Structure and magnetic properties of Tb-Co/Ti and Tb-Co/Al₂O₃ multilayers

A.V. Svalov[1], V.O. Vas'kovskiy[2], V.N. Lepalovskij[1], A. Larrañaga[3], G.V. Kurlyandskaya[2,4]

[1]Department of Solid State Magnetism, Institute of Natural Sciences and Mathematics, Ural Federal University, Ekaterinburg, Russia

[2]Department of Magnetism and Magnetic Nanomaterials, Ural Federal University, Ekaterinburg, Russia

[3]SGIker, Servicios Generales de Investigación, Universidad del País Vasco (UPV/EHU), Bilbao, Spain

[4]Departamento de Electricidad y Electrónica, Universidad del País Vasco (UPV/EHU), Bilbao, Spain

Rare-earth–transition-metal (RE-TM) thin films and multi-layered structures are of special interest for their implementation in novel high-density and high-speed magnetic recording technologies [1]. At the same time, very limited data are available concerning the thickness dependence of magnetic properties for RE-TM films [2]. In this work, the influence of the thickness of the ferrimagnetic Tb-Co layers on the magnetic properties of Tb-Co/Ti and Tb-Co/Al₂O₃ multilayers was studied.

Multilayers were prepared by magnetron sputtering deposition onto Si and glass substrates. The thickness of the Tb-Co layers was varied in the interval of 12 to 0.8 nm. The thickness of Ti and Al₂O₃ spacers was kept constant (2 nm). The composition of Tb-Co(200 nm) reference thick films was about 19 at.% Tb, so that the compensation temperature (T_{comp}) was about 200 K (Fig. 1,a). The presence of the Bragg peaks in the diffractograms of the samples even with the thinnest Tb-Co layers demonstrates the existence of a well-defined layered structure in all cases under consideration (Fig. 1,b).

It was found, among the other results that the compensation temperature and Curie temperature of the multilayers depend on magnetic layer thickness and material of the spacers. The possible effects of the Tb-Co layer thickness and spacer material on magnetic properties of Tb-Co multilayers are discussed.
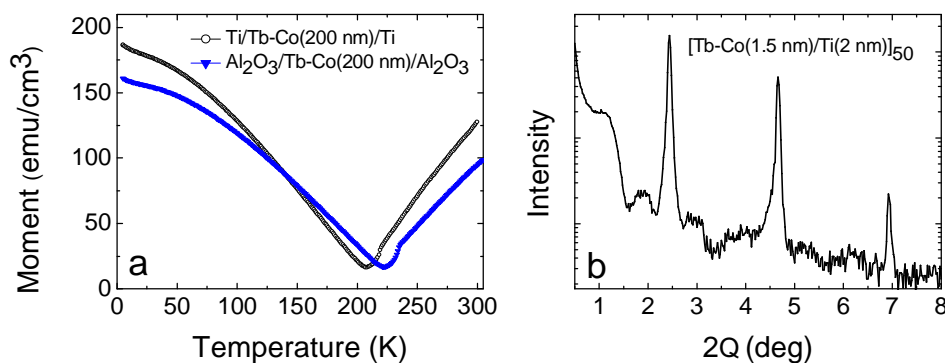
Figure 1. M(T) curves (a) and low angle X-ray diffraction (b) for different samples.

[1] A. Kirilyuk, A.V. Kimel, Th. Rasing, Rev. Mod. Phys., 82 (2010) 2731-2784.
[2] B. Hebler, A. Hassdenteufel, P.Reinhardt, H. Karl, M. Albrecht, Front. Mater. 3:8 (2016) 1-8.