Peculiarities of nanosized relief formation on the $Cd_xHg_{1-x}Te$ single crystals surface using $K_2Cr_2O_7$ – HBr – solvent etchants

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The purpose of this work is to develop procedure for formation of nanosized relief on the $Cd_xHg_{1-x}Te$ surface. Single crystals of $Cd_{0.2}Hg_{0.8}Te$ which have been grown by Bridgman method were used for experiments. Preliminary surface treatment of plates consisted of the grinding of the samples by abrasive powders, mechanical polishing with diamond paste and chemical etching to remove the damaged layer. A comparative analysis of changes in the parameters of the surface roughness (**Rz**) of $Cd_{0,2}Hg_{0,8}Te$ after different stages of mechanical treatment was performed (see Table).

Treatment stage of $Cd_xHg_{1-x}Te$	R_z, nm
Cutting string	4580
Cutting string + grinding by abrasive ASM 10/7	3103
Cutting string + grinding by abrasive ASM 10/7 + ASM 5/3	1353
Cutting string + grinding by abrasive ASM10/7 + ASM5/3 + ACM1/0	430

The etching mixtures were prepared from 40 % HBr, 10.9 % $K_2Cr_2O_7$ and ethylene glycol (EG). The chemical-dynamic polishing (CDP) was performed using the method of disc rotating at T = 284 K and disk rotation speed γ = 82 min^{-1}. The rates of CDP of $Cd_{0,2}Hg_{0,8}Te$ by developed polishing solutions is within the range of 0.9-7.3 μm/min. Finishing step of chemical-mechanical polishing (CMP) was carried out on a glass polisher covered with a batiste cloth. Etchant were dropped by a drip method from a dropping funnel with a built-in dispenser at a rate of 2-3 ml/min at T = 293 K. V_{pol} can be partly regulated from 18.7 to 0.8 μm/min due to the simultaneous mechanical and chemical effects on the surface and changes in the composition of the solutions during CMP.

The results of atomic force microscopy of the $Cd_xHg_{1-x}Te$ surface confirm that polishing the plates using developed solutions promotes the formation of a super smooth surface ($R_a \leq 10$ нм). It was found that surface roughness of $Cd_{0,2}Hg_{0,8}Te$ after CDP with $K_2Cr_2O_7$ – HBr – EG is Ra = 2.5 nm and after CMP – Ra = 1.9 nm.