Removing of Thin Layers from the CdTe and $Zn_xCd_{1-x}Te$ Surfaces by the HBr – $K_2Cr_2O_7$ – Ethylene Glycol Etching Compositions

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The investigation was carried out on the single crystals of CdTe and $Zn_{0,1}Cd_{0,9}Te$, which have been grown by Bridgmans method, and $Zn_{0,04}Cd_{0,96}Te$ obtained from the gas phase. We have developed a method of getting a high quality surfaces of these semiconductors and removing from them a thin layers of then that consists of the following steps: grinding of the plates by abrasive powders marks M10-M1→ mechanical polishing with diamond paste → chemical etching to remove the damaged layer (80-100 μm) → finishing polishing by new slow etchants.

Finishing step is the process of chemical-dynamic polishing (CDP) using the method of disc rotating at T = 284 K and disk rotation speed $\gamma = 82$ min^{-1}. The etching mixtures were prepared using 40 % HBr, 10,9 % aqueous solution of $K_2Cr_2O_7$ and ethylene glycol (EG). Putting in the etchant composition EG as viscous component, can partially regulate the interaction of HBr and $K_2Cr_2O_7$ with evolving of Br_2 and promotes the better dissolution of interaction products of etchant with semiconductor. This is an opportunity to get high-quality surface without films and sediments.

The choice of polishing etchants compositions were performed in the concentration range (in vol. %): (20-80) HBr : (20-50) $K_2Cr_2O_7$:(0-60) EG. The dependence of the chemical dissolution of the CdTe and $Zn_xCd_{1-x}Te$ rates versus solutions concentration, mixing, temperature, nature of semiconductor material, and time of solutions storage has been investigated. It was established that the polishing area occupy the most of the researched concentration interval, and the rate of dissolution is in the range: 1.8-6.7 μm/min for CdTe; 1.7-7.5 μm/min for $Zn_{0,04}Cd_{0,96}Te$ and 1.8-7.9 μm/min for $Zn_{0,1}Cd_{0,9}Te$. It was found that the dissolution process is limited by the diffusion stages ($\boldsymbol{E_a} < 30$ kJ/mol). After finishing CDP the samples must be washed by 0.1 M aqueous solution of $Na_2S_2O_3$, then with large quantity of distilled water and dry in air flow. Polished plates can be stored in isopropanol for several weeks.

The results of metallographic and profilometric analysis of plates surface after finishing CDP showed that etched semiconductor surfaces are characterized by high quality ($\boldsymbol{R_z}$ <0,05 μm) and good luster. Optimized composition of etchants can be recommend for controlled reducing of the plates thickness to the specified size, removing of thin layers of material from the surface and finishing CDP of CdTe and $Zn_xCd_{1-x}Te$ solid solution.