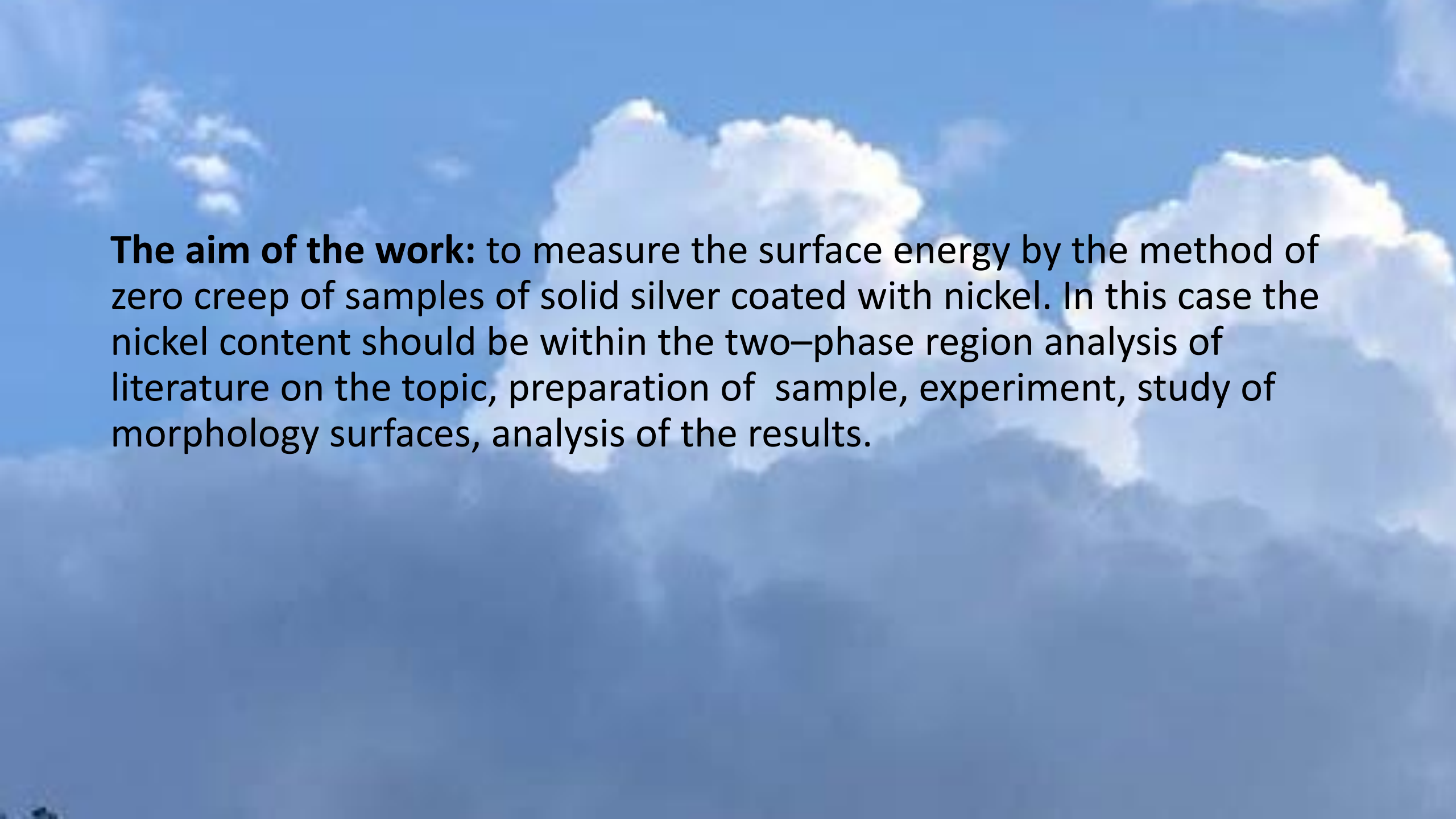


# The effect of Nickel on the Surface Energy of Solid Silver

Antonova Valeriya

MFZ-20-1-1

Moscow, 2021



**The aim of the work:** to measure the surface energy by the method of zero creep of samples of solid silver coated with nickel. In this case the nickel content should be within the two-phase region analysis of literature on the topic, preparation of sample, experiment, study of morphology surfaces, analysis of the results.

# Introduction:

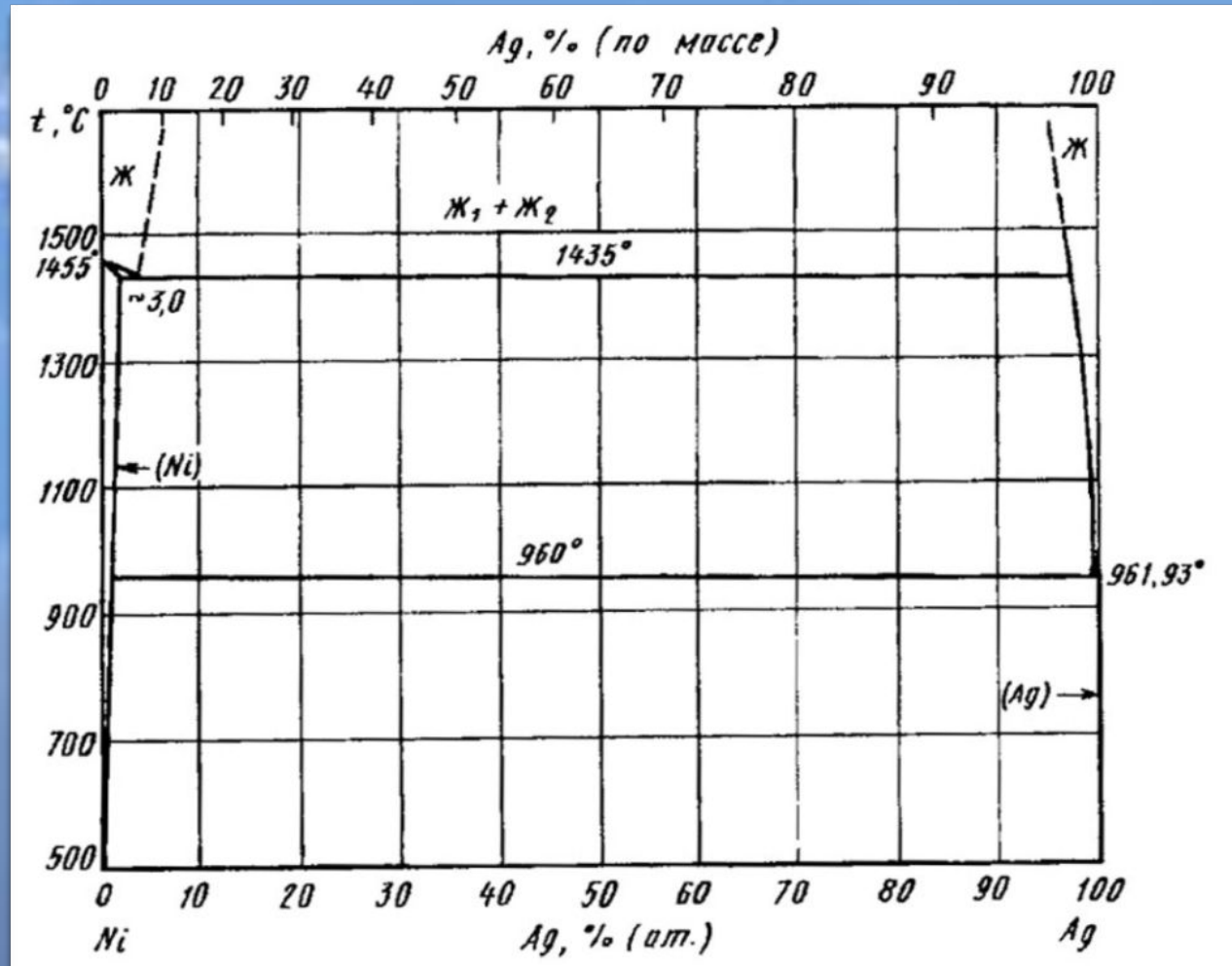


Fig. 1. Phase diagram Ag-Ni.

# Experimental setup:

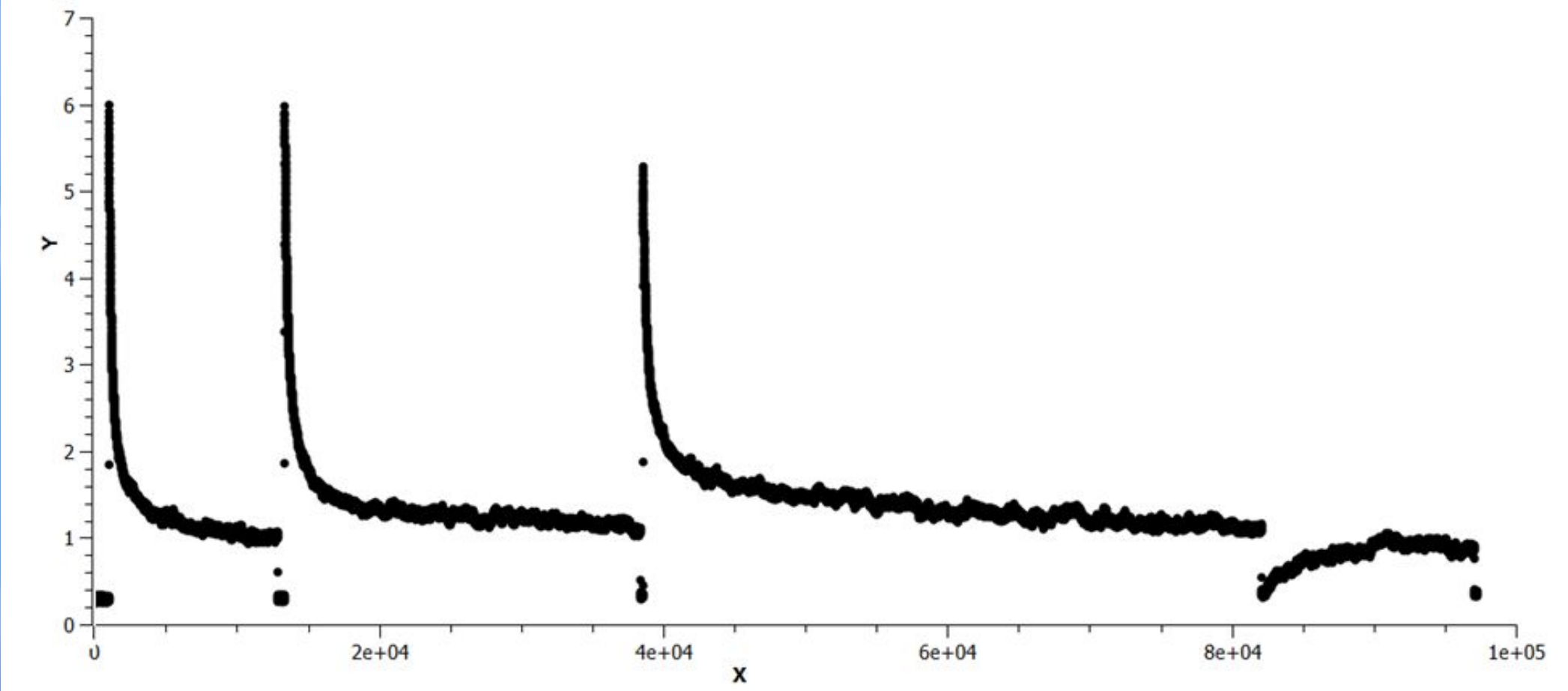
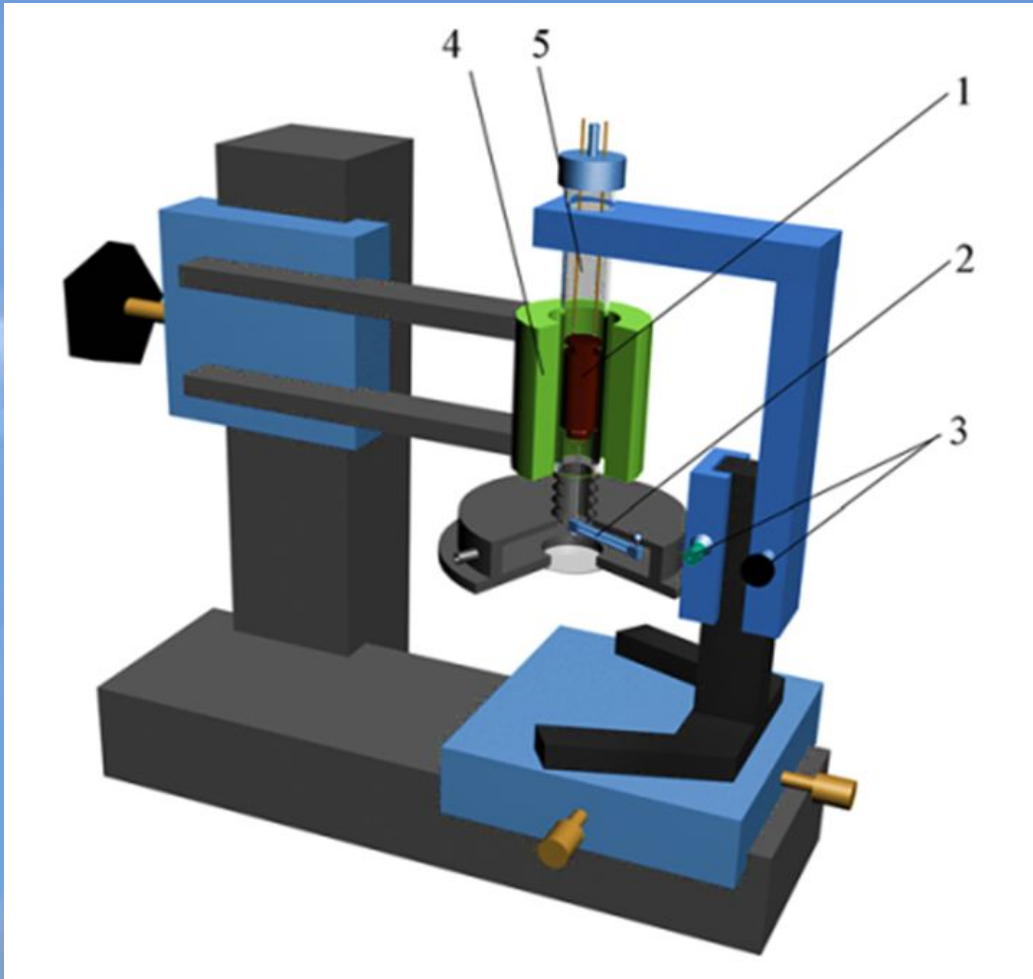


Fig. 2. Experiment Graphs.



- 1 – sample;
- 2 – weight sensor;
- 3 – micro- and macro- offset screws;
- 4 – furnace;
- 5 – camera.

Fig. 3. Equipment for measuring the dependence of the load on time and temperature.

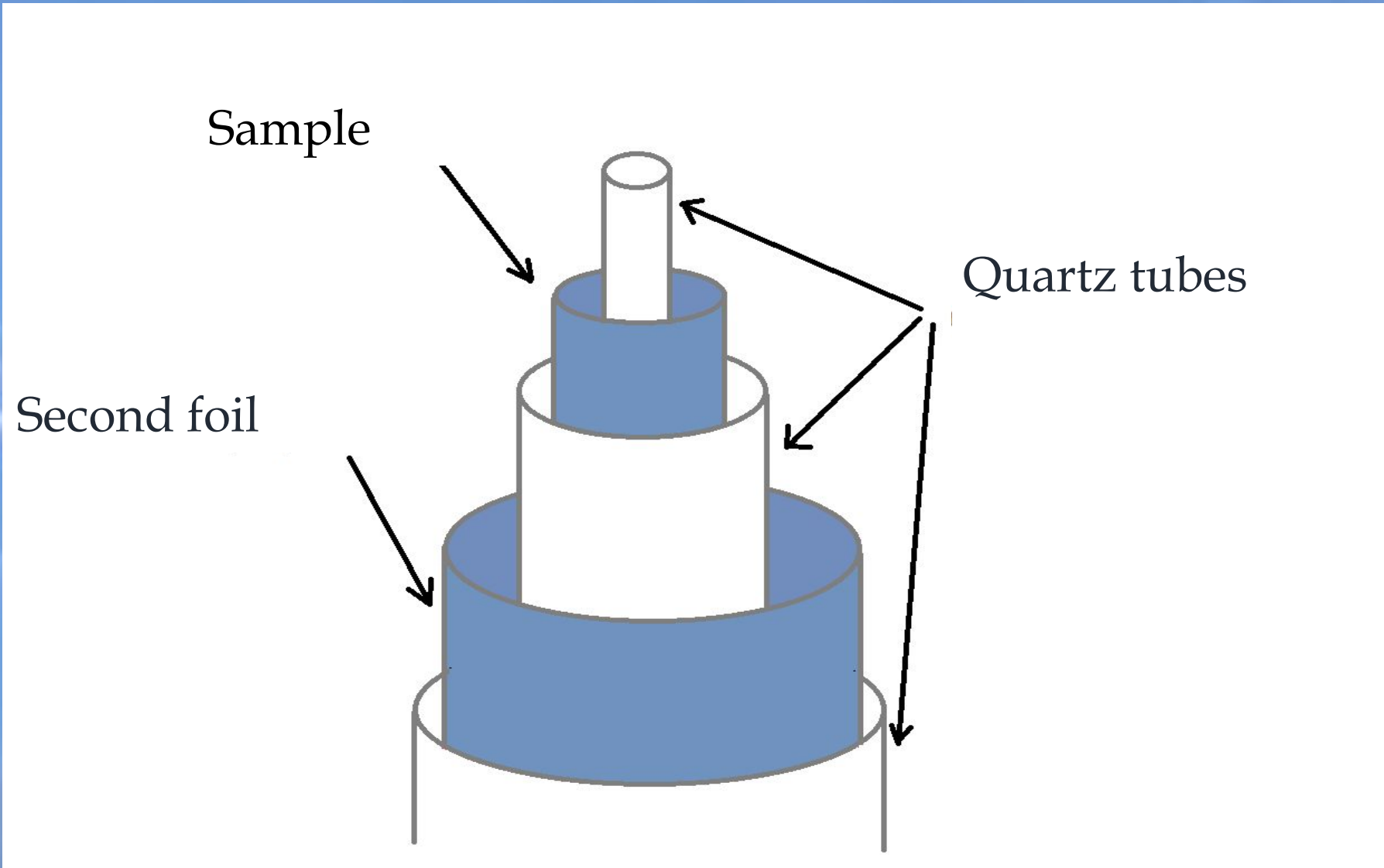


Fig. 4. The figure shows a schematic representation of the sample.

## Method description:

Deformation in this method follows the Nabarro-Herring mechanism

$$\frac{d\varepsilon}{dt} = \frac{1}{\eta} \sigma',$$

where  $\varepsilon$  – relative deformation,  $\eta$  – viscosity index,  $\sigma'$  - tension.

$$\eta = B \frac{kT}{D\Omega} V^{2/3},$$

where B –constant from Nabarro-Herring theory,  $\Omega$  –atomic volume, D – bulk diffusion coefficient, V – average grain volume.

$$\sigma' = \sigma - \sigma_0,$$

$\sigma_0$  – zero creep stress;  $\sigma$  – stress set by the sensor.

Since the sensor is also an elastic beam, then

$$\varepsilon = A\sigma,$$

proportional factor that corresponds to the installation.

$$\begin{cases} \frac{d\varepsilon}{dt} = \frac{1}{\eta}(\sigma - \sigma_0) \\ \varepsilon = A\sigma \end{cases} \Rightarrow \frac{Ad\sigma}{dt} = \frac{1}{\eta}(\sigma - \sigma_0) \Rightarrow$$

$$\sigma = \sigma_0 + (\sigma_{\text{нач}} - \sigma_0) \exp\left(-\frac{t}{\eta A}\right)$$

The resulting equation is the dependence of the sensor voltage on time at a specific temperature.

$$V_c = \frac{\sigma_0}{\dots}$$



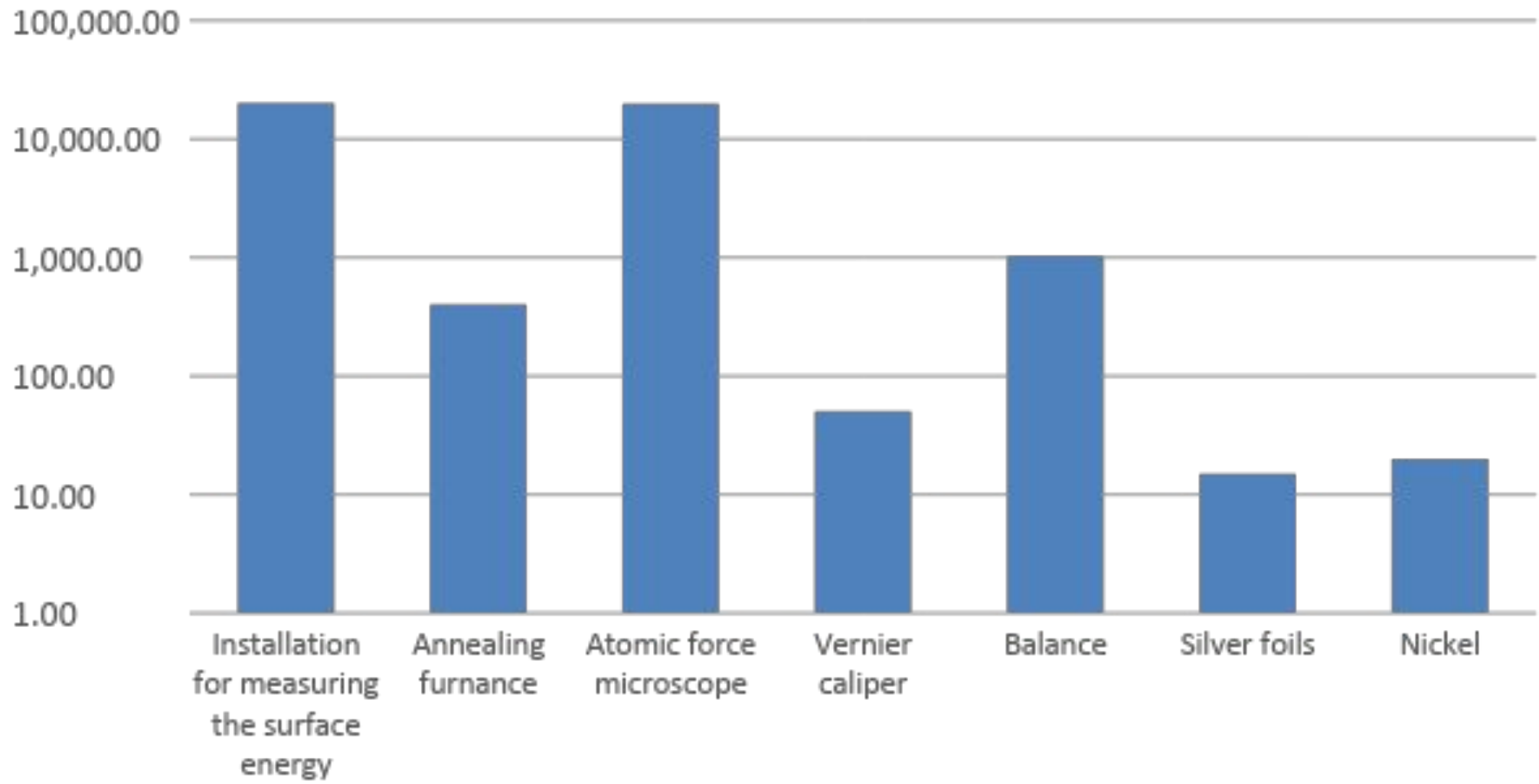
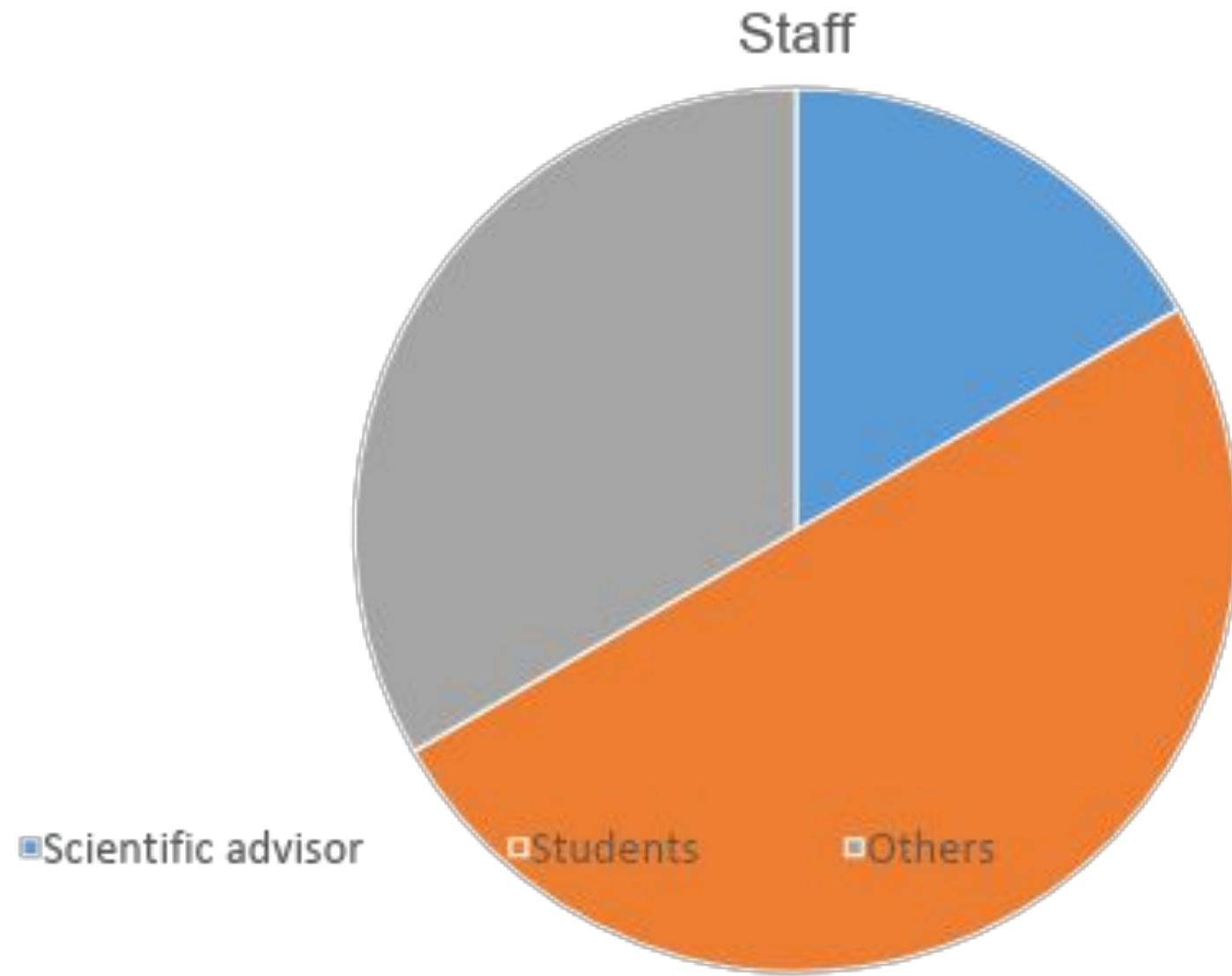
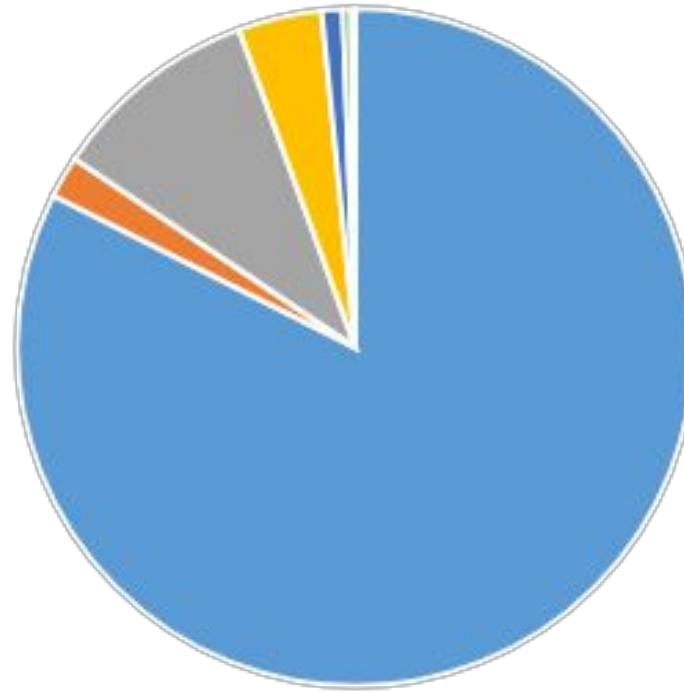


Fig. 5. Equipment and Materials



Picture 6. Diagram description of financial staff

## FINANCIAL ANALYSIS



- Equipment
- Building
- Land
- Vehicles
- Marketing and Promotion
- Licenses and Permits
- Office Supplies

Fig. 7. Diagram description of financial analysis

A large, fluffy white heart-shaped cloud is the central focus of the image, set against a clear, vibrant blue sky. The cloud has soft, irregular edges and a bright white center. Several smaller, wispy white clouds are scattered across the lower right portion of the sky.

Спасибо за внимание!!!