MCD spectra of diluted magnetic semiconductors at *L*-critical point

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Spin-dependent band structure is the most fundamental property of magnetic materials, including diluted magnetic semiconductors (DMSs). Magnetic circular dichroism (MCD) spectroscopy [1, 2] with a wide range of photon energy from below the band gap to the *L* critical point (CP) through the Γ-CP brings us fruitful information on the band structure of DMSs. For example, we have found a very strong and broad MCD signal of (Ga,Mn)As below the band gap, which indicates the optical transitions from the occupied impurity states in the band gap [3].

Here, we will discuss the MCD signal near the *L*-CP of DMSs. In II-VI DMSs, the Zeeman splittings for optical transitions at the Γ-CP have been well clarified. But the situation is very different for the transitions far from the Γ point. Theoretical calculations [4, 5] predicted that the Zeeman splittings of two optical transitions at the *L* point, i.e., E_1 and $E_1+\Delta_1$, have equal magnitudes and opposite signs. But our systematic study showed that the signs of Zeeman splittings in DMSs is not simple as believed [6]. (Cd,Cr)Te, (Cd,Fe)Te, (Cd,Co)Te, (Zn,Cr)Te, (Zn,Fe)Te, (Zn,Co)Te and (Zn,Ni)Te show the expected opposite signs of the two optical transitions. However, (Cd,Mn)Te, which is the canonical II-VI DMS, shows an anomaly, *i.e.*, the same signs. (Zn,Mn)Te also shows another anomaly that both of the signs of the two optical transitions are just opposite to the expected ones for the DMSs with Mn^{2+}. These anomalies seem to occur around the $3d^5$ configuration. These experimental results require further theoretical studies of the *sp-d* exchange interactions in DMSs.

We will also discuss the Mn concentration dependence of MCD spectra of (Ga,Mn)As around the *L*-CP, which indicated the inhomogeneous character of this materials.

This work was partly supported by a Grant-in-Aid for Scientific Research by Kakenhi (20360013).

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