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A novel recipe to improve the magnetic properties of Mn doped CeO₂ as a room temperature ferromagnetic diluted metal oxide

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Abstract

Mn doped ceria nanocrystals have been prepared using hexamethylene triperoxide diamine assisted solvothermal technique for the first time. The impact of this novel recipe on the structure, magnetic and spectroscopic behaviors was discussed. The doped oxides were studied using X-ray powder diffraction (XRD), transmission electron microscopy, X-ray photoelectron spectroscopy (XPS), and magnetic measurements. The XRD analysis revealed that all the powders can be indexed to the pure cubic ceria, revealing complete solubility of Mn atoms in the ceria crystal structure with an interstitial substitution of Mn in the Ce sites. At the percolation concentration $x=0.08$ (Mn_{0.08}Ce_{0.92}O₂), the Mn doped cerium oxide displays a very high saturation magnetization of 448 emu/g and coercivity of 175.5 Oe. The enhanced magnetic properties are attributed to the formation of the complex between the Mn ion and an oxygen vacancy which is confirmed by the XPS analysis. According to the obtained results, one can say that this novel synthetic recipe increased the solubility of Mn ions into the CeO₂ crystal structure and improved the magnetization by more than 37 times compared to the Mn doped CeO₂ prepared by conventional methods. (C) 2014 Elsevier BY. All rights reserved.

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