

## Mössbauer Studies of a Heat Treatment Effects in Ni-Co Ferrite

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The Ni-Co ferrite  $\text{Ni}_{0.3}\text{Co}_{0.7}\text{Fe}_2\text{O}_4$  has been investigated by X-ray diffraction and Mössbauer spectroscopy. The crystal structure is found to be cubic spinel with the lattice constants  $a_0 = 8.361 \pm 0.005 \text{ \AA}$  and  $a_0 = 8.368 \pm 0.005 \text{ \AA}$  for slow-cooled and quenched  $\text{Ni}_{0.3}\text{Co}_{0.7}\text{Fe}_2\text{O}_4$ , respectively. Mössbauer spectra of  $\text{Ni}_{0.3}\text{Co}_{0.7}\text{Fe}_2\text{O}_4$  ferrite have been taken at various temperatures from 13 K to 780 K. The isomer shifts indicate that the valence states of the irons at both tetrahedral(A) and octahedral(B) sites are in ferric high-spin states. The variation of the iron ions at magnetic hyperfine fields at the A and the B sites is explained on the basis of A-B and B-B supertransferred hyperfine interactions. The Debye temperatures for the A and the B sites of  $\text{Ni}_{0.3}\text{Co}_{0.7}\text{Fe}_2\text{O}_4$  are found to be  $\theta_A = 565 \pm 5 \text{ K}$  and  $\theta_B = 285 \pm 5 \text{ K}$  for slow-cooled and  $\theta_A = 499 \pm 5 \text{ K}$  and  $\theta_B = 249 \pm 5 \text{ K}$  for quenched  $\text{Ni}_{0.3}\text{Co}_{0.7}\text{Fe}_2\text{O}_4$ , respectively. Atomic migration of  $\text{Ni}_{0.3}\text{Co}_{0.7}\text{Fe}_2\text{O}_4$  starts near 450 K for the slow-cooled Ni-Co ferrite and 400 K for the quenched one and increases rapidly with increasing temperature to such a degree that about 61% of the ferric ions at the A sites in the slow-cooled compound and 71% in the quenched compound have moved over to the B sites by 700 K.