Targets for Studying the Equation-of-State

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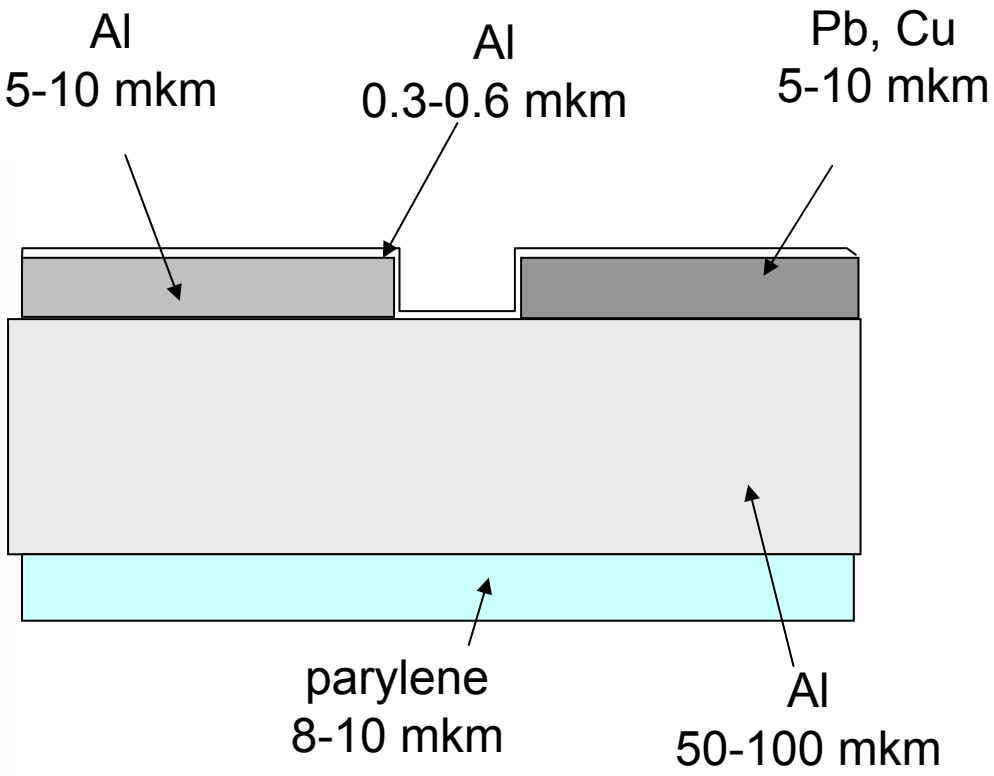
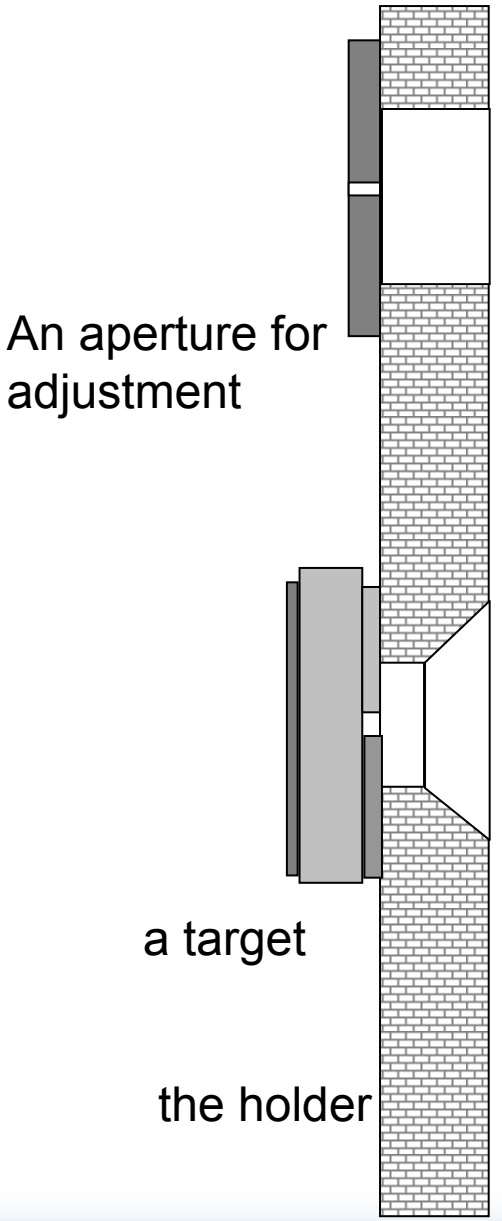
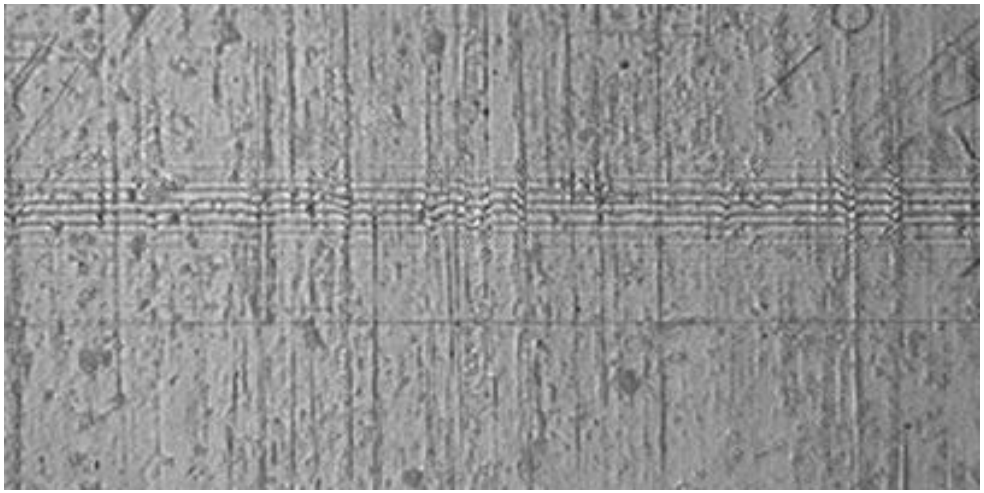




The schematic sketch of a target for studying of the equations of state.
On the left - an arrangement of layers,
on the right - disposition of a target on the holder.

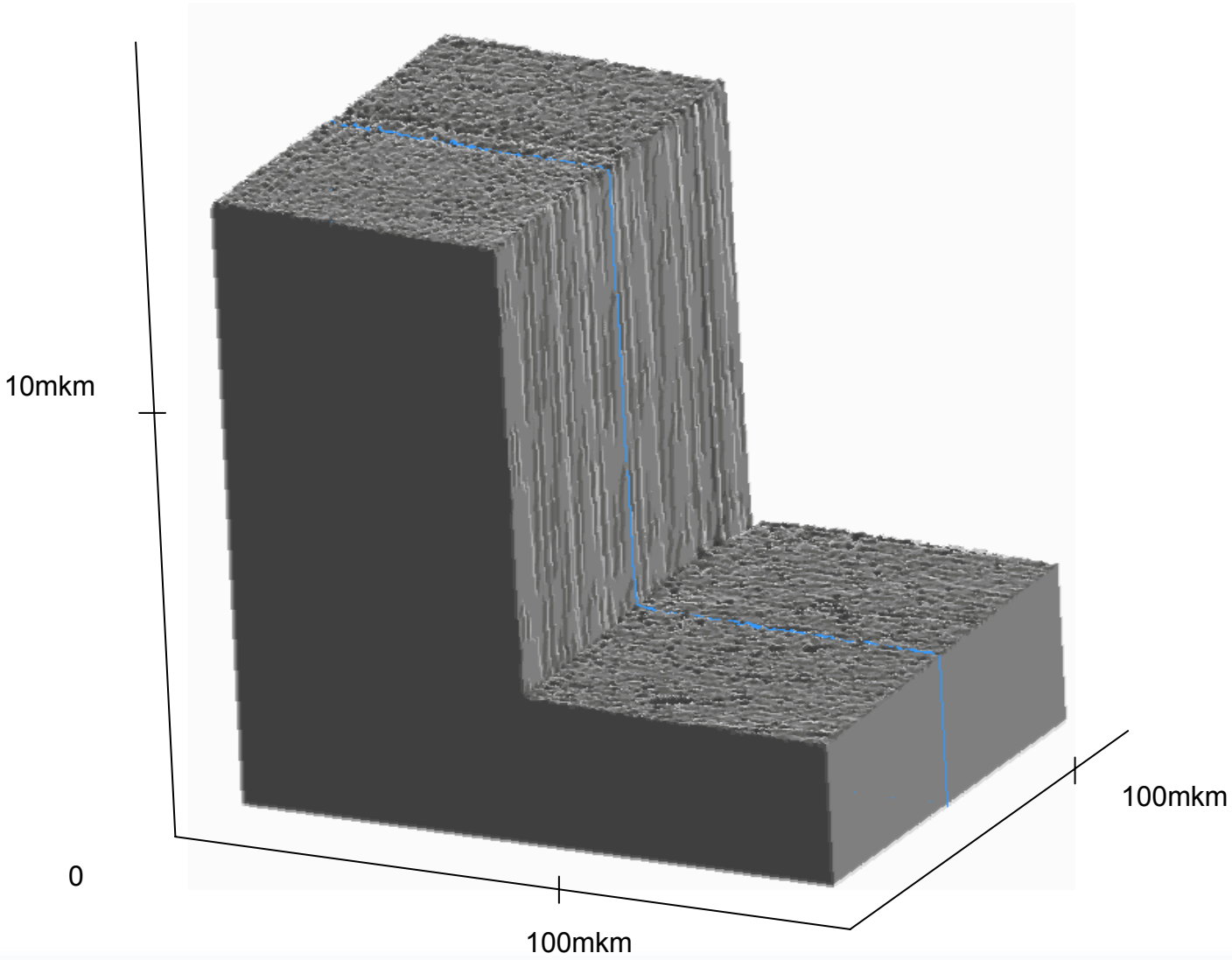
Microinterferograms
of base plate surface

before pressing



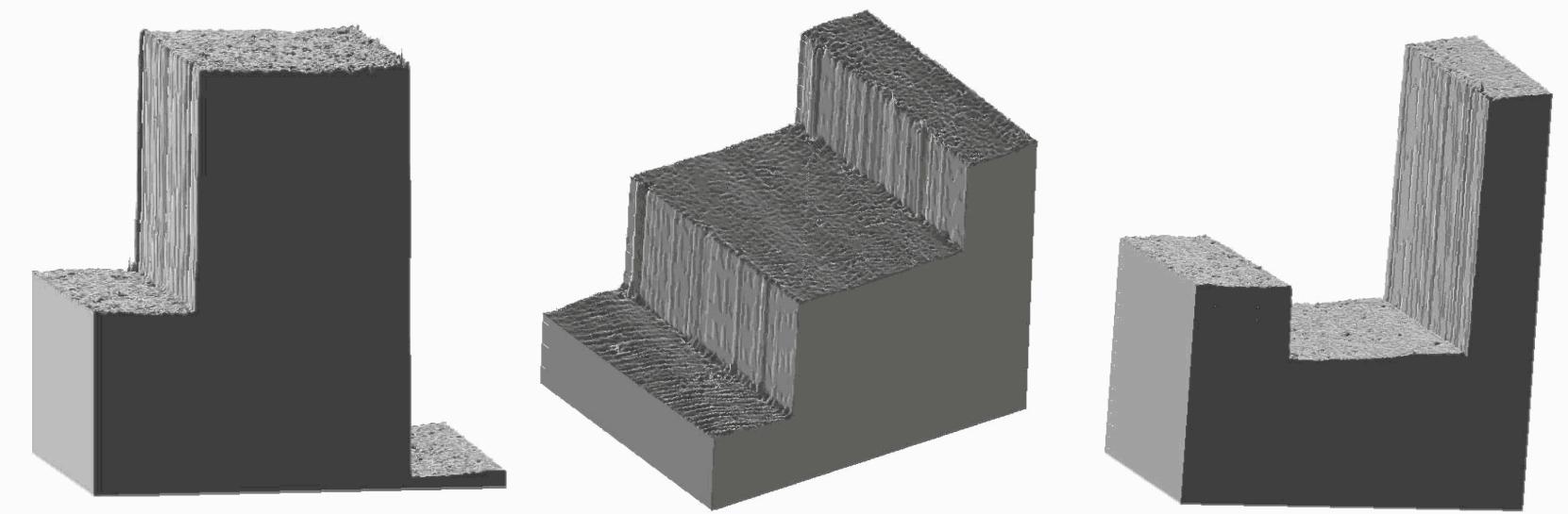
after pressing

3D - image of a surface of a step with height 11.2 microns



3D images of steps on Al foil, made by means of two-level matrixes

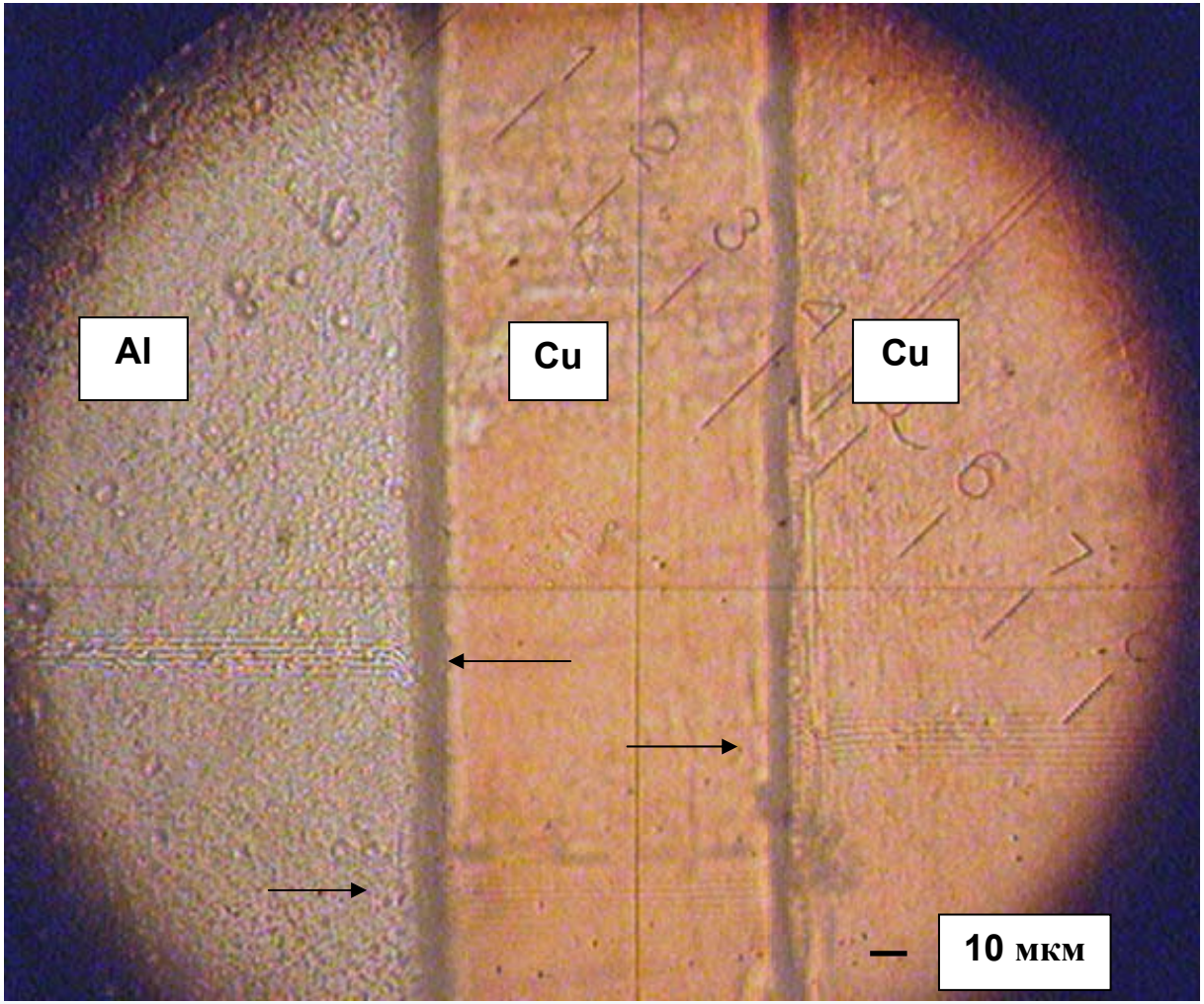
with the mean plane widths 100 mkm and step heights:



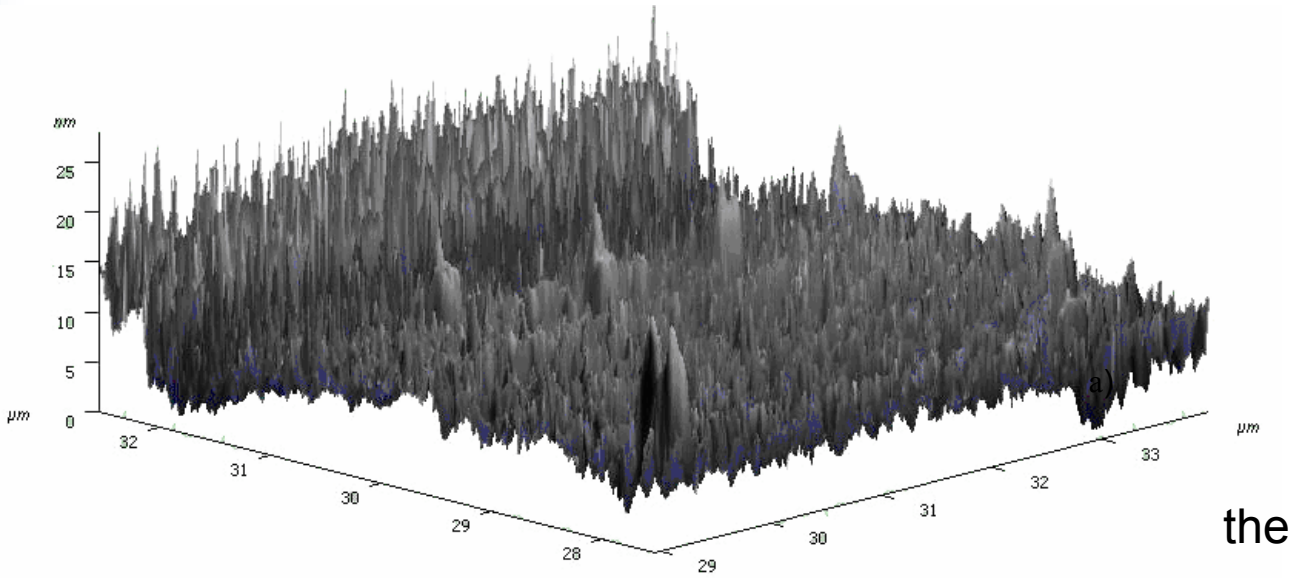
a) 9.7 mkm and 16.5 mkm, b) 7.4 mkm and 6 mkm, c) 3 mkm and 10 mkm

Interferogram received on microinterferometer MII-4,

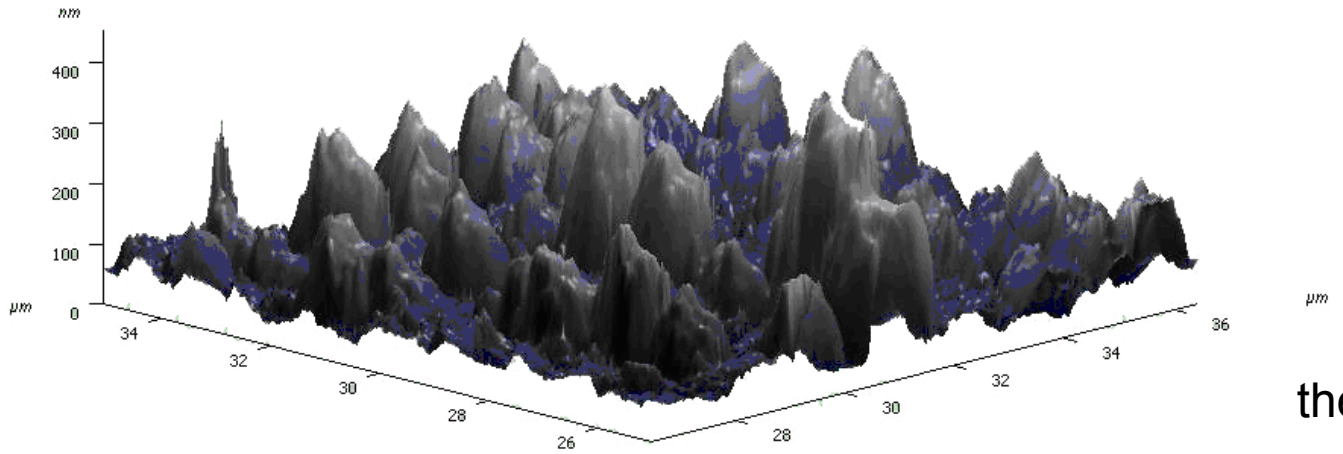
two-level target Al and Cu steps (7 and 5 microns)
on a Cu base plate (thickness 40 microns)



Surface structures measured with a AFM



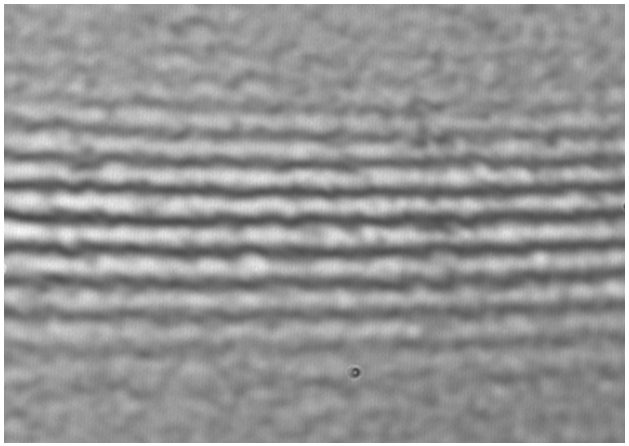
the copper film



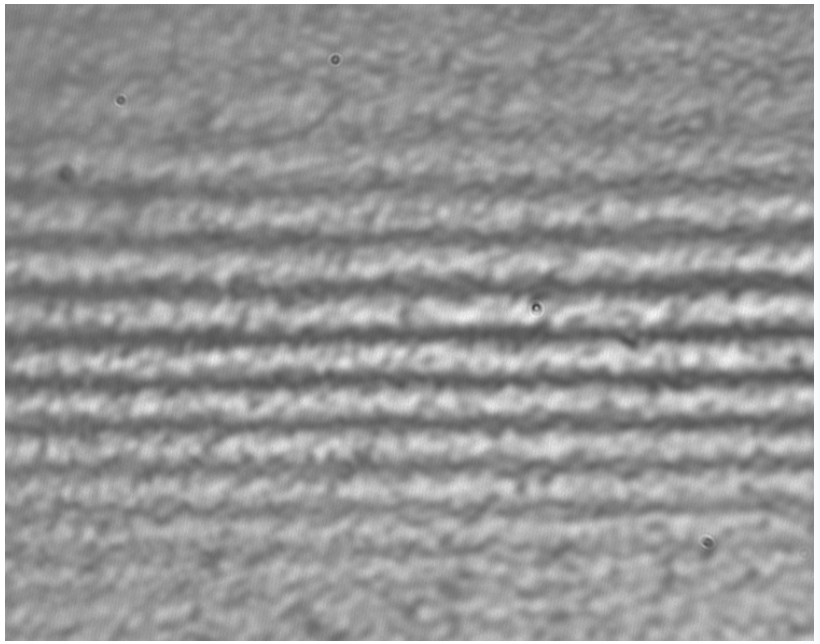
the lead film

Interference fringes measured with microinterferometer MII-4
on a surface of a aluminum layer 12,6 microns thickness, deposited on

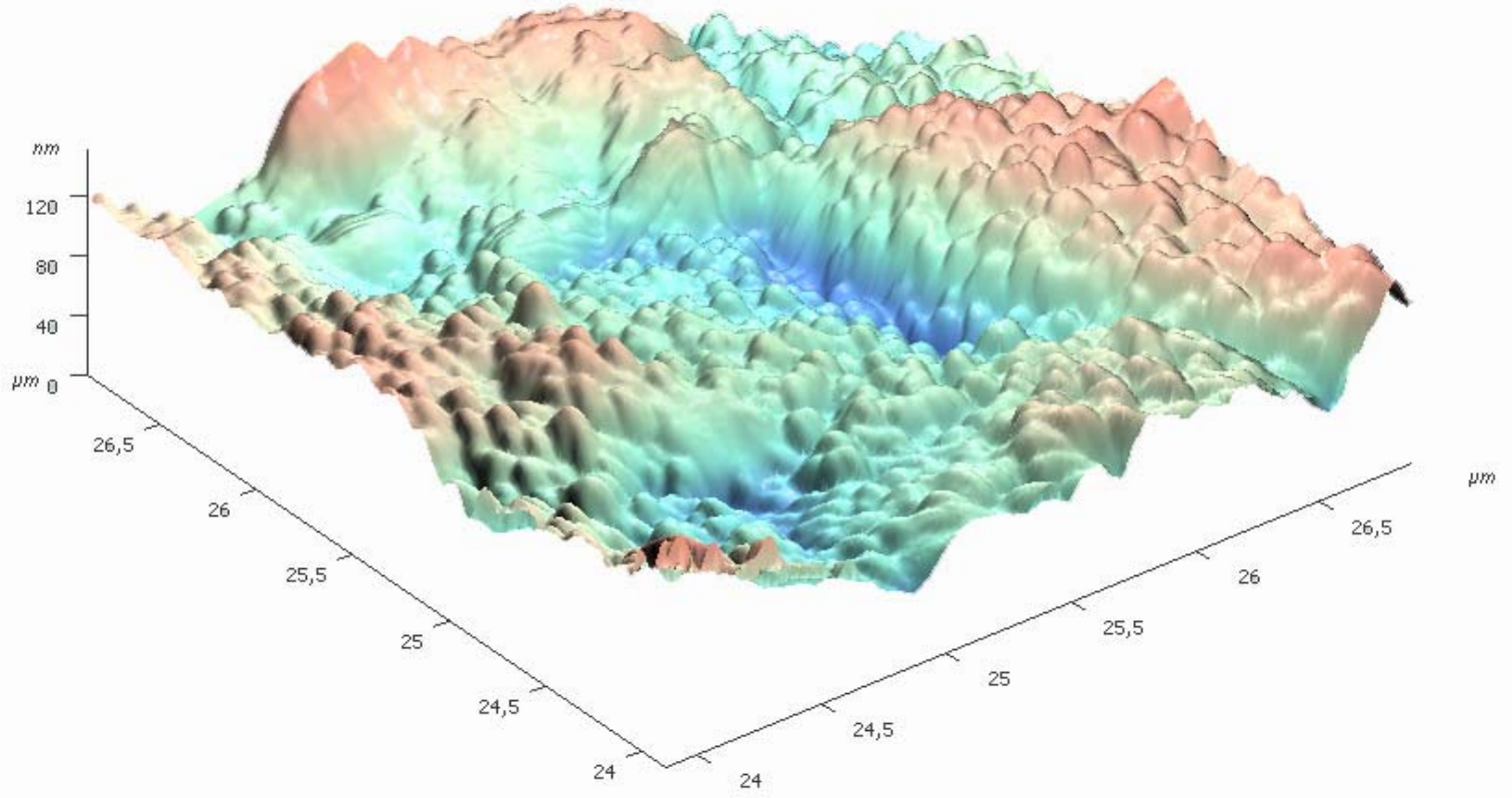
a glass substrate



polished NaCl substrate

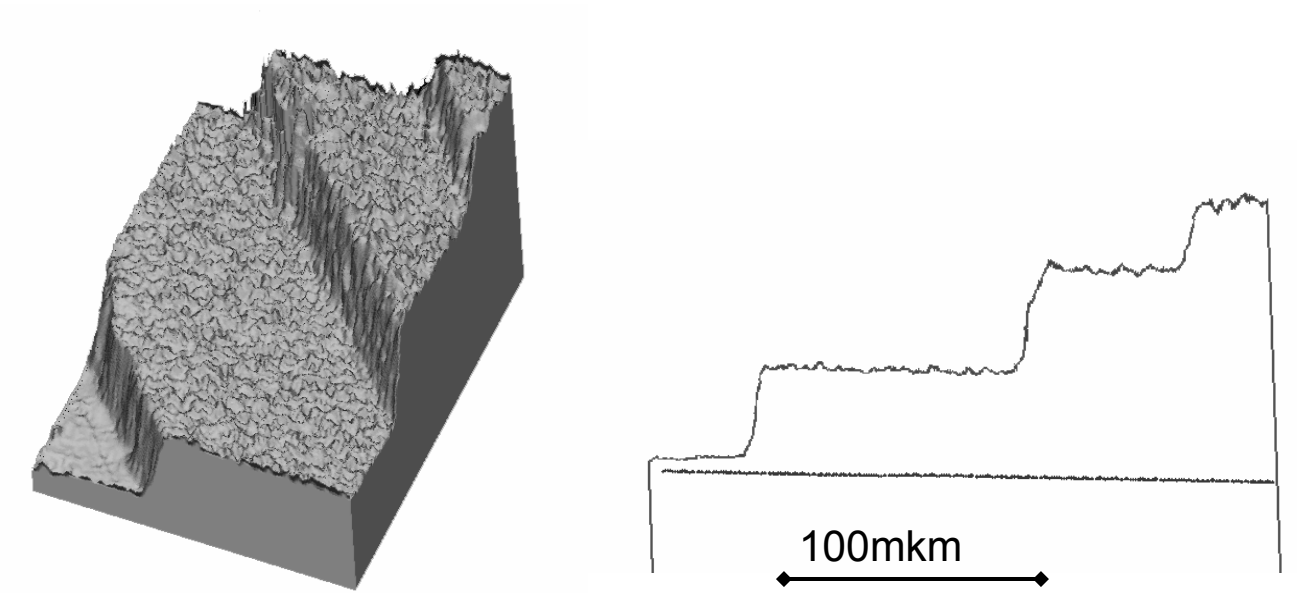


Surface profile of an aluminum layer thickness 12,6 microns on NaCl substrate, measured with AFM.



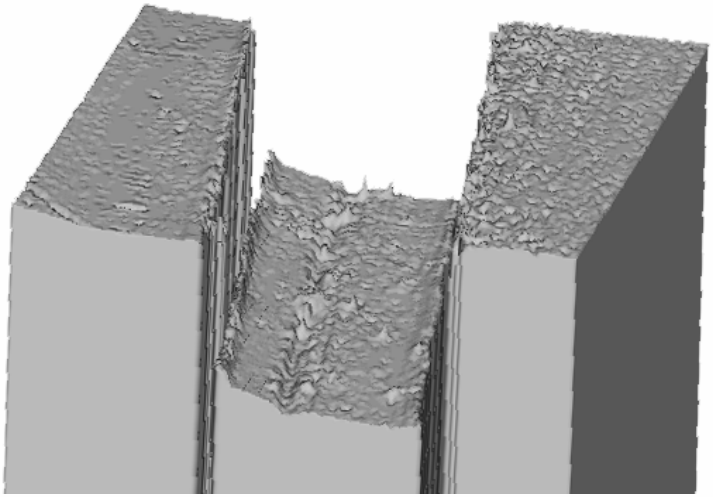
A three-stage target (region of steps)

The image is received in scanning interferometer.

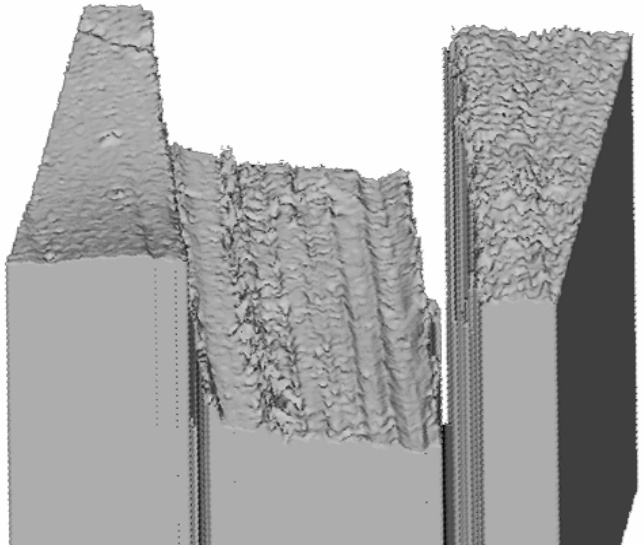


Steps from left to right with height 8.3, 9.2, 6.7 mkm
and roughnesses ~0.1, ~0.35-0.4, ~0.5, ~0.6 mkm

The images of a two-level targets measured with scanning interferometer

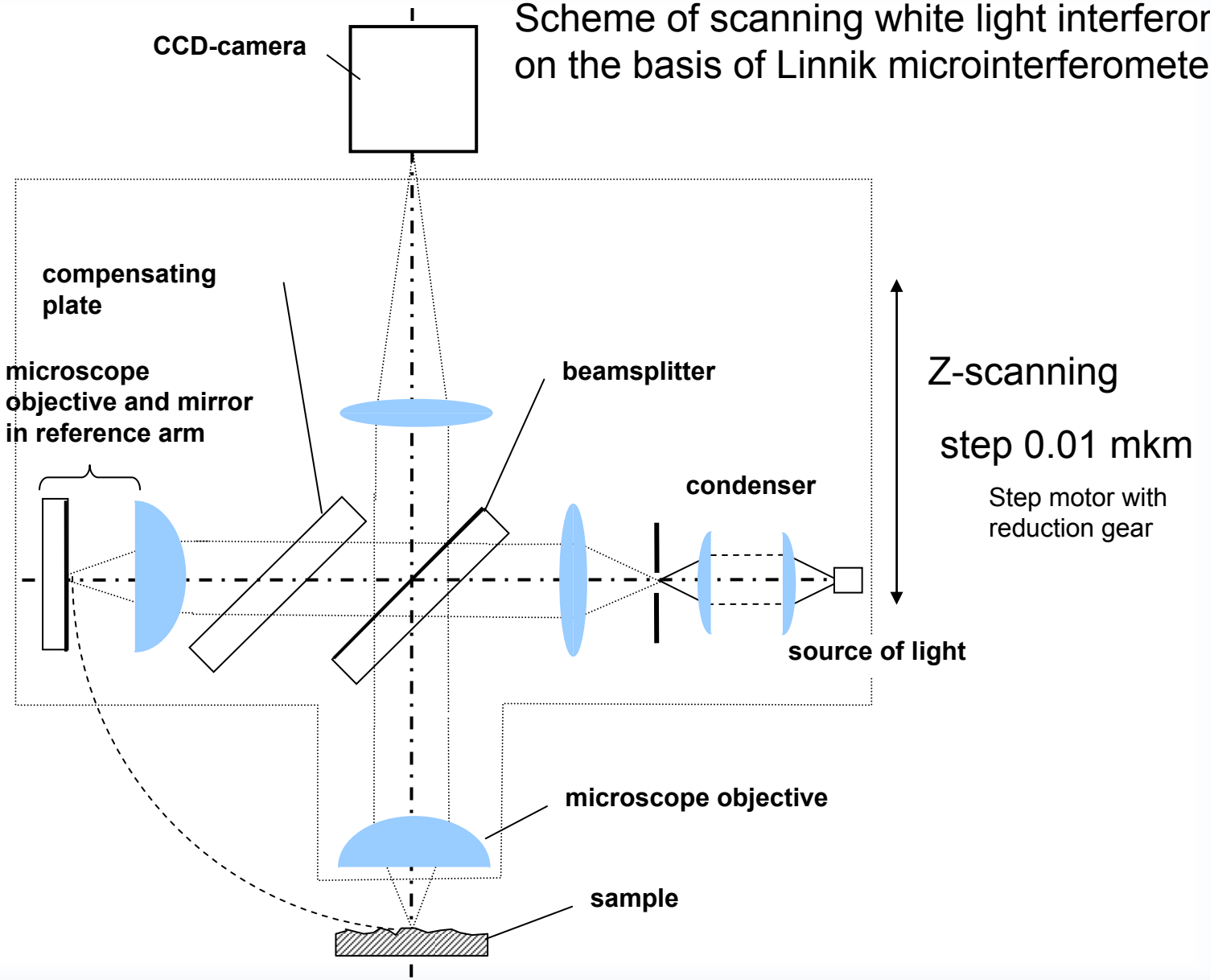


Height of Cu step is 6.0 mkm,
Height of Al step is 8.2 mkm,
Distance between them is 73 ±3 mkm,
Roughnesses of Al base plate is ~0.04-0.05 mkm
(outside of a scratch, possibly left at mask installation) ,
Roughness of a Cu layer is ~0.02 mkm,
Roughness of a Al layer is ~0.07 - 0.1 mkm.

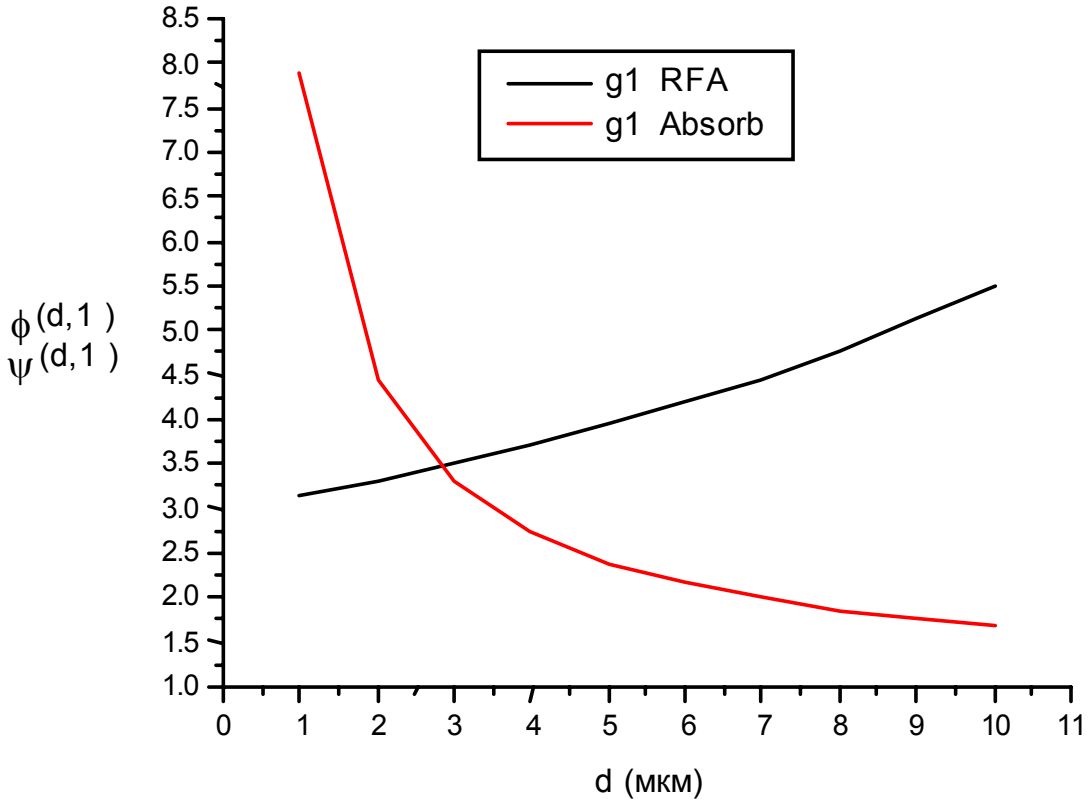


Height of Cu step is 6.4 mkm,
Height of Al step is 7.8 mkm,
Distance between them is 86±5 mkm,
Roughnesses of a base plate is ~0.15-0.2 mkm
Roughness of a Cu layer is ~0.03 - 0.04 mkm,
Roughness of a Al layer is ~0.15 - 0.2 mkm.

Scheme of scanning white light interferometer on the basis of Linnik microinterferometer

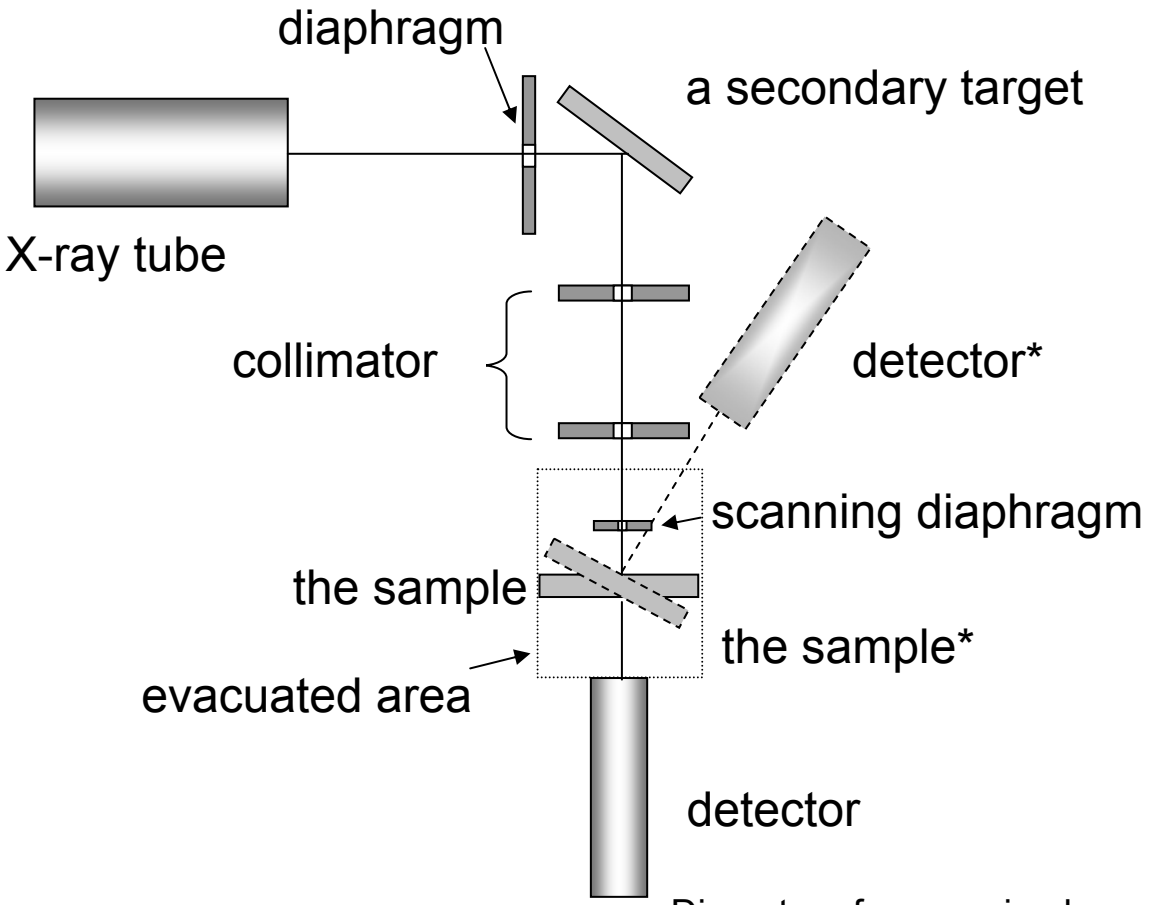


Measurements of film thickness by X-ray spectral methods.



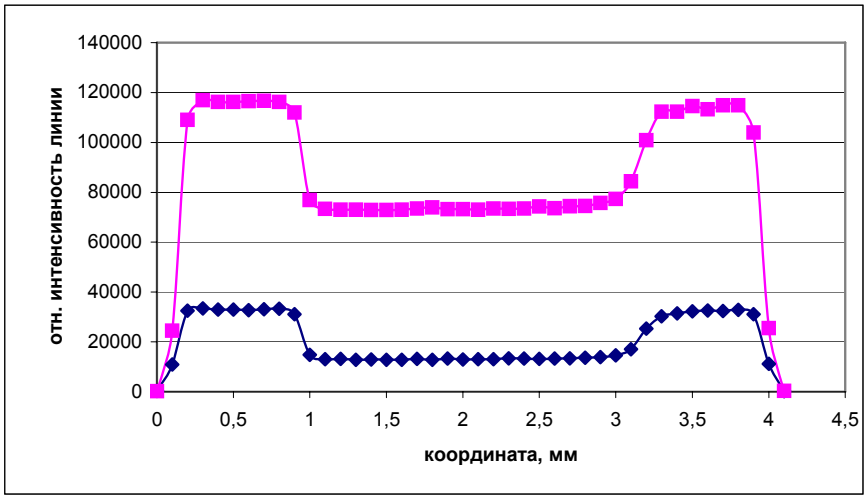
Dependence of a relative error for film thickness measurement by fluorescent and absorptive methods

Measurements of film thickness by X-ray spectral methods.

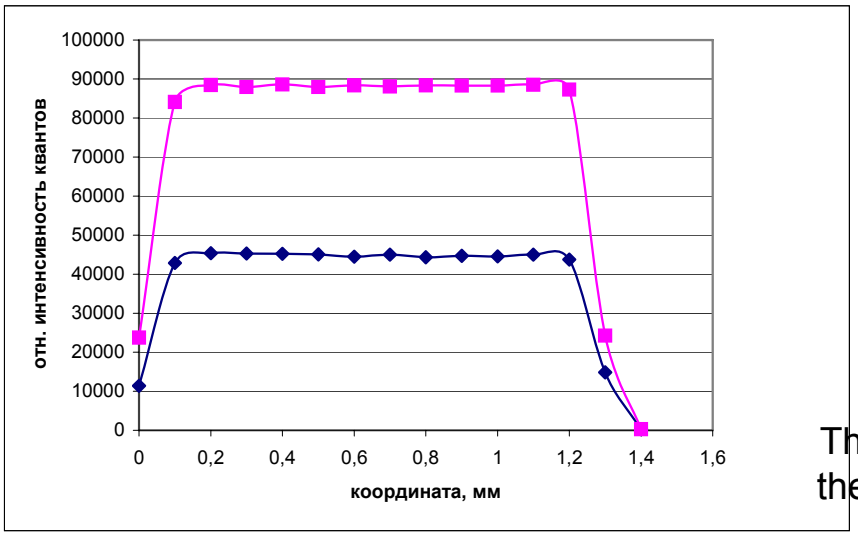


The scheme of film parameters measurements by X-ray absorptive and fluorescent methods

Measurements of film thickness by X-ray spectral methods.

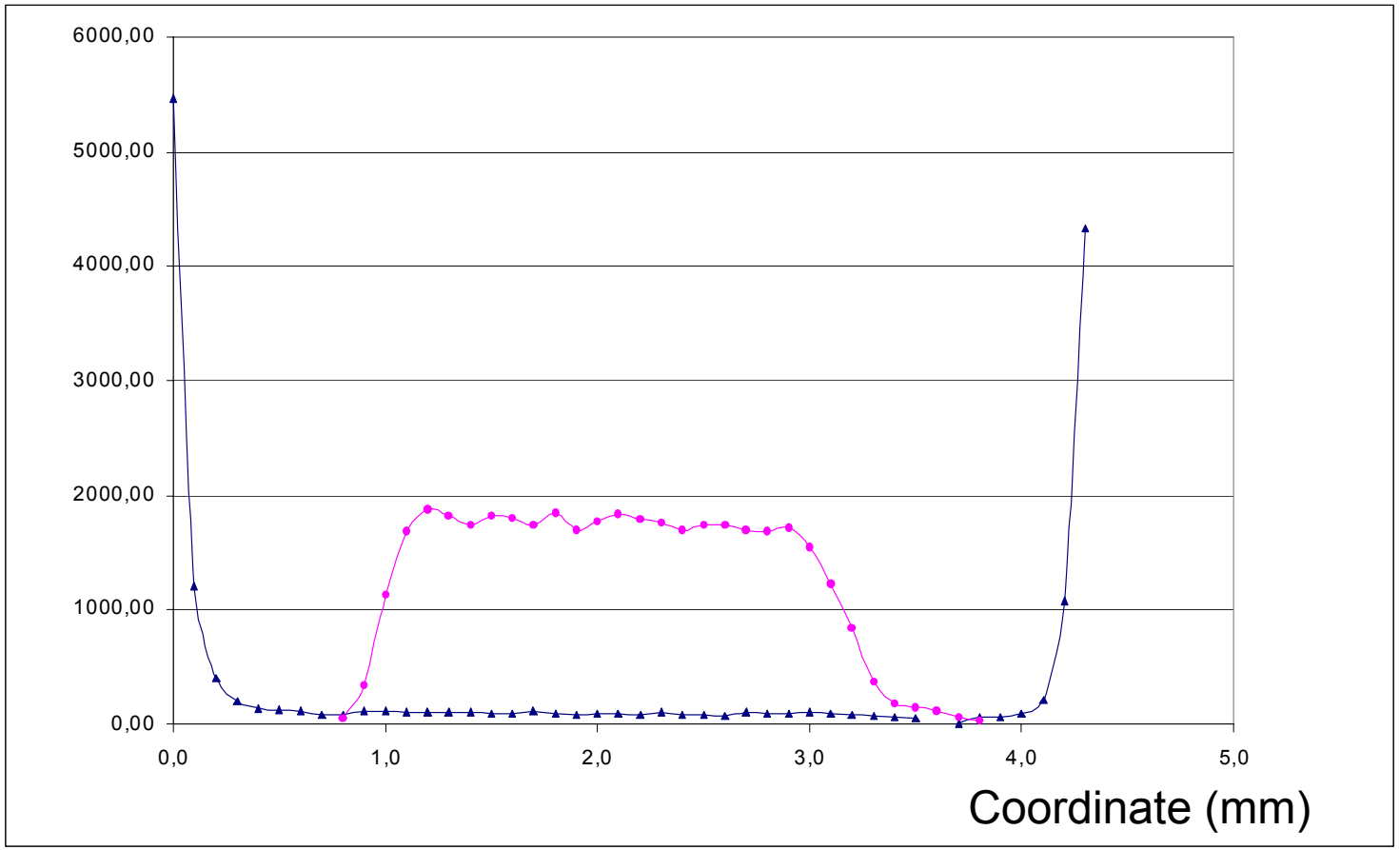


Intensity of quantum
of characteristic radiation of a secondary target, past through the Pb-Al sample, versus scanning coordinate.
The bottom curve - a nickel target (EKa=7,472 кэВ), the top curve - a zirconium target (EKa=15,746 кэВ).



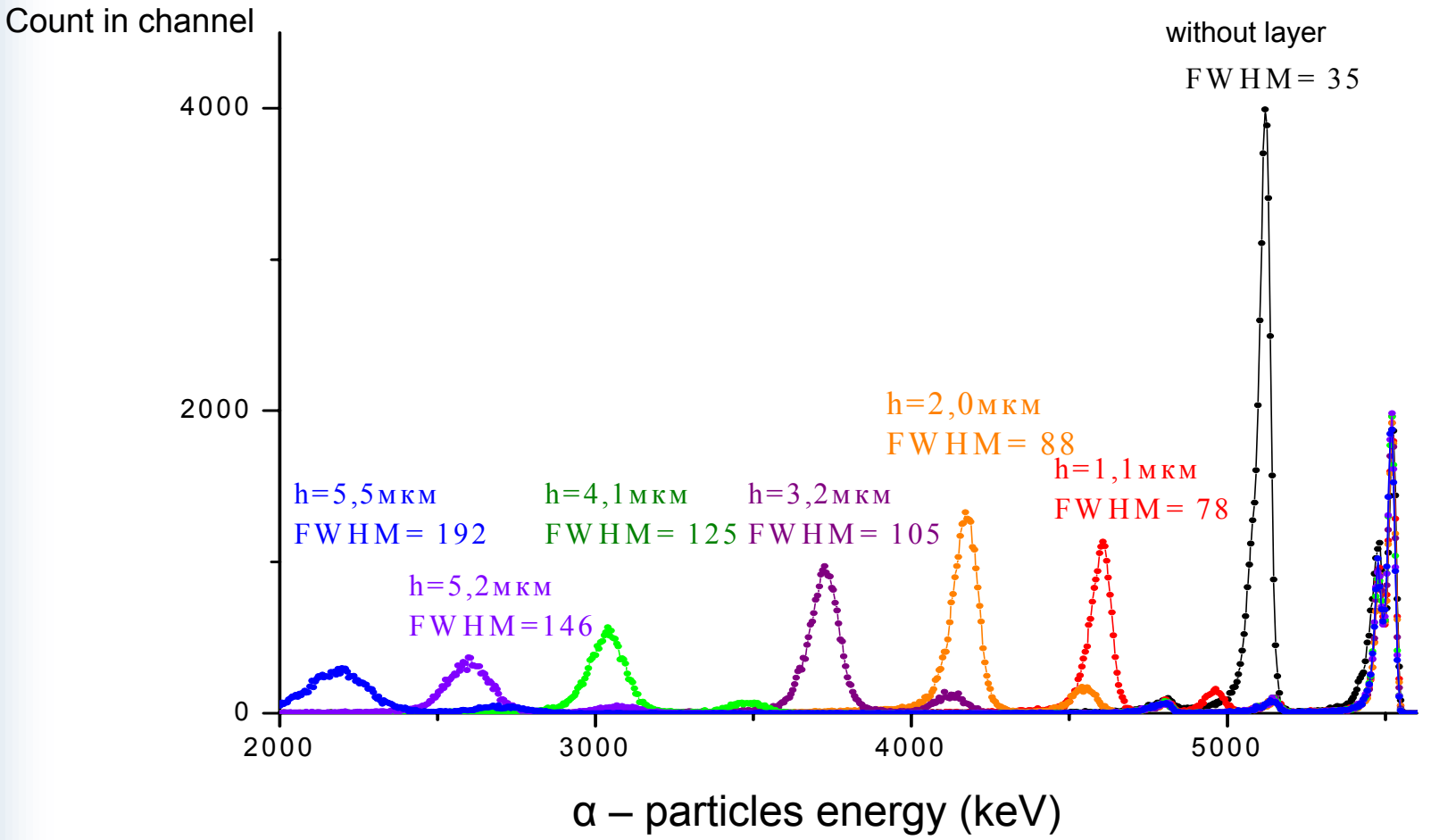
Intensity of quantum of characteristic radiation
of a secondary target
past through the Cu-Al sample
versus scanning coordinate.
The bottom curve - a nickel target (EKa=7.472 кэВ), the top curve - a germanium target (EKa=9.876 кэВ).

Relative intensity



Fluorescence intensity of lead film (the top curve)
and copper mandrel (the bottom curve)
in various points of scanning (excitation from a lead film).

Measurement of film thickness with alpha-spectrometry method



Instrumental spectra at copper film measurement

Now the following methods are applied for EOS-targets manufacturing:

- Pressing of industrial aluminum foil has enabled to reduce size of a surface roughness from 0.5-0.7 mkm down to 0.1-0.2 mkm;
- Surface polishing for copper industrial foil permits to receive base plates with surface roughness 0.05 mkm;
- Pressing method has enabled to produce single-and multistage targets from a homogeneous material, aluminum or copper, with surface roughness less than 0.1-0.05 mkm and with width of a transition zone for steps no more than 3 mkm;
- The vacuum sputtering method at corresponding processing of the base plate surface gave the possibility to make copper and lead steps with a root-mean-square roughness of a surface 10 nm and 80 nm accordingly, and with transitive zone width no more than 10 mkm;
- We succeeded in sputtering deposition films of aluminum with 10 mkm thickness and rms-roughness of surface 50-70 nm, using the crucible evaporator and corresponding substrate processing;

Developments of measuring methods enable to register the parameters of targets with sufficient accuracy:

- Using of industrial white light optical interferometer MII-4 permits to measure step height up to 10 mkm with an accuracy of 0.05 mkm and with lateral resolution about 0.4 mkm. On the basis of this device the scanning white light interferometer has been created. It enables to receive the 3D image of surface structure in the field-of-view 150x190 mkm^2 and to measure step height up to 50 mkm with an accuracy of 100 nm;

- Development of X-ray - spectral methods has enabled to measure film thickness with accuracy of 1-2 %, and to build by scanning a one-dimensional profile of layer thickness for films with various element structure;

- α-spectrometry method permits to receive qualitative value of film thickness heterogeneity on the chosen area of a target;

- Use of an industrial atomic-power microscope enables to receive 3D image of a film surface with accuracy of 1 Å and the lateral resolution 1-10 nm. Measuring of surface with a height step up to 5 mkm is possible.

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