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HIGH ENERGY PHOTOEMISSION FROM COVERED LAYER

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The experiment was performed using the Tunable High Energy X-ray Photoemission Spectrometer (THE-XPS) at wiggler beam line station BW2 of the HASYLAB, DESY, Hamburg, Doris III storage Ring. Double crystal monochromator (Si(111) covers an energy range from 2.4 to 10 keV with a monochromatic photon flux of about 5×10^{12} photons/s and with total energy resolution power of 0.5 eV for radiation energy around 3000 eV was used.

The nanostructure was grown by MBE deposition method in the Institute of Physics, Polish Academy of Sciences in Warsaw [1]. The CdTe buffer layer (45 nm) was evaporated on GaAs (100) wafer and $Pb_{0.95}Eu_{0.05}Te$ layer of 6 nm thickness was evaporated on it. The layer of $Pb_{0.95}Eu_{0.05}Te$ was covered by CdTe layer of thickness 22 nm.

The energy $h\nu$ = 3510 eV was found as an optimal for measurements where the kinetic energy of the Eu3*d* electrons is not overlapping of Pb Auger electrons from the $Pb_{0.95}Eu_{0.05}Te$ layer. The set of spectra containing: valence band, Cd 3*d* and 4*d*, Pb 4*f* and 5*d*, Eu 3*d*, was measured. The big thickness of CdTe layer (22 nm) covering $Pb_{0.95}Eu_{0.05}Te$ layer was strongly damping the electrons emitted from Pb and Eu atoms. After Ar ion sputtering of CdTe top layer, down to about 7nm, the photoemission signal belonging to the electrons of covered layer atoms, Pb 5*d*, Pb 4*f* and Eu 3*d*, remarkably increases. The increase of the signal of photoemited electrons from Pb 5*d* and Eu 3*d* of buried layer appears when the angle of light incidence approaches the region of the value located close to the critical angle. The change of relative height of Pb 5*d* peak relatively to the height of Cd 4*d* (Pb5*d*/Cd4*d*) versus the angle incident of light were determined.

The interference of incidence and reflected part of X-ray beam leads to the creation of standing waves in the crystal. It leads to the creation of electric field structure in the region of sample surface. The remarkable change of the value of electric field occurs for the angle of X-ray incidence in the region of critical angle (value around 89 degree relatively to the perpendicular to the plane of crystal surface). The intensity of excited photoelectrons from particular depth of the sample surface region is proportional to the value of electric field corresponding to the depth of the region from the surface. The electric field distribution in the samples CdTe/PbEuTe/CdTe studied by X-ray photoemission, have been calculated with a program based on Parrat algorithm implementing the Fresnel recursive approach [2]. The calculated results helps to interpret measured results.

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