

CONVENTIONAL AND UPCONVERSION LUMINESCENCE OF POLYMORPHOUS $\text{BiPO}_4:\text{Yb}^{3+},\text{Tb}^{3+},\text{Eu}^{3+}$ PHOSPHORS

Egle Ezerskyte, Arturas Katelnikovas

Institute of Chemistry, Faculty of Chemistry and Geosciences, Vilnius University, Lithuania
eglezerskyte@gmail.com

There are many factors contributing to the colour of both conventional and upconversion emission such as chemical composition of matrix, crystalline structure of upconverting materials, etc. Yb^{3+} ions, which are part of researched Yb-Tb-Eu system, absorbs 980 nm radiation and transfers the obtained energy to Tb^{3+} ions which then can emit green light themselves or transfer energy to Eu^{3+} ions, if they are in close vicinity, which would lead to orange/red emission of Eu^{3+} ions. Moreover, the investigated $\text{BiPO}_4:\text{Yb}^{3+},\text{Tb}^{3+},\text{Eu}^{3+}$ phosphors are able to form three different crystalline structures: trigonal, low-temperature monoclinic and high-temperature monoclinic, which also affects colour of luminescence. Thus, the purpose of this research is to produce green-to-red emitting luminescent materials by manipulating $\text{Tb}^{3+}/\text{Eu}^{3+}$ ratio and crystalline phase of phosphor.

The investigation of structural, morphological and optical properties of the synthesized compounds was carried out by powder X-ray diffraction (XRD), scanning electron microscopy (SEM) analysis and UV-VIS-NIR spectroscopy.

$\text{BiPO}_4:\text{Yb}^{3+},\text{Tb}^{3+},\text{Eu}^{3+}$ samples with trigonal and low-temperature monoclinic crystal structure (Fig.1 (a) and (b) respectively) were synthesized via co-precipitation and high temperature solid-state reaction methods.^[1,2] The XRD patterns of produced samples correspond well with the reference patterns. In addition, single phase compounds are obtained at any $\text{Tb}^{3+}/\text{Eu}^{3+}$ ratio.

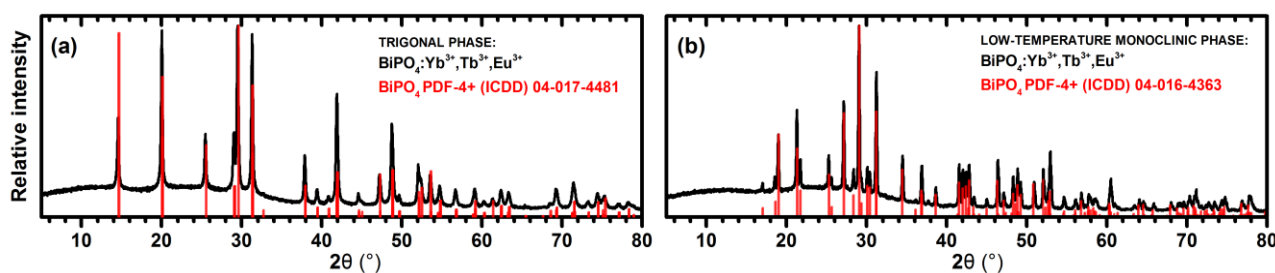


Fig. 1. XRD patterns of trigonal $\text{BiPO}_4:\text{Yb}^{3+},\text{Tb}^{3+},\text{Eu}^{3+}$ (a) and low-temperature monoclinic $\text{BiPO}_4:\text{Yb}^{3+},\text{Tb}^{3+},\text{Eu}^{3+}$ (b).

Reflection, excitation and emission spectra, decay curves, photoluminescence lifetime values, CIE 1931 colour space coordinates of $\text{BiPO}_4:\text{Yb}^{3+},\text{Tb}^{3+},\text{Eu}^{3+}$ phosphors were also investigated and will be discussed.

Acknowledgements: This project has received funding from European Social Fund (project No 09.3.3-LMT-K-712-16-0161) under grant agreement with the Research Council of Lithuania (LMTLT).

1. Achary, S.N., et al., Experimental and theoretical investigations on the polymorphism and metastability of BiPO_4 . Dalton Transactions, 2013. 42(42): p. 14999-15015.
2. Liu, S., et al., Synthesis and luminescent properties of Eu^{3+} and Dy^{3+} doped BiPO_4 phosphors for near UV-based white LEDs. Journal of Materials Science: Materials in Electronics, 2013. 24(11): p. 4253-4257.