Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Carrier properties of hydrogen-implanted ZnO and Mn-doped ZnO films S.Y. PARK, P.J. KIM, H.W. LEE, Y.P. LEE, Hanyang Univ., J.-H. KANG, Kookmin Univ., T.H. KIM, Ewha Womans Univ. — Recently, many research groups have been interested in the carrier properties of transition metal (TM)-doped ZnO as well as undoped ZnO due to the application for spintronics and optoelectronics. Especially, the magnetic properties of TM-doped ZnO (TM: Mn, Fe, and Co) are theoretically expected to be connected with the characteristics of charge carrier characteristics which are formed by hydrogen contamination. In this study, we present the effects of hydrogen implantation on the magnetic properties for Mn-doped ZnO and undoped ZnO film. All of the films were grown by using UHV magnetron co-sputtering. These films were implanted with 30 keV H- ions at a dose of 6.9x10^{16} cm^{-2} at room-temperature. The lattice parameters of the implanted samples were increased owing to the interstitial H and the ion-induced crystalline damages. The time-of-flight secondary-ion mass-spectroscopy results show that H was implanted uniformly with keeping the original crystalline structures. Their magnetic properties were determined by using a SQUID. The $M - H$ curves reveal that the H-implanted film with post-annealing as well as the as-grown film exhibit the ferromagnetic behavior at room temperature with a Tc above 350 K, while the H-implanted film prepared at a higher oxygen pressure shows the nonmagnetic behaviors. The detailed analysis of the magnetic properties for implanted Mn-doped ZnO film will be discussed in comparison with the as-grown samples.

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Date submitted: 05 Dec 2006 Electronic form version 1.4