Nanocomposites and nanomaterials

Organo-thermal synthesis thin films of magnetite

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Magnetite (Fe_3O_4) is a promising candidate for functional spintronics devices that operate at room temperature, because it has high Curie temperature ($T_c \approx$ 860K) and is theoretically predicted to be a half-metal with 100% spin polarization [1,2].

The original method of synthesis of magnetite thin films on different substrates (glass, polycrystalline Al_2O_3 and mica) was developed. Metallic iron was sputtered on cleared substrates by an electron beam method. After sputtering one part of films of metallic iron was oxidized to ferric iron state with formation of hematite Fe_2O_3. The samples of films of metallic iron and hematite were processed at organo-thermal conditions in hermetic autoclaves in presence an ethyl spirit and acetone at a temperature 670 K during 20-22 hours. Thus in the certain oxidation-reduction conditions there was complete oxidization of metallic iron or hematite with formation of magnetite. It is confirmed results of x-ray diffraction analysis.

Ferromagnetic resonance (FMR) studies of the films were performed at the X-band (9.5 GHz) at room temperature. FMR spectra of Fe_2O_3 films were studied for different orientation of DC magnetic field with perpendicular to the film plane and in-plane geometry. The out-of-plane angular dependence of resonance field of polycrystalline films show main role of the shape anisotropy and magnetization are in-plane. The in-plane measurements of polycrystalline films exhibit in-plane magneto isotropy.

1. *Yanase A. and Siratori K.* Band Structure in the High Temperature Phase of Fe3O4 // J. Phys. Soc. Jpn.–1984.-**53**.-P. 312-317.
2. *Zhang Z. and Satpathy S.* Electron states, magnetism, and the Verwey transition in magnetite // Phys. Rev. B.-1991.-**44**.-P. 13319-13331.