Laboratory infrastructure of the department of Metallurgical processes, heat engineering and technology of special materials

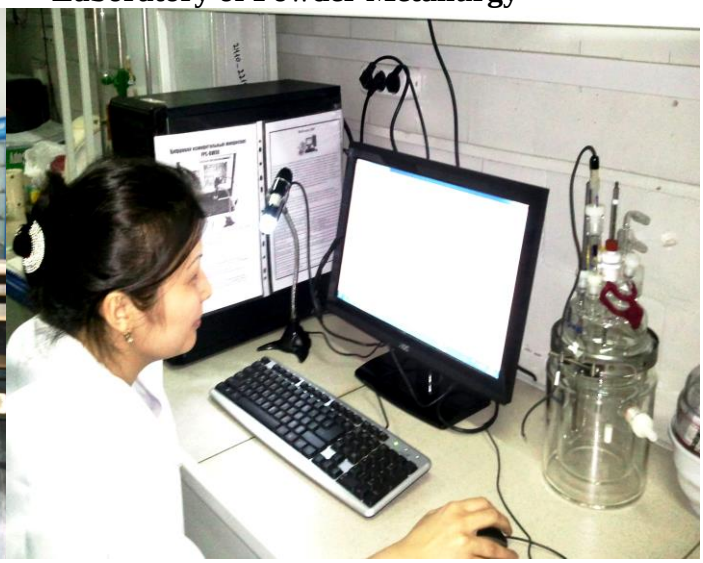
Material and technical provision

The Department of Metallurgical processes, heat engineering and technology of special materials has 3 educational laboratories and 3 specialized educational and research laboratories, 1 computer classroom, 1 classroom with an interactive whiteboard, which provide the educational process of bachelor's, master's and doctoral studies and the implementation of research:

1 Laboratory of special courses
2 Laboratory of metallurgical processes
3 Laboratory of thermal engineering processes
4 Laboratory of physical and chemical research
5 Laboratory of spectroscopic research methods
6 Laboratory of powder metallurgy
7 Computer class
8 An audience with an interactive whiteboard

Laboratory of special courses

Laboratory of Powder Metallurgy

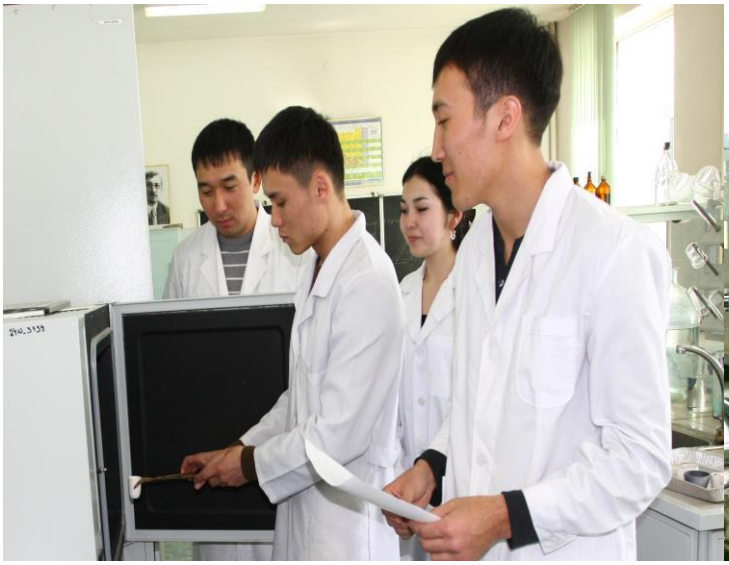


The total production area of laboratories and offices of the department is 362 m^2. The total area of classrooms per student is 3.2 m^2 .

The area of laboratories and offices of a special profile per student is 2.8 m^2 . The area of classrooms per student is 2m^2. The equipment of laboratories with modern instruments and equipment corresponds to the tasks of bachelor's degree training in the specialty 050709- Metallurgy. The material and technical base of the department as a whole meets the qualification requirements established by the Rules for Licensing educational Activities.

Laboratory of Metallurgical Processes

Laboratory of physico – chemical research



Laboratory of physical and chemical research

Differentiating scanning thermogravimetric colorimeter

Electric tubular furnace with three zone control

Spectrometer FTIR-8400 Shimadzu **Potentiostat-galvanostat Reference 600**

Pyrometallurgical studies.

Research on the roasting of metallurgical raw materials (sulfidating roasting, pyrrhotinizing, dearsening, oxidative roasting).

Diarsenating roasting of arsenic-containing raw materials; thermal decomposition of pyrite raw materials, tailings of enrichment.

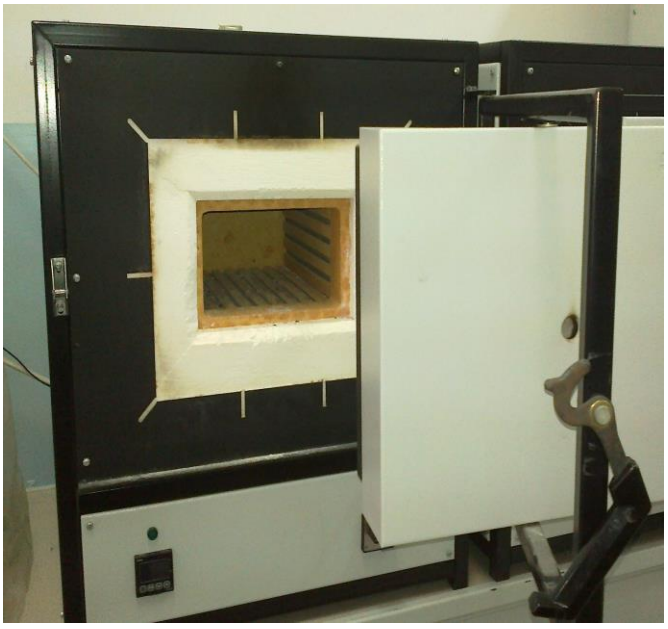
Activating, pyrrhotinizing roasting of oxidized lead-zinc ore, industrial products of enrichment.

High-temperature hydrolysis (production of iron oxide nanopowders).

Educational and scientific laboratory "Theory of metallurgical processes"

Tubular Furnace

Thermostat



Muffle furnace

Planetary Mill

The educational laboratory was created for the purpose of carrying out laboratory work on the theory of metallurgical processes (in the field of hydrometallurgy, pyrometallurgy); research of various types of heat

exchange and thermal properties of refractories of different composition; modeling of thermal processes of firing, firing of refractory materials, as well as the use of volumetric methods for determining the composition of gases; for the purpose of conducting research on the firing of metallurgical raw materials, extraction processes, sorption, electrolysis for bachelors, undergraduates, doctoral students, teaching staff.

Research on metal corrosion (study of corrosion processes only in the metallurgical sphere).

Studies of hydrometallurgical processes: leaching of metallurgical objects of study (leaching of copper, zinc, nickel, cobalt), extraction (extraction processes of copper, nickel, cobalt), sorption processes (sorption of copper, various non-ferrous metals), refining and precipitation of metals.

Extraction of lead and tin from alkaline solutions.

Anodic dissolution of lead-tin, copper-nickel, heat-resistant alloys.

Rhenium extraction.

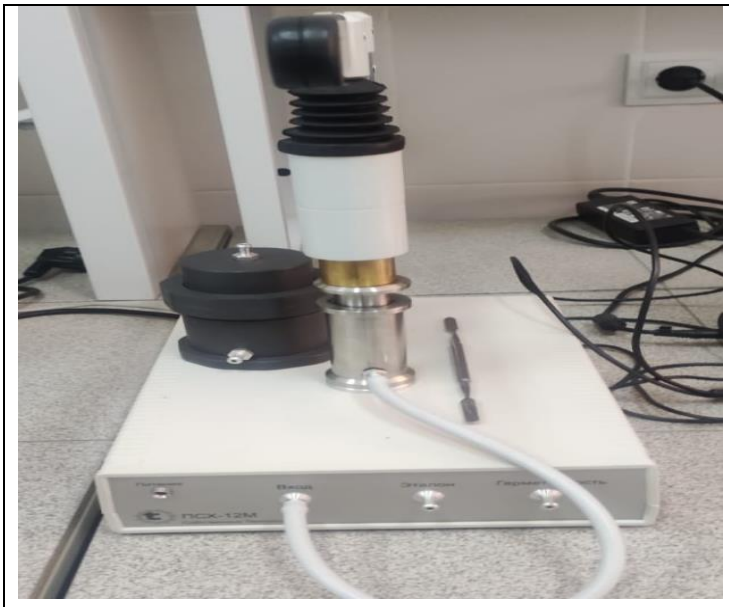
Photocolorimetric analysis.

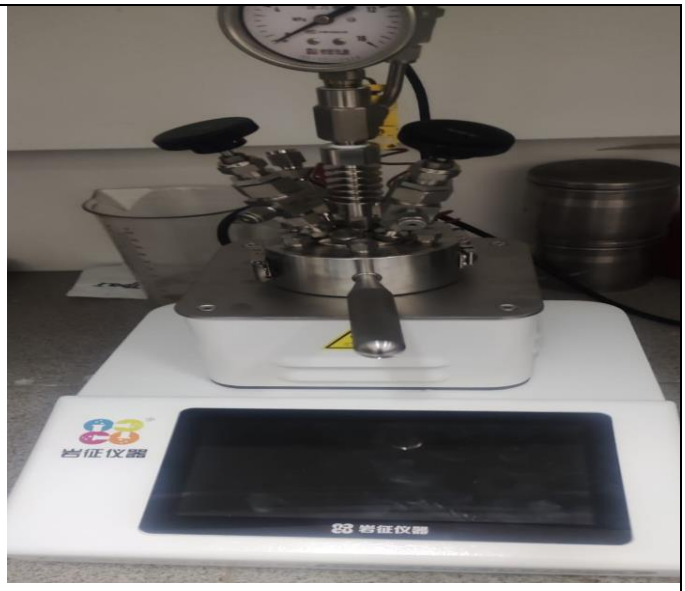
Granulometric analysis.

Leaching of gold-containing sludge.

A high-temperature vacuum furnace for heat treatment with a controlled inert atmosphere is pre-evacuated to ensure a minimum oxygen content in the furnace, and then nitrogen, argon are introduced to obtain the desired heat treatment while protecting the atmosphere. Due to its excellent atmosphere and compactness, it is widely used in materials laboratories or in small-scale production of semiconductors, silicon nitride and other products.

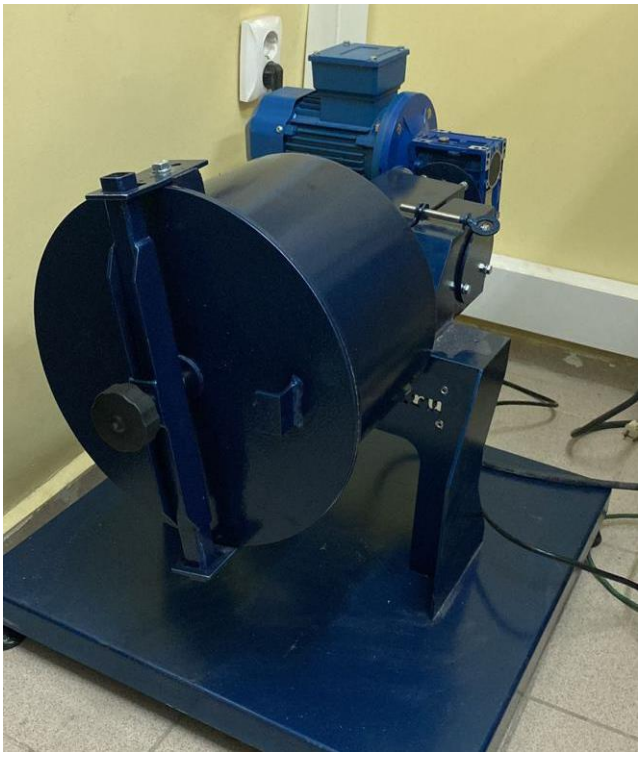
Micro reactors of high pressure 25 ml with magnetic stirrer series are widely used in chemical, pharmaceutical, polymer, metallurgical and environmental fields. These are catalytic hydrogenation, polymerization, hydrometallurgy. Suitable for laboratory countertops, small volume, easy operation, standard operating temperature: 300℃, 10 MPa, uses high temperature resistant magnetic technology, magnetic stirring, mixing speed 1500 rotation/min, suitable for mixing materials with low viscosity.




岩征仪器


RPM/RCF
Acc/Dec
Time/Prog
FRONTIER
Prog Setup
Start
Store
Stop
Quick Spin
Door Open
RPM RCF
Accel Decel
Time


MOC-120H



The AKV-2ZHV viscometer is designed to determine the effective viscosity of greases in accordance with GOST 7163-84. Technical specifications:

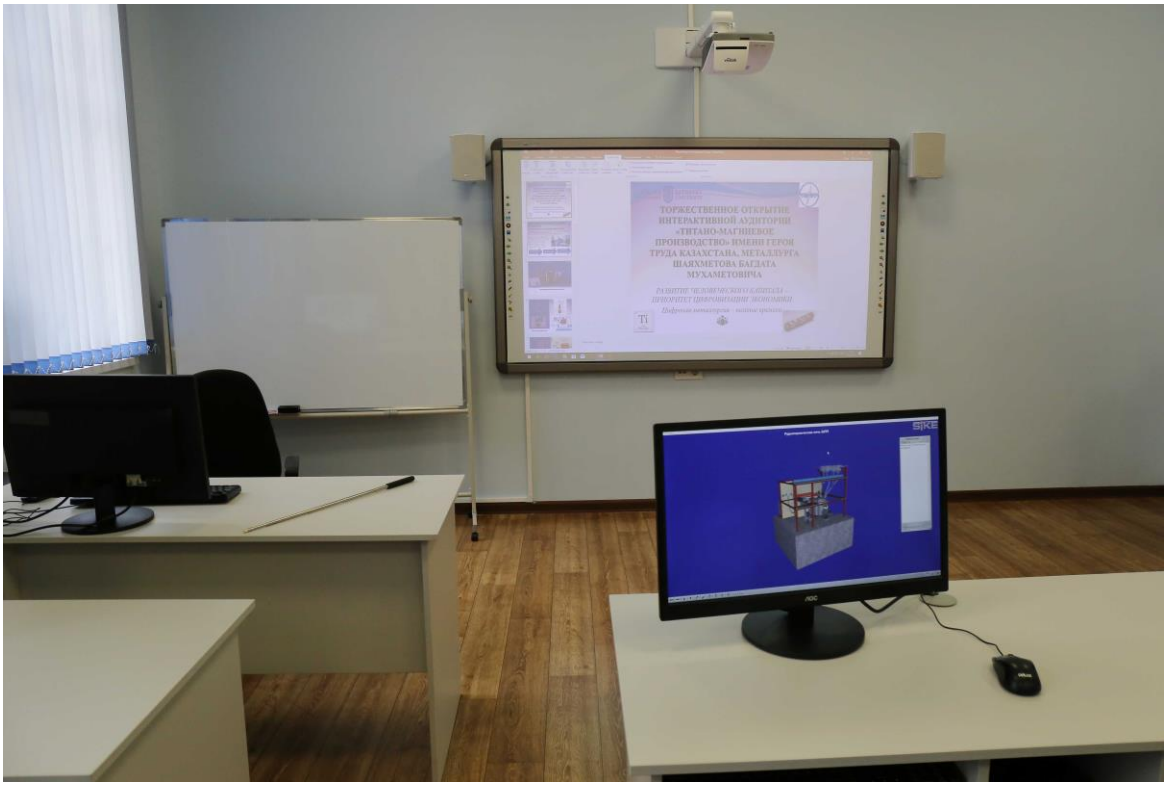
— Measuring range: from 1 to 6000 Pa ×s
— Nominal value of the stem diameter: 10 mm
— Linear velocity of the diagram tape:
for I velocity W=1.63 cm/sec
for II velocity W=0.093 cm/sec
for III velocity W=0.005 cm/sec
— Capillary radii: from 0.5 to 2.5 mm
— Temperature of the controlled environment: from minus 60 to plus 130 °C
— Limits of the permissible relative error when measuring dynamic viscosity: ± 10%
— Deviation from the nominal value of the capillary radius: ± 10 microns
— Deviation from the nominal value of the capillary length: ± 10 microns
— Deviation from the nominal value of the rod radius: ±2 microns
— Deviation from the nominal value of the linear velocity of the diagram tape: ± 3%
— Characteristics of the measurement results of effective viscosity according to GOST 7163-84

Frontier FC5515 high-speed laboratory centrifuge with a powerful brushless asynchronous motor. It is supplied with a standard rotor for micro-tubes of various capacities or with a bio-protected rotor. The unique rotor mounting and lid locking system allows you to quickly change rotors at the touch of a button. The rotor unbalance system stops the centrifuge when an unbalance is detected, and the electromechanical locking system prevents the lid from opening until the rotor stops. An intuitive control panel with a rotary knob used to set the parameters of centrifugation, including the ability to set and control the rotation speed. Switching modes is done by pressing a button. Protecting the control panel from water penetration allows you to significantly increase the service life of the device. The backlit LCD display provides a clear display of information. Up to 99 records of the parameters used are stored in the device's memory.

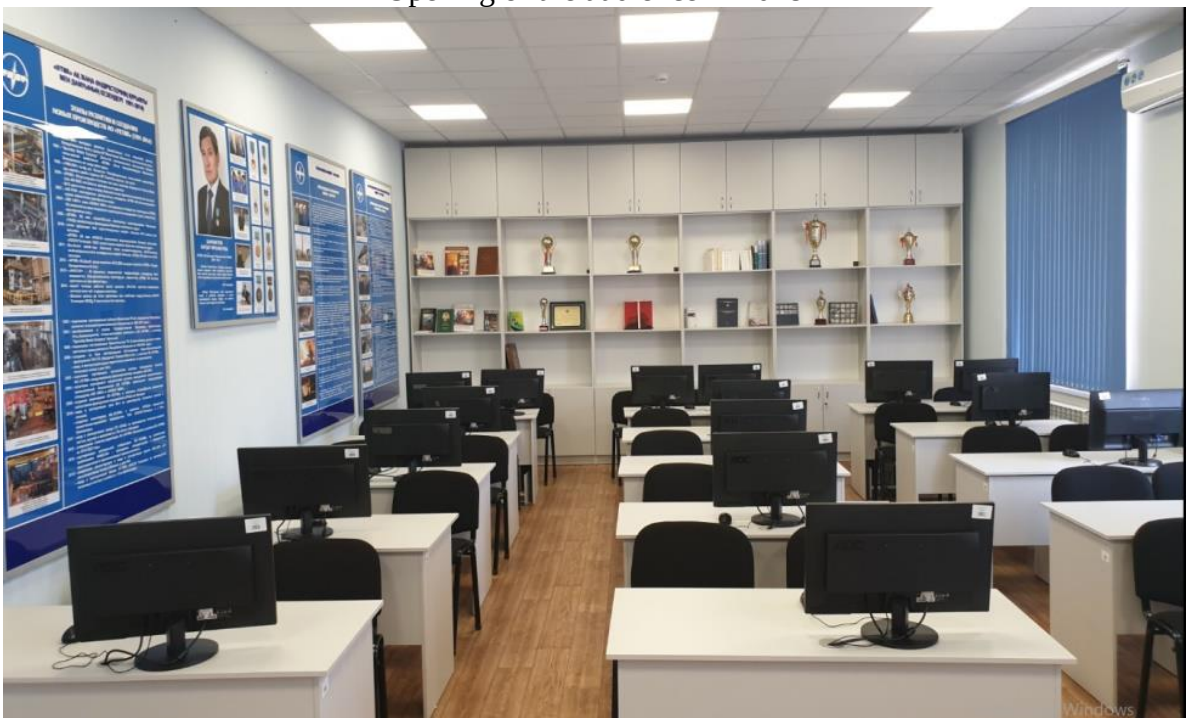
The device for determining the specific surface area and average particle size of dispersed materials PSX-12 M is designed for laboratory research and control of technological processes of dispersion of solid materials by their specific surface area and average particle size. Technical specifications measurement range: specific surface area, cm2 / g 300 - 50,000 average mass particle size, mm 0.5 -200 Measurement error, no more than % ± 3 Power consumption (220 V; 50 Hz; W) 30 Dimensions, mm270x330x430 Weight, kg 8The SHLM-APM-10 mill is designed for fine wet grinding of samples of ore and non-metallic materials. Technical specifications:- drum volume - 7 liters- Balls weight – 15 kg- Remote control.

Infrared thermogravimetric humidity analyzer MOS-120N for automatic determination of humidity of solid bulk materials (ore, concentrate, solid fuel, etc.) with the ability to output results to the printer.

The department has an auditorium named after B. Shayakhmetov, the First President of the Titanium–Magnesium Combine, equipped with sponsorship investments from the Titanium-Magnesium Combine. The interactive audience is equipped with professional software for metallurgical calculations, as well as 3 D atlases and virtual simulators for metallurgical heat engineering. During the pandemic, the audience performed the functions of a virtual laboratory, as evidenced by the act of introduction into the educational process.



Opening of the audience in 2018

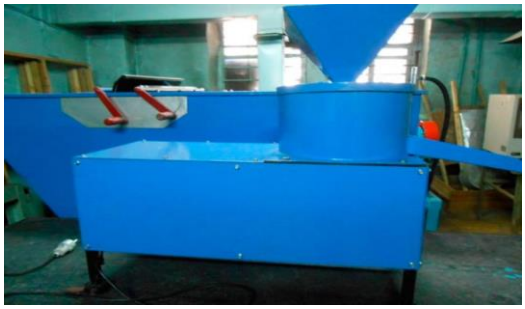


Virtual laboratory of Metallurgical Heat engineering, auditorium 313

Laboratory infrastructure of the Department of Metallurgy and Mineral Processing

In the direction of ore enrichment, the department is equipped with various equipment for crushing and grinding ore, flotation and magnetic enrichment to obtain concentrates of non-ferrous and rare metals. The laboratory equipment for ore dressing is located on an area of about 365.0 m2 and is manufactured in a standard factory design, allowing you to reproduce the full technological cycle for ore dressing. The big share of the Metallurgy and Mineral Processing Department's contracts is performed annually by Associate Professor Telkov Sh.A.

Some types of equipment have been developed by the staff of the department, in particular, the installation of gravity enrichment of sludge fractions of ores containing precious metals (author-Professor M.R. Shautenov).



Ultrasonic aerohydrodeshlamator and vibrating machine

Based on the results of the research, new samples of devices have been developed and patented – a centrifugal hydraulic concentrator (Patent RoK №. 25645) and an ultrasonic aerohydrodeslamator.

In the metallurgical direction, Department of the Metallurgy and Mineral Research has equipment that allows performing the entire cycle of laboratory research, including the processes of crushing, grinding, roasting, melting, leaching, electrolysis, extraction, ion exchange. The area of the laboratories is 424 m ^{2}.

In the laboratories of the department there is a planetary mill, an autoclave plant and spectrophotometers, a high-temperature furnace "Naberterm" with a vertical workspace, a similar furnace of horizontal design. Such equipment makes it possible to simulate the melting processes of charge materials to temperatures of 1500-1700^{o}C and is necessary when conducting laboratory studies of pyrometallurgical processes.


Autoclave installation


Vertical and horizontal high temperature furnaces Nabertherm

The department has equipment for physical and chemical studies of raw materials, industrial products and products of processing processing and metallurgical production.


Spectrophotometers for solution analysis

The laboratories have a SPARK-1 spectrophotometer for X-ray fluorescence express analysis of solid and powder materials. Of the analytical equipment, there is also a differential scanning calorimeter STA 409 PC/PG NETZSCH Company, (Germany), conducting thermal analysis of samples, etc.


Extraction, evaporation, condensation


Educational and research work is carried out using modern computer technologies and software. At the disposal of students and teaching staff and there is a complex of various analytical programs: thermodynamic calculations - program HSC Outocumpu, Thermokinetic NETZSCH Company (Germany) - the program of kinetic calculations.

Also, the Scientific Center named after Ibrahim Abylgazievich Onaev, Doctor of Technical Sciences, Professor, corresponding member of the Academy of Sciences of the Kazakh SSR, Honored Scientist of the Kazakh SSR has been functioning at the Department of Metallurgy and Mineral Processing since 2004.

Scientific Center named after Ibrahim Abylgazievich Onaev at the Department Metallurgy and Mineral Processing

In 2014, a research laboratory "Biogeotechnology of gold, uranium and polymetallic ores" was also opened on the basis of the department. The head of the laboratory, professor Turysbekova G.S. The amount of research funding for this laboratory since its opening is more than 200 million tenge.

Research laboratory Biogeotechnology of gold, uranium and polymetallic ores

On April 13, 2022, on the basis of the Department of Metallurgy and Mineral Processing, at the expense of sponsorship investments, an interactive audience was opened named after Academician of the National Academy of Sciences of the Republic of Kazakhstan, KazNAEN, NAGN, metallurgical scientist, Doctor of Technical Sciences, Professor Abisheva Zinesh Sadyrovna.