Synthesis and elemental analysis of gadolinium halides (GdX_3) in glass matrix for radiation detection applications

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Abstract

Numerous researchers were intrigued to glasses for radiation detection and scintillation applications in nuclear and high-energy physics research. To mitigate the requirements of density and luminescence enhancement, gadolinium (Gd) compounds are widely practiced. Gd halides (GdX_3) are hygroscopic salts that can function as excellent sensitizers in a glass network to improve activator (Ce) luminescence. To ensure the elemental abundance of the constituents in glass samples after high temperature combustion, EDX reports at both the intermediate and final phases of the glass samples can be useful. However, EDX analysis was unable to detect halogens in glass substances in their intermediate and final forms. The implications were examined on the basis of prior literature indicating the feasibility of high temperature combustion in an air environment. Nevertheless, it was discovered that transmittance spectra are essential for the performance of radioluminescence and scintillation features. Two samples that were previously enriched with GdI_3 had transmittance values more than 55% at the X-ray generated emission peak point. α -peaks with an energy resolution (FWHM) of 29% and 31% were obtained utilizing these samples. The scintillation decay projections from these two samples were fitted with three exponential decay components, with the shortest components being 30.6 ns and 29.5 ns, contributing 38% and 37.4%, respectively.

The full text can be found at the following link:

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