

Scintillation and Synchrotron X-ray Tomography Performance of Ce³⁺-Activated Oxyhalide Glass Scintillators

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In this study, the scintillation and synchrotron X-ray tomography performance of Ce³⁺-activated oxyhalide glass scintillators were evaluated. The glasses were synthesized using the melt-quenching method with the composition 20NaCl + 10GdF₃ + 10AlF₃ + 59.5P₂O₅ + 0.5CeF₃. During preparation, the soaking time was varied at intervals of 0, 60, 90, 120, 150, and 180 minutes. The density of the glass ranges from 2.85 to 2.86 g/cm³. Transmission spectra demonstrate that the material is highly transparent, with over 80% transmittance in the visible range and a cutoff wavelength close to 325 nm (3 mm thickness). Photoluminescence (PL) studies showed broad emission bands due to the f-d transitions of Ce³⁺ ions within the glass matrix. The main emission peak appeared between 350 and 365 nm under excitation by Ce³⁺ and Gd³⁺, respectively, with optimal intensity recorded after soaking for 60 minutes with 86% of quantum efficiency. Radioluminescence (RL) measurements verified the scintillation response of all glass samples, revealing spectra similar to those observed in PL. The highest RL intensity was also achieved after 60 minutes of soaking, reaching 53% of SG-101 glass and 52% of BGO crystal. Synchrotron X-ray tomography was carried out with the newly developed glass, producing 3D X-ray images of comparable quality to those obtained using a YAG:Ce scintillator.