UD15

magnetization of the Weak-ferromagnets Caused by Elastic Deformations

Kuz'menko A.P., Zhukov E.A., Li Cz.
Dept. of Electronics & Electroengineering, Pacific State University, Khabarovsk, Russia
*Corresponding author: kap@mail.khstu.ru, Phone: +74212358321, Fax: +74212358166

The present work deals with dynamics of domain wall (DW) in $YFeO_3$ at subsonic velocities; the amplitudes of plate Lamb waves generated by DW have been studied for the first time, to our knowledge, and have been original researched static DW with nanometre scales. Study was made using a plate of yttrium orthoferrite 10^{-4} m thick, cut perpendicular to on optic axis, with a near rectangular shape measuring $(4\div6)\cdot10^{-3}$ m. By using technique [1] a two-domain structure was produced with a straight-line DW. An alternating magnetic field with the use of Helmholtz coils made DW shift from equilibrium. Dynamics of the DW was investigated on the basic of the magnetooptic Faradey effect. Domain wall displacements were recorded with a digital camera or a photomultiplier. Signal from the photomultiplier was recorded on an oscilloscope TDS 5054. To study elastic vibrations induced by the DW motion the interference method has been used [1]. A sample of $YFeO_3$ with a moving DW was placed in a Michelson interferometer arm. As shown in [2], the threshold response of the method is $5\cdot10^{-10}$ m. Deformation of the sample surface observed were determined from: $U=\lambda\Delta i/(2\pi i)$, where λ is the wavelength, i is a photocathode acurrent. The maximum deformation due to DW motion was observed within this region at a frequency f_R=kHz. Elastic vibrations are of a harmonic nature at this frequency; the amplitude of deformation was, in this case, equal to $U=7\cdot10^{-9}$ m. The assessment of energy density $E=2\rho(\pi f_R U)2$ yields a value of 0.004 J/m^3.

As shown been investigations static position DW at the such platen of $YFeO_3$ by AFM "Ntegra Prima" one had elastic deformation magnitude $7\cdot10^{-9}$ m also (Fig. 1,a). Observed complex structure DW which have been periodic constitutions with size until $500\text{-}1000\cdot10^{-9}$ m (Fig. 1,b). The beginnings sizeable static deformation may be due to the fact that mechanism of exchange intensification.

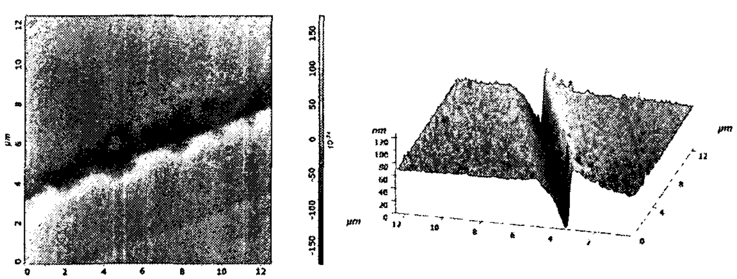

Fig.1. AFM image DW (a) and deformation magnitude (b) of $YFeO_3$.

REFERENCES
[1] A. P. Kuzmenko, E.A. Zhukov, M.B. Dobromyslov, J. Magn. Magn. Mater. 302 (2006) 436–438.
[2] A.N. Bondarenko, P.V. Bazylev, V.A. Lugovoy, Avtometriya 2 (2002) 101-107

UD16

Thermal stability of [Pd/Ferromagnet]N/FeMn multilayer with perpendicular magnetic anisotropy

H.-W. Joo[1], J. Heo[2], M.-S. Kim[1], H.-C. Choi[3], C.-Y. You[3], K.-A. Lee[2], S.-S. Lee[1], and D.-G. Hwang*[1]
[1] Department of Applied Physics & Electronics, Sangji University, 660 Woosan-Dong, Wonju, Gangwon, 220-702, Korea
[2] Department of Physics, Dankook University, Anseo-Dong, Cheonan, Chungnam, 330-714, Korea
[3] Department of Physics, Inha University, Yonghyun-Dong, Nam-gu, Incheon, 402-751, Korea
*Corresponding author: dghwang@sangji.ac.kr, Phone: +82 33 730 0413, Fax: +82 33 730 0415

Several studies on exchange bias effects in the perpendicular magnetic anisotropy (PMA) Co(or CoFe)/Pt(or Pd) multilayers with FeMn and IrMn have been reported [1]. We focused on the basic magnetic properties of exchange bias in PMA materials, was conducted,because it has not, as yet, been clearly understood, furthermore PMA system has an advantage for the MRAM applications due to the lack of the edge domains. In this study, the exchange biasing field (H_{ex}) and coercivity (H_c) of the $[Pd/F]_N$ and $[Pd/F]_N$/FeMn multilayers (F: Co or CoFe) as a function of the annealing temperature for various stack number N were investigated. The total thickness of the layer is kept while the N is varied, in order to adjust the surface anisotropy only with constant volume anisotropy. The dependencies of H_c and H_{ex} on the annealing temperature without/with FeMn layer are shown in Fig. 1. (a), (b), and (c) for N = 2 ~ 10, respectively. Here we showed only the results of non-bias Co and bias $Co_{0.5}Fe_{0.5}$ multilayers, since the behaviors of various ferromagnetic layers are almost similar. H_c slowly increase with annealing temperature from 150 °C and shows their maximum values at 350 °C and 250 °C for without and with exchange bias FeMn layer. The decrease of peak temperature of H_c indicated that the diffusion of Mn from FeMn starts at the lower temperature compare to the inter-diffusion of between Co (or CoFe) and Pd layers. The dependence of H_{ex} is also similar, H_{ex} is sharply dropped after annealing temperature higher than 250 °C. The almost same annealing temperature dependences for all studied system suggest that the decrease of H_c and H_{ex} has common physical origin: possibly diffusion of Mn of FeMn layer [2].

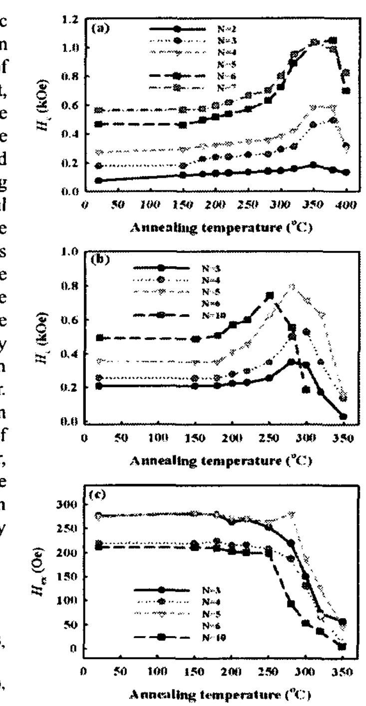

Fig. 1. The H_c and H_{ex} of a function of the annealing temperature in (a) Ta (2.1 nm)/[Pd(3.1/N)/Co(1.2/N)]$_N$/Ta (2.1) and (b), (c) Ta(2.1)/[Pd(3.1/N)/$Co_{0.5}Fe_{0.5}$(0.9/N)]$_N$ /FeMn(10.8)/Ta(2.1) multilayers

REFERENCES
[1] F. Garcia, F. Fettar, S. Auffret, B. Rodmacq and B. Dieny, J. Appl. Phys. 93, 8397(2003) and references therein.
[2] S. W. Kim, J. Y. Lee, S. S. Lee, E. J. Han and D. G. Hwang, J. Magn. 9(4), 122(2004).