

LUMINESCENCE OF $K_2(Cs/Rb)Y(VO_4)_2:Eu^{3+}$ PHOSPHORS WITH TRIGONAL CRYSTAL STRUCTURE

Egle Ezerskyte, Arturas Katelnikovas

Faculty of Chemistry and Geosciences, Vilnius University, Naugarduko 24, LT-03225 Vilnius, Lithuania
eglezerskyte@gmail.com

The purpose of this research was to synthesize new and efficient red light emitting phosphors which possess narrow emission spectrum assuming these luminofors could be used in the production of white LEDs. Therefore, phosphors containing Eu^{3+} ions are ideal candidates in fulfilling this task due to the fact that their emission spectra consists of few narrow emission lines at approximately 610 nm (see Fig. 1. (b) and (d)). Thus, we decided to investigate the little studied $K_2(Cs/Rb)Y(VO_4)_2:Eu^{3+}$ phosphors assuming that by changing their chemical composition the emission of Eu^{3+} ions will be easily manipulated.

Samples of $K_2RbY(VO_4)_2:Eu^{3+}$ and $K_2CsY(VO_4)_2:Eu^{3+}$ with trigonal (P-3m1, #164) structure were synthesized via conventional high temperature solid-state reaction. The stoichiometric amounts of precursors (Y_2O_3 , Eu_2O_3 , K_2CO_3 , NH_4VO_3 , Rb_2CO_3 , Cs_2CO_3) were blended in the agate mortar employing acetone as the grinding media. The obtained powders were transferred to the porcelain crucibles and annealed at 800 °C for 10 h in air [1].

The investigation of structural, morphological and optical properties of the synthesized phosphors was carried out by powder X-ray diffraction (XRD), scanning electron microscope (SEM) analysis, Fourier-transform infrared (FTIR) spectroscopy and UV-Visible spectroscopy.

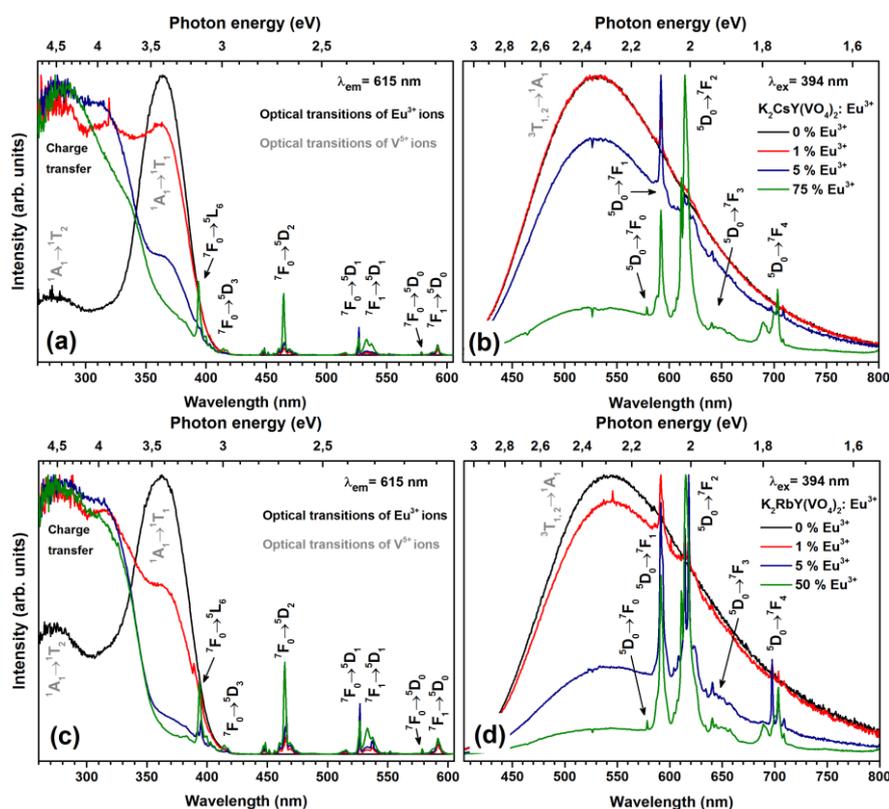


Fig. 1. Excitation (a) and emission (b) spectra of $K_2CsY(VO_4)_2:Eu^{3+}$ samples with different Eu^{3+} concentrations; excitation (c) and emission (d) spectra of $K_2RbY(VO_4)_2:Eu^{3+}$ samples with different Eu^{3+} concentrations.

XRD patterns, SEM images and FTIR spectra confirming crystal structure, showing the distribution of crystallites and revealing impurities of samples will be discussed in this work. Moreover, reflection spectra, excitation spectra ($\lambda_{em} = 615$ nm), emission spectra ($\lambda_{ex} = 330, 394, 464.5$ nm), temperature dependent emission spectra in 77 – 100 K temperature interval, decay curves, photoluminescence lifetime values, external quantum efficiencies, colour coordinates of $K_2RbY(VO_4)_2:Eu^{3+}$ and $K_2CsY(VO_4)_2:Eu^{3+}$ phosphors will be discussed.

Acknowledgements: This research was funded by the European Social Fund under the No 09.3.3.-LMT-K-712-09-0159 “Development of Competences of Scientists, other Researchers and Students through Practical Research Activities” measure.

[1] David, A.D.J., G.S. Muhammad, and V. Sivakumar, *Synthesis and optical properties of Eu^{3+} -substituted glaserite-type orthovanadates $CsK_2Y(VO_4)_2$* . Luminescence, 2017. 32(5): p. 735-744.