Nanocomposites and nanomaterials

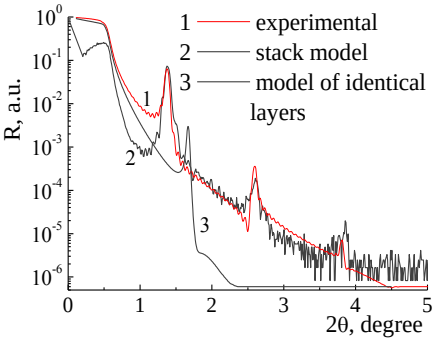
Modeling inner structure of multilayer granular nanosystems

I.G. Shipkova, Iu.I. Veretennikova, A.Yu. Devizenko, E.A. Zhelunitsina

Department of Physics of Metals and Semiconductors, National Thechnical University "Kharkiv Polytechnic Institute". Kirpichov St., 2, Kharkiv-61002, Ukraine.
E-mail: ship@kpi.kharkov.ua

Multilayer nanosystems consisting of granular magnetic layers separated by nonmagnetic interlayers can reveal high resistivity along with low coercivity provided magnetic phase concentration is near percolation threshold. The optimal combination of above mentioned physical characteristics may be obtained varying thickness of layers and interlayers. Control of inner structure parameters is very important task in process of development of such new materials. In this work we review the possibilities of glance angle X-Ray diffraction method (GAXRD) for finding magnetic phase concentration in individual layers as well as layer thickness distribution in multilayer composite systems.

We studied the multilayer systems composed of $n = 60$ $(Co_{41}Fe_{39}B_{20})_x$- $(SiO_2)_{100-x}$ magnetic layers of 35 – 45 Å thickness separated by SiC interlayers of the same thickness. Concentration of magnetic phase in composite layers was in the range of x = 24 – 55 vol.%. For modeling GAXRD experimental spectra (see Fig., line1) we used commercial X-Ray Calc software [1]. Due to fitting results it was found that inner structure of samples under investigations differs from expected one (Fig., line 3) and can be described as combination of bilayer stacks that vary in magnetic phase concentration.



Layer number	Material	t, Å	ρ, g/cm^3
1	SiO_2	3	2.5
20	SiC	27	2.5
	FeCoB-SiO_2	43	5
20	SiC	27	2.5
	FeCoB-SiO_2	43	3
20	SiC	27	2.5
	FeCoB-SiO_2	43	3.5

1. *http://sci-progs.com*