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Structure and magnetic properties of Mn-doped CeO₂ nanostructures prepared by egg-white solution route

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Ce_{1-x}Mn_xO₂ ($x = 0.05, 0.075$ and 0.1) nanoparticles were synthesized by simple solution method using cerium(III) nitrate hexahydrate manganese (II) nitrate hydrate (Mn(NO₃)₂·H₂O) and freshly extract egg white (ovalbumin) in an aqueous medium. The precursors were calcined at 600 °C for 2 h in air. The nanoparticles were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and X-ray absorption near edge structure (XANES) techniques. The XRD results indicated the presence of a cubic structure of Ce_{1-x}Mn_xO₂ in all samples. The SEM and TEM images showed thin platelike clusters with the particle sizes \approx 20-40 nm. The oxidation states of Mn and Ce K-edge in samples were confirmed by X-ray absorption near edge structure (XANES) technique. The magnetic properties were studied by a vibrating sample magnetometer (VSM). All samples exhibit superparamagnetism behavior. The saturation magnetization (M_S) of Ce_{1-x}Mn_xO₂ ($x = 0.05, 0.075$ and 0.1) nanoparticles increase from 0.00003 to 0.00035 emu/g with increasing Mn content. The origin of the magnetic properties observed in the prepared Ce_{1-x}Mn_xO₂ nanoparticles is discussed.

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