Crystallographic and magnetic properties of $Al_xCoFe_{2-x}O_4$ ferrite powders

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The $Al_xCoFe_{2-x}O_4(0.00\leq x\leq 0.20)$ ferrite powders are fabricated by a sol gel method. The growth of particles, crystallographic and magnetic properties of powders are investigated by x-ray diffraction, Mössbauer spectroscopy and vibrating sample magnetometer.

$Al_xCoFe_{2-x}O_4(x=0.20)$ ferrite powders annealed at and above 873 K have only a single spinel structure and behave ferrimagnetically. Powders annealed between 673K and 773 K show a paramagnetic and ferrimagnetic phase coexist. The magnetic behaviour of powders annealed at and above 673 K shows that an increase of the annealing temperature yields a decrease in the coercivity and, in contrast, an increase in the saturation magnetization. In the $Al_xCoFe_{2-x}O_4(x=0.20)$ ferrite powders the maximum coercivity and the saturation magnetization are 1564 Oe and 62.6 emu/g, respectively.

All the structures of $Al_xCoFe_{2-x}O_4(0.00\leq x\leq 0.20)$ ferrite powders annealed at 1073 K are spinel, and the lattice constants decrease with increasing x. The Mössbauer spectra, consisted with two Zeeman sextets due to Fe^{3+} ions at tetrahedral and octahedral sites at room temperature. The variation of Mössbauer parameters has been discussed with the crystallographic and magnetic properties of powders. The magnetic hyperfine fields decrease with increasing x in $Al_xCoFe_{2-x}O_4(0.00\leq x\leq 0.20)$. The coercivity and the saturation magnetization slowly decrease with increasing x in $Al_xCoFe_{2-x}O_4(0.00\leq x\leq 0.20)$.