Crystallization and magnetic behavior of nanosized nickel ferrite prepared by citrate precursor method - DTU Orbit (17/12/2018)

Crystallization and magnetic behavior of nanosized nickel ferrite prepared by citrate precursor method
NiFe2O4 nanoparticles have been synthesized by citrate precursor gel formation with subsequent heat treatment. Differential thermal and thermogravimetric (DTA/TG) analyses show that the metal citrates decomposed around 230°C followed by crystallization of the ferrite. X-ray diffraction (XRD) patterns reveal the formation of the cubic spinel phase in the samples after sintering the gel at 350°C, 500°C and 700°C. For the samples annealed at 350°C and 500°C a small amount of α-Fe2O3 was detected whereas single phase was obtained for the sample annealed at 700°C. The lattice constant a for all the samples is comparable to the value of the bulk material. The mean crystallite size DXRD of the samples determined from XRD line broadening is 26.2-28.5 nm. Transmission electron microscope (TEM) analysis shows that the single-phase particles form clusters with the particle size in the range of 21-82.5 nm and the most probable value DTEM of 55.4 nm. Magnetic measurements show that its Curie temperature TC is close to the bulk value while the spontaneous magnetization Ms at 5 K is lower than that of the bulk. The thermal variation of Ms in the temperature range from 5 to 300 K can be best fitted to a modified Bloch Tα law with the exponent value α ≈ 2. The magnetization data are explained with reference to the disordered surface spins and the finite size effects. In this investigated temperature range, the coercive force Hc decreases linearly with increasing temperature. The coercivity mechanism in the nanoparticle sample with broad particle size distribution is expected to be complex and different factors which affect the Hc value were proposed. [All rights reserved Elsevier].

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