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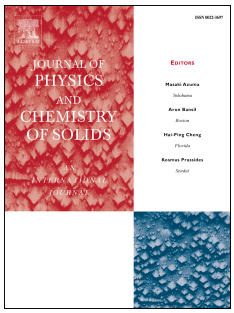

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Structural, photoluminescence and magnetic properties of Mn, Cr dual-doped ZnS quantum dots: Influence of Cr concentration

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Abstract

Mn-doped ZnS and Mn, Cr dual-doped ZnS quantum dots were prepared using a simple co-precipitation method. The synthesized samples were analyzed by X-ray diffraction (XRD), transmission electron microscopy (TEM), energy dispersive X-rays (EDX), scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), UV–visible spectroscopy, photoluminescence (PL) spectra and vibrating sample magnetometer (VSM). Cr doping reduced the crystallite size. The reduction of activation energy due to the incorporation of Cr is responsible for the increase of micro-strain and the suppression of crystallite size. The change in lattice parameters by Cr doping is attributed to the replacement of Cr^{3+}/Cr^{2+} ions instead of Zn^{2+} ions in the ZnS host lattice. Doping concentration of the samples was confirmed by energy dispersive X-ray (EDX) spectra. Occurrence of higher intensity in absorption and a shift in absorption edge towards the lower angle side were supported by the proper substitution of Cr^{2+} ions instead of Zn^{2+} ions in the ZnS host. The diminishment of absorption intensity for Cr doping beyond 2% can be ascribed to defect states caused by imperfections in the lattice structure due to the different sizes of $Cr^{2+/3+}$, Mn^{2+} and Zn^{2+}. When Cr is introduced into the Zn-Mn-S assembly, a shift in UV emission is observed from 392 nm to 379 nm for Cr = 2% and 382 nm for Cr = 4%; these peak shifts