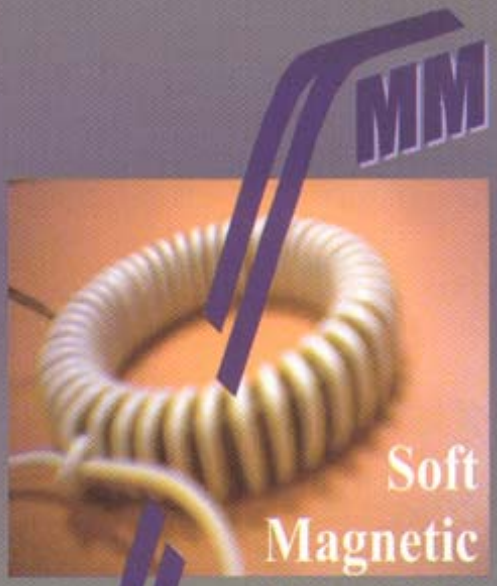

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FERROMAGNETIC PROPERTIES OF Fe SUBSTITUTED ON ZnO-BASED MAGNETIC SEMICONDUCTOR

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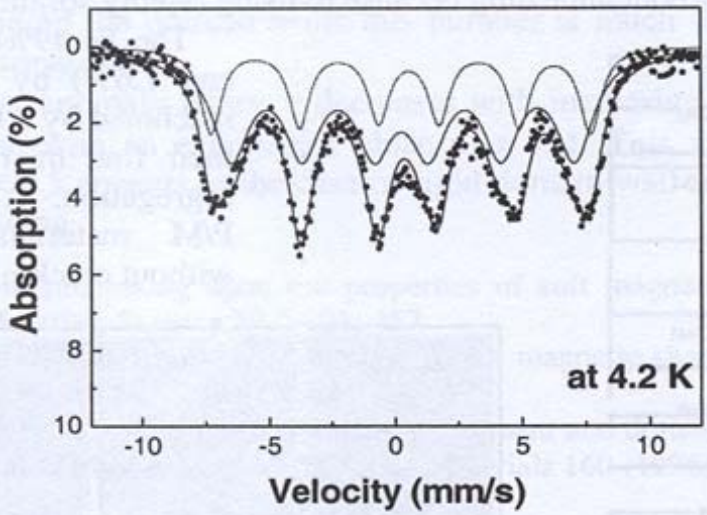
The diluted magnetic semiconductor $Zn_{1-x}{}^{57}Fe_xO$ (x=0.01, 0.02, 0.03) compounds were prepared by solid state reaction method. High purity ZnO (99.99 %) and ^{57}Fe oxide powder were mixed thoroughly and annealed in Ar atmosphere at 1200 °C during 6 hours. The crystal structures of the samples were examined by X-ray diffraction (XRD) with Cu$K\alpha$ radiation. Magnetic properties were characterized by using a vibrating sample magnetometer (VSM), SQUID, and Mössbauer spectroscopy. The Mössbauer spectra were recorded using a conventional spectrometer of the electromechanical type with a ^{57}Co source in a rhodium matrix. XRD patterns showed a single phase, without any segregation of Fe. The crystal structure of $Zn_{0.97}{}^{57}Fe_{0.03}O$ at room temperature is determined to be a hexagonal structure of $P6_3mc$ with lattice constants a_0 = 3.252 Ĺ and c_0 = 5.205 Ĺ by Rietveld refinement. The determined Bragg factors R_B and R_F were 3.23 % and 2.81 %, respectively. From the inverse susceptibility versus T curve the paramagnetic Curie temperature is found to be 2.7 K and effective moment is found to be 4.01 μ_B, thereby suggesting that the exchange interactions between Fe ions are ferromagnetic. Mössbauer spectra of $Zn_{0.97}{}^{57}Fe_{0.03}O$ have been taken at various temperatures ranging from 4.2 K to 295 K. We have fitted the spectra to a model [1] based on a random distribution of Fe ions. The probability that an Fe ion has twelve nearest-neighbor site occupied by Fe ions was calculated using the binomial formula

$$P_{(n,x)} = \frac{12!}{n!(12-n)!}(x)^n(1-x)^n \qquad (1)$$

where x is the iron concentration. Analysis of Mössbauer data were disregarded when the probability P (n, x) of Fe nearest-neighbors are below 10 %. Mössbauer spectrum for $Zn_{0.97}{}^{57}Fe_{0.03}O$ at 4.2 K have shown ferromagnetic phase (sextet).



[1] L. K. Leung, A. H. Morrish, and B. J. Evans, Phys. Rev. B, **13**, 4069 (1976)

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