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The performance of indirect X-ray imaging systems depends on the ability of a scintillator to efficiently convert X-rays into visible light while preserving the spatial distribution of the transmitted radiation. High-resolution imaging therefore requires efficient X-ray absorption and radioluminescence (RL) combined with thin, optically homogeneous scintillation layers. Metal-halide perovskites are promising for this purpose due to their strong X-ray absorption, efficient photoluminescence (PL), and compatibility with solution-based fabrication [1]. In particular, CsPbBr₃ perovskite nanocrystals (PNCs) exhibit a high effective atomic number $Z_{eff} \approx 63.2$ and PL quantum yields approaching 100% [2], while their incorporation into polymer matrices enables the fabrication of thin-film composite scintillators.

In this work, thin-film scintillators based on CsPbBr₃ PNCs embedded in a modified poly(methyl methacrylate) (PMMA) matrix were fabricated and tested for X-ray imaging. Films with thicknesses up to approximately 500 μm were found to be preferable for high-resolution imaging. A dedicated experimental setup was assembled in which the radiographic image was formed by the X-ray shadow of the investigated object projected onto the scintillator surface and converted into visible emission. The image was recorded using a conventional digital camera (Canon EOS R6 Mark II), with an Apogee 5500 Series X-ray tube operated at 50 kV as the radiation source. Using a TYP 39-A test pattern with 0.03-mm-thick lead lines, a spatial resolution of approximately 8-9 lp/mm was achieved at an exposure time of 5-10 s. The thermal stability of both PL and RL intensities was also investigated. Only a minor decrease in emission intensity relative to its initial value was observed after the heating-cooling cycle. Radioluminescence remained detectable even at 445 K, while the relative decline of RL intensity was lower than that of CsI:Tl, BGO and GAGG:Mg,Ce over the investigated temperature range.

Overall, the results demonstrate the potential of CsPbBr₃/polymer thin-film scintillators for high-resolution X-ray imaging using a simple optical readout scheme.

Keywords: scintillators, CsPbBr₃, radioluminescence, X-ray imaging, spatial resolution.

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