Site Preference and Hyperfine Structure in Doped Z-Type Hexaferrite $Ba_{1.5}Sr_{1.5}Co_2(Fe_{1-x}Al_x)_{24}O_{41}$ Investigated by Mössbauer Spectroscopy

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The $Ba_{1.5}Sr_{1.5}Co_2(Fe_{1-x}Al_x)_{24}O_{41}$ (x = 0, 0.01, 0.03, and 0.05) polycrystalline samples were synthesized by the polymerizable complex 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 P_{63}/mmc. The hysteresis curves of these samples were measured under 20 kOe at 295 K, showing that they were not saturated with increasing Al ion contents because spin structure was modified due to the reduction of magnetic anisotropy. With increasing Al ions contents, the value of M20kOe decreases due to the preferential occupation of non-magnetic Al ions in the up-spin site, while Hc increases. The Mössbauer spectra of the samples were obtained at 295 K, and analyzed as six distinguishable sextets ($4f_{IV}$, $4f^*_{IV}$, $12k^*_{VI}$, $4f^*_{VI} + 4e_{IV}$, $12k_{VI}$, and $2d_V + 2a_{VI} + 4f_{VI} + 4e_{VI}$) below T_C due to the superposition of ten sextets of Fe sites corresponding to the Z-type hexagonal ferrite. The occupation number of up-spin site decreases with increasing Al ions. This suggests that the Al ions preferentially occupy the tetrahedral sublattices, leading to decrease in M_{20kOe}.

Index Terms— **Hexaferrite, Mössbauer spectroscopy, Z-type Ba ferrite.**