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Magnetic properties of Cu^{2+} substituted Co-ferrite

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ABSTRACT

Copper substituted Co–Cu ferrites $Co_{1-x}Cu_xFe_2O_4$ ($0 \le x \le 0.5$) have been studied with Mössbauer spectroscopy, x-ray diffraction, and vibrating sample magnetometer (VSM). The Co–Cu ferrite toroidal core samples were sintered at 860–940 °C for 2 h and the initial permeability, quality factor, density and shrinkage were also measured. The crystal structure was found to be an inverse cubic spinel with the lattice constant $a_0 = 8.390$ Å and $a_0 = 8.386$ Å for Co-ferrite and Cu^{2+} substituted Co-ferrite, respectively, by Rietveld profile analysis using the FULLPROF program. Hyperfine field was decreased with increasing Cu^{2+} concentration. The saturation magnetization (*Ms*) of the Co–Cu ferrite annealed at 900 °C decreased drastically and the coercivity, *Hc*, dropped dramatically from about 1419 to 455 Oe as copper concentration x decreased from 0.0 to 0.5. This shows that *Ms*, *Hc* can be controlled using Cu content, and initial permeability and quality factor Q is nearly constant in Cu^{2+} substituted Co-ferrite. The toroidal core data showed that the density and shrinkage of $Co_{1-x}Cu_xFe_2O_4$ ($0 \le x \le 0.5$) ferrites increased with increasing quantity of Cu ions.