NiFe/Au/Co/Au layered films – magnetic properties and possible applications

M. Urbaniak

Institute of Molecular Physics, Polish Academy of Sciences
M. Smoluchowskiego 17, 60-179 Poznań, Poland

The magnetic and magnetoresistive properties of $[NiFe(t_{NiFe})/Au(t_{Au})/Co(t_{Co})/\ Au(t_{Au})]_N$ multilayers (MLs) characterized by the in-plane magnetic anisotropy of NiFe layers and the perpendicular anisotropy of Co layers are described for the broad range of sublayer thicknesses and different numbers of repetitions, *N*. It is shown that the magnetic stray fields originating from the domain structure of Co layers and calculated from the theory of Draaisma [1] (Fig. 1. a), describing the MLs with purely perpendicular anisotropy, can qualitatively explain the measured $R(H)$ dependence in the field range corresponding to the magnetization reversal of Co layers (Fig. 2. b). The calculated resistance changes corresponding to the stray fields of Co layers are close to the experimental values but saturation fields of $M(H)$ and $R(H)$ dependencies are not properly described.

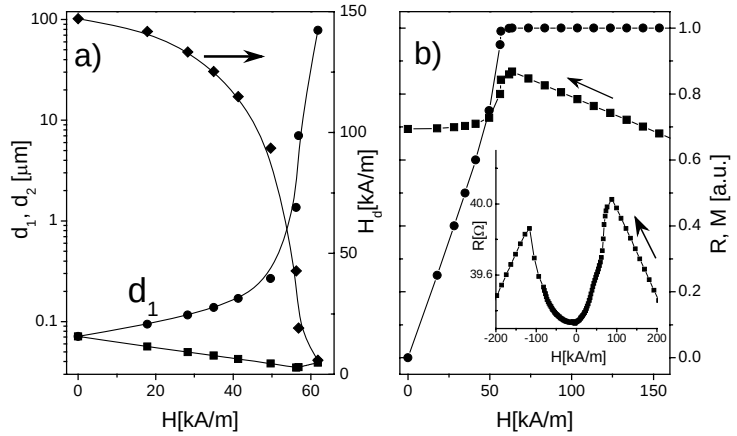

Fig. 1. a) The field dependence of the widths of up (•) and down (■) domains calculated from the theory of Draaisma and the corresponding average stray fields (at the midlines of NiFe layers) originating from magnetic domains (♦) and b) the calculated field dependence of the magnetization of Co layers (•) and the appropriate $R(H)$ (■) dependence calculated for $[NiFe(2\ nm)/Au(1.5\ nm)/Co(0.8)/Au(1.5\ nm)]_{10}$ ML. The inset shows the measured $R(H)$ dependence.

We show that the investigated MLs are resistant to low temperature annealings. It is shown too, that the magnetic properties of MLs can be additionally tailored by inserting thin Co layers on the NiFe/Au interfaces what modifies the effective shape anisotropy of NiFe layers. Finally we analyze the magnetoresistive properties of investigated structures in view of their possible applications.

---

[1] H.J.G. Draaisma and W.J.G. de Jonge, J. Appl. Phys. **62** (1987) 3318

Name of the presenting author (invited): Maciej Urbaniak
e-mail address: urbaniak@ifmpan.poznan.pl
http://www.ifmpan.poznan.pl