

Strong Coupling in Bulk Nanoplasmonic Nanoplatelet Perovskite Scintillators

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Streszczenie

Control of light emission underpins photonics and radiation detection. Strong coupling between excitons and confined electromagnetic modes forms light-matter states known as polaritons, enabling emission control. In scintillators, such effects have been investigated mainly in nanoscale architectures under optical excitation, limiting their relevance to bulk materials under ionizing radiation. Here, we demonstrate exciton-plasmon strong coupling in macroscopic CsPbBr₃ nanoplatelet/Ag nanocube-PDMS composites under optical and X-ray excitation. Nanocube-size engineering and temperature tuning control detuning, producing spectral splitting and mode anticrossing for the 85 and 80 nm composites. Collective coupling strengths of about 90 and 98 meV exceed strong-coupling thresholds, showing that hybridization remains observable in a bulk composite under X-ray excitation. The average decay time shortens by up to (6.58 ± 0.88) times. Following X-ray irradiation, the same strongly coupled composites exhibit prolonged emission with average decay times of about 37 and 33 s, whereas this component is absent in the unresolved 75 nm composite and bare NPL reference. Spatially averaged electrodynamic analysis indicates that isolated-CNP multilayer configurations cannot fully account for the collective interaction, highlighting the importance of strongly weighted local plasmonic environments. These results establish nanoscale plasmonic architecture as an additional design parameter for bulk scintillators.

Słowa kluczowe

nanoplatelets, scintillators, strong coupling

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