

Mössbauer and magnetic properties of Co–Ti substituted barium hexaferrite nanoparticles

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Co–Ti substituted *M*-type hexagonal barium ferrite nanoparticles $\text{BaFe}_{12-2x}\text{Co}_x\text{Ti}_x\text{O}_{19}$ ($0 \leq x \leq 1.0$) have been prepared by a sol-gel method. Magnetic and structural properties of the powders were characterized with a Mössbauer spectroscopy, vibrating sample magnetometer, x-ray diffraction (XRD), thermogravimetry (TG), and differential thermal analysis (DTA). The decomposition of amorphous hydroxides in the dried precipitate continued until 570 °C, according to a TG-DTA analysis. The result of XRD measurements shows that the *a* and *c* lattice parameters increase with increasing *x* from $a=5.882$ and $c=23.215$ Å for $x=0.0$, to $a=5.895$ and $c=23.295$ Å for $x=1.0$. The ^{57}Fe Mössbauer spectra were fitted by a least-squares technique with four subpatterns of Fe sites in the structure and corresponding to the $4f_2$, $4f_1+2a$, $12k$, and $2b$ sites. The relative spectra areas of $\text{BaFe}_{10}\text{CoTiO}_{19}$ at 295 K were 15%, 30%, 50%, and 5% for $4f_2$, $4f_1+2a$, $12k$, and $2b$ subspectra, respectively. The $2b$ site had a very large quadrupole splitting. The isomer shifts indicated that the valence states of the Fe ions were ferric. The magnetization slightly decreases and the coercivity, H_C , drops dramatically from about 5014 to 228 Oe as *x* increases from 0.0 to 1.0. Co–Ti substituted barium hexaferrite to be controlled to reduce their coercivities with a small decrease of their magnetization. © 2002 American Institute of Physics. [DOI: 10.1063/1.1452203]