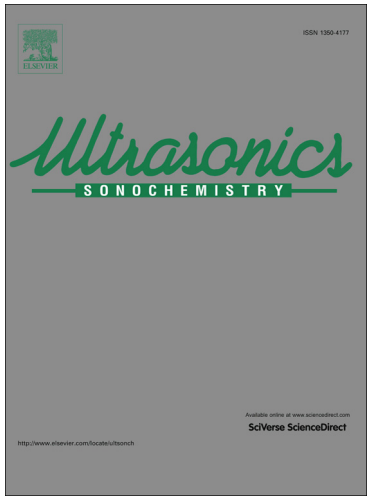

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Sonochemical Synthesis of Gd^{3+} doped $CoFe_2O_4$ Spinel Ferrite Nanoparticles and Its Physical Properties

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Abstract

In this work, a facile and green method for gadolinium doped cobalt ferrite ($CoFe_{2-x}Gd_xO_4$; x=0.00, 0.05, 0.10, 0.15, 0.20) nanoparticles by using ultrasonic irradiation was reported. The impact of Gd^{3+} substitution on the structural, magnetic, dielectric and electrical properties of cobalt ferrite nanoparticles was evaluated. The sonochemically synthesized spinel ferrite nanoparticles were characterized by X-ray Diffraction (XRD), scanning electron microscopy (SEM), Raman spectroscopy, Fourier transform infrared (FTIR) spectroscopy, X-ray photoelectron spectroscopy (XPS), vibrating sample magnetometer (VSM). X-ray diffraction (XRD) study confirmed the formation of single phase spinel ferrite of $CoFe_{2-x}Gd_xO_4$ nanoparticles. XRD results also revealed that ultrasonic irradiation seems to be favourable to achieve highly crystalline single crystal phase gadolinium doped cobalt ferrite nanoparticles without any post annealing process. Fourier Transform Infrared and Raman Spectra confirmed the formation of spinel ferrite crystal structure. X-ray photoelectron spectroscopy revealed the impact of Gd^{3+} substitution in $CoFe_2O_4$ nanoparticles on cation distribution at the tetrahedral and octahedral site in spinel ferrite crystal system. The electrical properties showed that the Gd^{3+} doped cobalt ferrite ($CoFe_{2-x}Gd_xO_4$; x= 0.20) exhibit enhanced