

# THE SYNTHESIS AND CHARACTERIZATION OF NICKEL AND COBALT FERRITE NANOPOWDERS

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The materials of ferrites especially nickel and cobalt ferrites are popular with their unique ceramic and magnetic properties. Currently the involvement of ferrite nanomaterials and nanopowders in life sciences, biochemical processes (magnetic liquids, hyperthermia etc.) and coating technologies with polymers are very outstanding.

The studied nanopowders of ferrites are obtained by the chemical sol-gel self-combustion method and by the high frequency plasma chemical synthesis. In sol-gel method the disperse Co and Ni ferrites are obtained from the appropriate metal nitrate salt solutions of stoichiometric ratio. Glycine (Gly) is used as the self-combustion agent with molar ratio Me/Gly = 1:0,8 and Gly/Nitr. = 1:4. The high frequency plasma synthesis of the nanosized materials is based on vaporization of metal oxides in the plasma and very fast cooling of the vapor, resulting in nanosized ferrite particles.

Synthesized ferrites are analyzed by X-ray diffraction method and the phase content and the crystallite size is determined (using Scherer equation) for all samples. In all cases there is found single phase materials without additional phases (commonly magnetite, maghemite, hematite or other metal oxides).

Nanopowders synthesized in the high frequency plasma are of specific surface area 28 – 30 m<sup>2</sup>/g (the average particle size 38 – 40 nm, crystallite size ~40 nm). The ferrite nanopowders obtained by sol-gel self-combustion method have the specific surface area of 35 – 40 m<sup>2</sup>/g (average particle size 30 - 35 nm, crystallite size ~20 nm).

The magnetic properties of nanopowders obtained by the high frequency plasma synthesis are next: for nickel ferrite saturation magnetization  $M_S=44,2$  emu/g, remanent magnetization  $M_r=10,0$  emu/g, coercivity  $H_c=74$  Oe, for cobalt ferrite  $M_S=75,4$  emu/g,  $M_r=32,0$  emu/g,  $H_c=780$  Oe. The magnetic saturation values of these samples are very close to the values of the standard bulk material. This one proves the high purity of the samples. However the magnetic properties of the samples obtained with sol-gel self-combustion method differ from which the plasma products have. In this case we have for nickel ferrite  $M_S=29,0$  emu/g,  $M_r=6,0$  emu/g,  $H_c=140$ , for cobalt ferrite  $M_S=53,4$  emu/g,  $M_r=20,3$  emu/g,  $H_c=1170$ . Probably, it is connected with the particle size.

Also the results on properties of compacted materials from the obtained nanopowders are reviewed.

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