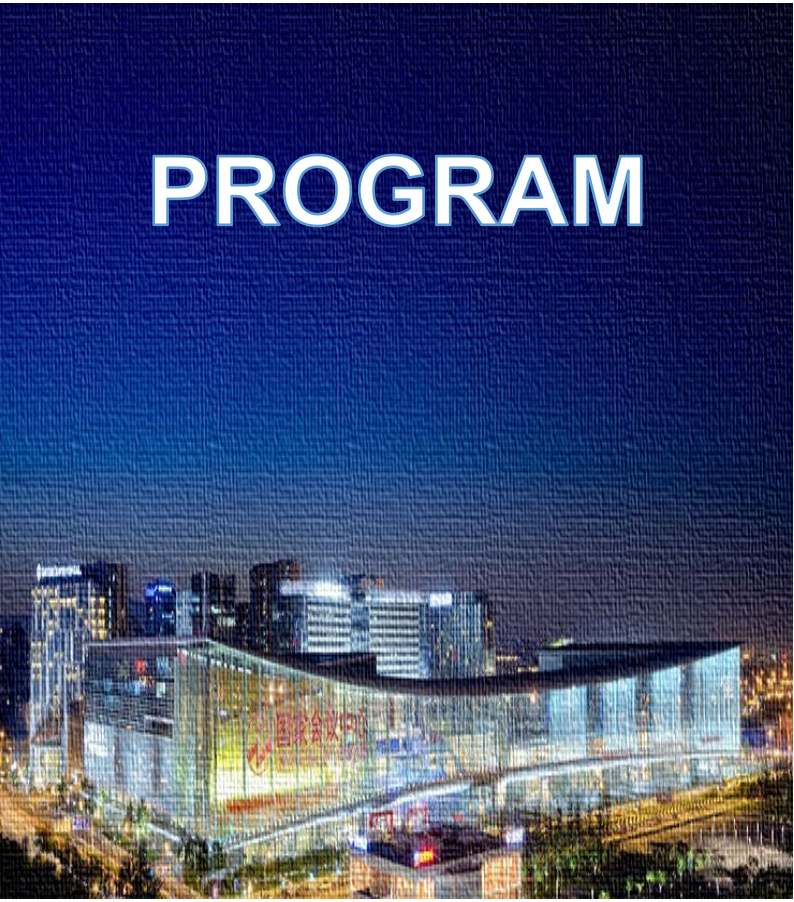
IEEE International Magnetics Conference



China National Convention Center

May 11-15, 2015, Beijing, China

BR-13. Electromagnetic nondestructive evaluation of mechanical strength in flake and spheroidal graphite cast irons. *Y. Kamada*[1], S. Masuda[1], T. Kowata[1], S. Hiratsuka[1] and H. Kage[2] *1. Faculty of Engineering, Iwate University, Morioka, Japan; 2. Kusaka Rare Metal Products Co., Tokyo, Japan*

BR-14. Investigation of magnetic properties of Sr doped $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ Z-type hexaferrite by Mössbauer spectroscopy. *J. Lim*[1] and C. Kim[1] *1. Kookmin University, Seoul, Korea*

BR-15. Preparation and Application on Antenna of Soft Ferrite Core for Wireless Sensor Networks. *L. Li*[1,2], Y. Fang[3,4] and Y. Liu[1,2] *1. State Key Laboratory of Networking and Switching Technology, Beijing University of Posts and Telecommunications, Beijing; 2. Beijing Key Laboratory of Network System Architecture and Convergence, Beijing University of Posts and Telecommunications, Beijing; 3. Research Institute of Functional Materials, China Iron and Steel Research Institute, Beijing; 4. Beijing Engineering Laboratory of Advanced Metallic Magnetic Materials and Preparation Techniques, Beijing*

TUESDAY AFTERNOON 1:30

PLENARY HALL B

Session BS
MAGNETOCALORIC MATERIALS II (Poster Session)

Julia Lyubina, Co-Chair
Evonik Industries AG
Fengxia Hu, Co-Chair
Institute of Physics, Chinese Academy of Sciences

BS-01. Tailoring of magnetic properties in Heusler-type NiMnGa glass-coated microwires. V. Zhukova[1,3], V. Chernenko[4,2], M. Ipatov[1,3] and *A. Zhukov*[1,2] *1. Department of Material Physics, Basque Country University, San Sebastian, Spain; 2. IKERBASQUE, Basque Foundation for Science, Bilbao, Spain; 3. Dpto. de Física Aplicada, EUPDS, University of Basque Country (UPV/EHU), San Sebastian, Spain; 4. BCMaterials & University of Basque Country (UPV/EHU), Bilbao, Spain*

Investigation of magnetic properties of Sr doped $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ Z-type hexaferrite by Mössbauer spectroscopy

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INTRODUCTION

Recently, the magnetoelectric (ME) effect observed in some of spiral magnets has been extensively studied. Especially, Z-type hexagonal $Ba_{3-x}Sr_xCo_2Fe_{12}O_{22}$ show ME effect via a complex helical spin structures such as heliconicalmagnet and transverse conicalmagnet [1,2]. Also, Z-type hexaferrite has been considered for microwave application due to high cut-off frequency and high permeability at GHz [3]. Their properties are strongly affected by the hyperfine distribution in hexagonal structure.

EXPERIMENT PROCEDURES

The samples of polycrystalline $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ (x = 0.0, 0.5, 1.0, 1.5) were synthesized by the solid-state reaction method. The high purity $BaCO_3$ (99.98%), $SrCO_3$ (99.995%), CoO (99.99%), and Fe_2O_3 (99.995%) powders were used as the starting materials, and were mixed with the appropriate stoichiometric ration for Z-type hexaferrite. The mixture was ground, and calcined at 1000 ^oC. The calcined samples were pressed into a cylindrical pellet, and sintered at 1200 ^oC. Finally, the samples were slowly heated at a rate of 2 ^oC/min to 1200 ^oC, and sintered again at 1250 ^oC.

The crystallographic and magnetic properties of $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ (x = 0.0, 0.5, 1.0, 1.5) samples were investigated by using x-ray diffractometer (XRD) with Cu-Kα (λ = 1.5406 Å) radiation, vibrating sample magnetometer (VSM), and Mössbauer spectrometer. In order to separate the sub-lattice lines, Mössbauer spectra were obtained in the external magnetic fields range from 0 to 50 kOe.

III. RESULTS AND DISCUSSION

The results of XRD patterns analyzed by Rietveld refinement of $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ (x = 0.0, 0.5, 1.0, 1.5) at 295 K, samples were found to be single-phased with the Bragg factor (R_B) and structure factor (R_F) less than 5 %. The crystalline structure was confirmed to be hexagonal structure with the space group $P6_3/mmc$. The lattice constants (a_0, c_0), and unit cell volume (V_u) of samples decrease with increasing Sr ions contents, because the ionic radius of Ba^{2+} ions (r = 1.49 Å) are larger than the ionic radius Sr^{2+} ions (r = 1.32 Å) does.

From the applied-field dependent hysteresis curves under 10 kOe at 295 K, the saturation magnetization (M_s) and coercivity (H_c) of $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ (x = 0.0, 0.5, 1.0, 1.5) samples were found to be M_s = 50.90, 45.59, 44.98, 44.83 emu/g and H_c = 37.10, 40.24, 40.41, 40.67 Oe, respectively.

Base on the zero-field-cooled (ZFC) magnetization curves under 100 Oe between 4.2 and 300 K, all samples showed spin transition (T_s). The T_s decrease from 230 for x = 0.0 to 135 K for x = 1.5 with increasing Sr ion contents due to the reduction of planar anisotropy with the difference in ionic radius of Ba^{2+} and Sr^{2+} ions.

The zero-field Mössbauer spectra of the samples were taken at various temperatures ranging from 4.2 to 750 K and analyzed the spectra below T_C as six distinguishable sextets due to superposition of ten-sextets for Fe sites corresponding to the Z-type hexagonal ferrite. Isomer shift values of all samples show that the charge states are Fe^{3+} high spin. In addition, all samples has shown abrupt changes in the hyperfine field (H_{hf}) and electric quadrupole shift (E_Q) around T_s. Also, From the Mössbauer spectra of all samples taken at 4.2 K with applied field parallel to the direction of γ-ray emission ranging from 0 to 50 kOe, Mössbauer spectra under zero external magnetic field show overlapped absorption lines, while Mössbauer spectra show well-distinguished 2-site absorption lines with increasing external magnetic field.

Reference

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[2] M. Soda, T. Ishikura, H. Nakamura, Y. Wakabayashi, and T. Kimura, Phys. Rev. Lett **106**, 087201 (2011).

[3] B. W. Li, Y. Shen, Z. X. Yue, and C. W. Nan, Appl. Phys. Lett. **89**, 132504 (2011).