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第322回 未来化学創造センターセミナー



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Strategic dopant-engineered Halide Perovskite nanocrystals for optoelectronic applications

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Colloidal CsPbBr₃ perovskite nanocrystals (NCs) are promising candidates for optoelectronics and quantum photonics. In particular, Zn-alloyed NCs synthesised using ZnBr₂ demonstrate exceptional potential as single-photon sources (SPS), offering enhanced photostability, near-unity photoluminescence quantum yield, and significantly reduced blinking. Single-particle photoluminescence and transient absorption spectroscopy reveal improved single-photon purity and suppressed multiphoton emission via accelerated Auger recombination. Complementary studies on Ag and Bi doping highlight further advancements in optoelectronic properties, with Ag/Bi co-doped NCs exhibiting enhanced charge transfer, reduced trap states, and up to ~900% improvement in photodetector performance. Femtosecond transient absorption spectroscopy confirms prolonged hot carrier relaxation and phonon lifetimes, supporting efficient charge transport. Together, these works establish a powerful doping/alloying framework that tunes carrier dynamics, emission characteristics, and device functionality. This integrated strategy not only advances the design of efficient photodetectors but also significantly strengthens the practical viability of perovskite-based single-photon sources for quantum technology applications.

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