SURFACE EFFECTS IN HIGHLY ANISOTROPIC CRYSTALS

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9.7 cm

The influence of the crystal open surface leads to the formation of a near-surface layer with a magnetic structure differing from that in the bulk. For small particles such a nonuniformity governs the features of macroscopic magnetic properties. With the help of the Mössbauer spectroscopy and studies of magnetic properties of the highly anisotropic barium hexaferrite, a near-surface layer thickness with the "canted" magnetic structure, and a change of the nonuniformity extent of the particle magnetic structure as a function of temperature are found. At 300 K the layer thickness does not exceed 10 nm and hence for the plate-like patricles with $h \approx 10$ nm the magnetic structure is perturbed in the whole bulk. The studies of the effective magnetic anisotropy of the nanocrystal powder enabled of estimation the "surface" anisotropy constant, K_s, and the relative volume of the near-surface region, V_s/V of particles with diameters of 20 - 140 nm in the temperature interval 300 - 730 K. Actually, for particles with d=60 nm, when temperature changes from 300 to 600 K, the V_s/V ratio increases by 50 to 75%. When approaching to the Curie temperature, the near-surface thickness increases sharply and within 3 K of T_C equals 200 nm. So, even for the highly anisotropic ferrimagnet at high temperatures the nanometric particles in the whole bulk exhibit properties inherent in the near-surface layer of the crystal.

13.4 cm

Subject category :

2. Magnetic Films, Surfaces and Multilayers

Presentation mode :
poster

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