Crystalline structure, magnetic and magnetoelastic properties of Nd<sub>6</sub>Fe<sub>13-x</sub>CoxCu intermetallic compounds

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Abstract

Influence of the partial substitution of Co for Fe on the structural, magnetic and magnetoelastic properties of Nd<sub>6</sub>Fe<sub>13</sub>Cu compounds are investigated. Analysis of X-ray diffraction patterns indicates that the multi-phase sample is formed for all samples. Upon Co substitution, the second phase Nd<sub>2</sub>Fe<sub>17</sub>, Nd<sub>2</sub>Fe<sub>17-y</sub>Coy with 0 < y < 1 and Nd<sub>2</sub>Fe<sub>17-z</sub>Co<sub>z</sub> with 1 < z < 2 is formed in the samples with x = 0, 1, 2, respectively so that the lattice parameters are decreased and the Curie temperature is increased. Due to the ferromagnetic phase Nd<sub>2</sub>Fe<sub>17-y</sub>Coy in sample with x = 1, the change of the anisotropy and increase of exchange effects are observed. The effects of long-range magnetic ordering processes on Néel temperature clearly appear in the temperature dependence of the spontaneous magnetostriction. Longitudinal (λ<sub>L</sub>) and transverse (λ<sub>T</sub>) magnetostrictions are measured to study the magnetoelastic behaviour of these compounds using a strain gauge method. In the low field region, magnetostrictive strains are small and then increase with increasing fields. Strong pinning center of Nd atoms that creates large magnetocrystalline anisotropy prevents easy movement of domain walls. In the sample with x = 0, the magnetostriction contribution from the rare earth sublattice (Nd) dominates at low temperature and the Fe sublattice contribution becomes increasingly important as temperature rises.

Keywords: intermetallic compound, Nd<sub>6</sub>Fe<sub>13-x</sub>CoxCu, structural analysis, magnetic properties, magnetoelastic properties

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