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Energy-Transfer Mechanisms in Nd-Containing Perovskite Quantum-Dot Liquid Scintillators for Rare Nuclear Process Detection

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We investigate Nd-containing mixed-halide perovskite quantum dots in organic liquids as candidate scintillation media for rare nuclear processes. Photoluminescence measurements have been completed for twelve compositions based on pseudocumene, dodecane, and syntin, with varying 2,5-diphenyloxazole (PPO) and naphthalene content. Comparative data analysis is ongoing. In the analyzed pseudocumene dilution series, emission maxima lie at 501.5–505.5 nm. Adding PPO at 2 g/L does not enhance quantum-dot emission under the optical excitation conditions studied. Relative suppression increases with dilution, reaching 48.8% in peak intensity and 35.3% in integrated band intensity at a nominal 1:30 dilution compared with the corresponding sample without PPO. Steady-state spectra alone cannot distinguish absorption losses from changes in energy transfer and nonradiative decay. Further absorption and fluorescence-decay measurements are planned to examine energy transfer between the solvent, organic additives, and quantum dots. Scintillation performance will be assessed independently using ^{137}Cs , with relative light yield evaluated from the Compton edge near 477 keV in a fixed geometry, accounting for photodetector spectral sensitivity. The detector concept combines neodymium incorporation and scintillation in the same active volume. Potential applications, subject to scintillation and stability validation, include detectors for ^{150}Nd double-beta-decay studies, neutrino experiments, and gamma-ray spectroscopy. Keywords: liquid scintillator; perovskite quantum dots; neodymium; energy transfer; photoluminescence; double-beta decay; gamma-ray detection.

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