Referee Report on the Doctoral Thesis of Mgr. Marek Bugár

The thesis reports on the results, which were obtained within the research carried out in Faculty of Mathematics and Physics at the Charles University in Prague. The aim of the project was to study the influence of annealing on the electrical, optical and structural properties of CdTe and $Cd_{0.96}Zn_{0.04}Te$ single crystals.

Chapter 1 of the thesis gives the extensive review about basic knowledge of principles of the CdTe crystal growth and its defect structure (point defects and inclusions of the second phase). Chapter 2 informs us about the methods were used. Among them there are a lot of modern ones what are used in many world-wide well-known laboratories. The obtained results are of current importance because they can be used for the improvement of existing technologies of CZT detectors and producing high-quality substrates. The main results of this thesis were published in several peer-reviewed journals.

Concerning comments and possible criticism, I did not notice any serious drawbacks. I mention some inaccuracies only, which are given in the list below:

1. The position of some point defects in the forbidden gap is arguable. For example, double charged Cd interstitials in some papers is mentioned as $E_d \sim E_C - 0.2 \div 0.24$ eV and in others as $E_C - 0.5 \div 0.6$ eV.
2. Some data for segregation coefficient in Table 1.2 are not precise because they were taken from very old publication (Zanio, 1974).
3. The modeling of point defect ensemble (Fig. 4.3 and 4.4) is not enough precise for 600-700°C and $[Cl]=3.4*10^{16}$ at/cm^3.
4. There are no explanations for the nature of p-n transition under high-temperature Hall effect measurements under Te overpressure (Fig. 4.10).
5. In some cases it was not shown the clear plan in what way the best annealing conditions were reached.
6. The explanation on page 66 for copper coming from 3N $CdCl_2$ looks not correct. In this case copper content will not exceed $4*10^{13}$ at/cm^3 because of $[CdCl_2]=4*10^{16}$ at/cm^3.
7. In the Fig. 4.10 (b and c) the Y-axes don't represent carrier density and mobility.

Reading the text, I came to some questions, which could be answered during the defense:

1. In what way the chlorine content was determined in the samples? If it was done by Hall effect measurements after annealing under Cd overpressure, how were the influence of excess content of Cd interstitials in the lattice or compensation processes during cooling down accounted?
2. Can the 2nd step annealing conditions be predicted from high-temperature Hall effect measurements under Te overpressure?
3. What is the main reason of inclusions disappearing during high-temperature annealing?
4. In Table 2.1, the results for CdTe crystals, doped by comparable amount of chlorine and grown by VGF method, differ by more than 10 orders. What is the reason?
5. Can you propose hypotheses concerning the double relaxation of electron density with Cd overpressure reducing?

I have no objections against theoretical and experimental methods, approaches, reported results, and their interpretation. The thesis proves the author's ability for an independent creative scientific activity. I recommend the thesis to be accepted and to award to Mgr. Marek Bugár the doctoral degree.

Chernivtsi, Ukraine

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Prof. Petro Fochuk