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MAGNETIC HYSTERESIS PROPERTIES OF Tb-Co MULTILAYERED FILMS

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The hysteresis properties of $[Tb\text{-}Co/Ti]_n$ and $[Tb\text{-}Co/Si]_n$ multilayered films were studied. The value of the coercive force and its temperature dependence strongly change with a decrease of the Tb-Co layer thickness.

Tb-Co amorphous thin films attract special attention due to their high potential in magnetic random access memory as the materials in which current-induced magnetization switching based on spin-orbit torque can be realized. They are also useful for the development of novel ultrafast memory devices [1,2]. For all these practical applications, magnetic hysteresis properties of films are of great importance. The aim of this work is to study the hysteresis properties of Tb-Co layers of various thicknesses forming parts of the $[Tb\text{-}Co/Ti]_n$ or $[Tb\text{-}Co/Si]_n$ multilayered films.

TbCo-based magnetic multilayers with different thicknesses of Tb-Co layers and non-magnetic spacers (Ti, Si) have been prepared by rf-sputtering technique. Chemical composition of Tb-Co films deposited from the mosaic target was $Tb_{27}Co_{73}$. Low angle X-ray diffraction and reflectivity measurements confirmed the layered structure of the samples. The magnetic properties of the samples were measured by a SQUID magnetometer.

For all studied samples, an increase in the coercive force H_c is observed with decreasing of the temperature. However, depending on the Tb-Co layer thickness $L_{Tb\text{-}Co}$, there are differences in the level of H_c and the temperature ranges of the existence of the high coercivity state (Fig. 1). In particular, for the films with $L_{Tb\text{-}Co} > 3$ nm, H_c increases relatively smoothly. This apparently reflects the temperature behavior of the magnetic anisotropy and magnetostriction of Tb-Co films [3]. At $L_{Tb\text{-}Co} \leq 3$ nm, the temperature interval, in which the hysteresis is confidently recorded, is reduced (Fig. 1) . It is quite probable that, with a decrease in $L_{Tb\text{-}Co}$, an increasing role in determining the magnetic properties of multilayer films begins to play the interfaces arising as a result of interlayer diffusion. It can be assumed that the layers in such films are ternary amorphous Tb-Co-Si(Ti) alloys of variable composition, which can have the properties

of spin glass [4]. The material of spacers has a great influence on the formation of the hysteresis properties of Tb-Co layers, while silicon plays a more active role.

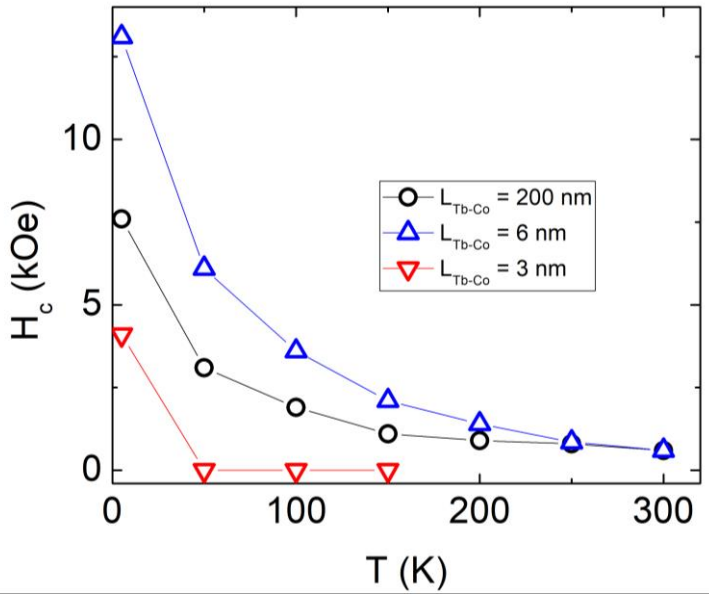

Fig. 1. Temperature dependences of the coercive force of $[Tb\text{-}Co/Si]_n$ multilayered films with different Tb-Co layer thicknesses.

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