

# Recent development of fast red/NIR oxide phosphors doped with $\text{Eu}^{2+}$

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Red and near-infrared phosphors are commonly used as light sources in white light-emitting diodes (LEDs), white lasers, and scintillators. In recent years, there has been a significant increase in the demand for broad- and fast-emitting red and near-infrared phosphors.  $\text{Eu}:\text{Ca}_3\text{Sc}_2\text{Si}_3\text{O}_{12}$  has gained attention as a chemically stable phosphor capable of producing broad, red, or near-infrared and fast emission due to its near-infrared emission of 873 nm and fast photoluminescence decay of 95.1 ns [1, 2]. However, the synthesis of single-phase  $\text{Ca}_3\text{Sc}_2\text{Si}_3\text{O}_{12}$  remains a challenge. In this study, we synthesized  $\text{Eu}:\text{CaSc}_2\text{O}_4$  as an alternative phosphor to  $\text{Eu}:\text{Ca}_3\text{Sc}_2\text{Si}_3\text{O}_{12}$ , and evaluated its emission properties.

Mixed powders of  $\text{Eu}_2\text{O}_3$ ,  $\text{CaCO}_3$ , and  $\text{Sc}_2\text{O}_3$  were sintered at 1500 °C for 5 h in an  $\text{N}_2+10\%\text{H}_2$  reducing atmosphere to synthesize  $\text{Eu}:\text{CaSc}_2\text{O}_4$ . The crystal phase was identified using powder X-ray diffraction. The luminescence, photoluminescence emission, and excitation properties were evaluated at 10 K and 300 K in a synchrotron facility (BL3B, UVSOR-III). Photoluminescence decay curves were also measured.

$\text{Eu}:\text{CaSc}_2\text{O}_4$  exhibited a single-crystal phase of  $\text{CaSc}_2\text{O}_4$ . Photoluminescence excitation and emission spectra were successfully measured.  $\text{Eu}:\text{CaSc}_2\text{O}_4$  exhibits broad near-infrared emission at approximately 750 nm under the excitation of UV or visible photons, as shown in Figure 1. In addition to  $\text{Eu}^{2+}$  emission,  $\text{Eu}^{3+}$  emission was also observed.

The photoluminescence decay curve of  $\text{Eu}:\text{CaSc}_2\text{O}_4$  was fitted by a double exponential function, and the decay constants were estimated to be 3.10 ns (19%) and 16.3 ns (81%).  $\text{Eu}:\text{CaSc}_2\text{O}_4$  exhibits outstanding fast decay among near-infrared phosphors. In this presentation, details of the emission properties are explained.

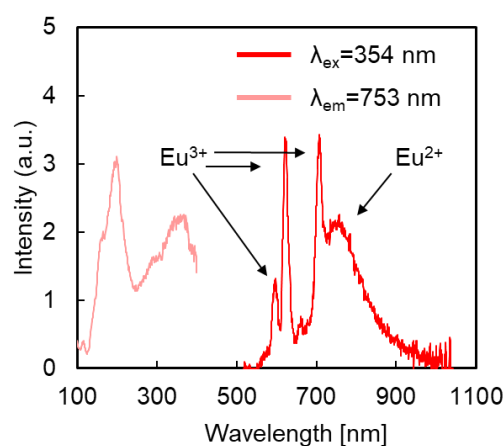


Figure 1. Photoluminescence excitation and emission spectra of  $\text{Eu}:\text{CaSc}_2\text{O}_4$

[1] L. Zhou *et al.*, *Chemistry of Materials*. 28 (2016) 2834.

[2] I.V. Berezovskaya *et al.*, *Chemical Physics Letters*. 585 (2013)11.

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