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8:30

PLENARY HALL B

Session CS
FERRITES, GARNETS AND OTHER SOFT MATERIALS II
(Poster Session)

Zhongwu Liu, Chair
South China University of Technology

<u>CS-01</u>. **Influences of Li_2O-B_2O_3-ZnO Glass Addition on Microstructural and Magnetic Properties of LiZnTi-Ferrites.** F. Xie[1], *L. Jia*[1], Z. Zheng[1] and H. Zhang[1] *1. University of Electronic Science and Technology of China, Chengdu, Sichuan*

<u>CS-02</u>. **Effect of the nanosized Ni fillers on electromagnetic properties of NiCuZn ferrite/Ni/polymer functional composites.** *S. Tong*[1], M. Tung[1], W.S. Ko[1], Y.T. Huang[1] and J.M. Wu[2] *1. Material and Chemical Research Laboratories, Industrial Technology Research Institute, Hsinchu, Taiwan; 2. Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu, Taiwan*

<u>CS-03</u>. **Mössbauer studies and magnetic properties of $BaCo_{2-x}Zn_xFe_{16}O_2$** *H. Kim*[1] and C. Kim[1] *1. Department of Physics, Kookmin University, Seoul, Korea*

<u>CS-04</u>. **Preparation of low microwave loss YIG thin films by Pulsed Laser Deposition.** *B. Bhoi*[1], B. Sahu[2], N. Venkataramani[3], R. Aiyar[1] and S. Prasad[2] *1. Center for Research in Nanotechnology and Science, Indian Institute of Technology Bombay, Mumbai, Maharastra, India; 2. Department of Physics, Indian Institute of Technology Bombay, Mumbai, Maharastra, India; 3. Department of Metalurgical and Material Science, Indian Institute of Technology Bombay, Mumbai, Maharastra, India*

<u>CS-05</u>. **A study of FMR line width and magnetic order in nano crystalline $ZnFe_2O_4$ thin films.** *B. Sahu*[1], N. Venkataramani[2], S. Prasad[1] and K. Ramanathan[3] *1. Physics, IIT Bombay, Mumbai, Maharastra, India; 2. Department of Mettalurgical and Material Science, Indian Institute of Technology Bombay, Mumbai, Maharastra, India; 3. Department of Physics, CNRS/ Universite de Versailles-St-Quentin, Versailles Cedex, Versailles Cedex, France*

Mössbauer studies and magnetic properties of $BaCo_{2-x}Zn_xFe_{16}O_{27}$

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INTRODUCTION

W-type hexaferrite has two spinel block (S-block) and the block containing Ba (R-block), and its unit cell is ordered as SSRS*S* R* [1]. W-type hexaferrite containing Co^{2+} at divalent ionic site have reported to show spin reorientation phenomenon since the Co^{2+} ion located at octahedral site gives a strong planar anisotropy contribution [2, 3].

In this sturdy, we substituted non-magnetic Zn ion substituted for Co ion. We have studied crystallographic and magnetic properties of $BaCo_2Fe_{16}O_{27}$ (Co_2W) materials. We have studied the crystallographic and magnetic properties of $BaCo_{2-x}Zn_xFe_{16}O_{27}$ with XRD, VSM, and Mössbauer spectroscopy. Especially, we have focused on the site occupancy, magnetic hyperfine filed (H_{hf}) and electric quadrupole shift (E_Q) using Mössbauer spectroscopy. We investigated the origin of their magnetic properties and spin reorientation phenomenon

EXPERIMENT PROCEDURES

The Zn substituted Co_2W samples, $BaCo_{2-x}Zn_xFe_{16}O_{27}$ (x = 0.0, 0.5, 1.0), were synthesized by solid-state reaction method, which can be easily utilized in many industrial manufacturing processes. The amount of Ba, Co, Zn, and Fe was calculated by stoichiometry. These were mixed in distilled water and ball milled for 24h and the dried powders were calcined at 1275 ^{o}C for 3h in air.

XRD patterns of samples were measured with Cu-$K\alpha$ radiation (λ = 1.5406 Å) and analyzed by Rietveld refinement method using Fullprof program. magnetic properties were investigated by VSM measurements. The Mössbauer spectra were recorded using spectrometer using a ^{57}Co γ-ray source in a rhodium matrix for a constant acceleration mode.

RESULTS AND DISCUSSION

From the Rietveld refined XRD pattern, the crystal structure of $Ba_2Co_{2-x}Zn_xFe_{16}O_{27}$ (x = 0.0, 0.5, 1.0) samples are determined to be hexagonal with space group *P6₃/mmc* at room temperature. The lattice constants of x = 0.0 are5.905 Å, c_0 = 32.936 Å and x = 1.0 are a_0= 5.912 Å, c_0 = 32.980 Å, respectively. Lattice constants a_0 and $c_0$are increasing with increasing Zn^{2+} contents because the ionic radius of Zn^{2+} = 0.74 Å is bigger than radius of Co^{2+} = 0.70 Å. But a_0/c_0 is constant regardless of increasing Zn contents.

To obtain the magnetic properties of $BaCo_{2-x}Zn_xFe_{16}O_{27}$ (x = 0, 0.5, 1.0) samples, we performed VSM measurements. We obtained the value of magnetization at 20 kOe (M_s), coecivity (H_c) for all the synthesized samples. By increasing Zn contents, M_S increases from 75.67 to 80.11 emu/g, and H_c decreases from 162.08 to 34.54 Oe. To determine spin reorientation temperature (T_{sr}) and Curie temperature (T_c), the temperature dependence of zero-field-cooled (ZFC) magnetization curves were measured under applied field of 100 Oe between 4.2 and 800 K. At various Zn contents, the value of the first spin reorientation temperature (T_{sr1}) was determined to be 100 K (x = 0.0), 120 K (x = 0.5), and 135 K (x = 1.0) from the mass susceptibility curves. Also, the second spin reorientation temperature (T_{sr2}) was determined to be 550 K (x = 0.0), 485 K (x = 0.5), and 385 K (x = 1.0) from the magnetization curves. We determined Curie temperature (T_c) and T_c decrease with increasing Zn contents. The value of T_c decreases with increasing Zn contents, which is expected from the smaller super-exchange interaction of Zn^{2+}. Fig. 1 shows the T_{sr1}, T_{sr2}, T_c with increasing Zn contents.

Co_2W have seven iron ions at crystallographic sites of $4f_{VI}$, $6g$, $4f_{VI}$, $4e_{IV}$, $4f_{IV}$, $12k_{VI}$, $2d_V$, we analyzed Mössbauer spectra with five magnetic site of $4f_{VI}$, $6g+4f_{VI}$, $4e_{IV}+4f_{IV}$, $12k_{VI}$, $2d_V$ [4]. The fitted subspectra of the Mössbauer spectra were obtained for all samples. With five sextets for Fe sites of Co_2W spectra were least-squares fitted. Mössbauer spectra were obtained from 4.2 to 295 K and we investigated the origin of their magnetic properties and spin reorientation phenomenon by observing the changes in magnetic hyperfine filed (H_{hf}) and electric quadrupole shift (E_Q). With increasing non-magnetic Zn ions contents, the occupation area ratio of down-spin site ($4e+4f_{VI}$) was decreased. Therefore, it is obvious that the Zn ions preferentially occupy the tetrahedral sublattices, leading to increase in M_s.

Reference

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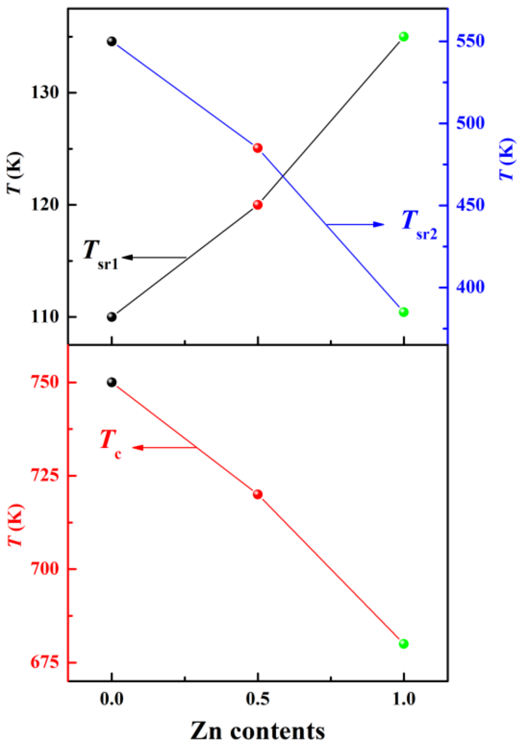

Fig. 1 T_{sr1}, T_{sr2} and T_c for $BaCo_{2-x}Zn_xFe_{16}O_{27}$(x = 0.0, 0.5, 1.0).