Scintillation properties of Sm and Eu doped $Lu_2Si_2O_7$ single crystal

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Scintillator material is one of the luminescent materials which can convert high energy photons such as γ-rays and X-rays to the lower energy photons such as ultraviolet and visible light immediately after the absorption of the ionizing radiation. Usually, scintillators are used in combination with photodetector which is called scintillation detector [1]. Recently, the single crystal type scintillators using the rare earth ions as the luminescence center have been commonly used. $Lu_2Si_2O_7$ (LPS) has been used for the host materials due to the high effective atomic number, and presents good scintillation performance such as short decay time and highest light yield when it is activated with Pr^{3+} ions compared with the other Orthosilicates host [2]. In this study, photoluminescence and scintillation properties of LPS single crystals doped with Sm and Eu have been investigated for comparative study of different luminescence centers. Samples were fabricated by the floating zone method. Figure 1 shows the X-ray induced scintillation spectra of the Eu and Sm doped LPS samples. Several emission peaks appear around 600 nm in the spectrum of Eu:LPS due to Eu^{3+} 4f-4f transitions [3]. In that of Sm:LPS's, three emission bands from 560, 600 and 650 were all from the Sm^{3+} 4f-4f transition in different ground states [4]. Figure 2 represents the X-ray induced scintillation decay time profiled of the Eu and Sm doped samples. The scintillation decay times of them were around 1.145 and 1.738 ms for the Eu^{3+} and the Sm^{3+} 4f-4f transition, respectively.

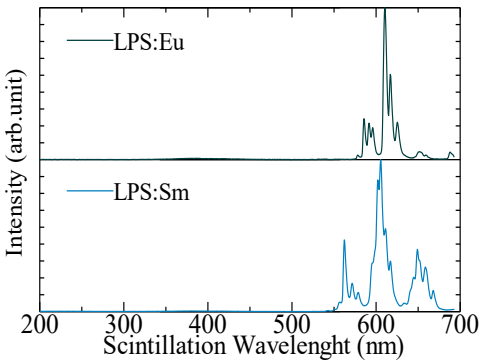

Figure 1. X-ray induced scintillation spectra of Eu:LPS (top) and Sm:LPS (bottom) crystals.

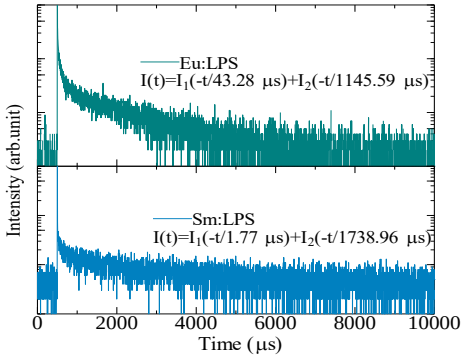

Figure 2. X-ray induced scintillation decay time profiles of Eu:LPS (top) and Sm:LPS (bottom) crystals.

[1] T. Yanagida. *Journal of Luminescence* 169 (2016): 544-548.
[2] T. Yanagida, et al. *Japanese Journal of Applied Physics* 57.10 (2018).
[3] D. Nakauchi, et al. *Journal of the Ceramic Society of Japan* 124 (2016): 546-549.
[4] C.S. Dwaraka Viswanath, C.K. Jayasankar *Ceramics International* 44 (2018): 6104-6114