Photoluminescence of CdTe/CdMgTe double quantum wells with a two-dimensional electron gas

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Previous research on asymmetric double quantum wells (ADQW) based on CdTe concerned only samples with the barrier or one of the wells formed by a diluted magnetic semiconductor, mainly CdMnTe. This type of material allows to manipulate the shape of the barrier and observe magnetically tuned interwell coupling [1] or exciton transfer [2]. In the present paper we present results of the measurements done on a new type of structure – CdTe/CdMgTe ADQW with a two-dimensional electron gas.

The samples (named A, B and C) contained two different CdTe quantum wells separated with a MgTe barrier, 2 or 3 monolayer-thick, and were digitally doped with iodine. The sample A was doped only below the wafer surface ("above" the two wells, going "up" from the substrate), the sample C was doped symmetrically (identical spacer and doping "below" the first and "above" the second well), and the sample B - asymetrically.

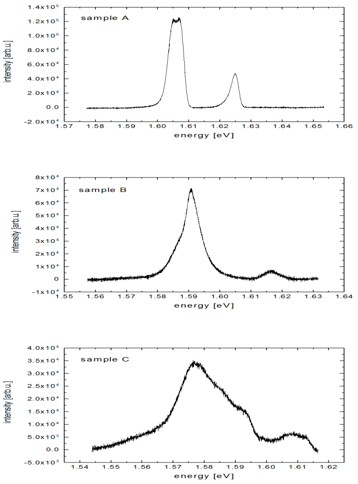

Fig. 1: The spectra of the samples at $B = 0$ T

Photoluminescence experiments (excitation with an Ar+ laser line of 514 nm) with σ- and σ+ polarization resolution were carried out with samples placed in an optical helium cryostat supplied with a split coil. All the samples were subjected to three types of experiments. The first one was done at $T = 1.6$ K and the magnetic field (B) from 0 to 6 T. The second one was done at $B = 0$ T and 1.6 K with changing the power of excitation from 5 μW to 1.3 mW. The third one was done at $B = 0$ T with changing temperature from 1.6 K until the luminescence disappeared (at about 200 K) and the power of excitation appropriate for each sample.

We observed a shift of the centroid (a "center of mass" of spectrum) in B towards higher energies – 0.21 meV/T, 0.30 meV/T and 0.47 meV/T for sample A, B and C, respectively. For sample B and at $B > 3.5$ T we observed a Landau quantization as it is shown in Fig. 1. The centroid shifts with T towards lower energies 13.6 meV (A), 1.66 meV (B) and 7.82 meV (C) through range of T. Energy shift in a function of the power of excitation is as follows: 0.72 meV (A), 0.61 meV (B) and 3.2 meV (C) through range of power.

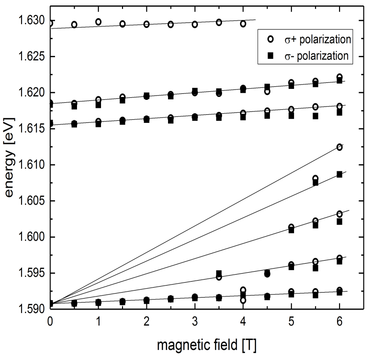

Fig. 2: Magnetic dependence of measured lines for sample B in σ- and σ+ polarization detection. The lines are guide to the eye.

[1] I. Lawrence *et al.*, *Superlattices and microstructures,* **12**, 1, 1992
[2] O. Geode *et al.*, *Superlattices and microstructures*, **12**, 3, 1992

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