The both crystals PbTe and CdTe are of different crystalline structure and their relative solubility is remarkably low. The PbTe belongs to the group of IV-VI narrow gap (0.23eV) semiconductor compounds and crystallizes in the six fold coordinated lattice of rock salt type structure, while the CdTe belongs to the group of II – VI middle gap (1.45eV) semiconductor compounds and crystallizes in four fold coordinated zinc blend type structure. Highly promising case of the crystals application is represented by the quantum dots (QD) of PbTe crated in CdTe matrix for certain electronic or optoelectronic devices [2,3]. The other example of PbTe-CdTe system for potential application is Pb$_{1-x}$Cd$_x$Te bulk crystal with a high Cd content which can be used for the thermoelectric applications.

The Pb$_{1-x}$Cd$_x$Te rock salt crystals were grown in the Institute of Physics, Polish Academy of Sciences and were obtained by Self-Selecting Vapor Growth (SSVG) method [2]. This method provides most favorable growth conditions, as the growing crystal contacts exclusively with its own source material of the same composition. Moreover, the almost isothermal, closed growth system tends to an increase of entropy with the result in excellent compositional uniformity. This system allows to grow the metastable Pb$_{1-x}$Cd$_x$Te crystals in the temperature range of stability with rapid cooling to freeze the high-temperature phase existing between the solidus line and bottom temperature of stability known from the published phase diagram [3]. The study of X-ray diffraction of Pb$_{1-x}$Cd$_x$Te ternary crystal performed in room temperature confirm a single-phase rock-salt solution.

[Fig.1. a - Valence band spectra measured for different crystals composition. b – High energy spectrum of Te(4d), Pb(5d), Cd(4d) and valence band electrons. Used radiation hv =3510eV.]
The electronic structure of Pb$_{1-x}$Cd$_x$Te crystals valence band and core level regions were measured with application of Tunable High Energy X-ray Photoemission Spectroscopy (THE-XPS) and Ultraviolet Photoemission Spectroscopes (UPS). The photoemission studies were performed at room temperature with application of the synchrotron radiation in the HASYLAB, DESY, Hamburg, Doris III storage ring. The clean crystal surface was obtained by Argon ions sputtering and annealing under UHV conditions. The Tunable High Energy X-ray Photoemission Spectroscopy (THE-XPS) experiment was performed at wiggler beam line station BW2. The Ultraviolet Photoemission spectroscopy experiments were performed at beam line station FLIPPER II (E1). Synchrotron radiation obtained from the storage ring DORIS III was monochromatized with the plane grating vacuum monochromator designed for the photon energy range of 15–200 eV. The spectrometer was equipped with a CMA electron energy analyzer and the energy resolution was kept at 0.2eV for UPS spectra.

Fig.2. a – Spectrum of Pb4d and Cd3d. b – spectrum of Te3d. Used radiation hv =3510eV.

The experiments show that a solid solution has been created with strongly modified density of states distribution in the valence band. Obtained results of the valence band are planed to be compared with the calculated band structure [3]. The compositions of Te3d peaks expected for Cd –Te and Pb – Te interaction was not found for the spectrum.

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