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Hyperfine structure and magnetic properties of Zn doped Co_2Z hexaferrite investigated by high-field Mössbauer spectroscopy

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The polycrystalline samples of $Ba_3Co_{2-x}Zn_xFe_{24}O_{41}$ ($x = 0.0$, 0.5, 1.0, 1.5, and 2.0) were synthesized by the standard solid-state-reaction method. Based on the XRD patterns analyzed by Rietveld refinement, the structure was determined to be single-phased hexagonal with space group of $P6_3/mmc$. With increasing Zn ion concentration, the unit cell volume (V_u) of samples was increased, as the sites of Fe^{3+} ions changed from tetrahedral to octahedral sites. We have obtained zero-field Mössbauer spectra of all samples at various temperatures ranging from 4.2 to 750 K. The measured spectra below T_C were analyzed with six distinguishable sextets due to the superposition of ten-sextets for Fe sites, corresponding to the Z-type hexagonal ferrite. Also, the hyperfine field (H_{hf}) and electric quadrupole shift (E_Q) have shown abrupt changes around spin transition temperature (T_S). In addition, Mössbauer spectra of all samples at 4.2 K were taken with an applied field ranging from 0 to 50 kOe, which indicates the decrease in the canting angle between applied field and H_{hf} of samples with increasing Zn concentration.
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