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Ferromagnetism in annealed ce0-95Co0-05O2 and Ce0-95Ni0-05O2 nanoparticles

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Abstract

This paper reports an investigation on the role of transition-metal ions in producing ferromagnetism in CeO2 nanoparticles by electron paramagnetic resonancePR). Several samples of CeO2 nanoparticles annealed at 200, 300, 400, and 500C, doped with 5% Ni and 5% Co ions, characterized by X-ray diffractionRD), X-ray photoelectron spectroscopyPS), thermogravimetry analysisGA) and mass spectroscopyS), were investigated by X-band EPR at 4, 10 and 300 K, and by magnetometry at 300 K. Magnetic properties and EPR/FMRerromagnetic Resonance) spectra of these nanoparticle samples were found to depend strongly on the annealing temperatureA), oxygen stoichiometry, and dopant-ion species. Different behavior of saturation magnetization in the samples with the dopants, Co and Ni, is found to be due to different-inward and outward-surface diffusion of these impurity ions, respectively, during annealing. A detailed simulation of EPR/FMR spectra of isolated Co and Ni ions carried out here provides in-depth details on the role of the doped ions and oxygen? defects played in the observed magnetic properties.

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Keywords

CeO2 Nanoparticles, Ferromagnetism, Magnetic Properties., Spectroscopy