MAGNETIC PROPERTIES OF FERROFLUID WITH COBALT FERRITE PARTICLES

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9.7 cm

In this paper the magnetic fluid, composed of nano-sized cobalt ferrite particles dispersed in a hydrocarbon, has been studied at low temperatures by Mössbauer spectrometry as well as conventional magnetic methods. Due to the distribution of particle sizes, the observed Mössbauer spectra are composed of a magnetically split component superimposed on a central paramagnetic doublet. For temperatures exceeding 100 K a sharp asymmetric doublet dominates and reveals the strong superparamagnetic behaviour of cobalt ferrite particles whereas at lower temperatures the magnetically split component becomes more important. This component is composed of at least two main hyperfine sextets corresponding to two nonequivalent Fe-sites in the crystal lattice. The intensity of the magnetic component increases rapidly with decreasing temperature indicating the suppression of the superparamagnetic relaxation in single domain particles and the blocking of their magnetic moments. For the ferrofluid studied, the temperature at which 50% of the total volume of particles is blocked is about 80 K. In this paper the mean particle diameter as well as the distribution of the particle sizes are estimated from the isothermal magnetization curves (measured by means of the VSM) applying the Langevin formalism and assuming a log-normal distribution function. The complex Mössbauer and magnetic studies performed here enables one to estimate the effective anisotropy constant of the cobalt ferrite ultrafine particles and also to discuss the role of the surface effects in the granular system with high surface to volume ratio.

13.4 cm

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