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Scintillation Properties of La_2Hf_2O_7 Transparent Ceramics by the Spark Plasm Sintering Method

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Scintillators are used in medical imaging and high-energy physics as radiation detectors, and high effective atomic number materials are required in order to obtain the high gamma-ray detection efficiency. Recently, pyrochlore structure type materials have been investigated as scintillation materials, because these materials had good light outputs [1]. Since $La_2Hf_2O_7$, a member of the pyrochlore group, has high an effective atomic number of approximately 62, this material can be high gamma-ray detection efficiency. On the other hand, the melting point of this material is over 2,500 °C. Since almost crucibles cannot be operated under the such high temperature, and the common single-crystal-growth method is hard to apply to this material. Thus, we investigate the luminescent properties of $La_2Hf_2O_7$ as ceramics. Here, the spark plasma sintering (SPS) method is one of the methods to fabricate the ceramics, and it takes shorter time to obtain the ceramics compared with other methods such as HIP.
First, pure RE-doped $La_2Hf_2O_7$ ceramics powers were prepared by the solid state reaction, where is Eu, Tb, and transparent ceramics were obtained by the SPS method. All samples were confirmed to be the single phase, and these samples had transparency.
Both Eu and Tb-doped $La_2Hf_2O_7$ samples had some sharp emission peaks around 550-700 and 350-650 nm, respectively, in the radio luminescence spectra excited by X-rays or 5.5 MeV alpha rays from an ^{241}Am source. Each peak was originated from Eu^{3+} and Tb^{3+} 4f-4f transition. In this paper, we show the optical and scintillation properties of these materials including temperature dependence and time profile in this presentation.

[1] A. Suzuki, S. Kruosawa, A. Yoshikawa et al., Applied Physics Express 5 102601(2012)

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