

# Investigation of Magnetic Properties of Sr-Doped $\text{Ba}_{3-x}\text{Sr}_x\text{Co}_2\text{Fe}_{24}\text{O}_{41}$ Z-type Hexaferrite by Mössbauer Spectroscopy

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The polycrystalline  $\text{Ba}_{3-x}\text{Sr}_x\text{Co}_2\text{Fe}_{24}\text{O}_{41}$  ( $x = 0.0, 0.5, 1.0,$  and  $1.5$ ) samples were synthesized by the solid-state reaction method. The crystalline structure of the samples was found to be a hexagonal structure with a space group of  $P6_3/mmc$ . The lattice constants  $a_0$ ,  $c_0$ , and  $V_u$  of the samples decrease with increasing Sr concentration. From the field-dependent hysteresis curves under 10 kOe at 295 K, the values of  $M_s$  increase while the values of  $H_c$  decrease. The zero-field-cooled magnetization curves under 100 Oe between 4.2 and 300 K show the spin transition, and the value of  $T_s$  decreases from 230 K for  $x = 0.0$  to 135 K for  $x = 1.5$  with increasing Sr concentration due to the reduction of planar anisotropy with the difference in ionic radius between  $\text{Ba}^{2+}$  and  $\text{Sr}^{2+}$  ions. From the isomer shift value ( $\delta$ ) obtained from Mössbauer spectra, the charge states of all samples are determined to be  $\text{Fe}^{3+}$  high spin state. With increasing Sr concentration, the reduction of hyperfine field ( $\langle H_{\text{hf}} \rangle$ ) suggests the change in hyperfine interaction between Fe ions because of the larger ionic radius of  $\text{Ba}^{2+}$  ion than that of  $\text{Sr}^{2+}$  ion, leading to decreasing  $M_s$ .

*Index Terms*— $\text{Ba}_{3-x}\text{Sr}_x\text{Co}_2\text{Fe}_{24}\text{O}_{41}$ , Mössbauer spectroscopy, Z-type hexaferrite.