffraction after heating sample at high temperatures for 24 hours. There was no other phases after heating the same Y_2BaZnO_5 sample at 300 °C, 600 °C and 950 °C for 24 hours in all temperatures.

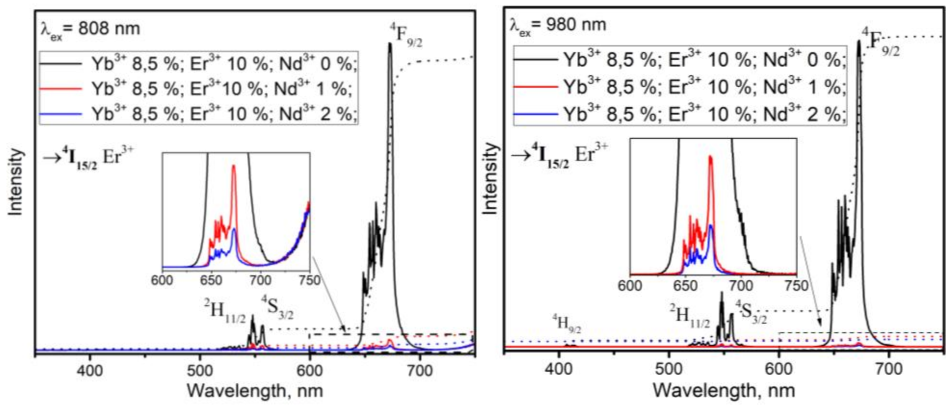

Fig. 1 Y_2BaZnO_5 co-doped with Er^{3+}, Yb^{3+} and Nd^{3+} apconversion emision spectra with different exitation wavelength a) 808 nm and b) 980 nm.

[1] Zhou, B.; et al. Nature Nanotechnology 10: 924–936 (2015).
[2] L. Y. Ang, M. E. Lim, L. C. Ong, Y. Zhang, Nanomedicine, 6, 2011, p. 1273 – 1288.
[3] I. Etchart, Metal Oxides for Efficient Infrared to Visible Upconversion, Summary of doctoral dissertation, University of Cambridge, Cambridge, 2010.
[4]V. Kumar, S. Som, S. Dutta, H. C. Swart, Proceedings of SAIP, 2015, p. 255 – 260.