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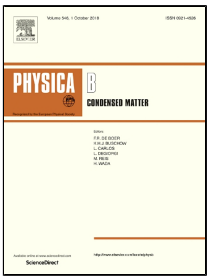

Microstructural, optical, magnetic and photocatalytic properties of Mn doped ZnO nanocrystals of different sizes

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Microstructural, optical, magnetic and photocatalytic properties of Mn doped ZnO nanocrystals of different sizes

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Abstract

The present work explores the differences in the various properties of Mn doped ZnO nanocrystals when the sizes of the doped nanocrystals are significantly different. Mn doped ZnO nanocrystals of sizes ≈ 20 nm and ≈ 5 nm were synthesized by the chemical co-precipitation method. The targeted Mn doping concentrations were 2%, 6% and 10% (atomic), however, the observed doping concentrations were low (≈ 0.5%, ≈ 1% and ≈ 2%). The microstructural, morphological, optical and magnetic properties as well as the photocatalytic activities of the nanocrystals were investigated. The variations of the lattice strain and lattice volume with increasing Mn concentrations were found to be correlated. The un-doped and Mn doped ZnO nanocrystals were found to be ferromagnetic at room temperature. Variation of band gap with increasing Mn concentrations was observed. Significant/insignificant quenching of the photoluminescence emissions was observed for sizes ≈ 20 nm/≈ 5 nm after doping. The saturation magnetization was found to depend on the Mn concentrations as well as on the nanocrystal sizes. Agglomerated Mn^{2+} resulted in a decrease in saturation magnetization of the ≈ 2% Mn doped nanocrystals of sizes ≈ 5 nm. Correlation between the photoluminescence properties and photocatalytic activities was observed.