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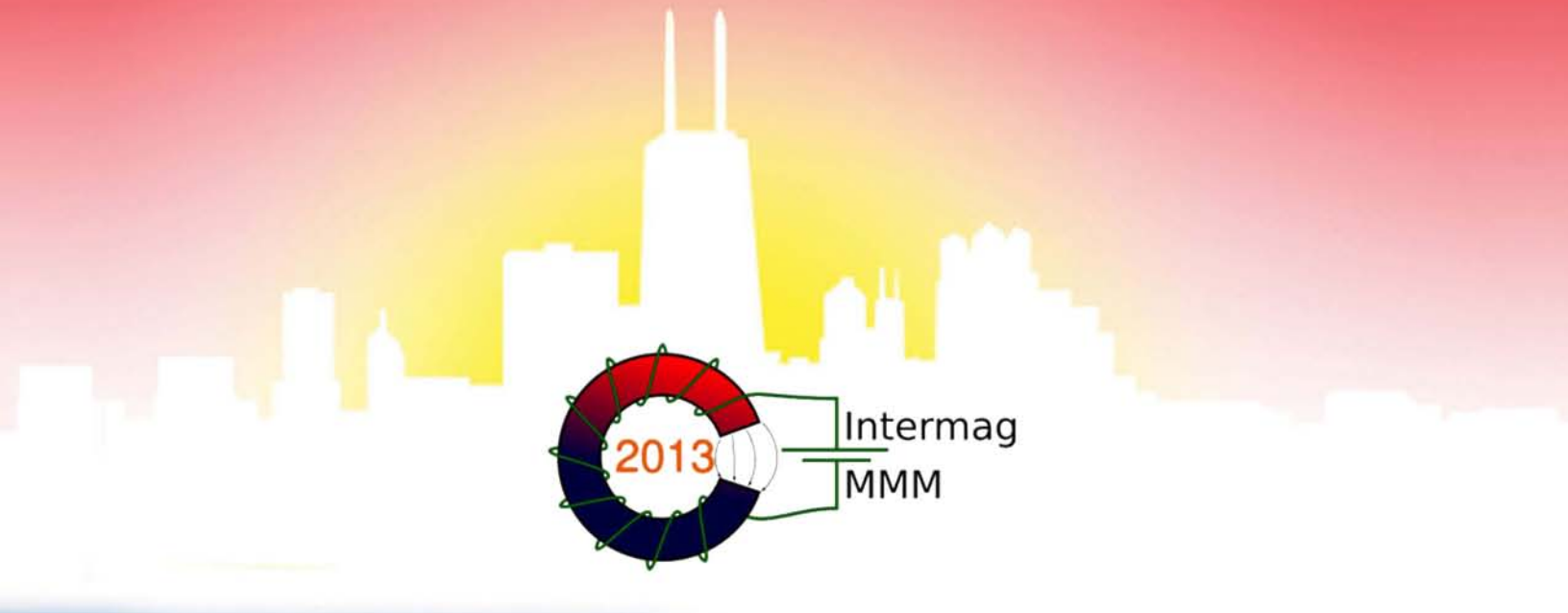

ABSTRACTS

IEEE MAGNETICS

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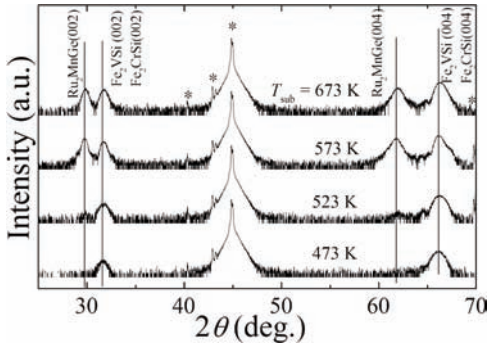

Fig.1 XRD θ–2θ scans of $MgAl_2O_4$//Fe_2VSi/Fe_2CrSi/Ru_2MnGe.

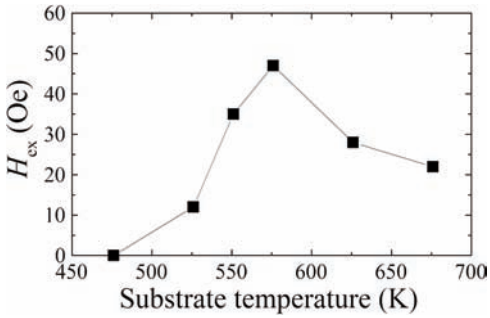

Fig. 2 The exchange-anisotropy field H_{ex} in the Fe_2CrSi/Ru_2MnGe bilayer at 77 K as a function of the substrate temperature during the deposition of the Ru_2MnGe.

HS-08. Magnetocapacitance properties of multilayered $CoFe_2O_4$/$BaTiO_3$/$CoFe_2O_4$ thin films by pulsed laser deposition. *S. Yoon*[1], C. Kim[1] and I. Shim[1] *1. Department of Physics, Kookmin University, Seoul, Republic of Korea*

The $CoFe_2O_4$(CFO)/$BaTiO_3$(BTO)/$CoFe_2O_4$(CFO) multilayered thin films were deposited on Pt/TiO_2/SiO_2/Si substrates by PLD system with a KrF excimer laser (λ = 248 nm). Especially, thin films with three different BTO, BTO/CFO and CFO/BTO/CFO structures were prepared and studied for their crystal structure and microstructure as well as magnetic and electrical properties. For the measurement of the C-V characteristics, platinum electrodes were patterned and deposited on top of these films by DC magnetron sputtering. The C-V characteristics of these multilayered thin films with different capacitor structures were measured with Aglient 4284A LCR meter, to investigate the change of their capacitances under external magnetic field. The x-ray diffractometer (XRD) pattern confirmed that the prepared thin films are single-phase as well as the presence of inverse spinel (CFO) and perovskite (BTO) structure. From the field-emission scanning electron micrographs (shown in Fig. 1), we estimated that the thicknesses of CFO and BTO deposited on Pt/TiO_2/SiO_2/Si substrate were about 200 nm and 320 nm, respectively. Also, from the energy dispersive x-ray spectroscopy (EDS) analysis, we confirmed that all the elements have been precipitated during deposition process. And top and bottom layers are successfully formed with required elements. The saturation magnetization (M_s) and coercivity (H_c) were measured by vibrating sample magnetometer (VSM) under the applied field of 10 kOe at room temperature. The C-V curve showed the enhancement of capacitance of CFO/BTO/CFO multilayered thin films under magnetic field (Fig. 2). When the capacitance of CFO/BTO/CFO thin film was measured as a function of bias voltage under the in-plane magnetic field of 1000 Oe, its value increased to 951.04 pF at 1 MHz, from the value of 831.90 pF measured at zero field. Our study suggests the tunability of the capacitance of the multilayered CFO/BTO/CFO thin film with applied magnetic field.

[1] H. Zheng, J. Wang, S. E. Lofland, Z. Ma, L. Mohaddes-Ardabili, T. Zhao, L. Salamanca-Riba, S. R. Shinde, S. B. Ogale, F. Bai, D. Viehland, Y. Jia, D. G. Schlom, M. Wuttig, A. Roytburd and R. Ramesh, Science. **303**(5658), 661-663 (2004). [2] J. Zhu, L.X. Zhou, W. Huang, Y.Q. Li, Y.R. Li, J. Cryst. Growth. **311**, 3300–3304 (2009).

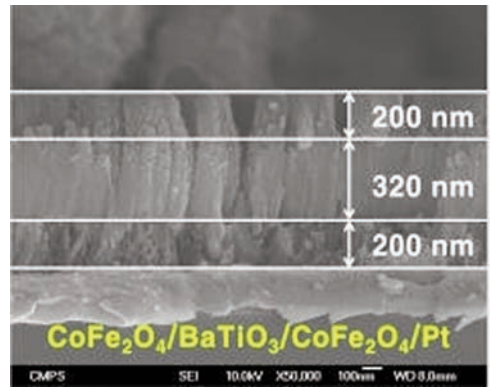

Fig. 1. Cross-sectional FE-SEM images of $CoFe_2O_4$/$BaTiO_3$/$CoFe_2O_4$/Pt multilayered thin films.

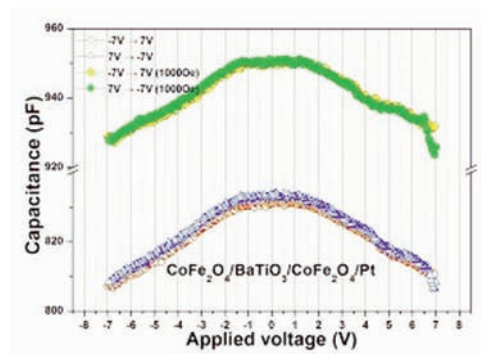

Fig. 2. C-V curve of $CoFe_2O_4$/$BaTiO_3$/$CoFe_2O_4$/Pt multilayered thin films.

HS-09. Ga-doping modulation of magnetic anisotropy in FeRh epitaxial thin films. *I. Suzuki*[1], M. Itoh[1] and T. Taniyama[1] *1. Materials and Structures Laboratory, Tokyo Institute of Technology, Yokohama, Japan*

FeRh alloys chemically ordered into CsCl structure show fascinating magnetic properties such as the first-order magnetic phase transition from the antiferromagnetic (AF) to ferromagnetic (FM) states at around 400 K[1]. One of the most curious features is the vanishing magnetic anisotropy of FeRh despite the single crystalline structure. In order to get insight into the underlying mechanism, we investigate the magnetic anisotropy of Ga-doped FeRh (Ga-FeRh) and find the clear cubic magnetic anisotropy. The mechanism of the magnetic anisotropy of FeRh and Ga-FeRh is discussed, associated with phase separation in the FM phase. 30-nm-thick FeRh and Ga-FeRh thin films were grown epitaxially on MgO(001) substrates by MBE. X-ray diffraction measurements ensure that both films have well-ordered CsCl single crystalline structures. The temperature dependent magnetization of the Ga-FeRh film reveals a marked reduction in the transition temperature down to room temperature from 380 K of FeRh. The remanent magnetization of FeRh in the FM state just above the transition temperature hardly shows anisotropic nature, while that of Ga-FeRh exhibits cubic anisotropy with the easy axis along [100] of FeRh. As reported previously, the AFM-FM magnetic transition is of its first order and magnetic phase separation could occur near the transition temperature. Recently, Baldasseroni et al., in fact, have observed the nucleation and evolution processes of FM domains, demonstrating magnetic phase separation[2]. Therefore, the magnetically phase separated states, in which FM domains are embedded in AFM host, likely gives the magnetically isotropic property in FeRh just above the transition temperature arising from randomly oriented FM domains. On the other hand, Ga