COMPUTER ANALYSIS OF INNER FIELD INFLUENCE ON MAGNETIZATION CURVES OF GRANULAR NANOSTRUCTURES

Chekrygina Iu.I., Shipkova I.G.
National technical university «Kharkov polytechnic institute», Kharkov

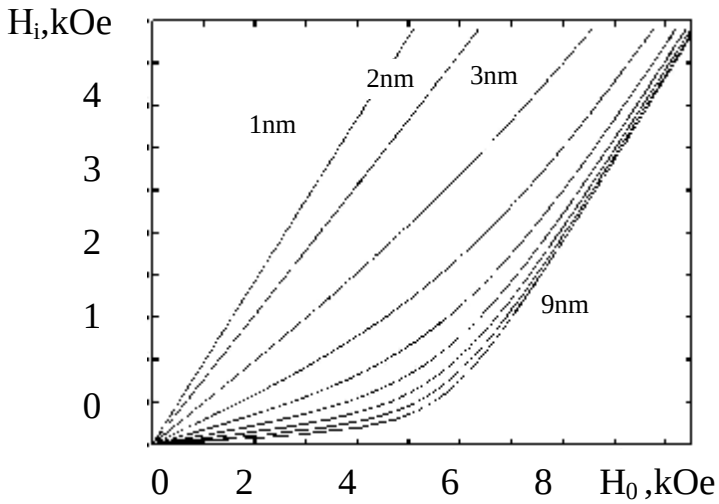
Granular magnetic nanostructures of metal-insulator type are promising material for spintronics devices based on the tunnel magnetoresistance effect (TMR). TMR field dependence is connected with sample magnetization curve. Magnetization processes are caused by changes of the inner fields depending on the size, shape, content of granules, etc. Mathematical description of the inner field in granular structures is an open problem nowadays and it needs to be proved out in the experimental stage.

In this work we have carried out the fitting of magnetization curves of spherical noninteracting superparamagnetic particles using the Matlab system. We apply the inner field definition approach [1] taking into account both the sample demagnetizing fields and the individual granule one:

$$H_i = H_0 - \frac{4p}{3}(1-f)M_S L(vM_S H_i / kT),$$

where f is the granule volume content, M_S is the saturation magnetization of granule, L is the Langevin function, v is the granule volume.

The dependences of inner field H_i on applied magnetic field H_0 for granules with different sizes that were in accord with the superparamagnetic state condition were calculated (see Figure). The calculated magnetization curves were compared with the experimental ones measured by vibrating magnetometer for Co-SiO_2, CoFeZr-Al_2O_3 nanostructures. It was shown that some correction of individual granule demagnetizing field should be done towards its decreasing to satisfactorily fit both curves .



Literature: 1.Kakazei G. et al. J.Appl.Phys., v. 85. (1999), p.5654.