MAR06-2005-002060

Abstract for an Invited Paper
for the MAR06 Meeting of
the American Physical Society

Room-temperature ferromagnetism in (Zn,Cr)Te

HIDEKAZU SAITO, Nanoelectronics Research Institute, National Institute of Advanced Industrial Science and Technology

Ferromagnetic diluted magnetic semiconductors (DMSs) are the key material to developing semiconductor spintronic devices. One of the most characteristics physical phenomena in DMS is a strong interaction between *sp*-carriers and localized *d*-spins (*sp-d* exchange interaction) [1]. Confirmation of this interaction is essential to prove a synthesis of real DMS, and can be done directly by the magneto-optical studies such as a magnetic circular dichroism (MCD) measurement [2]. Here, we report room-temperature (RT) ferromagnetism with the *sp-d* exchange interaction in $Zn_{1-x}Cr_xTe$ (x=0.20) [3]. $Zn_{1-x}Cr_xTe$ films with x≦0.20 were grown on GaAs (001) substrates by a molecular beam epitaxy method. No sign of a secondary phase was detected in any films by the reflection high-energy electron and X-ray diffractions. MCD spectra were measured in a transmission mode. Magnetization (M) measurements were carried out using a SQUID. The $M-H$curves of $Zn_{1-x}Cr_xTe$ (x=0.20) showed a ferromagnetic behavior up to about RT. Curie temperature T_C was estimated to be 300±10 K by the Arrott plot analysis. A strong enhancement of the MCD signal at the optical transition energies of critical points of host ZnTe was observed in $Zn_{1-x}Cr_xTe$, indicating a strong *sp-d* exchange interaction. The MCD spectra of $Zn_{1-x}Cr_xTe$ at any magnetic field could be superposed upon a single spectrum, indicating that the observed MCD signals come from a single material, that is, $Zn_{1-x}Cr_xTe$. The magnetic field dependence of MCD intensity showed the ferromagnetic feature, which coincides with the $M-H$ curves measured using a SQUID. Furthermore, the MCD data showed the same T_C as that obtained from magnetization data. These results indicate that $Zn_{1-x}Cr_xTe$ (x=0.20) is an intrinsic DMS with RT ferromagnetism.
References [1] J. K. Furdyna, J. Appl. Phys. **64**, R29 (1988). [2] K. Ando, in *Magneto-Optics, Springer Series in Solid-State Science,* edited by S. Sugano and N. Kojima (Springer, Berlin, 2000), Vol.128, p. 211. [3] H. Saito, V. Zayets, S. Yamagata, and K. Ando, Phys. Rev. Lett., **90** 207202 (2003).