NGR Investigations of Nanosized Powder of Magnetite

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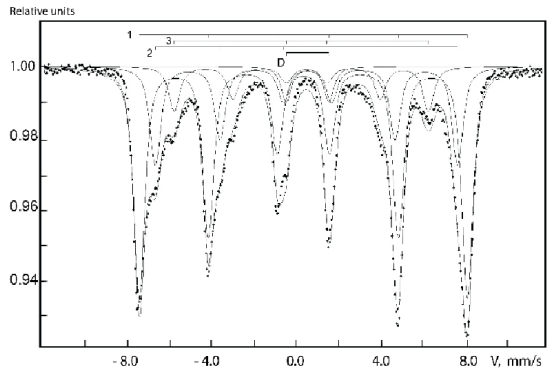
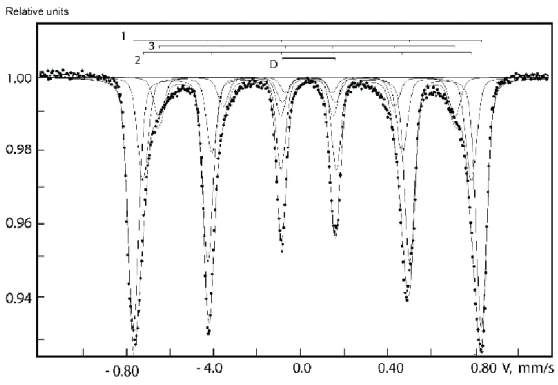
The fine powder of magnetite Fe_3O_4 was obtained by deposition of aqueous solutions of chemically pure More's salt - $Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$ and $FeCl_3$ to pH = 8.0 using concentrated NH_4OH. The fine powders with the particle size from 5 to 25 nm were obtained. Some portions of powders were subjected to heat treatment in air at temperatures of 473, 573 and 673 K.

The NGR spectrum of Fe_3O_4 without annealing measured at room temperature in its appearance corresponds to non-stoichiometric magnetite (Fig.1). In the spectrum of this sample for the octahedral and tetrahedral iron ions correspond to sextets with parameter of pure magnetite but these sextets differ of their intensities ratio.



This spectrum was laid out on three sextets and one doublet. The sextet 1 refers to the Fe^{3+} ions which are in tetrahedral positions. The sextet 2 corresponds to ions (Fe^{2+} + Fe^{3+}) which are in oxygen octahedral. The intensities of the first and the second sextet differ and are respectively 57.41% and 24.35%.

Fig. 2 shows the NGR spectrum of annealed sample in air at T = 673 K. Compared with the spectrum of not annealing powder the structure of resonance lines is disappeared and their total width is decreased. With the increasing of annealing temperature of nanopowder magnetite in the air, the values of H_{eff} for all sextets increase due to the oxidation of the iron ions and transformation the magnetite ferrite to γ-Fe_2O_3.



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