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Abstracts
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Ni$_{0.6}$Cu$_{0.2}$Zn$_{0.2}$Fe$_2$O$_4$ was synthesized by the solid-state reaction method. The crystallographic and magnetic properties of NiCuZn ferrite were characterized by the x-ray diffraction, vibrating sample magnetometry (VSM), and applied-field Mössbauer spectroscopy. The crystal structure was found to be a cubic spinel [1] with the lattice constant $a_0 = 8.373 \pm 0.005\text{Å}$. The magnetization ($M_s$) and coercivity ($H_c$) values were 57.5 emu/g and 38 Oe at room temperature, respectively. Ni and Cu ions in NiCuZn ferrite prefer octahedral sites B and Zn ions in it prefer tetrahedral sites A [2]. According to the probability of distribution, we have analyzed Mössbauer spectra as 5 sets with six-lines at 4.2 K. Hyperfine fields of A and B sites at 4.2K in zero magnetic field were $H_{hf}(B_0) = 548$ kOe, $H_{hf}(B_1) = 535$ kOe, $H_{hf}(B_2) = 520$ kOe, $H_{hf}(B_3) = 493$ kOe, and $H_{hf}(A) = 507$ kOe. Applied-field Mössbauer spectra of the Ni$_{0.6}$Cu$_{0.2}$Zn$_{0.2}$Fe$_2$O$_4$ were measured with parallel to the γ-ray direction under 5 T at 4.2 K. Hyperfine fields of A and B sites under 5 T was $H_{hf}(A) = 521$ kOe and $<H_{hf}(B)> = 454$ kOe. The average hyperfine field of B site was smaller than the value of $<H_{hf}(B)> = 524$ kOe with non-external field, while the value for A site was bigger than the one with non-external field. Also, the second and fifth absorption lines of Mössbauer spectra were completely disappeared above 3 T. It means that the spins of Fe ions at A and B sites are collinear to the external field. The Fe valence states were determined to be ferric with the isomer shift values.