Fabrication and investigation of the effects of various gadolinium compounds on Ce^{3+}-activated phosphate glasses for scintillation applications

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Abstract

Ce^{3+}-activated phosphate-based glasses were fabricated for scintillation purposes following melt-quenching technique. Chemical compositions of the glasses were designed in mol. % ratio

with formula ($62P_2O_5$:$20Li_2CO_3$:$10X$:$5Al_2O_3$:$3CeBr_3$ where X Gd_2O_3/GdF_3/$GdCl_3$/$GdBr_3$/GdI_3). The amorphous structure of the glasses was verified by the powder X-ray diffraction measurements. Fourier-transform infrared (FTIR) measurements were carried out to study the structural properties of the fabricated glass samples. X-ray-induced luminescence and photoluminescence (PL) spectra were used to investigate the luminescence properties of the glasses. A broad PL excitation band was found for all prepared glasses that refers to Gd^{3+} and Ce^{3+} characteristic transitions. GdI_3 containing glass sample provided the optimum emission under X-ray and UV (308 nm) excitations peaking at 347 and 341 nm, respectively. The scintillation property of the GdI_3 containing glass was studied under 5.5 MeV α-particle from ^{241}Am radiation source and a clear alpha peak was observed with energy resolution of 35.3%. The shortest decay component of the glass sample was observed to be 27.9 ns, 30.7 ns and 29.12 ns under the α-particles, γ-ray, and 266 nm pulsed laser excitations, respectively. In conclusion, the GdI_3 prepared glass sample can be used for α -particles detection.

The full text can be found at the following link:

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