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Mössbauer studies of $Zn_{0.05}Fe_{2.95}O_4$ nanoparticles

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Nanoparticles of spinel ferrite ($Zn_{0.05}Fe_{2.95}O_4$) were prepared using the process of high- temperature thermal decomposition (HTTD) and were treated with an Ar plasma for 30 min. The crystal structure was found to be cubic spinel with space group (Fd-$3m$). The lattice constants of $Zn_{0.05}Fe_{2.95}O_4$ before and after the plasma treatment were found to be 8.3862 and 8.3853 Å, respectively. The saturation magnetization value increased from 69.1 to 73.5 emu/g after the plasma treatment of the $Zn_{0.05}Fe_{2.95}O_4$ nanoparticles. The Mössbauer spectra before and after the plasma treatment of $Zn_{0.05}Fe_{2.95}O_4$ were analyzed at 4.2 K using four sextets. As the temperature was increased, the lines of the Mössbauer spectra broadened due to a fluctuation in the anisotropic hyperfine field. The Mössbauer spectra were found to have the same anisotropic field fluctuation of $+H$ ($P_+ = 0.5$) and $-H$ ($P_- = 0.5$). The relaxation frequency factor, f, was also calculated from the Mössbauer spectra.

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