# Tm Concentration dependence of scintillation properties for Tm-doped $Lu_2Si_2O_7$ single crystal

**NAIST, °Prom Kantuptim, Masaki Akatsuka, Daisuke Nakauchi, Takumi Kato,**

**Noriaki Kawaguchi, Takayuki Yanagida**

**E-mail: prom.kantuptim.pf2@ms.naist.jp**

A scintillator is a luminescence material which can convert photons and particles with high energy to photons with low energy such as ultraviolet and visible light. Emitted photons are collected into photodetectors and converted to electrical signals for radiation detection [1]. Single crystalline scintillators are doped with rare-earth ion as a luminescence center have been commonly investigated. As such an emission center ion, $Tm^{3+}$ is well known for clear visible light emission in the blue range which is necessary in the display and other blue phosphors related devices [2]. For a host material, $Lu_2Si_2O_7$ (LPS) were selected in this study owing to the high effective atomic number and good scintillation properties when doped with $Ce^{3+}$ ions such as a short decay time and a high light yield [3].

In this study, we focused on the optical and scintillation properties of 0.1-5.0 % Tm-doped LPS (Tm:LPS) single crystals synthesized by the floating zone method. Figure 1 presents the X-ray-induced scintillation spectra of the Tm-doped LPS crystals. The Tm-doped sample showed similar emission peaks to those in PL. Several sharp peaks appeared at 350 nm and 450 nm due to the $Tm^{3+}$ 4f-4f transitions ($^1D_2 \rightarrow {}^3H_6$ and $^1D_2 \rightarrow {}^3F_4$ respectively) [4]. $^{137}Cs$ γ-rays irradiated pulse height spectra of Tm:LPS samples are presented in Fig. 2. The highest absolute scintillation light yields in this study was 2400 ph/MeV in the 2.0 % doped sample. In this measurement, a typical error for the light yield estimation was 10 %.

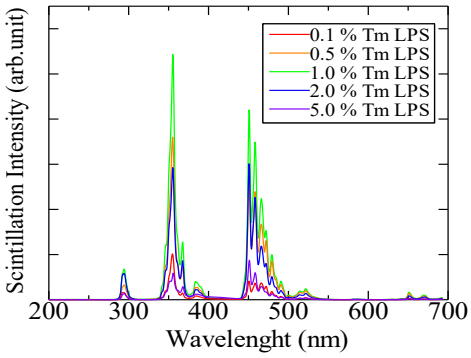


Figure 1. X-ray induced scintillation spectra of Tm:LPS and undoped LPS crystals.

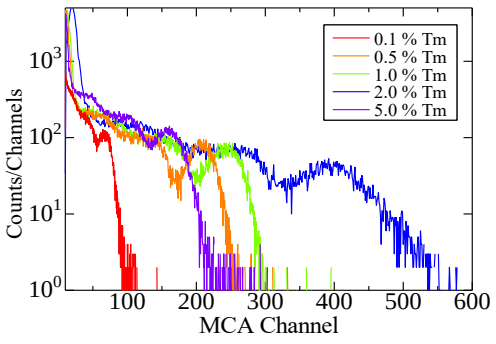


Figure 2. Pulse height spectra of $^{137}Cs$ γ-rays measured using Tm:LPS samples.

[1] T. Yanagida. *J. Lumin.* 169 (2016): 544-548.

[2] B. E. William, et al. *Phys. Procedia* 8 (2010): 142-150.

[3] F. He, et al. *J. Rare Earths*, 2012, 30.8: 775-779.

[4] S. A. Cicillini, et al. *J. Alloys Compd.* 374 (2004): 169-172.