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# Ferromagnetic properties of Fe-substituted ZnO-based magnetic semiconductor

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**Abstract**

The diluted magnetic semiconductor $Zn_{1-x}{}^{57}Fe_xO$ ($x = 0.01, 0.02, 0.03$) compounds were prepared by the solid-state reaction method. 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 $a_0 = 3.252$ Å and $c_0 = 5.205$ Å by Rietveld refinement. The Bragg factors $R_B$ and $R_F$ were determined as 3.23% and 2.81%. 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 $\mu_B$, 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 to 295 K. Mössbauer spectrum for $Zn_{0.97}{}^{57}Fe_{0.03}O$ at 4.2 K has shown ferromagnetic phase (sextet), and the spectra were fitted based on a random distribution model of Fe ions.
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