Nanocomposites and nanomaterials

Preparation and crystal structure of nanosize nickel-substituted cobalt ferrites

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Magnetic ferrite nanoparticles with spinel structure are under intensive research during last years due to their interesting physical properties that can be utilized in various applications, as magnetic recording or biomedicine [1]. Because of the wide range of possible applications, the requirements on magnetic properties are imposed, namely on the blocking temperature, coercivity and saturation magnetization. The $CoFe_2O_4$ nanoparticles are mainly highly attractive due to large coercivity with moderate saturation magnetization (80 $A \cdot m^2 \cdot kg^{-1}$) [2], remarkable chemical stability and mechanical hardness. On the other hand the $NiFe_2O_4$ is a soft magnetic material with low coercivity and saturation magnetization. By combining these two materials, a smooth variation of magnetic properties can be well achieved.

The present work deals with the synthesis and study of nanoparticles of $Ni_xCo_{1-x}Fe_2O_4$ (where $x = 0.0, 0.1, 0.2, 0.3, 0.4, 0.5$) by sol-gel method with participation of auto-combustion [3]. After completing the process auto-combustion was obtained only one phase, which corresponded to the cubic structure of spinel space group Fd3m. It was found that the average size of coherent scattering regions not exceeding 62 nm. The dependences of the lattice parameter, X-ray density and specific surface area of the ferrite powders from nickel content were found. It was shown that at substitution of cations cobalt on cations nickel latest give preference only *B* positions, thus displacing part of Fe^{3+} in the *A* positions.

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