

Evaluation of the Spectroscopic Reliability of Lead-Free Cs₃Cu₂I₅ Perovskite Scintillators for Nuclear Medicine

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High radiation detection efficiency is crucial for medical imaging systems to minimize patient exposure and mitigate potential radiation-induced damage. Among various candidates, Cs₃Cu₂I₅ scintillator has emerged as a compelling alternative owing to its high light yield and effective radiation detection efficiency [1, 2]. However, achieving reproducible spectroscopic performance in bulk-scale crystals remains a significant challenge for practical implementation. In this work, a Cs₃Cu₂I₅ single crystal was successfully grown by a vertical Bridgman method to evaluate its suitability for nuclear medicine applications. High-purity CsI (5N) and CuI (4N) powders were stoichiometrically mixed and encapsulated in a double-layered quartz ampoule under a high vacuum of 10⁻⁶ Torr to prevent contamination. The grown Cs₃Cu₂I₅ crystal was subsequently polished using a specialized slurry of silicone oil and alumina powder. For spectroscopic evaluation, the Cs₃Cu₂I₅ crystal was optically coupled to a photomultiplier tube (PMT) biased at -800 V, and irradiated with a ¹³⁷Cs source. The output signals were recorded using a digitizer. The crystal exhibited an energy resolution of 9.8% at 662 keV, demonstrating competitive spectroscopic performance comparable to that of established commercial scintillators such as GAGG, LYSO. These results highlight that Cs₃Cu₂I₅ can hold strong potential for high-resolution gamma-ray detections in nuclear medicine applications. More detailed measurements and analyses will be presented at the conference.

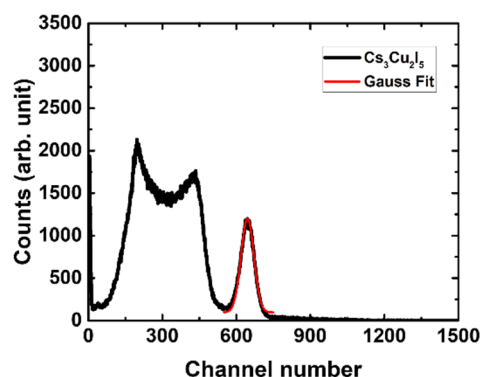


Fig. 1. Energy spectrum of a Cs₃Cu₂I₅ single crystal irradiated by a ¹³⁷Cs source.

References

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