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Superparamagnetic Properties Ni-Zn Ferrite for Nano-Bio Fusion Applications

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Magnetic nanoparticles have been investigated for use as biomedical purposes for several years. For biomedical applications the use of particles that present superparamagnetic behavior at room temperature is preferred [1-3]. Nanoparticles $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4$ is fabricated by a sol-gel method. The magnetic and structural properties of powders were investigated with XRD, SEM, Mössbauer spectroscopy, and VSM. $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4$ powders were annealed at 300°C had spinel structure and behaved superparamagnetically. The estimated size of superparamagnetic $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4$ nanoparticle is around 12 nm. The SEM micrographs indicate the distribution of grains with uniform size and have the spherical shape. The Mössbauer hyperfine spectra of nanosize $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4$ particles were taken at various temperatures from 13 to 400 K. The hyperfine fields at 13 K for the *A* and *B* patterns were found to be 523 and 499 kOe, respectively. The isomer shifts indicate that the iron ions were ferric at the tetrahedral (*A*) and the octahedral (*B*). The ZFC curves are rounded at the blocking temperature (T_B) and show a paramagnetic-like behavior above T_B . T_B of superparamagnetic $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4$ nanoparticle is about 275 K. Also, Temperature increased up to 43°C within 7 minutes under AC magnetic field of 7 MHz. It is considered that $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4$ powder that was annealed at 300°C is available for biomedicine application such as hyperthermia, drug delivery system and contrast agents in MRI.

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