Polymer-Assisted Precursor Spin-Coated Cs-Cu-I Thin Films for Scintillator

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Lead-based halide perovskites have considerable attention as next-generation scintillator candidates due to their highly efficient scintillation performance. However, the toxicity of lead raises significant concerns about its impact on the environment and potential risks to human health. In this study, we investigate Pb-free Cs-Cu-I based compounds which have attracted attention as alternatives to lead-based halide perovskites. To achieve high detection efficiency in scintillators, a large Stokes shift is important to minimize photon loss due to self-absorption. Cs-Cu-I based compounds exhibit a large Stokes shift arising from self-trapped exciton (STE) emission [1]. The STE emission mechanism can mitigate non-radiative loss pathways associated with defects, thereby providing relatively stable emission. Under radiation excitation conditions, high-energy particles or photons generate a high carrier density, which can lead to increased losses during carrier migration and recombination processes. In this regard, STE emission can offer a significant advantage. Moreover, Cs-Cu-I can be processed into thin films via low-temperature, solution-based precursor routes, which is attractive for large-area and low-cost fabrication. In this study, we implemented a precursor-based process to form Cs-Cu-I thin films directly on glass substrates by spin-coating CsI and CuI precursors dissolved in dimethylformamide (DMF) and introduced polymethyl methacrylate (PMMA) as a polymer additive to improve film quality and enhance luminescence efficiency [2]. As a result, polymer-assisted spin coating was found to be an effective strategy for improving crystallization/film uniformity and significantly enhancing the optical emission of Cs-Cu-I thin films, supporting their potential as a Pb-free scintillator thin-film platform.

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2. Wei Zhou, Xiaodie Zhu, Jing Yu, Dedan Mou, Hongxing Li, Lingyu Kong, Tianchun Lang, Lingling Peng, Wenbo Chen, Xuhui Xu, and Bitao Liu, "High-Quality $Cs_3Cu_2I_5$@PMMA Scintillator Films Assisted by Multiprocessing for X-ray Imaging," *ACS Applied Materials & Interfaces*, **15**, 38741-38749 (2023)

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