

# Effects of halide component on luminescence and scintillation performance of Ce<sup>3+</sup> doped inorganic phosphate glasses for radiation detection

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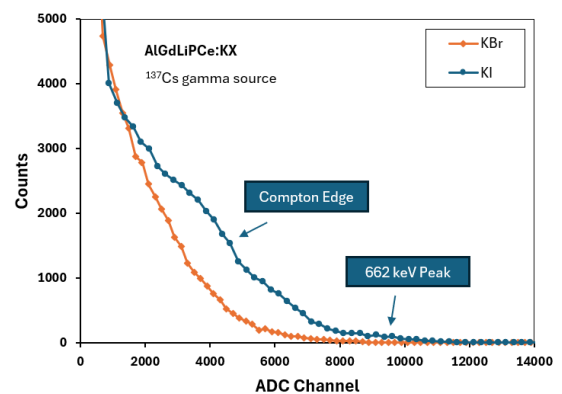
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Currently, glass scintillators are being extensively investigated due to their easily controllable shape, low production cost, and high chemical durability in atmospheric conditions [1-3]. In this work, the structural, luminescence and scintillation properties of Ce<sup>3+</sup> doped halide phosphate glasses Al<sub>2</sub>O<sub>5</sub>:GdF<sub>3</sub>:LiCl:P<sub>2</sub>O<sub>5</sub>:CeF<sub>3</sub>:KX (AlGdLiPCe:KX, X=Br<sup>-</sup> and I<sup>-</sup>) were studied for their potential applications in gamma and alpha detection. The samples were synthesized via the conventional melt-quenching method at 1190°C. Powder X-ray diffraction measurements were carried out to confirm the amorphous nature of the prepared glass samples. At room temperature, a broad emission of Ce<sup>3+</sup>, and energy transfer from Gd<sup>3+</sup> to Ce<sup>3+</sup> ions were observed in both photoluminescence (PL) and X-ray-induced luminescence (XRL) measurements. Scintillation performance was investigated through pulse height spectral analysis and decay profile measurements under <sup>137</sup>Cs gamma and <sup>241</sup>Am alpha irradiation. By successfully detecting both gamma and alpha scintillation signals, the scintillation performance of all samples was found to be comparable. However, samples containing I<sup>-</sup> ions exhibited a more clearly resolved gamma photopeak than those containing Br<sup>-</sup> ions. Preliminary studied demonstrate that the fabricated glasses are suitable for gamma and alpha detection.



Pulse height spectra of AlGdLiPCe:KX glass under  $\gamma$ -rays excitation from <sup>137</sup>Cs source.

1. Ntarisa, A.V. et al., "Luminescence and scintillation properties of Ce<sup>3+</sup>-doped P<sub>2</sub>O<sub>5</sub>-Li<sub>2</sub>CO<sub>3</sub>-GdBr<sub>3</sub>-Al<sub>2</sub>O<sub>3</sub> glasses," *Non-Cryst. Solids.*, **567**, (2021).
2. Nakabayashi, Y. et al., "Photoluminescence and scintillation properties of Al(PO<sub>3</sub>)<sub>3</sub>-CsPO<sub>3</sub>-CsBr-CeBr<sub>3</sub> glass scintillators," *J. Mater. Sci.: Mater. Electron.*, **33**, (2022).
3. Quang, N.D. et al., "Effects of alkali ions on luminescence and scintillation performance of Ce<sup>3+</sup> doped phosphate glasses for radiation detection," *Ceram. Int.*, **49**, (2023).