

## Nanostructured surfaces

### Peculiarities of nanosized relief formation on the PbTe and Pb<sub>1-x</sub>Sn<sub>x</sub>Te substrates during chemical-mechanical polishing with H<sub>2</sub>O<sub>2</sub> – HBr – organic solvent etchants

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Method of high quality polishing surfaces formation of PbTe and Pb<sub>1-x</sub>Sn<sub>x</sub>Te single crystals including string cut ingots into plates, their mechanical grinding, chemical-mechanical polishing (CMP) using developed by us bromine evolving etchants has been developed. The research was carried out on PbTe and Pb<sub>0.83</sub>Sn<sub>0.17</sub>Te, Pb<sub>0.8</sub>Sn<sub>0.2</sub>Te single crystal plates grown by Bridgman method.

CMP was carried out on a glass polisher covered with lawn cloth at a continuous supply of etchant (2-3 ml/min) for 2 min and a pressure on the plates in 2-3 kPa. The crystal dissolution rates were registered by reducing its thickness before and after etching with an electronic indicator TESA DIGICO 400. Microstructure of the plate's surfaces after various stages of the mechanical and chemical treatments was studied using table scanning microscope JEOL JCM-5000 NeoScope. The sample surface microprofile characteristics and roughness were obtained using a profilometer HOMMEL-ETAMIC W5, which allows to determine the roughness more than 5 nm. Morphological study of the polished PbTe surface was spent on scanning probe microscope NanoScope IIIa Dimension 3000TM (Digital Instruments, USA).

The proposed compositions of (H<sub>2</sub>O<sub>2</sub>–HBr–EG)/GL (ethylene glycol or glycerol) polishing etchants and treatment methods of PbTe and Pb<sub>1-x</sub>Sn<sub>x</sub>Te single crystal surfaces contribute to a significant decrease in surface roughness (see Table) compared with its value obtained after cutting ingots into plates with the next grinding and CMP ( $R_a < 10$  nm).

#### The parameters of Pb<sub>0.83</sub>Sn<sub>0.17</sub>Te surface roughness after various processing steps

Treatment stage	$R_a$ , nm	$R_{max}$ , nm	Surface condition
cutting string	1418 <sup>1</sup>	9179 <sup>1</sup>	structural damage and traces of cut
cutting string + free abrasive grinding	46 <sup>1</sup>	781 <sup>1</sup>	mat, structural defects
cutting string + free abrasive grinding + CMP (H <sub>2</sub> O <sub>2</sub> – HBr – EG/GL)	1 <sup>2</sup>	15 <sup>2</sup>	smooth, mirror-smooth

<sup>1</sup> HOMMEL-ETAMIC W5 profilometer

<sup>2</sup> AFM data