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High loading nanocomposites of cesium lead halide nanocrystals for fast timing

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Cesium lead halide nanocrystals are widely studied in many fields for their excellent luminescent properties. Recently, their potential for fast timing applications in radiation detection has been demonstrated. To ensure material stability, these nanocrystals are often embedded into a polymer matrix, forming nanocomposite scintillators. However, most research on nanocomposites focuses on low loadings (around 1 w%)—insufficient for detecting high-energy X-rays or γ-rays, with only a few studies exploring materials with higher loading but with limited success in terms of transparency of the final material. In our work, we present nanocomposites of cesium lead halide nanocrystals with loading up to 40 w%. We employ copolymerizable ligands to enhance nanocrystal dispersion within the matrix, thereby improving the final material transparency. We characterise the radioluminescent properties of nanocomposites of cesium lead bromide and cesium lead bromochloride nanocrystals with varying chloride content and asses their timing capabilities under X-rays. Our findings reveal a significant improvement in time resolution under X-rays compared to previously published values for cesium lead bromide polymer nanocomposites. When combined with increased stopping power of high nanocrystal content, this advancement holds great promise for practical applications in TOF-PET, TOF-CT or high energy physics.

Field

Detectors and electronics

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