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MÖSSBAUER STUDIES OF FERROMAGNETISM IN Fe-DOPED ZnO MAGNETIC SEMICONDUCTOR

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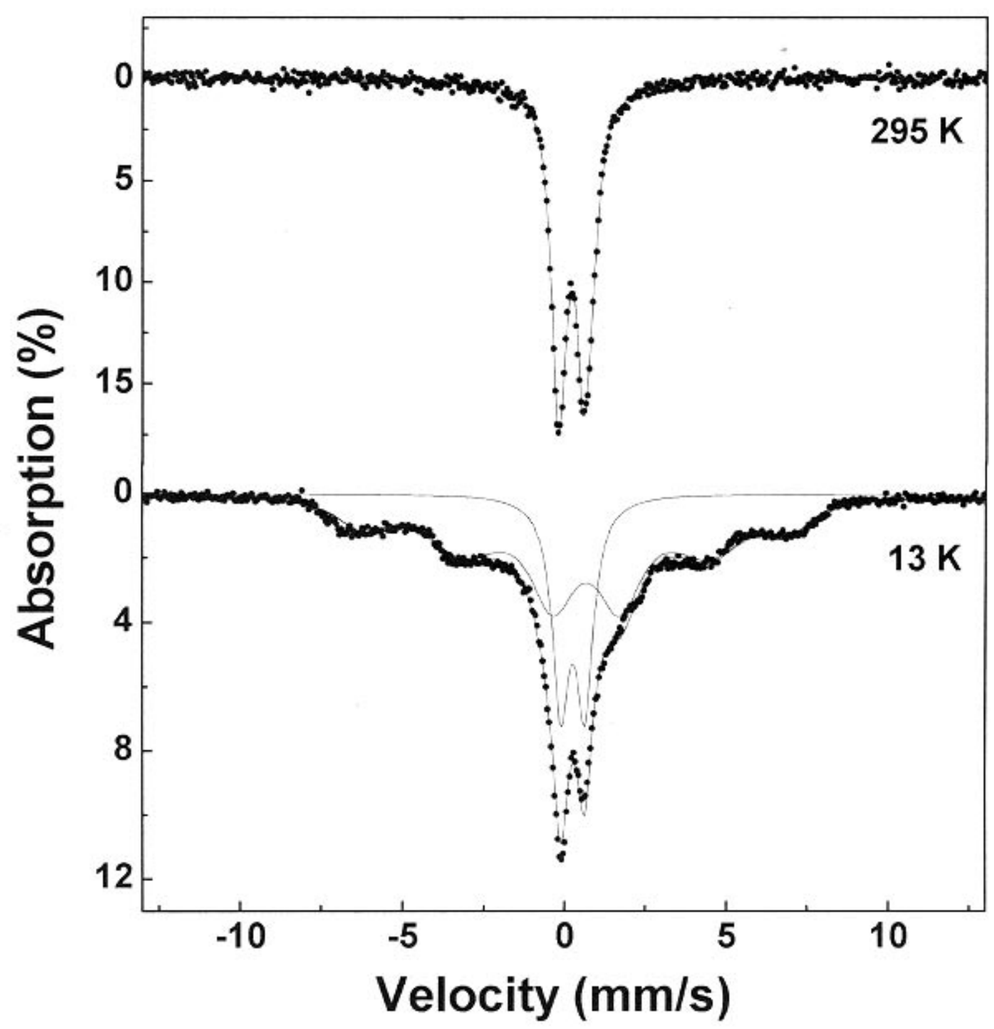
$Zn_{1-x}Fe_xO$ (x=0.01, 0.02, 0.03) compounds were fabricated using the solid-state reaction method. All samples were annealed in Ar atmosphere at 1200 ℃ during 6 hours. The crystal structure and magnetic properties of the $Zn_{1-x}Fe_xO$ (x=0.01, 0.02, 0.03) were studied using x-ray diffraction, vibrating sample magnetometer, and Mössbauer spectroscopy. X-ray diffraction patterns showed a single phase, without any segregation of Fe. The lattice constants increased as the Fe concentration increased. The crystal structure of the $Zn_{0.97}Fe_{0.03}O$ was determined to be hexagonal structure (space group : $P\bar{6}m2$) at room temperature with the lattice constants of a_0 = 3.252 □ and c_0 = 5.205 □. In order to determine magnetic behavior and ionic state of the doped transition metal (^{57}Fe) in ZnO, we carried out Mössbauer measurements at various temperatures ranging from 13 to 295 K. Mössbauer spectra for $Zn_{0.97}Fe_{0.03}O$ at 13 K have shown the ferromagnetic phase (sextet) and paramagnetic phase (doublet), but the only paramagnetic phase (doublet) is seen at 295 K, as shown in Fig. 1. Isomer-shift value for the ferromagnetic phase was found to be 0.502 mm/s, which was consistent with the Fe^{2+} ion state. The hysteresis loop at 40 K for $Zn_{0.97}Fe_{0.03}O$ indicated the coexistence of ferromagnetic and paramagnetic phases.



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