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Temperature-Dependent Photoluminescence of Mn Doped CsPbCl₃ Perovskite Nanocrystals in Mesoporous Silica

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ABSTRACT

Highly luminescent Mn doped perovskite nanocrystals (NCs) are promising in solid state lighting. The thermal stability of Mn²⁺ luminescence in Mn:CsPbCl₃ NC/mesoporous silica (MPS) composites was studied at temperature ranging from 80 K to 450 K by steady-state and time-resolved photoluminescence (PL) spectroscopy. The Mn:CsPbCl₃ NCs with various Mn doping concentrations were synthesized by changing the Mn/Pb molar ratios at 190 °C. It was found that the Mn doped NC films showed a more significant decrease in PL intensities and lifetimes at high temperature above 320 K than the Mn doped NC/MPS films, indicating that the Mn²⁺ luminescence in doped NC/MPS films exhibited better thermal stability than that of NC films. Further the broadening and shifts of Mn²⁺ emission bands in doped NC and NC/MPS films were observed at elevated temperature. The temperature-dependent linewidths of Mn²⁺ emission bands were discussed by electron-phonon coupling.

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