Magnetic field induced splitting of intraionic transition of Co^{2+} in ZnSe

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The dynamic development of solotronics, including engineering of semiconductor quantum dots with single magnetic ion opens new research perspectives [1]. Particularly, a direct control of an ion's state by the resonance excitation of intraionic (d-d) transitions, in contrast of indirect one through the interaction with polarized excitons, seems to be a very interesting challenge. Therefore it is interesting to study in more details the nature of d-d transitions and their behaviour in the magnetic field. The Zeeman effect of intraionic transitions of Co^{2+} in ZnO has already been investigated [2]. For Co^{2+} in (Zn,Co)Se, the intraionic transitions were reported for zero-field only [3]. In this work we present the magneto-photoluminescence studies of Zeeman effect for d-d transitions of Co^{2+} in ZnSe.

Three different layers of diluted magnetic semiconductors were grown using MBE, the (Zn,Co)Se as well as (Zn,Mn)Se and (Cd,Co)Se for comparison. These samples were the object of the optical magneto-reflection and magneto-photoluminescence (PL) experiments. The observation of excitonic giant Zeeman effect in reflectivity, allowed the fit of a Brillouin function with effective temperature and consequently determination of the concentration of magnetic ions. For (Zn,Co)Se sample presented in this work, cobalt concentration is 0.2%.

PL measurements were performed in the wide range of energies. In the excitonic region the significant difference between (Zn,Mn)Se and (Zn,Co)Se was noticed; in the latter system the exction line is strongly quenched. For lower energies in (Zn,Co)Se the intraionic $^4A_2 - {}^2T_1$ transition of Co^{2+} was observed [3] showing the Zeeman splitting in the magnetic field (0-10T) at liquid helium temperature. Using four split components and observed selection rules, it was possible to determine both g-factors of the excited and the fundamental state of Co^{2+} in ZnSe and to propose the model of the observed transitions.

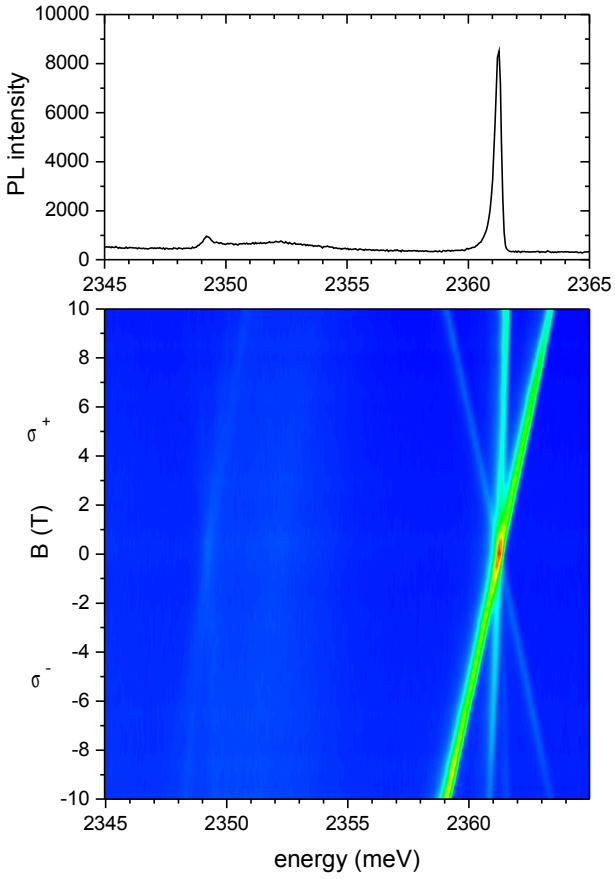

Fig. (a) d-d transition of Co^{2+} (PL) for (Zn,Co)Se with sharp zero-phonon line in B = 0 T and **(b)** splitting of d-d line of Co^{2+} in the magnetic field.

Literature:

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