Spectroscopy of multiple CdTe-based quantum wells with BN coverage

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Boron nitride has been frequently used nowadays in hybrid structures. A particularly interesting is interaction of BN with 2D materials (like dichalcogenides of transition metals) which improves significalntly optical or transport properties of the 2D layer. In this work we addressed a question of the influence of a BN layer on optical properties of a modultion-doped multi-quantum wells based on CdTe.

We studied a few samples incorporating ten CdTe quantum wells, modulation-doped with iodine donors, with $Cd_{0.7}Mg_{0.3}Te$ barriers. The samples were grown by an MBE technique. Subsequent wells were separated by $Cd_{0.7}Mg_{0.3}Te$ layer with the thickness which was set constant for given sample and changed between 30 nm to 45 nm in different samples. Thus, a distance between subsequent quantum wells was big enough to consider them as non-interacting.

We prepared a few pairs of samples. Samples in each pair were cut from the same wafer (i.e., they shared the same sequence of layers) but one of them was covered with a BN layer with a thickness of several nm. The technique of transfering of BN layers from their original substrate onto the surface of samples studied has been previously described in [1].

We carried out two types of spectroscopic experiments - in the visible and THz part of the electromagnetic spectrum. Both were done with the same low-temperature (4.2 K) insert and magnetic fields up to 9 T. Specifically, we observed a magnetophotoluminescence in σ^+/σ^- polarizations (registered with a spectrometer supplied with a CCD camera) and magnetotransmission of 0.336 THz radiation (registered as a signal from a bolometer placed in the insert directly below the sample).

Both photoluminescence and transmission spectra showed Landau quantization. However, in transmission one observes quantization of the conduction band only while the peaks in the photoluminescence reflect quantization of both the conduction and valence bands.

Magnetotransmission results showed a change of the free electron concentration resulting from coverage the sample with BN layer. Energy of photoluminescence transitions was also changed by BN but a detailed analysis of this data requires a numerical model of the Landau quantization of the valence band which is under development.

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