Journal of Magnetics 10(1), 5-9 (2005)

Superparamagnetic Properties of Nanoparticles $Ni_{0.9}Zn_{0.1}Fe_2O_4$ for Biomedical Applications

Seung Wha Lee[1] and Chul Sung Kim[2]*

[1]*Department of Electronic Engineering Chungju National University, Chungju 380-702, Korea*
[2]*Department of Physics, Kookmin University, Seoul 136-702, Korea*

(Received 2 February 2005)

Nanoparticles $Ni_{0.9}Zn_{0.1}Fe_2O_4$ is fabricated by a sol-gel method. The magnetic and structural properties of powders were investigated with XRD, SEM, Mössbauer spectroscopy, and VSM. $Ni_{0.9}Zn_{0.1}Fe_2O_4$ powders annealed at 300 °C have a spinel structure and behaved superparamagnetically. The estimated size of $Ni_{0.9}Zn_{0.1}Fe_2O_4$ nanoparticle is about 10 nm. The hyperfine fields at 13 K for the *A* and *B* patterns are found to be 533 and 507 kOe, respectively. The ZFC curves are rounded at the blocking temperature (T_B) and show a paramagnetic-like behavior above T_B. T_B of $Ni_{0.9}Zn_{0.1}Fe_2O_4$ nanoparticle is about 250 K. Nanoparticles $Ni_{0.9}Zn_{0.1}Fe_2O_4$ annealed at 400 and 500 °C have a typical spinel structure and is ferrimagnetic in nature. The isomer shifts indicate that the iron ions were ferric at the tetrahedral (*A*) and the octahedral (*B*). The saturation magnetization of nanoparticles $Ni_{0.9}Zn_{0.1}Fe_2O_4$ annealed at 400 and 500 °C are 40 and 43 emu/g, respectively. The magnetic anisotropy constant of $Ni_{0.9}Zn_{0.1}Fe_2O_4$ annealed at 300 °C were calculated to be 1.6×10^6 ergs/cm^3.

Key words : Superparamagnetism, Nanoparticle, Mössbauer, Applications in Biomedicine