ULTRAFINE $Co_{1-x}Zn_xFe_2O_4$ PARTICLES SYNTHESIZED BY HYDROLYSIS: EFFECT OF THERMAL TREATMENT AND ITS RELATIONSHIP WITH MAGNETIC PROPERTIES

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Zinc-substituted cobalt ferrite powders, $Co_{1-x}Zn_xFe_2O_4$ (x = 0, 0.2 and 0.4), were for first time prepared by forced hydrolysis method. This method allowed us to produce ultrafine particles with thin disordered surface layer. High-resolution TEM and X-ray diffraction experiments show that the average grain size of these ferrites is 3 nm. The substitution of Co by Zn atoms causes an increase in the saturation magnetization, while these ultrafine powders of ferrites are in the ferrimagnetic state, with a blocking temperature T_B lower than room temperature. At $T > T_B$ all samples are superparamagnetic. With a heat treatment of the samples at 500 °C for 3 hours, the average particle size increased to ~ 7 –12 nm. The blocking temperature became higher than room temperature and an increase in coercive field was found at 4.2 K. Additionally, we obtained higher saturation magnetization values than those of the as-produced samples suggesting a decrease of the disordered surface layer with thermal treatment.

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