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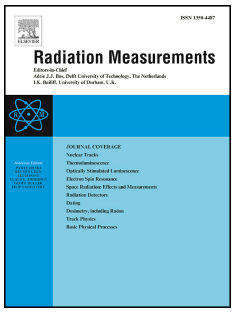

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Yuya Isokawa, Shotaro Hirano, Go Okada, Noriaki Kawaguchi, Takayuki Yanagida

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Title

Characterization of Ce-doped lithium borosilicate glasses as tissue-equivalent phosphors for radiation measurements

Yuya Isokawa[1*], Shotaro Hirano[1], Go Okada[1], Noriaki Kawaguchi[1], Takayuki Yanagida[1],

[1] Graduate School of Materials Science, Nara Institute of Science and Technology, 8916-5 Takayama, Ikoma, Nara, 630-0192, Japan

Corresponding author: isokawa.yuya.ir9@ms.naist.jp

Keywords: lithium borosilicate; glass; cerium; dosimeter; scintillation

Abstract

We synthesized lithium borosilicate glasses doped with different concentrations of Ce (0.01%, 0.03%, 0.10%, and 0.30%) as well as undoped glass, and then the prepared glasses were studied for their optical, dosimetric, and scintillation properties. The Ce-doped samples exhibited scintillation and photoluminescence (PL) due to the 5d–4f transitions of Ce^{3+}, with broad spectral features peaking around 350 nm. The PL and scintillation decay times were 30.7–31.6 ns and 64–82 ns, respectively. As the concentration of Ce increased, the scintillation intensity increased. Among the present samples, the 0.03% Ce-doped sample showed the highest PL quantum yield (9.7%). The quantum yield was well correlated with the decay time. In addition, thermally stimulated luminescence was observed after irradiation with X-rays. The sensitivity was highest for the 0.10% Ce-doped sample, having a dynamic range from 0.05 mGy to 10 Gy, which was equivalent to that of commercial dosimeters. Furthermore, the thermally