Interpretation of ferromagnetic Fe doped ZnO by Mössbauer spectroscopy

Seung-Iel Park, Geun Young Ahn,[a] and Chul Sung Kim[b]
Department of Physics, Kookmin University, Seoul 136-702, Korea

(Presented on 11 January 2007; received 31 October 2006; accepted 23 December 2006; published online 3 May 2007)

Single phase $Zn_{0.95}Fe_{0.05}O$ sample was obtained by the sol-gel method with annealing at 650 °C for 6 h in H_2 5%/Ar balance gas atmosphere. The crystalline structure of $Zn_{0.95}Fe_{0.05}O$ is determined to be a $P6_3mc$ hexagonal structure with lattice constants a_0=3.255 Å and c_0=5.207 Å at room temperature. The Mössbauer spectra were obtained at various temperatures ranging from 4.2 to 295 K. The values of the isomer shifts (δ) show that for all temperature ranges, they are in the ferrous (Fe^{2+}) state. The magnetic hyperfine field (H_{hf}) and electric quadrupole splitting (ΔE_Q) in the weak ferromagnetic state at 4.2 K have been analyzed, yielding the following results: H_{hf} =37.8 kOe, θ=67.5°, φ=0°, η=0.75, ΔE_Q=2.06 mm/s, and R=7.4, respectively. From the Mössbauer spectrum at 77 K, the paramagnetic quadrupole phase is related to the temperature dependence of spin-lattice relaxation. © *2007 American Institute of Physics*.
[DOI: 10.1063/1.2712527]