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Study the effect of annealing temperature on structural and magnetic properties of $\text{Ni}_{0.3}\text{Cd}_{0.7}\text{Fe}_2\text{O}_4$ ferrite nanoparticles

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Abstract

In this investigation nickel-cadmium ferrite nanoparticle with stoichiometric composition of $\text{Ni}_{0.3}\text{Cd}_{0.7}\text{Fe}_2\text{O}_4$ was synthesized by Sol-gel auto-combustion method. In order to study the effect of particle size on physical properties of samples, the powder samples were annealed at temperatures 350, 400, 450 and 500°C for 3h. Structural, morphological and magnetic properties of samples were analyzed using X-ray diffraction (XRD), field emission scanning electron microscope (FESEM), vibrating sample magnetometer (VSM) and ac susceptibility. XRD data revealed spinel mono-phase formation and crystalline size was estimated in the range of 17- 35 nm, using sherrer's equation, which also confirmed by FESEM. The VSM results indicate that magnetization increases by increasing particle size. Using the results of ac susceptibility measurements and analysis by the Neel- Brown, Vogel-Fulcher and critical slowing down methods, indicates that the samples annealed at temperatures of 350 and 400°C are super-paramagnet at room temperature and have super-spin glass behavior at low temperatures.

Keywords: nanoparticle, ferrite, super-paramagnetic, super-spin glass

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