Magnetic domains without domain walls and their influence on magnetization reversal process in ferrimagnetic Tb/Co multilayers

Ł. Frąckowiak,[1] F. Stobiecki,[1] G. D.Chaves-O'Flynn,[1] M. Urbaniak,[1] M. Matczak,[2] P. P. Michałowski,[3] A. Maziewski,[2] M. Reginka,[4] A. Ehresmann,[4] and P. Kuświk[1]

[1]*Institute of Molecular Physics, Polish Academy of Sciences, Poznań, Poland*

[2]*Faculty of Physics, University of Białystok, Białystok, Poland*

[3]*Łukasiewicz Research Network - Institute of Microelectronics and Photonics, Warsaw, Poland*

[4]*Institute of Physics and Center for Interdisciplinary Nanostructure Science and Technology (CINSaT), University of Kassel, Kassel, Germany*

In the past, great interest in ferrimagnetic (FI) rare-earth (RE) - transition metal (TM) films with perpendicular magnetic anisotropy (PMA) was motivated by their potential applications in magneto-optical memories. Nowadays, the FI films are intensively investigated because of recently discovered phenomena (all-optical switching, fast domain wall propagation, creation and propagation of skyrmions), which are important for a wide range of potential applications. Here, a recently found property of magnetically patterned FI-Tb/Co multilayers will be described. Using 10keV He ion bombardment we reduce the magnetic contribution of the Tb sublattice to effective properties of Tb/Co as the ion dose increases. As a result, an ion bombardment allows to locally change the domination from Tb+(RE+) to Co+(TM+) in multilayers that are Tb dominated prior to the bombardment. This local magnetic patterning was used to fabricate a 2D-lattice of artificial magnetic domains. This domain pattern exhibits an interesting spin texture, in which adjacent magnetic domains with oppositely oriented effective magnetization exist without domain walls in between [1]. This unique magnetic configuration is very stable due to a deep minimum in the energy of the system caused by flux closure and a corresponding reduction of the magnetostatic energy without a corresponding increase in energy by exchange and anisotropy terms relevant to the walls. This stability strongly affects the magnetization reversal process of this system [2].

References:

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