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6P4-09 J.T. Lim, *C.S. Kim*
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The polycrystalline of $Ba_2Co_{2-x}Zn_xFe_{12}O_{22}$ (x = 0, 2) samples were prepared by using a solid state reaction method. The crystal structure and magnetic properties of samples were studied by using x-ray diffractometer (XRD), vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. The results of the Rietveld refinement showed that the crystal structures of samples were found to be single-phased with the Bragg factor (R_B) and structure factor (R_F) less than 5 %, and determined to be rhombohedral with space group of R-3m. The unit cell volume (V_u) of $Ba_2Co_{2-x}Zn_xFe_{12}O_{22}$ (x = 0, 2) samples were V_u = 1296.6, and 1303.7 $Å^3$, respectively. The V_u of the samples increased linearly with increasing Zn ion concentration. Base on the magnetic hysteresis curves up to 10 kOe at 4.2 K, the saturation magnetization (M_s) of $Ba_2Co_{2-x}Zn_xFe_{12}O_{22}$ (x = 0, 2) samples were found to be M_s = 33.2, and 68.6 emu/g, respectively. As a result, the non-magnetic Zn ions preferentially occupy the tetrahedral sublattices with down-spin site. From the Zero-field-cooled (ZFC) magnetization curves under 100 Oe between 4.2 and 740 K, the Curie temperature (T_C) were found to be decreasing with increasing Zn contents. The $Ba_2Co_2Fe_{12}O_{22}$ sample showed spin transition from the helicalmagnetic to collinear ferrimagnetic around 215 K[1]. However, the $Ba_2Zn_2Fe_{12}O_{22}$ sample observed the disappearance of the spin transition. Zero-field Mössbauer spectra of the samples were taken at various temperatures ranging from 4.2 to 750 K. The spectra below Curie temperature were least-squares fitted with six sextets for Fe sites. Isomer shift values of samples show that the charge states are Fe^{3+} hing spin. In addition, $Ba_2Zn_2Fe_{12}O_{22}$ sample has observed abruptly changes in hyperfine field (H_{hf}) around 215 K. From the Mössbauer spectra taken at 4.2 K with applied field ranging from 0 to 50 kOe, the canting angle between the applied field and the hyperfine field of samples were 34, and 17 ^{o}, respectively.

[1] S. Ishiwata, Y. Taguchi, H. Murakawa, Y. Onose, Y. Tokura, Science 319, 1643 (2008).

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