

# Mössbauer Studies of Superparamagnetic $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$ Nanoparticles

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Superparamagnetic  $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$  nanoparticle is fabricated by a sol-gel method. The magnetic and structural properties as a function of annealing temperature were characterized by using X-ray diffraction (XRD), Mössbauer spectroscopy, and vibrating sample magnetometry (VSM) as well as scanning electron microscope (SEM).  $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$  powder that was annealed at 573 K has spinel structure and behaved superparamagnetically at room temperature. The estimated size of superparamagnetic  $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$  nanoparticle is around 7 nm. The hyperfine fields of the A and B patterns at 4.2 K were found to be 514 and 481 kOe, respectively. The blocking temperature ( $T_B$ ) of superparamagnetic  $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$  nanoparticle is about 90 K. The magnetic anisotropy constant of  $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$  nanoparticle were calculated to be  $1.6 \times 10^6$  erg/cm<sup>3</sup>.

*Index Terms*—Blocking temperature, Mössbauer spectroscopy,  $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$ , sol-gel method, superparamagnetic.