Investigation of Magnetic Properties of Zn Doped Y-Type Barium Ferrite

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The $Ba_2Co_{2-x}Zn_xFe_{12}O_{22}$ ($x = 0.0$, 0.5, 1.0, 1.5, and 2.0) polycrystalline samples were synthesized by the solid-state reaction method. Based on the Rietveld refinement, the crystal structures of samples were found to be single-phased and determined to be rhombohedral with space group of $R-3m$. The unit cell volume (V_u) of the samples increased with increasing Zn ion concentration. In the magnetic phase diagram of $Ba_2Co_{2-x}Zn_xFe_{12}O_{22}$ system, samples with $x \leq 1.5$ showed the spin transitions both at T_s and T_C. For $x = 2.0$ sample, we observed the disappearance T_s. The non-magnetic Zn ions preferentially occupy the tetrahedral sublattices of $6c_{IV}$, and $6c^*_{IV}$ with down-spin site. At low temperature, this leads to the increase in M_s. However, the experimentally measured M_s at 295 K shows a slight decrease around $x = 1.5$. In addition, we have measured Mössbauer spectra of samples at various temperatures ranging from 4.2 to 750 K, which can analyzed with six-sextets for Fe sites corresponding to the $3b_{VI}$, $6c^*_{IV}$, $6c_{VI}$, $18h_{VI}$, $6c_{IV}$, and $3a_{VI}$ of the Y-type hexagonal crystallographic sites. From the Mössbauer spectra of 295 K, we observed the line-width broadening with increasing Zn concentration.

Index Terms—**Hexaferrite, Mössbauer spectroscopy, Y-type barium ferrite.**