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Giant Faraday Rotation in $Cd_{1-x}Mn_xTe$ (0<x<0.7) Crystals

Soo-seong Chung, Younghun Hwang, and Youngho Um*
Department of Physics, University of Ulsan, Ulsan, 680-749, Korea
*Corresponding author: yhum@ulsan.ac.kr, Phone: +82 52 259 2327, Fax: +82 52 259 1693

Diluted magnetic semiconductors (DMS's) are based on II-VI semiconductor compounds in which a fraction of the nonmagnetic cations are randomly replaced by magnetic ions[1]. One of the most striking effects observed in DMS's is the giant Faraday rotation at photon energies close to the band-gap energy[2]. This property makes DMS's promising candidates for fabricating magneto-optical devices, such as magnetic field sensors, isolators, and modulators[3]. Previously, Bartholomew *et al.*[4] have analyzed their Faraday rotation data for CdMnTe and ZnMnTe using a single-oscillator model for the index of refraction involving an interband excitonic transition at the fundamental gap E_0, however, at lower values of Mn ion. Therefore, we investigated the magneto-optical properties for the $Cd_{1-x}Mn_xTe$ (0<x<0.7) single crystals grown using a vertical Bridgman method. The $Cd_{1-x}Mn_xTe$ crystals with various Mn mole fractions have been grown in the zinc-belnde structure and the band-gap energy was increased and the lattice constant was decreased showing inverse relationship with the band-gap energy with increasing Mn contents. The Faraday rotation was increased as Mn content is increased and the Verdet constant becomes larger because the effect of the *sp-d* exchange interaction is enhanced as the temperature is lowered. The origin of the enhancement of the Faraday rotation in $Cd_{1-x}Mn_xTe$ crystals can be explained in terms of the magnetization.

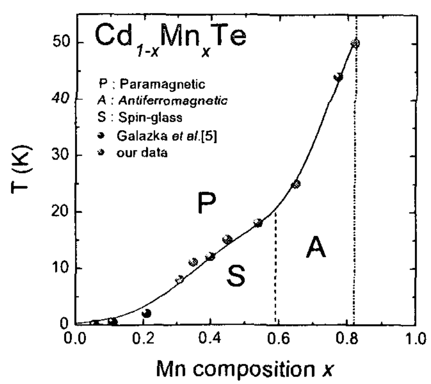

Fig. 1. Mangetic phase diagram for CdMnTe ISAMMA conference.

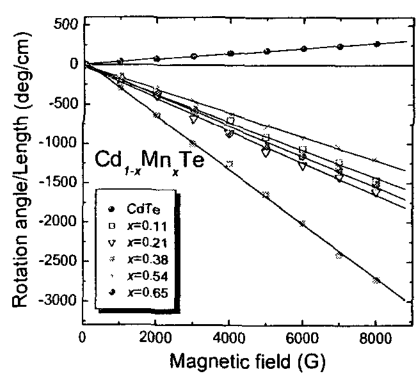

Fig. 2. Faraday rotation for CdMnTe conference.

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PD15

Weak Ferromagnetism in CdMnZnTe Single Crystal

Soo-Sung Chung, Younghun Hwang, and Youngho Um*
Department of Physics, University of Ulsan, Ulsan, 680-749, Korea
*Corresponding author: yhum@ulsan.ac.kr, Phone: +82 52 259 2327, Fax: +82 52 259 1693

For the last two decades, scientists have had considerable interest in diluted magnetic semiconductors (DMS's), in which a fraction of the nonmagnetic cations in II-VI, III-V, IV, and IV-VI compounds is replaced by a magnetic transition metal. The unique properties observed in DMS's are due to a magnetic interaction induced by the localized magnetic moments of magnetic ions and *s-p* band electrons[1]. Recently, ferromagnetic DMS's are extensively investigated for the applications spintronics due to their good compatibilities with the existing semiconductor devices[2,3]. This ferromagnetism should be also possible in other isoelectric II-VI semiconductors such as CdTe and ZnSe. Irie *et al.* reported that the Fe doped Mn-based DMS, $Cd_{1-x-y}Mn_xFe_yTe$, showed high temperature ferromagnetic behavior in the sample of $x \sim 0.37$[4]. In this work, we investigated the magnetic and magneto-optical properties of the Zn-added CdMnTe DMS, $Cd_{1-x-y}Mn_xZn_yTe$ ($x \sim 0.37$), and discuss the effect of the Zn on the magnetic nature of $Cd_{1-x}Mn_xTe$. In this work, we investigate the magnetic and magneto-optical properties of the Zn-addition to $Cd_{1-x}Mn_xTe$. The magnetization measurement of the sample showed the weak ferromagnetic ordering up to 250 K.

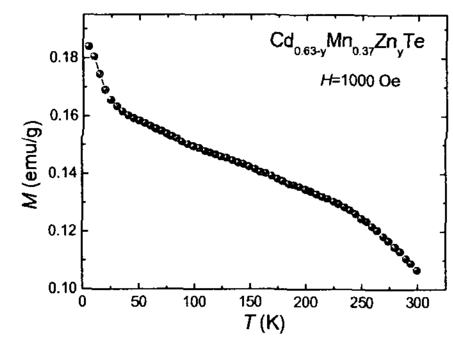

Fig. 1. *M-T* data for CdMnZnTe.

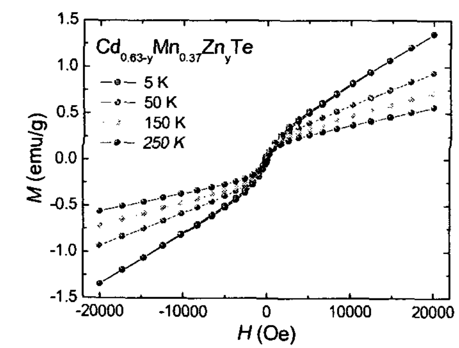

Fig. 2. *M-H* data for CdMnZnTe.

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