Synthesis, optical and fluorescence properties of Mn-doped ZnS Quantum Dots

Authors

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Abstract

ZnS and 3 wt% Mn:ZnS QDs were prepared by the hydrothermal method. The samples were characterized by XRD, FT-IR, SEM, TEM, EDX, UV-Vis spectroscopy, and photoluminescence (PL). The UV-Vis spectroscopy data showed that the peaks of the prepared ZnS and Mn:ZnS samples display a hypsochromic shift compared to that of the bulk ZnS. The calculated band-gap energy values of the ZnS and Mn:ZnS QDs are found to be 4.85 and 4.3 eV, respectively, and larger than that of bulk ZnS (3.68 eV) owing to strong quantum confinement. The calculated particle sizes from bandgap energies are found to be 1.8 nm and 1.7 nm for ZnS and Mn:ZnS, respectively. The PL measurements showed that the emission intensity of ZnS QDs increased by Mn^{2+} doping. The fluorescence quantum yield (FLQY) of ZnS and 3 wt% Mn:ZnS QDs is found to be 0.86 and 0.85, respectively. The incident photon-to-electron conversion efficiency (IPCE) measurement was performed to investigate the photovoltaic properties of ZnS and 3 wt% Mn: ZnS QDs. At 370 nm, the measured IPCE (%) values are found to be 1.2 % and 2.1 % for ZnS and Mn:ZnS, respectively, suggesting that the Mn^{2+} dopant enhances the optical properties of the host crystal (ZnS QDs).

Keywords

Quantum dots, ZnS, Mn: ZnS, IPCE (%)