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Analysis of the structure, particle morphology and photoluminescent properties of ZnS:Mn^{2+} nanoparticulate phosphors

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ABSTRACT:

The structure, particle morphology and photoluminescent properties of n^{2+} doped ZnS nanoparticles are reported. The X-ray powder diffraction studies showed that incorporation of Mn^{2+} did not cause any change to the crystallized cubic (sphalerite) phase of ZnS but it reduced crystallinity due to increased incoherent scattering resulting in increased broadening of the diffraction peaks. The average crystallite size calculated from the broadening of the X-ray diffraction peaks using Scherrer equation was $\sim$2 nm implying that our particles were highly quantum confined. The field emission scanning electron microscopy data confirmed that the undoped ZnS powders consisted mainly of an agglomeration of spherical particles while the Mn^{2+} doped powders consistent of particles with irregular shapes. The photoluminescence spectroscopy showed simultaneous blue and orange emissions associated with radiative transitions in ZnS and Mn^{2+} respectively. Postulated mechanism of this dual emission is discussed.