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ABSTRACTS

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Jointly sponsored by AIP Publishing, LLC and the IEEE Magnetics Society characterization with conventional extraction magnetometry showed a ferromagnetic behavior at room temperature. The RF Sputtering film, 160 nm thick, was deposited in a heated substrate (at 873 K) and after deposited the sample was annealed in situ at 973 K for 1.5 hours. Graze incident conventional X Ray and Rietveld analysis reveal a polycrystalline BFO single phase with mean particle size smaller than 35 nm, with residual in plane microstrain (Fig. 1). The magnetic hysteresis was measured along the perpendicular and parallel directions (Fig. 2). Understanding the magnetic behavior of BFO thin films is a key for the development of heterogeneous layered structures and multilayered devices, e.g. multiferroic tunnel junctions [4] and for multiferroic exchange bias heterostructures, e.g. in Magnetoelectric Random Acess Memories (MERAMS) [5]

[1] R. Ramesh and N. Spaldin, Nature Materials., 6.,21-29 (2007). [2] I. Sosnowska, Journal of Physics C: Solid State Physics., 15.,23/ 4835 (1982). [3] I. C. Noyan, J. B. Cohen, Residual stress measurement by diffraction and interpretation, Springer, New York, (1987). [4] Y. W. Yin *et al*, Journal of Applied. Physics., 117/172601 (2015). [5] M. Bibes and A. Barthélémy., Nature Materials. 7/067202 (2008).

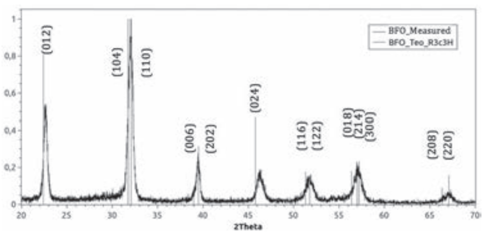

Figure 1: Grazing incidence X-Ray diffraction BFO sputtered thin film.

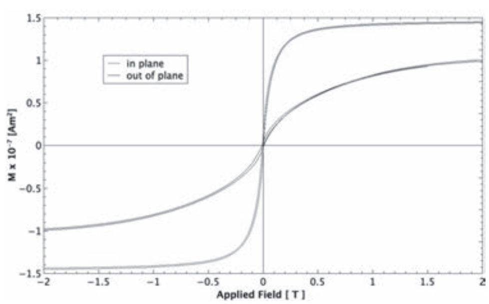

Figure 2: Magnetization Measurements in plane and out of plane measured at 300K.

GP-12. Effects of Zn-Ti substitution on the magnetoelelctric coupling of Co_2Z hexaferrites at room temperature. *X. Wang*[1], K. Song[1], H. Luo[1], F. Chen[1] and R. Gong[1] *1. School of Optical and Electronic Information, Huazhong University of Science and Technology, Wuhan, China*

The Co_2Z hexaferrites ($Sr_3Co_2Fe_{24}O_{41}$) with low-field magnetoelectric (ME) effects even at room temperature have been attracting a great amount of research interest due to the potential applications in ME devices. It is well known that the magnetocrystalline anisotropy in the hexaferrites can be effectively adjusted through cation substitution. The change in magentocrystalline anisotropy field essentially alters the magnetic structure and phase evolution with temperature, which sensitively influences ME effect. In this work, we aim to investigate on the effects of Zn-Ti ions on crystallographic structure, magnetic phase transition, magnetic anisotropy and magnetoelectric interaction for Z-type hexaferrites. First of all, polycrystalline samples of $Sr_3Co_2Zn_xTi_xFe_{24-2x}O_{41}$ (x=0, 0.1, 0.2, 0.3) were prepared by solid state reaction. X-ray diffraction (XRD) measurements indicate a single phase of Z-type ferrite crystallographic structure for all the four samples. Grain size and grain morphology of the sintered samples were observed using a scanning electron microscope (SEM). The effect of Zn-Ti upon the field dependence of magnetization, coercivity, and anisotropy field was investigated by vibrating sample magnetometer (VSM). A Keithley 6517B electrometer was employed to determine resistivity and ME response to magnetic fields. All the samples show high resistivity with an order of the magnitude up to ~10^9 Ωcm. Fig.1 shows ME current density (i.e. the peak value of the ME current at a sweep rate of 100 Oe/s) as a function of external magnetic field H with different levels of Zn-Ti substitution. It is observed that the substitution of Zn-Ti ions markedly influences the ME current. The present work reveals the tailoring of the ME effect in Z-type hexaferrite by means of judicious cation substitution.

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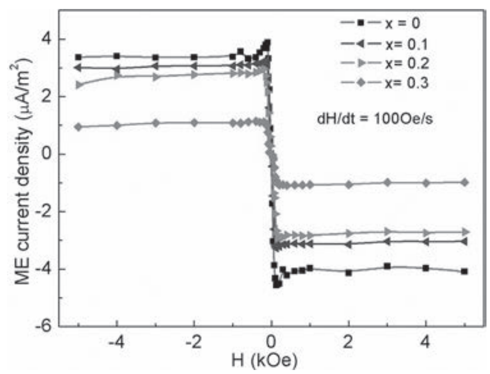

Fig.1 The ME current density for the $Sr_3Co_2Zn_xTi_xFe_{24-2x}O_{41}$ (x=0, 0.1, 0.2, 0.3)

GP-13. Microscopic evidence of magnetic and structure phase transition in multiferroic spinel FeV_2O_4. *B. Myoung*[1], J. Lim[1], T. Kouh[1] and C. Kim[1] *1. Kookmin University, Seoul, The Republic of Korea*

We report the microscopic evidence of magnetic and structure phase transition from the hyperfine magnetic interaction in multiferroic spinel FeV_2O_4 with the local electronic state of Fe^{2+} cation on A site and V^{3+} cation on B site. FeV_2O_4 was synthesized by the solid-state method. The magnetization measurement was carried out with a superconducting quantum interference device (SQUID) magnetometer and, the Mössbauer spectra were recorded using a conventional spectrometer of the electromechanical type. The x-ray diffraction patterns of FeV_2O_4 were measured at various temperature and refined with Rietveld's refinement method at 295 K. Based on XRD analysis, the structure of FeV_2O_4 is determined to be spinel structure with the space group *Fd3m*, having the lattice constant of a_0 = 8.467 Å. Here, Fe^{2+} cations only take the tetrahedral (A) sites, while V^{3+} cations occupy the octahedral (B) sites. FeV_2O_4 sample have four crystal structures, and show the phase transitions from tetragonal to orthorhombic structure around 70 K, from orthorhombic to tetragonal structure around 109 K, and from tetragonal to cubic structure around 140 K. From the temperature dependent magnetization curves under 1000 Oe between 4.2 and 150 K, we observed two characteristic temperatures, which were spin transition temperature (T_S = 70 K) and Néel temperature (T_N = 109 K). Our observation suggests the coupling between the magnetic characteristics and the crystal structure. Mössbauer spectra of FeV_2O_4 sample were obtained at various temperatures and these spectra were analyzed as severely distorted 8-line below T_N, and doublet at T_N. The value of electric quadrupole splitting (ΔE_Q) is 3.05 mm/s at 4.2 K, and the large value of ΔE_Q indicates the Jahn-Teller effect. With increasing temperature, the obtained Mössbauer spectra changed from doublet to singlet around 140 K due to the reduction of Jahn-Teller effect. In addition, the hyperfine field (H_{hf}) *has shown abrupt changes around* T_S.

[1] G. J. MacDougall, V. O. Garlea, A. A. Aczel, H. D. Zhou, and S. E. Nagler, Phys. Rev.B 86, 060414(2012).