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Role of oxygen vacancy in ferromagnetic Mn-doped ZnO films S.Y. PARK, Y.J. YOO, P.J. KIM, Y.P. LEE, Hanyang University, T.H. KIM, Ewha Woman University, J.-H. KANG, Kookmin University — We report that $Zn_{1-X}Mn_XO$ (x = 0.4) films grown by reactive magnetron co-sputtering have ferromagnetism at temperatures above 300 K. The ferromagnetic behavior is sensitive to not only the carrier concentration but also the film growth parameters, such as the substrate, substrate temperature, deposition rate and oxygen partial pressure (P_{O2}) during deposition. In this study, we focused on the role of oxygen vacancy for the ferromagnetism in $Zn_{1-x}Mn_xO$ films with x $\leq$ 0.05. In order to fabricate high-quality samples, the preparation was performed in an ultrahigh vacuum, and the accurate P_{O2} was monitored using a residual gas analyzer during deposition. The magnetic and the structural properties of films were characterized by SQUID and XRD, respectively. The normal-mode and oxygen-resonance-mode RBS were carried out to confirm the mount of Mn, Zn and O contents. The film, prepared at an oxygen partial pressure of 2.2x10^{-7} Torr, exhibits a strong ferromagnetism with Tc above 300 K, while the films at an partial pressure of higher than 1.2x10^{-6} Torr show the nonmagnetic behaviors. Our results can be elucidated with a theoretical model by Coey[1] that the oxygen vacancy could results in the magnetic ordering of Mn-doped ZnO film by the enhancement of overlap between s-band and imputity d-band. [1] J. M. D. Coey et al., Nat. Mater. **4**, 173 (2005).

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